Technische Berichte des Hasso-Plattner-Instituts für
Softwaresystemtechnik
an der Universität Potsdam

Nr. 24

Erster Deutscher IPv6 Gipfel

Christoph Meinel, Harald Sack, Justus Bross

Potsdam 2008

Bibliografische Information der Deutschen Nationalbibliothek
Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über http://dnb.d-nb.de/ abrufbar.

Universitätsverlag Potsdam 2008
http://info.ub.uni-potsdam.de/verlag.htm

Am Neuen Palais 10, 14469 Potsdam
Tel.: +49 (0)331 977 4623 / Fax: -4625
E-Mail: ubpub@uni-potsdam.de

Die Schriftenreihe **Technische Berichte des Hasso-Plattner-Instituts für Softwaresystemtechnik and der Universität Potsdam** wird herausgegeben von den Professoren des Hasso-Plattner-Instituts für Softwaresystemtechnik an der Universität Potsdam. Sie erscheint aperiodisch.

Autoren: Prof. Dr. Christoph Meinel, Dr. Harald Sack, Justus Bross

Druck: allprintmedia GmbH, Berlin

ISSN 1613-5652
ISBN 978-3-940793-45-4

INHALTSVERZEICHNIS

HPI-Tagung: Deutschland im neuen Internet bereits an der Spitze

Deutschland hat bereits eines der weltweit größten Kontingente an Adressen für die nächste Generation des Internets reserviert. Das teilte der Direktor des Hasso-Plattner-Instituts, Prof. Christoph Meinel, zum Abschluss eines Expertengipfels über die Einführung des neuen Internetstandards IPv6 mit. Mit seinem Anteil von 13 Prozent an den zugeteilten neuen Anschlussnummern sei Deutschland hinter den USA mit 20 Prozent die Nummer 2 in dieser Technologie und liege noch vor Frankreich und Japan (je 11 Prozent), betonte Latif Ladid, Präsident des internationalen IPv6-Forums, auf der Tagung. Rund 70 führende Fachleute aus dem In- und Ausland hatten zwei Tage lang in Potsdam darüber beraten, wie der Übergang auf die neue Internetgeneration gestaltet werden soll. Sie bietet mehr Sicherheit, höhere Leistung, leichtere Erweiterbarkeit und bessere Anpassbarkeit an neue Anforderungen. Der alte Standard IPv4 gilt seit 1981. Das Kürzel IP steht für "Internet-Protokoll" und bezeichnet das Verfahren, mit dem sich Computer und Geräte im weltweiten Netz verknüpfen.

„Unser IPv6-Gipfel hat deutlich gemacht, dass die Vorbereitungen für die Umstellung schon weit gediehen sind", berichtete Meinel. Von der Potsdamer Tagung sei ein ermutigender Impuls auf alle an dem Übergang Beteiligten ausgegangen. Die Veranstaltung habe zudem gezeigt, dass Deutschland gute Chancen habe, im technologischen Wettbewerb um das Internet der Zukunft mitzuhalten. Jetzt gehe es im Hinblick auf den dritten nationalen IT-Gipfel Ende November in Darmstadt darum, einen Fahrplan für die anstehenden Aktivitäten zum Übergang auf den modernen Internetstandard aufzustellen.

Zur Eröffnung der Potsdamer Tagung hatten sich EU-Kommissarin Viviane Reding und Internetpionier Dr. Vinton Cerf für eine schnelle Einführung der neuen Internetgeneration ausgesprochen. Cerf (64), der als einer der Väter des weltweiten Rechnernetzwerkes gilt und Vorstandsmitglied beim Suchmaschinen-Anbieter Google ist, appellierte an die Computernutzer, bei den Internetanbietern auf die zügige Einführung des neuen Technikstandards IPv6 zu drängen. Er schätzt, dass "irgendwann zwischen 2010 und 2011" keine alten IPv4-Adressen mehr verfügbar sein dürften, um neue Router und Webserver ans Internet anzubinden.

Die für Informationsgesellschaft und Medien zuständige EU-Kommissarin Reding kündigte einen Aktionsplan der Europäischen Union zur beschleunigten Einführung der nächsten Internetgeneration an. Reding sagte, die Kommission werde den Mitgliedsstaaten Maßnahmen vorschlagen, um den entscheidenden Schritt in die neue Welt der Internetversion IPv6 bis zum Jahre 2010 zu schaffen. Detlef Eckert, Berater aus Redings Generaldirektion, berichtete, weltweit seien nur noch etwa 16 Prozent der alten IP-Adressen verfügbar. Dennoch böten bisher überhaupt nur rund 10 Prozent der internationalen Internetserviceanbieter und 30 Prozent der europäischen den neuen IPv6-Standard an. Ziel der EU-Kommission sei es, das bis Ende des Jahres 2010 rund 25 Prozent aller europäischen Anwender die Möglichkeit haben sollen, IPv6 zu nutzen und dabei auf die meisten ihrer gewohnten Dienste und Inhalte zugreifen zu können. "Dies wäre ein Riesenschritt", betonte Eckert. Nach seinen Worten ist geplant, dass der EU-Ministerrat die Kommissions-Pläne Ende 2008 diskutiert und beschließt, um zu einem gemeinsamen Vorgehen aller Mitgliedsländer zu kommen.

Für die Bundesregierung bezeichnete der IT-Direktor des Bundesinnenministeriums, Martin Schallbruch, den neuen Internetstandard IPv6 als "schiere Notwendigkeit". Darauf werde der Bund künftig bei der Beschaffung setzen. Erstmals werde das im Herbst zum Tragen kommen, wenn im Rahmen der Initiative "Deutschland Online Infrastruktur" (DOI) gemeinsame Netzinfrakstrukturprojekte für Bund, Länder und Gemeinden ausgeschrieben würden. Dies sei als ein Signal der Regierung zu verstehen. Der Präsident des internationalen IPv6-Forums, Latif Ladid, begrüßte die Ankündigung der Bundesregierung, künftig auf die neue Internetgeneration IPv6 zu setzen. Auch EU-Kommissarin Reding hatte die deutsche Bundesregierung ausdrücklich für ihr Engagement gelobt. "Sie wird IPv6 auf den Weg bringen und ich freue mich auf die Zusammenarbeit", sagte Reding.

Schallbruch riet der deutschen Wirtschaft, auf das neue Internet zu setzen: "Jedes Unternehmen ist gut beraten, sich die entsprechenden Vorteile zu sichern", sagte er bei dem Gipfeltreffen im Hasso-Plattner-Institut. Die öffentliche Verwaltung in Deutschland investiert nach Schallbruchs Worten jährlich 2,4 Milliarden Euro in die Netzinfrastruktur.

Hinweis: Weitere Informationen zur Tagung unter www.ipv6council.de.

GRUSSWORT

Sehr geehrten Damen und Herren,
liebe Teilnehmer des ersten nationalen IPv6-Gipfels in Deutschland,

ich heiße Sie ganz herzlich in unserem Hasso-Plattner-Institut anlässlich des ersten nationalen Ipv6-Gipfels in Deutschland willkommen. Ein besonderes Willkommen gilt dabei auch den hochrangigen Experten und Fachleuten aus dem In- und Ausland, die uns von Ihren Anstrengungen, Erfahrungen und Erfolgen beim Übergang auf die neue Internetgeneration IPv6 berichten und so helfen, diesen Übergang auch in Deutschland vorzutreiben und zu gestalten.

Wie Sie alle wissen, steht das Kürzel IP für „Internet-Protokoll" und bezeichnet das Verfahren, mit dem sich Computer und Geräte im weltweiten Netz verknüpfen. Die bisher verwendete Version IPv4 ist nun schon fast 30 Jahre alt. Ihre größten Nachteile sind die immer stärkere Verknappung von Internetadressen, signifikante Sicherheitsdefizite und fehlende Mechanismen zur Übermittlung von Realtime-Inhalten.

Das heute beginnende zweitägige Treffen bietet rund 30 Vorträge und Workshops rund um den Einsatz der neuen Internettechnologie IPv6. Es werden Referenten aus Politik und Wirtschaft von Ihren Projekten berichten, die helfen werden, auch in Deutschland gute Voraussetzungen für den Übergang zur neuen Internet-Generation zu schaffen. Sie als Teilnehmer werden so persönlich miterleben, wie ein neues Stück Internet-Geschichte geschrieben wird.

Am ersten Tag werden neben Grußworten der EU-Kommissarin für Informationsgesellschaft und Medien Viviane Reding und Internet-Pionier Vinton Cerf, mit Vorträgen des IT-Direktors des Bundesministeriums des Inneren, Martin Schallbruch, und des SAP-Vice President Corporate Research und Chief Development Architect, Prof. Lutz Heuser, zunächst die weltweiten IPv6-Strategien im Mittelpunkt des Programms stehen. Vor allem wird der Stand der Vorbereitungen in Europa, den USA, China, Japan, Süd-Korea, Malaysia und Indien beleuchtet. Am zweiten Tag wird über die Perspektiven von IPv6 aus der Sicht von Netzbetreibern und Zugangsanbietern sowie von öffentlichen Institutionen, zum Beispiel in den Bereichen Verwaltung, Bildung und Militär, diskutiert. Parallel zum Konferenzprogramm wird ein halbtägiges IPv6-Tutorium angeboten. Weiterführende Informationen zu den Vortragenden dieses Gipfels sowie das Tagungsprogramm finden Sie auf den folgenden Seiten dieser Broschüre.

Deutschland braucht gleichberechtigten Zugang zu dem neuen Internet. Der Potsdamer Gipfel wird weiteren Schwung in die deutschen Bemühungen um den Einsatz des verbesserten Internetprotokolls bringen.

Ich wünsche Ihnen allen spannende, lehrreiche und interessante Tage und gute Impulse für unser gemeinsames IPv6 Projekt.

Mit freundlichen Grüßen

Ch. Meinel

Prof. Dr. Christoph Meinel
(Direktor HPI und Vorsitzender Deutscher IPv6-Rat)

PROGRAMM

Hasso Plattner Institut
IT Systems Engineering | Universität Potsdam

Mittwoch, 7. Mai 2008

ab 11:00	**Registrierung**
13:00	**Begrüßung** *Prof. Christoph Meinel*, Direktor Hasso-Plattner-Institut
13:30	**Keynote Session 1** Chair: *Prof. Christoph Meinel*, Direktor Hasso-Plattner-Institut
	Welcome-Note *Latif Ladid*, President International IPv6 Forum
	Video-Keynote *Viviane Reding*, Commisioner for Information Society and Media
	Video-Keynote *Vinton Cerf*, Chief Internet Evangelist & Vice President, Google
	Bedeutung von IPv6 für die öffentliche Verwaltung *Martin Schallbruch*, IT-Direktor BMI
	Towards the Future Internet *Prof. Lutz Heuser*, Vice President of Corporate Research and Chief Development Architect, SAP
	European Commission IPv6 Strategies & Efforts *Detlef Eckert*, Advisor European Commission. Emerging Technologies and Infrastructure, Information Society and Media Directorate-General
15:30	**Kaffeepause**
16:00	**Keynote Session 2** Chair: *Latif Ladid*, President International IPv6 Forum
	IPv6 Strategy & Deployment Status in Japan *Horishi Miyata*, Yokogawa Electric corporation, IPv6 Promotion Council Japan
	IPv6 Strategy & Deployment Status in Malaysia *Prof. Dr. Sureswaran Ramadas*, President IPv6-Forum Malaysia
	IPv6 Strategy & Deployment Status in China *Prof. Wu Hequan*, Director CGNI Network
	IPv6 Strategy & Deployment Status in Korea Dr. Eunsook Kim, IPv6 Forum, Korea
	Greek Schools' IPv6 Network *Athanassios Liakopoulos*, GrNET
	IPv6 Network Mobility and IST Usages *Jean-Marie Bonnin*, Telecom Bretagne, NEMO
18:30 Uhr	**Empfang und Buffet**

DONNERSTAG, 8. MAI 2008

09:00-13:00	Parallel zum Konferenzprogramm: **IPv6 Tutorium - IPv6 in der Praxis** (deutsch)
09:00	**SESSION 1: Operators & ISP Deployment** Chair: *Dr. Bettina Kauth,* DFN
	IPv6 Deployment und Strategien der Deutschen Telekom *Henning Grote*, Deutsche Telekom
	IPv6 Deployment & Strategies of VSNL / Teleglobe *Yves Poppe*, VSNL International
	Deploying IPv6 in Operational Networks *Wolfgang Fritsche*, Manager Advanced IP Services, IABG
	Production ready IPv6 from customer LAN to the Internet *Lutz Donnerhacke*, IKS GmbH
11:00	**Kaffeepause**
11:30	**SESSION 2: IPv6 Applications and Developments (1)** Chair: *Jacques Babot*, European Commission
	IPv6-unterstützte Use-Cases im militärischen Umfeld und deren technologischer Umsetzung *Carsten Hatzig*, BWB
	Windows Vista & IPv6 *Bernard Ourghanlian*, CTO Microsoft Europe
12:30	**Mittagsbuffet**
14:00	**SESSION 2: IPv6 Applications and Developments (2)** Chair: *Peter Demharter, IBM*
	IPv6 & Home Networking *Tayeb BenMeriem*, EUv6 Task Force Steering Committee
	DNS and DHCP for Dual Stack Networks *Lawrence Hughes*, infoWeapons
	Car Industry: German Experience with IPv6 *Amardeo Sarma*, NEC Network Laboratories Europe
15:30	**Kaffeepause**
16:00 – 18:00	**SESSION 2: IPv6 Applications and Developments (3)** Chair: *Harald Sack,* Deutscher IPv6-Rat
	3G and IPv6 impact on use of battery lifetime *David Kessens*, Nokia
	IPv6 & Autonomic Networking *Rangali Chaporadza*, Fraunhofer Fokus
	Public Safety Communications: u2010 Project Experience *Thomas Engel*, University of Luxembourg
	P2P & GRID using IPv6 and Mobile IPv6 *Latif Ladid*, President International IPv6 Forum

Der Übergang zum Internet der neuen Generation

Radio- und Fernseh-Sendungen übertragen, Videos und Online-Spiele bereitstellen, Telefonate übermitteln und Video-Konferenzen ermöglichen - das Internet muss heute sehr viel mehr können als früher. Selbst minimale Zeitverzögerungen oder Aussetzer im Datenfluss sind oft nicht mehr geduldet – kommuniziert wird immer häufiger in „Echtzeit". Um Kapazität für die neuen Anwendungen bereitstellen und das „Internet der Dienste und Dinge" realisieren zu können, benötigt das weltweite Rechnernetzwerk dringend verbesserte Datenverkehrsregeln. Damit beschäftigt sich eine Tagung, die das Hasso-Plattner-Institut und der deutsche IPv6-Rat am 7. und 8. Mai 2008 in Potsdam veranstalten.

Das bisherige Regelwerk, international festgelegt in der so genannten Internet-Protokollversion IPv4, gilt schon seit fast 30 Jahren. Es begrenzt die Zahl der Netzanschlüsse rechnerisch auf 2 hoch 32, also knapp 4,3 Milliarden IP-Adressen. Weil gut 600 Millionen Adressen für besondere Zwecke reserviert sind, bleiben ca. 3,7 Milliarden IP-Adressen übrig - zu wenig, um jedem Menschen wenigstens eine Anschlussnummer fürs Netz zuweisen zu können. Der Adressraum dürfte spätestens 2012 ausgeschöpft sein. Derzeit sind laut Expertenberechnungen nur noch 16 Prozent der IP-Adressen verfügbar. Der Druck, den veralteten Internet-Standard durch einen neuen abzulösen, wächst daher stetig. Neben höherer Leistung werden fürs Internet der nächsten Generation vor allem mehr Sicherheit, bessere Fähigkeit zur Anpassung an neue Anforderungen und leichtere Erweiterbarkeit gefordert.

Der neue Standard IPv6, bereits vor zehn Jahren entwickelt (eine Version 5 wurde nie realisiert), schafft Platz für 2 hoch 128 IP-Adressen, also mehr als 340 Sextillionen Netzanschlüsse - eine Zahl mit 37 Nullen. Rechnet man das einmal auf die Erdoberfläche um, entspricht das 667 Billiarden Adressen pro Quadratmillimeter. Somit kann der Traum von einem zukünftigen „Internet der Dinge", in dem möglichst viele mobile und stationäre Geräte miteinander vernetzt sind, uneingeschränkt verwirklicht werden. Selbst wenn jeder Mensch auf der Erde Dutzende persönlicher Dinge wie Auto, Laptop, Handy, Kühlschrank, MP3-Player oder Medikament übers Internet Daten austauschen ließe, wäre die mögliche Zahl an „Hausnummern" der Netzanschlüsse bei weitem noch nicht ausgeschöpft.

Was sind die weiteren wesentlichen Vorteile gegenüber der bisherigen Version? Das neue Mega-Netz

- teilt IP-Adressen automatisch zu
- spart durch vereinfachte und feste Bezeichnung der Datenpakete (Header) Rechenleistung, entlastet die Router als Verbindungsknoten im globalen Internet und beschleunigt so den Datendurchsatz
- sorgt für eine kostengünstigere Netzwerkadministration
- erleichtert durch einfache Umnummerierung den Wechsel ganzer Firmennetze von einem Internetanbieter zum anderen
- bietet die Möglichkeit, seinen Laptop mit der heimischen IP-Adresse auch an jedem anderen Zugangsort zu nutzen, zum Beispiel auf Konferenzen oder im Bereich eines WLAN-Hotspots
- sorgt durch höhere Sicherheitsstandards für angemessene Verschlüsselung bei der Datenübertragung von Rechner zu Rechner
- macht eine neue Servicequalität für Datenübertragungen in Echtzeit möglich, zum Beispiel für Internet-Telefonie und Internet-TV. IPv6 sieht dafür ein Adressfeld vor, das bei der Datenpaketverarbeitung dazu genutzt werden kann, unterschiedliche Dienste differenziert zu behandeln. Das Ganze ist derzeit in der experimentellen Phase.

Das neue Internet breitet sich zunächst inselartig aus

Derzeit breitet sich der IPv6-Standard zunächst einmal auf neuen „Inseln" im Internet aus. Dazwischen wird es auf Jahre hinaus noch die alte Internet-Welt geben. Mehrere Techniken werden eingesetzt, um den Datenverkehr zwischen den IPv6-Inseln innerhalb des alten IPv4-Netzwerkes zu gewährleisten. Experten sprechen von „statischen Tunnels", Protokollübersetzungen und „Dual-Stack", dem IPv4/IPv6-Parallelbetrieb.

Die weltweite Überleitung des Internets auf den verbesserten Standard ist nicht nur technisch ein anspruchsvolles Vorhaben, sondern auch finanziell: Es muss viel Geld investiert werden, zum Beispiel in die erforderliche Anpassung der Internetknoten oder den Ausbau der Breitbandnetze. Die Investitionen müssen sorgfältig geplant werden. Es lohnt sich, bei ohnehin notwendigen Ersatzbeschaffungen gleich die IPv6-Technik zu installieren. Asiatische Länder tun das bereits seit Jahren. Sie können heute schon davon profitieren und nutzten zusätzlich noch ihre Chance zu sehr kurzfristigen Ersatz-Investitionen.

Die Umstellung auf den neuen Internetstandard ist also mittlerweile weltweit im Gange, verläuft aber je nach Weltregion unterschiedlich schnell. Einige asiatische Länder wie China, Japan und Südkorea haben besonders früh erkannt, dass die erste und entscheidende Verbesserung des Internets seit den achtziger Jahren unzählige Innovationen freisetzt, die den Nutzern wesentlich mehr Möglichkeiten geben. In diesen Staaten sorgen die Regierungen für Projektfinanzierungsmaßnahmen und Steuererleichterungen. Auch in den USA wird der Übergang auf die neue Internet-Generation wesentlich durch entsprechende Entscheidungen der Regierung, vor allem des Verteidigungsministeriums, beschleunigt.

Europas Internetanbieter sind technisch schon vorbereitet

In Europa hat die EU-Kommission in den vergangenen acht Jahren mehr als 100 Millionen Euro in die direkte Finanzierung von IPv6-Projekten fließen lassen. Die europäischen Internetserviceprovider und Mobilfunkanbieter sind rein technisch bereits darauf vorbereitet, für DSL-Anschlüsse und UMTS-Handys sofort den IPv6-Standard anbieten zu können. Die IPv6-Projektgruppe der Europäischen Union möchte, dass Deutschland eine Schrittmacherrolle für Europa übernimmt.

Bei der Tagung in Potsdam wird mit Ankündigungen aus Wirtschaft und Politikgerechnet, die gute Voraussetzungen für den Übergang zur neuen Internet-Generation schaffen. Auf dem Gipfel können die Teilnehmer persönlich miterleben, wie ein neues Stück Internet-Geschichte geschrieben wird. Für die öffentliche Veranstaltung steuern Internet-Pionier Vinton Cerf (Google) und die EU-Kommissarin Viviane Reding Video-Botschaften bei.

Dass der notwendige Schub in Deutschland bald kommt, davon ist der deutsche IPv6-Rat überzeugt. Die Initiative, in Deutschland einen IPv6-Rat zu gründen und damit die an der Weiterentwicklung von IPv6 interessierten Unternehmen, Forschungseinrichtungen und staatlichen Institutionen an einen Tisch zu bringen und mit den internationalen Akteuren zu vernetzen, hat das Ziel, der neuen Internet-Generation in Deutschland zum Durchbruch zu verhelfen. Der IPv6-Gipfel ist ein wichtiger Meilenstein dazu.

Auch wenn sich viele Internetanbieter schon auf IPv6 vorbereitet haben - der neue Standard wird von Privatkunden derzeit noch relativ selten verlangt, da den meisten Nutzern weder die drängende IPv4-Problematik bewusst ist noch die Möglichkeiten der IPv6-Nutzung überhaupt bekannt sind. Wird die IPv6-Konnektivität nicht ausdrücklich vom Internetnutzer nachgefragt, bieten Service-Provider sie noch nicht aktiv an. Die Nachfrage bestimmt das Angebot.

Ähnlich ist die Situation in vielen Unternehmen, in denen die Netzwerk-Verantwortlichen eine Umstellung auf IPv6-Betrieb nicht forcieren, da Bedenken gegenüber Risiken und Problemen bestehen, die mit dieser Umstellung verbunden sein könnten. „Never change a running system", heißt die Devise. Solange das bestehende IPv4-Netzwerk im Unternehmen störungsfrei läuft und allen Anforderungen gerecht wird, sehen viele IT-Verantwortliche keine zwingende Notwendigkeit, in eine Umstellung zu investieren.

In lokalen Netzwerken kann man schon gut mit IPv6 arbeiten

Dabei kann man in lokalen Netzwerken heute schon gut mit IPv6 arbeiten. Denn für Geräte wie Hubs ist keine Anpassung erforderlich und moderne Switches müssen ohnehin die notwendige Basistechnologie beherrschen. Erst wenn IPv6-Datenverkehr über Router ins Internet geleitet werden soll, wird es etwas schwieriger. Zu erwarten ist aber, dass es bei entsprechend großer Nachfrage möglich sein wird, auch privaten Internetkunden IPv6-Konnektivität zu akzeptablen Preisen anzubieten, die mit dem Preisniveau heutiger DSL-Anschlüsse vergleichbar sind. Die Deutsche Telekom AG hat offenbar bereits einen riesigen IPv6-Adressraum bestellt und bekommen. Der Zeitpunkt für den technischen Übergang und damit für den Einsatz entsprechender neuer Router, E-Mail- und Web-Server ist nur noch eine Frage der Zeit.

Bei den üblichen PC-Betriebssystemen sieht es übrigens bereits recht gut aus für einen nahtlosen Übergang ins neue Internetzeitalter. Windows Vista, Mac OS X und Linux beherrschen beide „Sprachen" gleichzeitig. Obwohl ihr PC dem neuen Standard bereits entspricht, werden viele Anwender die Auswirkungen an der Oberfläche kaum erkennen. Von außen bemerkt niemand, ob sein Rechner IPv6 oder IPv4 ‚spricht'. Das ist ähnlich wie bei einem normalen Haushaltsgerät, bei dem man ja ebenfalls nicht merkt, ob es Atom- oder Solarstrom ist, sondern nur, dass er fließt.

Kurzprofil Deutscher IPv6-Rat

Der am 6. Dezember 2007 in Potsdam gegründete IPv6-Rat ist der deutsche Landesverband des internationalen IPv6-Forums, dem mehr als 50 nationale Gremien angehören. Ziel ist es, alle nationalen Akteure aus Industrie, Forschung, Politik und Verwaltung, die mit der nächsten Internetgeneration befasst sind, zu vereinen und die Einführung des neuen Internet-Protokolls voranzutreiben. Dies soll durch die Sensibilisierung von Endnutzern und Industrie für ein ausgereiftes und sicheres Internet sowie durch Verbesserungen in Technik und Vermarktung erreicht werden. Dem Gremium gehören derzeit gut ein Dutzend Vertreter aus Politik, Wirtschaft und Wissenschaft an. Es will dem neuen Internetprotokoll IPv6 zum Durchbruch verhelfen und arbeitet an einem Fahrplan dafür, wie das neue Internetprotokoll in die nationalen Strategien im Bereich der Informations- und Kommunikations-Technologien eingebunden werden soll.

Hinweis: *Informationen zum internationalen Forum finden Sie unter www.ipv6forum.com, zum deutschen IPv6-Rat unter www.ipv6council.de.*

Kurzprofil Hasso-Plattner-Institut

Das Hasso-Plattner-Institut für Softwaresystemtechnik GmbH (HPI) in Potsdam ist Deutschlands universitäres Exzellenz-Zentrum für IT-Systems Engineering. Als einziges Universitäts-Institut in Deutschland bietet es den Bachelor- und Master-Studiengang „IT-Systems Engineering" an – eine praxisnahe und ingenieurwissenschaftlich orientierte Alternative zum herkömmlichen Informatik-Studium, die von derzeit 400 Studenten genutzt wird. Insgesamt 50 Professoren und Dozenten sind am HPI tätig. Es betreibt exzellente universitäre Forschung – auch für erste Adressen der Wirtschaft. Vor allem geht es um Grundlagen und Anwendungen für große, hoch komplexe und vernetzte IT-Systeme.

DER ERSTE DEUTSCHE IPV6 GIPFEL AM HASSO PLATTNER INSTITUT IN POTSDAM

PROF. DR. CHRISTOPH MEINEL

Dr. sc. nat. Christoph Meinel (1954) ist Direktor des Hasso-Plattner-Instituts für Softwaresystemtechnik GmbH (HPI) und ordentlicher Professor (C4) für Informatik an der Universität Potsdam. Er studierte von 1974 bis 1979 Mathematik und Informatik an der Humboldt-Universität in Berlin, promovierte dort 1981 und habilitierte sich 1988 an der Akademie der Wissenschaften in Berlin. Nach Forschungsaufenthalten am Max-Planck-Institut in Saarbrücken und einer Gastprofessur an der Univ. Paderborn wurde er 1992 zum ordentlichen Professor (C4) für Informatik an die Univ. Trier berufen. Seit 2004 ist er Direktor des Hasso-Plattner-Instituts für Softwaresystemtechnik GmbH (HPI) und hat dort einen Lehrstuhl (C4) für Internet-Technologien und Systeme. Neben seiner Lehrtätigkeit in Potsdam ist er Gastprofessor an der Univ. Luxembourg (Luxembourg) und an der TU Peking (China).

Christoph Meinel ist Autor bzw. Co-Autor von 7 Büchern und hat mehr als 300 wissenschaftliche Publikationen veröffentlicht. Seine weltweit patentierte Hochsicherheitsnetzwerklösung Lock-Keeper ist von der Siemens AG lizenziert. Seine Vorlesungen sind über das Internet frei verfügbar (www.hpi.uni-potsdam.de/meinel/ bzw. www.tele-task.de). Sein aktueller Forschungsschwerpunkt liegt auf dem Gebiet der Internet- und Web-Technologien und Systeme insbesondere in den Bereichen Sicherheit, Teleteaching – Semantic/Social Web und Telemedizin. Er war wissenschaftlich aktiv auch auf dem Gebiet der Komplexitätstheorie und hat (BDD-basierte) Datenstrukturen und effiziente Algorithmen untersucht und entworfen.
Als Direktor des HPI war Christoph Meinel 2006 zusammen mit Hasso Plattner Gastgeber des 1. Nationalen IT-Gipfels der deutschen Bundeskanzlerin Dr. Angela Merkel.

Neben seiner Tätigkeit als Universitätsprofessor ist er Chairman des 2007 gegründeten deutschen IPv6-Rats. Er ist Herausgeber des wissenschaftlichen Journals „ECCC - Electronic Colloquiums on Computational Complexity" und verantwortlich für den „IT-Gipfelblog" und das „tele-TASK"-Archiv. 1998 - 2002 war er Gründungsdirektor des von der Fraunhofer-Gesellschaft betreuten Instituts für Telematik e.V, in Trier, dass sich mit Fragestellungen aus dem Gebiet der Internet- und Web-Technologien, insbesondere aus den Bereichen Elektronisches Publizieren, Telemedizin und Sicherheit in offenen Netzen befasst hat. 1996 – 2007 gehörte dem wissenschaftlichen Direktorium des IBFI Schloss Dagstuhl an und war Sprecher der Fachgruppe „Komplexität" der Gesellschaft für Informatik (GI). Er hat in einer großen

Zahl internationaler Programm-Komitees mitgewirkt, ist in wissenschaftlichen Aufsichtsräten aktiv und hat diverse wissenschaftliche Symposien und Konferenzen veranstaltet.

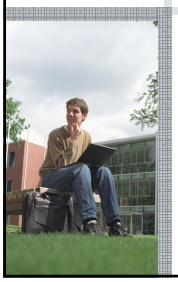
ABSTRACT

Die drohende Verknappung der IPv4 Adressen wirft ihre Schatten voraus und obwohl das neue Internetprotokoll IPv6 bereits seit 10 Jahren in den Startlöchern steht, beurteilen viele Unternehmen den Umstieg auf die neue Netzwerktechnologie nicht mit der notwendigen Dringlichkeit. Der deutsche IPv6 Rat wurde gegründet, um in den verantwortlichen Stellen in Politik, Industrie und Öffentlichkeit ein Problembewusstsein für den notwendigen Umstieg zu schaffen. Der deutsche IPv6 Gipfel ist eine der ersten öffentlichen Aktivitäten des IPv6 Rates unter der Beteiligung internationaler Experten, um einen Überblick über den aktuellen Stand des Einsatzes der IPv6 Technologie zu gewinnen und um sich zu positionieren.

German Council

HPI Hasso Plattner Institut

IT Systems Engineering | Universität Potsdam



Deutscher IPv6 Gipfel in Potsdam

7./8. Mai 2008

German IPv6 Summit in Potsdam

Prof. Dr. Christoph Meinel
Präsident und CEO, HPI
Chairman, German IPv6 Council

Deutscher IPv6 Gipfel in Potsdam

2

1. **Warum ein nationaler IPv6 Gipfel?**
2. Deutscher IPv6 Rat
3. Deutscher IPv6 Gipfel in Potsdam
4. Gastgeber HPI

Warum ein nationaler IPv6 Gipfel?

3

IPv6 ist aktuell wie nie zuvor

- >1.28 Milliarden Internet-Nutzer (2008, bitkom)
- 2 Milliarden Mobiltelefone weltweit und 2008 soll eine weitere Milliarde vertrieben werden...
- 3 Millionen Online Spielekonsolen wurden alleine in der Woche vom 17.-24. November 2007 weltweit verkauft
- Comcast (ISP und Kabel-TV Provider) hat 20 Millionen Endkunden aber nur 2^{24} (16 Mio) IPv4-Adressen
- Neue Entwicklungen im IT-Bereich machen den Einsatz von IPv6-Technologie unabdingbar, z.B.
  - IPTV
  - Car-2-Car Networking (Network on Wheels)
  - ...

Was zeichnet IPv6 aus gegenüber IPv4 ?

4

- Riesiger Adressraum
- Providerwechsel / Hierarchie / Mobilität
- Multicast / Anycast
- Security (IPsec, Source Route)
- Flow Labels
- High Performance Design
- Jumbograms (packets > 64 KB)

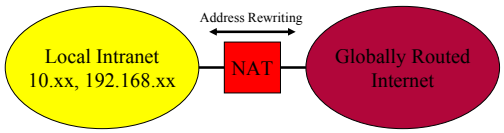
Braucht man IPv6 wirklich ?

5

- Network Address Translation (NAT)
- Application Level Gateways (ALG)
- Classless InterDomain Routing (CIDR)
- DHCP für IPv4
- IPsec für IPv4
- Mobilität für IPv4
- Multiprotocol Label Switching (MPLS)

Warum ist NAT keine Lösung ?

6

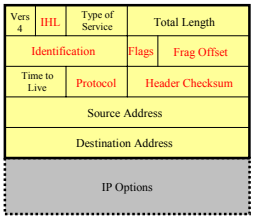


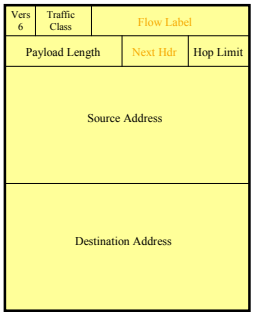
- Verlust der Transparenz
- keine Inbound Services
- einige Apps funktioniern nicht, e.g. IPsec, WINS

- Performance Beschränkungen
- Redundanz schwierig
- Nesting schwierig
- Merger schwierige

IPv4 und IPv6 Paketformate im Überblick

7





v4 Header = 20 Bytes + Options
v6 Header = 40 Bytes

Warum ein nationaler IPv6 Gipfel?

8

Umstellung auf IPv6 ist technologisch notwendig

- Erschöpfung der IPv4-Adressen
- NAT (Network Address Translation) ist nur eine Behelfslösung
  - **Probleme**:
    - P2P-Systeme setzen direkte Kommunikation mit Host voraus und scheitern oft an vorgeschalteten NAT-Geräten, die den Host verdecken
    - Problem bei Anwendungen, die die IP-Adresse des Hosts in Anwendungsschicht einbinden
    - NAT problematisch bei hohen Anforderungen an Dienstgüte (VoIP, Video-Streaming)
- Autokonfiguration mobiler Endgeräte bei „echter" Mobilität
- Wachsende Abhängigkeit von anwendungsspezifischen Identifizierungssystemen

Warum ein nationaler IPv6 Gipfel?

9

IPv6 Umstellung - Die Angst vor dem Wandel

- Furcht vor kostenintensivem Umstieg …
- Furcht vor nicht handhabbarer Komplexität des Umstiegs …
- Furcht, sich als erster der Kritik der Öffentlichkeit zu stellen zu müssen bei evtl. auftretenden technischen Problemen …
- „never change a running system..."
- „sollen die anderen erst einmal damit anfangen..."
- Keine direkten ökonomischen Anreize
- Direkte Vorteile (für Endanwender) oft nicht erkennbar …

Deutscher IPv6 Gipfel in Potsdam

10

1. Warum ein nationaler IPv6 Gipfel?
2. **Deutscher IPv6 Rat**
3. Deutscher IPv6 Gipfel in Potsdam
4. Gastgeber HPI

Deutscher IPv6 Rat

11

Deutscher IPv6 Rat – German IPv6 Council:

- Gegründet am 6.12.2007 am Hasso-Plattner-Institut in Potsdam als nationale Unterorganisation des International IPv6 Forums
- Chairman Prof. Dr. Christoph Meinel, HPI

www.ipv6council.de

Deutscher IPv6 Rat

12

Deutscher IPv6 Rat – German IPv6 Council:

- Gründungsmitglieder:
  - Bundesministerium des Inneren (BMI)
  - Bundesministerium für Verteidigung (BMVg)
  - Bundesamt für Wehrtechnik und Beschaffung (BWB)
  - Computer Science Corporation (CSC)
  - Deutsche Telekom
  - DFN Verein
  - Hasso-Plattner-Institut für Softwaresystemtechnik (HPI)
  - IBM
  - MD Europe Force 10
  - RIPE Network Coordination Center
  - Space Net AG
  - 101 Worldwide AG
  - …

www.ipv6council.de

Deutscher IPv6 Rat

13

Ziele des deutschen IPv6-Councils:

- Einrichtung eines **Gremiums aus Interessenvertretern und Experten** mit den deutschen IPv6-Schlüsselakteuren
- **Wissens- und Erfahrungsaustausch** im Bereich IPv6
- **Förderung** der IPv6 Technologien, neuer IPv6-Anwendungen und deren **weltweiten Einsatz**
- **Förderung und Koordination der Migration** von IPv4 nach IPv6
- **Diskussion und Umsetzung von Lösungswegen**, um Hindernisse und Barrieren, die dem IPv6 Einsatz entgegenstehen, aus dem Weg zu räumen
- **Kooperation** mit internationalen Partner-Organisationen

Einige aktuelle IPv6 Projekte

14

DOI - Deutschland-Online Infrastruktur
(wichtiger Bestandteil des Aktionsplans Deutschland Online)

- Eine einheitliche „Deutschland Infrastruktur" soll ein gemeinsames Backbone zur Verfügung stellen, die gesamte Fläche abdecken und zentrale Regelwerke für zentrale und dezentrale Dienste bereitstellen.
- Ziel ist es, die strategische und technische Umsetzung vorzubereiten, d.h. Partner für die Umsetzung zu gewinnen, eine abgestimmte Gesamtarchitektur zu entwerfen und entsprechende Vorschläge auszuarbeiten und abzustimmen.
- IPv6 ist im Zusammenhang mit der Neukonzeption der Netzinfrastrukturen in der öffentlichen Verwaltung eine Notwendigkeit, um eine barrierefreie ebenenübergreifende Kommunikation zu ermöglichen...

Einige aktuelle IPv6 Projekte

15

Deutsche Telekom
und weitere große nationale ISPs

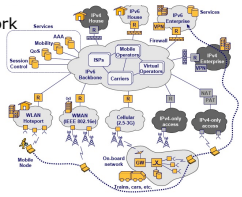
- sind auf dem Sprung, IPv6 Konnektivität bis zum Endkunden zu bringen
- rund ein Drittel der am Deutschen Commercial Internet Exchange (DE-CIX) angeschlossenen ISPs unterstützt IPv6
- um aber IPv6 zu den mehr als 10 Millionen Endkunden zu bringen ist neben den technischen Herausforderung auch der Aufbau einer funktionierenden und kompetenten Service- und Beratungsinfrastruktur ein entscheidendes Kriterium...

Einige aktuelle IPv6 Projekte

16

ENABLE

- EU-Projekt (2006/07) mit 8 Europäischen und einem chinesischem Partner (u.a. Siemens, IABG, Telecom Italia,...)
- Enabling deployment of efficient and operational mobility as a service in large scale heterogeneous IP network environments
- Taking into account the transition from IPv4 to IPv6
- Improve Mobile IPv6 scalability, reliability, and service control



Einige aktuelle IPv6 Projekte

17

NetOpFü

- Netzwerk-zentrierte Operationsführung in der **Bundeswehr**
- **Vernetzte Operationsführung** (NetOpFü) basiert auf der Vernetzung von Aufklärungs-, Führungs- und Wirkmitteln und verwandelt einen gewonnenen Informations- in einen Gefechtsvorteil
- Durch die streitkräftegemeinsame Vernetzung von Sensoren, Führung und Effektoren entsteht ein echtzeitnahes Lagebild und -verständnis, dessen Verfügbarkeit auf allen Führungsebenen einen Informations- und Führungsvorteil garantiert, der sich in einen Handlungs- und letztendlich Gefechtsvorteil umwandeln lässt
- **Sicheres Networking** im Verbund von **heterogenen Netzen mit mobilen Teilnehmern** und **garantierter Quality-of-Service**

Einige aktuelle IPv6 Projekte

18

EFIPSANS

- **E**xposing the **F**eatures in **IP**v6 **P**rotocols for designing/building Autonomic (=self-managing) Networks and Services
- EU-FP7 Projekt (2008-2010) mit 14 Europäischen Partnern (u.a. mit Ericsson, Fraunhofer Fokus, TU Berlin, Fujitsu, Alcatel-Lucent, ...)
- EFIPSANS envisions that IPv6 and the extensibility of the IPv6 protocol framework are a viable evolutionary platform for engineering autonomicity (self-managing properties) in systems, services and networks
- Initiate standardization process of new "EFIPSANS-defined" protocol and network architectural extensions required to implement the "EFIPSANS-specified" autonomic behaviors

Deutscher IPv6 Gipfel in Potsdam

19

1. Warum ein nationaler IPv6 Gipfel?
2. Deutscher IPv6 Rat
3. **Deutscher IPv6 Gipfel in Potsdam**
4. Vorstellung HPI

Deutscher IPv6 Gipfel in Potsdam

20

- **Keynote Session**
  mit Beiträgen zum aktuellen Stand des IPv6 Einsatzes weltweit
- **ISPs & Operators Session**
  mit Beiträgen der wichtigsten ISPs zum aktuellen Stand des IPv6 Angebots und des IPv6 Einsatzes
- **Applications & Developments Session**
  mit Beiträgen zu aktuellen IPv6 Anwendungen
- **IPv6 Tutorial**
- **IPv6 Ausstellung** im Foyer
- Get together, networking, socializing,...

Deutscher IPv6 Gipfel in Potsdam

21

Special Guests:

- **Viviane Reding,** Commisioner for Information Society and Media

„The adoption of IPv6 will facilitate the deployment of online mobile communications. It is also essential to ensure the growth and development of tomorrow's Internet."

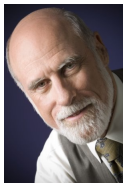
Deutscher IPv6 Gipfel in Potsdam

22

Special Guests:

- **Vinton Cerf,** Chief Internet Evangelist & Vice President, Google
  - „Father of the Internet"

„I think we will begin to see some real demand for IPv6 as IPv6-enabled mobiles, set tops and other edge devices are brought into the network. ... promoting the further spread of Internet to the 5.5 billion people who are not yet online."



Deutscher IPv6 Gipfel in Potsdam

23

Mittwoch, 7. Mai 2008

- **Keynote Session 01**
  Chair: *Prof. Dr. Christoph Meinel, Chairman German IPv6 Forum*
  - **Latif Ladid**, President International IPv6 Forum
  - **Viviane Reding**, Commisioner for Information Society and Media
  - **Vinton Cerf**, Chief Internet Evangelist & Vice President, Google
  - **Martin Schallbruch**, IT-Direktor BMI
  - **Prof. Lutz Heuser**, Vice President of Corporate Research and Chief Development Architect, SAP
  - **Detlef Eckert**, Advisor European Commision, Emerging Technologies and Infrastructure, Information Society and Media Directorate-General

Deutscher IPv6 Gipfel in Potsdam

24

Mittwoch, 7. Mai 2008

- **Keynote Session 02**
  Chair: *Latif Ladid, President International IPv6 Forum*
  - **Horishi Miyata**, Yokogawa Electric corporation, IPv6 Promotion Council Japan
  - **Prof. Dr. Sureswaran Ramadass**, President IPv6-Forum Malaysia
  - **Prof. Wu Hequan**, Director CNGI Network
  - **Dr. Eunsook Kim**, IPv6 Forum Korea
  - **Jean-Marie Bonnin**, Telecom Bretagne, NEMO
  - **Athanassios Liakopoulos**, GrNET

Empfang und Abendessen 19 Uhr / Dinner Reception at 7 pm

Deutscher IPv6 Gipfel in Potsdam

25

Donnerstag, 8. Mai 2008

- **Tutorial: Benedikt Stockebrandt:**
  IPv6 Funktionalitäten - Geschäftsmodelle - Deployment
- **Session 1**: OPERATORS & ISPs DEPLOYMENT
  Chair: *Dr. Bettina Kauth, DFN*
  - **Henning Grothe**, Deutsche Telekom
  - **Yves Poppe**, Director Business Development IP Services, VSNL International
  - **Wolfgang Fritsche**, Head of Internet Competence Center IABG
  - **Lutz Donnerhacke**, IKS GmbH

Deutscher IPv6 Gipfel in Potsdam

26

Donnerstag, 8. Mai 2008

- **Session 3**: IPv6 APPLICATIONS AND DEVELOPMENT (1)
  Chair: *Jacques Babot, European Commission*
  - **Carsten Hatzig**, BWB
  - **Bernard Ourghanlian**, CTO Microsoft Europe
  - **Tayeb BenMeriem**, EUv6 Task Force Steering Committee
  - **Lawrence Hughes**, infoWeapons
  - **Amardeo Sarma**, NEC Network Laboratories Europe

Deutscher IPv6 Gipfel in Potsdam

27

Donnerstag, 8. Mai 2008

- **Session 4**: IPv6 APPLICATIONS AND DEVELOPMENT (2)
  Chair: *Dr. Harald Sack, German IPv6 Council*
  - **David Kessens**, Nokia
  - **Rangali Chaporadza**, Fraunhofer Fokus
  - **Thomas Engel**, University of Luxembourg
  - **Latif Ladid**, President International IPv6 Forum

Deutscher IPv6 Gipfel in Potsdam

28

1. Warum ein nationaler IPv6 Gipfel?
2. Deutscher IPv6 Rat
3. Deutscher IPv6 Gipfel in Potsdam
4. **Gastgeber HPI**

IT-Systemtechnik

29

Moderne IT-Systeme können nicht mehr entworfen und betrieben werden, ohne die ingenieurwissenschaftlichen Erkenntnisse und Methoden der **IT-Systemtechnik**

IT-Systemtechnik basiert auf den

- Erkenntnissen und Entwicklungen der Informatik(wissenschaften)
- Erfahrungen bei Produktion und Einsatz solcher Systeme

und befaßt sich systematisch mit

- **Konzeption**
- **Entwurf**: Design, Architektur, Modellierung, Programmierung, Test, … und
- **Einsatz**: Korrektheit, Sicherheit, Performance, Wartbarkeit, Interaktionsschnittstellen, Anpassungsfähigkeit, …

von **komplexen IT-Systemen**

Mission und Ziele des HPI

30

- Angebot einer
  - **innovativen universitären Eliteausbildung**
  - auf dem Gebiet der IT-Systemtechnik
  - mit international anerkanntem Bachelor-, Master- und Doktor-Abschluss
- International prägende Einflussnahme auf die **ingenieurwissenschaftliche Forschungen** im Bereich der IT-Systemtechnik, wobei sich das HPI vornehmlich auf den Softwareaspekt konzentriert → Softwaresystemtechnik
- Beiträge zur Entwicklung einer **Ingenieurkultur** in der IT-Branche

Eliteausbildung am HPI beinhaltet …

31

Fundierte universitäre Ausbildung in den technologischen Grundlagen der IT-Systemtechnik und

- Vermittlung ingenieurswissenschaftlicher Kenntnisse und Erfahrungen
- Besondere Schulung im kreativen Design und der prototypischen Problemlösung
- Befähigung zur interdisziplinären Teamarbeit
- Erste Einsicht in Praxis eines IT-Systemingenieurs
- …

CHE-Ranking 2006:

- 4. Platz unter allen deutschsprachigen universitären Informatikstudiengängen

HPI – Das Hasso-Plattner-Institut

32

- HPI wird finanziert durch private Stiftung von Hasso Plattner (> 200 Mio € in 20 Jahren !)
- Prof. Hasso Plattner ist einer der Gründer von SAP, dem weltweit drittgrößten IT-Unternehmen
- Verbindung zur Universität Potsdam regelt Kooperationsvertrag: HPI ist An-Institut der Uni Potsdam
- Momentan ca. 420 Studierende

Erster Nationaler IT-Gipfel

33

Zur Beratung der weiteren Entwicklung und Stärkung des IT-Standorts Deutschland hat Bundeskanzlerin Dr. Angela Merkel am 18.12.2006 aus Politik, IT-Industrie und Wissenschaft 120 Spitzenleute zum

- ersten nationalen **IT-Gipfel**

an unser HPI eingeladen.

→ Verabschiedung einer Potsdamer Erklärung

IT-Gipfel Impressionen

34

HPI – Lehre und Forschung

35

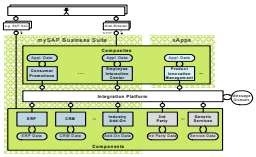
- Gute universitäre Lehre benötigt engagierte und international renommierte Professoren und Dozenten
- Am HPI wird deshalb in der Forschung großen Wert gelegt auf
  - wissenschaftliche Exzellenz,
  - Praxisnähe und
  - enge Kooperation mit der Industrie
- Die HPI-Studenten profitieren davon: Die Forschungsprojekte sind eng mit der Lehre verzahnt
- Es bestehen zahlreiche Kooperationen mit der Industrie und anderen Universitäten. Besonders hervorzuheben ist die Verbindung zur renommierten Stanford University in Palo Alto, USA

HPI – Fachgebiete

36

Enterprise Platforms and Integration Concepts
Prof. Dr. h.c. Hasso Plattner

- Die Forschung ist ausgerichtet auf die technischen Aspekte von Unternehmenssoftware und die Integration verschiedener Softwaresysteme zu einem Gesamtsystem im Sinne des Anwenders
- Einrichtung eines Forschungslabors „Enterprise Application Architectures Lab"

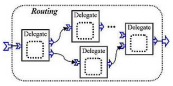


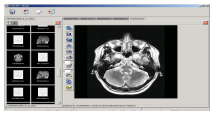
HPI – Fachgebiete

37

Internet Technologien und -Systeme
Prof. Dr. Christoph Meinel

- Entwicklung von Techniken und Methoden zum Security Engineering → Lock-Keeper, Telelab IT-Security, SOA-Security, …
- Anwendungen auf dem Gebiet der Telemedizin → jPACS, …
- Entwicklung innovativer Formen des Lehrens (Tele-Teaching) und Lernens (E-Learning) → tele-TASK



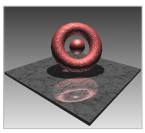


HPI – Fachgebiete

38

Computergrafische Systeme
Prof. Dr. Jürgen Döllner

- Befasst sich mit der Analyse, Planung und Konstruktion computergrafischer und multimedialer Systeme
- Den Kontext dieser Thematik bildet die Kommunikation zwischen Mensch und Maschine

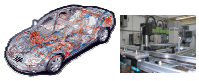
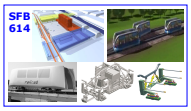




HPI – Fachgebiete

39

System Analysis and Modeling
Prof. Dr. Holger Giese
Main topics in research and teaching

- Model based development of reliable, flexible software systems (automotive, atomization, railway technologies, …)
- Modeling of flexible systems with scenarios, pattern, components and services
- Analysis and Synthesis of flexible systems (correctness, security, real time behavior, failure tolerance)
- Integration of tools and models (model transformation, model synchronization, correctness of model-transformations)

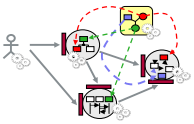
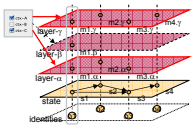



HPI – Fachgebiete

40

Software-Architekturen
Prof. Dr. Robert Hirschfeld

- Neue Programmierparadigmen, Entwicklungs- und Betriebsumgebungen für kontextabhängige Anwendungen
- Dynamische Dienstanpassung
- Distributed Processing Environments
- Aspekt- und Context-orientiertes Programmieren

HPI – Fachgebiete

41

Informationssysteme
Prof. Dr. Felix Naumann

- Untersucht wird der effizientere und effektivere Umgang mit heterogenen Informationen in großen, autonomen Systemen.
- Dazu zählen Methoden
  - der Informationsintegration,
  - der Informationsqualität und Datenreinigung,
  - der Informationssuche und
  - des Metadatenmanagements.

HPI – Fachgebiete

42

Betriebssysteme and Middleware
Prof. Dr. Andreas Polze

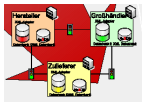
- Entwicklung von Entwurfsmustern Programmierparadigmen, und Beschreibungstechniken für große, verteilte Komponentensysteme
- Verbindung von Middleware und eingebetteten Systemen und deren vorhersagbares Verhalten in Bezug auf Echtzeitfähigkeit, Fehlertoleranz und Sicherheit


HPI – Fachgebiete

43

Business Process Technology
Prof. Dr. Mathias Weske

- Entwicklung neuartiger Modelle, Methoden und Techniken zur Unterstützung wissensintensiver und flexibler Geschäftsprozesse
- Besonders interessieren dabei die Sprachen und Konzepte zur Modellierung dieser Prozesse

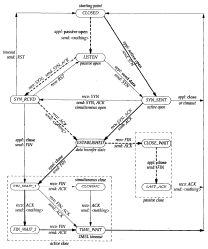


HPI – Fachgebiete

44

Kommunikationssysteme
Prof. Dr. Werner Zorn

- Ganzheitliche Betrachtung von Kommunikationssystemen allgemeiner Art
- Dies reicht von einfachsten Punkt-zu-Punkt Übertragungseinrichtungen bis hin zu komplexen verteilten Transaktionssystemen mit gemischtem Informations-, Waren- und Personenverkehr



HPI-Professor ist Internet-Pionier des deutschen und chinesischen Internets

45

Am 02.08.1984 Empfang der ersten deutschen E-Mail durch HPI Professor Werner Zorn unter zorn@germany

- Ab diesem Zeitpunkt hing Deutschland als vierte Nation am Computer Science Net CSNET, einer der wesentlichen Keimzellen offener weltweiter E-Mail-Kommunikation
- Juli 2006: Verleihung des Bundesverdienstkreuzes am Bande an Prof. Zorn als einen der Gründungsväter des deutschen Internet

1989 Gründung des Internet Service Provider „Xlink" als Hochschulprojekt

- Erste deutsche Internet-Standleitung in die USA
- Aus „Xlink" entwickelte sich etwa ein Drittel des heutigen deutschen Internets

HPI-Professor ist Internet-Pionier des deutschen und chinesischen Internets

46

Parallel zum Aufbau einer E-Mail-Verbindung in die USA Aufbau einer Internetanbindung nach China

- Ab 1987 Verwaltung der chinesischen Internetadressen in Karlsruhe, Deutschland
- 1994 Aufbau einer eigenen Internetanbindung von China über den Pazifik und eigenständige Verwaltung des E-Mail-Verkehrs auch dank der langjährigen Vorarbeit von Prof. Zorn
- 1999 Verleihung des Special Award an Prof. Zorn im Rahmen der Festveranstaltung "5 Jahre Internet in China"

Teleteaching

47

- Seit Sommersemester 2002 Aufzeichnung von Lehrveranstaltungen, Konferenzen und Kolloquien am HPI mit der neuartigen tele-TASK-Technologie
- Jeder Internet-Nutzer kann Vorlesungen und Vorträge online verfolgen und damit Einblick in die Lehre und Forschung am HPI nehmen
- Plattform www.tele-task.de bietet kostenfrei zugänglich live oder on demand mehr als 1000 Vorlesungsaufzeichnungen. Bisher etwa 10 Mio Zugriffe!
- Voraussetzungen: Internetzugang und kostenlose Betrachtungs-Software "RealPlayer„ oder Zugang über iPod

Internet-Brücke von Potsdam nach Peking

48

Rund 70 chinesische Informatik-Studenten der Technischen Uni von Beijing nehmen per Teleteaching an Vorlesungsreihe von Prof. Meinel teil

- Eine reguläre Vorlesungsreihe am HPI wird aufgezeichnet und übers Internet auf den Server der TU Beijing übermittelt
- Vorlesungsaufzeichnungen werden zu den örtlichen Vorlesungszeiten im Hörsaal abgerufen und vorgeführt

Thema

- **„Internet Security – Weaknesses and Tragets"**

Reguläre Lehrveranstaltung

- Regulärer Übungsbetrieb angeleitet von chinesischen Assistenten
- mündliche Prüfung der chinesischen Vorlesungsteilnehmer erfolgt vor Ort in Peking

Fachgebiete am HPI

49

… HPI-übergreifende Doktorandenschule mit z.Z. 22 PhD-Studenten

Research School on Service-oriented Systems Engineering

User Interfaces | Enterprise Platforms | Internet-Technologies | Computer Graphics | Operating Systems | Business Processes | Communication Systems | Software-Architectures | Information Systems

IT-Systems Engineering

Hasso Plattner Institute of Design „D.School" – Stanford University

50

- Gegründet 2005 an der Stanford University
- Getragen von den Dept. Mechanical Engineering-, Computer Science-, Industrial Design- and Business-Department
- einjähriger
- Ausbildungsgang
- Innovation
- interdisziplinär

Stanford, Entrance d.school, Sweet Hall

Prof. David Kelley *(Industrial Design)* | Prof. Larry Leifer *(Mechanical Engineering)* | Prof. Terry Winograd *(Computer Science)*

Ziel der Ausbildung: Create the best DESIGN THINKING

51

- ZUKÜNFTIGE INNOVATORen **ausbilden mit erfinderischem Geist und großer Tatkraft**
- DESIGN THINKING **nutzen zur Inspiration multidisziplinärer Teams**
- RADIkALE KOLLABORATION **fördern zwischen Studenten, Professoren und externen Partnern**
- GROßE PROJEKTE **anpacken und mittels Prototyping neue Lösungen entdecken**

HPI Potsdam: School of Design Thinking

52

- Gegründet im Mai 2007 am HPI, Potsdam
- Leitung durch Prof. Uli Weinberg
- zweisemestrige Zusatzausbildung
- Innovation driven
- interdisziplinär
- ohne Studiengebühren

School of Design Thinking, Potsdam

Prof. Hasso Plattner

Prof. Christoph Meinel

Prof. Ulrich Weinberg

Fachgebiete am HPI

53

HPI - School of Design Thinking

User Interfaces | Enterprise Platforms | Internet-Technologies | Computer Graphics | Operating Systems | Business Processes | Communication Systems | Software-Architectures | Information Systems | Andere Universitäten in BB

Research School on Service-oriented Systems Engineering

Hasso Plattner Ventures

54

- Im Herbst 2005 startete die von Hasso Plattner ebenfalls initiierte und finanzierte, in Deutschland einmalige, Start-UP-Fördereinrichtung
- Hasso Plattner Ventures ist eine neue Kombination aus Venture-Capital-Fonds und Business Inkubator
- Sitz auf dem HPI-Campus sorgt für unmittelbare Nachbarschaft und enge Zusammenarbeit zwischen HPV und HPI

HassoPlattnerVENTURES

Vielen Dank für Ihre Aufmerksamkeit

55

Kontakt:

Prof. Dr. Christoph Meinel
Hasso Plattner Institut
IT Systems Engineering | Universität Potsdam
Campus Griebnitzsee
14482 Potsdam
Tel: 0331 5509-0

http://www.hpi-web.de

VIVIANE REDING

Personal details

Born on 27 April 1951 in Esch-sur-Alzette, Luxembourg, separated, three children

Education: Doctor of human sciences, Sorbonne, Paris

Professional career

1978-1999 Journalist, Luxemburger Wort
1986-1998 President, Luxembourg Union of Journalists

Political career

1979-1989 Member of Luxembourg Parliament
- President of social committee
- Member of the Office of the Chamber of Deputies
- Member of the Assembly of Benelux Parliaments
- Member of the North Atlantic Assembly (leader of Christian Democrat/Conservative group)

1981-1999 City councillor, city of Esch-sur-Alzette
- President of Cultural Affairs Committee 1992-1999

1988-1993 National president of Christian-Social Women

1995-1999 Vice-president, PCS (Parti Chrétien-Social)

1989-1999 Member of the European Parliament
- President of the Petitions Committee 1989-1992
- Vice-president of Social Committee 1992-1994
- Vice-president of Civil Liberties and Internal Affairs Committee 1997-1999
- Head of Luxembourg delegation to EPP
- Member of EPP group office

1999-2004 Member of the European Commission (Education, Culture, Youth, Media, Sport)

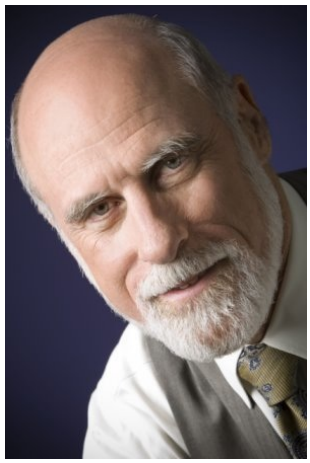
2004- Member of the European Commission (Information Society and Media)

Prizes and distinctions

1992 St George's Cross from the Generalitat of Catalunya
2001 Gold Medal of European Merit
2004 Doctorate Honoris Causa from the Hu Chen University of Taiwan
2004 Doctorate Honoris Causa from the University of Genoa
2004 Robert Schuman Medal
2004 Doctorate Honoris Causa from the University of Torino
2004 Prince of Asturias International Cooperation Prize
2005 "Gloria Artins" Medal of Honour from Poland
2005 Officer of the national Order of the French Legion of Honour

IPV6, ITS TIME HAS COME

VINTON CERF



Vinton G. Cerf is vice president and Chief Internet Evangelist for Google. He is responsible for identifying new enabling technologies and applications on the Internet and other platforms for the company.

Widely known as a "Father of the Internet," Vint is the co-designer with Robert Kahn of TCP/IP protocols and basic architecture of the Internet. In 1997, President Clinton recognized their work with the U.S. National Medal of Technology. In 2005, Vint and Bob received the highest civilian honor bestowed in the U.S., the Presidential Medal of Freedom. It recognizes the fact that their work on the software code used to transmit data across the Internet has put them "at the forefront of a digital revolution that has transformed global commerce, communication, and entertainment."

From 1994-2005, Vint served as Senior Vice President at MCI. Prior to that, he was Vice President of the Corporation for National Research Initiatives (CNRI), and from 1982-86 he served as Vice President of MCI. During his tenure with the U.S. Department of Defense's Advanced Research Projects Agency (DARPA) from 1976-1982, Vint played a key role leading the development of Internet and Internet-related data packet and security technologies.

Vint Cerf served as chairman of the board of the Internet Corporation for Assigned Names and Numbers (ICANN) from 2000-2007 and he has been a Visiting Scientist at the Jet Propulsion Laboratory since 1998. He served as founding president of the Internet Society (ISOC) from 1992-1995 and was on the ISOC board until 2000. Vint is a Fellow of the IEEE, ACM, AAAS, the American Academy of Arts and Sciences, the International Engineering Consortium, the Computer History Museum and the National Academy of Engineering. . In April 2008, Cerf and Kahn will receive the prestigious Japan Prize.

Vint has received numerous awards and commendations in connection with his work on the Internet, including the Marconi Fellowship, Charles Stark Draper award of the National Academy of Engineering, the Prince of Asturias award for science and technology, the Alexander Graham Bell Award presented by the Alexander Graham Bell Association for the Deaf, the A.M. Turing Award from the Association for Computer Machinery, the Silver Medal of the International Telecommunications Union, and the IEEE Alexander Graham Bell Medal, among many others.

He holds a Ph.D. in Computer Science from UCLA and more than a dozen honorary degrees.

ABSTRACT

It is now abundantly clear that the IPv4 unique address space is going to run out sometime in the period around 2010-2012. For over a decade a standard alternative has been available, IPv6, that supports up to 340 trillion trillion trillion addresses. There are various ways of structuring these addresses, so perhaps the resulting network environment might support a smaller actual number of terminations but this value vastly exceeds the current 4.3 billion unique addresses of IPv4.

For the most part, IPv6 software is available for client and server operating systems and in routers. Many of the current products have IPv6 included and ready to be activated. Internet Service Providers have been slow to implement this additional capability on the grounds that their customers are not demanding it. Significant Internet companies such as Google have begun testing IPv6 access to their services and it is expected that ISPs will be more responsive as demonstrated need and interest in the service increases. This is not a "flag day" cutover exercise but rather the addition of a second address space in parallel, while this makes operations somewhat more complex, it does allow for a lengthy transition during which both protocols can be supported. Because IPv4 and IPv6 are not directly interoperable, it is vital that everyone implement IPv6 before the last IPv4 addresses are assigned, otherwise the full connectivity of the Internet will become fragmented and awkward means such as proxies may be needed to bridge the gaps.

DIE BEDEUTUNG VON IPV6 FÜR DIE ÖFFENTLICHE VERWALTUNG IN DEUTSCHLAND

MARTIN SCHALLBRUCH

Dipl.-Inform. Martin Schallbruch, geb. 1965, ist seit 2002 IT-Direktor (Chief Information Officer) im Bundesministerium des Innern. In dieser Funktion ist er verantwortlich für die IT-Strategie und IT-Koordinierung des Bundes, die eGovernment-Initiativen Deutschland-Online und E-Government 2.0, die Sicherheit in der Informationstechnik sowie Pässe, Personalausweise und Meldewesen.

ABSTRACT

IPv6 ist für uns im Zusammenhang mit der Neukonzeption der Netzinfrastrukturen in der öffentlichen Verwaltung nicht nur ein technisches Feature sondern Notwendigkeit. Mit Hilfe des neuen Protokolls wird eine barrierefreie ebenenübergreifende Kommunikation innerhalb der öffentlichen Verwaltung möglich und die Einführung moderner Multimedia-Dienste wesentlich vereinfacht.

TOWARDS THE FUTURE OF THE INTERNET

PROF. LUTZ HEUSER

Professor Lutz Heuser, Vice President SAP Research and Chief Development Architect at SAP AG, is responsible for the overall research portfolio management.

His areas of expertise include Internet of Services, Internet of Things, RFID (Radio Frequency Identification) as well as the web-based service industry. He further initiated a number of research initiatives in the field of software technology for emerging economies and is active in this area on a global basis.

Professor Heuser joined SAP AG in 1999. Prior to his appointment at SAP AG, he was Director of the European Research Organization at Digital Equipment Corporation and member of the extended executive board of the German subsidiary of Digital Equipment.
Professor Heuser was co-founder of the CEC Karlsruhe.

Professor Heuser is a Visiting Professor at the National University of Paraguay and an Adjunct Professor of the Queensland University of Technology in Brisbane. In 2004, he was awarded an Honorary Professorship at the Technical University Darmstadt He has been a member of acatech (German Academy for Technological Sciences) and the Feldafinger Circle since 2006. In the same year he also became Chairman of the IRF (International Research Forum) a high level Think Tank regarding IT trends.

In 2007 Professor Heuser became Chairman of ISTAG (Information Society Technologies Advisory Group), a member of the supervisory board of the VDE (Association for electrical, electronic & Information Technologies), as well as a member of the Research Committee of the Munich Circle, a Think Tank dedicated to communications research.

ABSTRACT

The Future Internet needs to support the next phase of the services-based economy and media convergence. Worldwide trends in development, business and technology shape the requirements for the evolution of the network infrastructure. As chairman of the Information Society Technologies Advisory Group (ISTAG), Prof. Heuser will share with you this group's joint perspective on the Future Internet. Putting IPv6 technology into the broader context of the business and social drivers can help us to derive a better focus on research investments into technology and roll-out to maximize their impact. Thus, the talk will also present the promises of IPv6 and evaluates them under this business driven view.

Towards the Future Internet

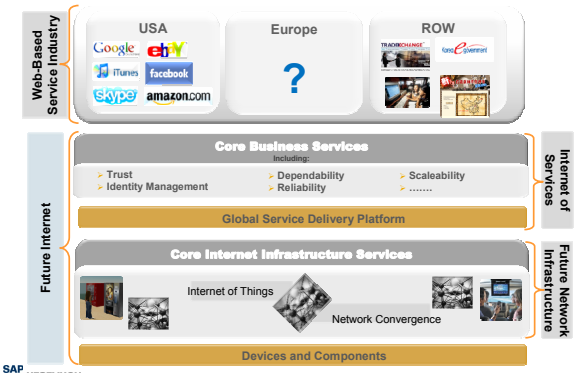
SYSTEMATIC THOUGHT LEADERSHIP FOR INNOVATIVE BUSINESS

Lutz Heuser
Vice President SAP Research

May 7, 2008

SAP RESEARCH THE BEST-RUN BUSINESSES RUN SAP

The Future Internet – Big Picture



SAP

The Future Internet – Infrastructure

CHARACTERISTICS

- Connectivity services.
- Computing resources as services.
- Supports "horizontal services" such as identity, trust and scalability.
- Use of web 2.0, semantic technologies and service-oriented architecture.
- Audio and video will become the bulk of the traffic.
- Enhanced sensor nodes and embedded systems.
- Real-world awareness.

SAP RESEARCH

The Future Internet – European Research Agenda

SUGGESTED FOCUS

- The Internet of Services (IoS)
  - Low entry barriers for provisioning and consumption of services.
  - IoS forms an open platform for tradable, composed, value-added services on the Internet.
  - The service consumer will get customized services.
  - Jointly address legal, security, business and technological aspects.
- The Internet of Things (IoT)
  - A world where physical objects are seamlessly integrated into the information network.
  - Physical objects can become active participants in business processes.
  - Research Challenge: How can technical issues, e.g. managing the convergence with the IoS, be solved?
- A new service-oriented network infrastructure
  - New generation of ICT utility infrastructure for providing services.
  - Technical integration of the "Internet of Services" and the "Internet of Things".

SAP RESEARCH

IPv6 – Contributions

- **Address Space**
- **Security**
- **Quality of Service**
- **Direct Connectivity**

SAP RESEARCH

IPv6 Related Recommendations – Address Space

Make basic services usable for every internet user!

- Increase the number of available addresses.
- Only an IPv6 customer can use an IPv6 service.
- Critical mass is the key feature for IPv6 success.
- Importance for emerging economies and for the Internet of Things.

So just roll it out!

SAP RESEARCH

IPv6 Related Recommendations – Security

Indeed, infrastructure security is relevant for IPv6!

- Routing & name-resolution security research topics are well covered by IPv6.

Go for it and enlarge deployment investments!

But most security issues can only be solved on the application layer!

- Security is what keeps you from getting your work done!

Leave most security aspects on appliation layer!

SAP RESEARCH

IPv6 Related Recommendations – Quality of Service

Quality of Service is not a technical issue anymore!

- For the vast majority of applications simple overprovisioning or multi-homing is enough.

Today, this is not an issue!

SAP RESEARCH

IPv6 Related Recommendations – Direct Connectivity

IPv6 enables direct connectivity!

- IPv4 address space work arounds often not perceived as limiting because they offer a degree of protection as well.
- In a world of connected devices, direct connectivity is a must!

Internet of Things is a key driver for IPv6 relevance!

SAP RESEARCH

IPv6 – Conclusion Part I

RECOMMENDATIONS FOR INVESTMENTS IN LAYER 3

Address Space

Security

Quality of Service

Direct Connectivity

SAP RESEARCH

The Future Internet – Conclusion Part II

RECOMMENDATIONS

- Common global standards in the network and service infrastructure.
- Large scale and generic test-beds / living labs early in the research life cycle to follow the rapidly rising business model of the web-based service providers.
- Enable cross-lingual dynamic business relationships and value networks.
- Forums and dialogue with all stakeholders in the Future Internet parallel to the technology research at as early stage as possible.

SAP RESEARCH

Thank you!

SAP RESEARCH

IPV6 STRATEGY & DEPLOYMENT STATUS IN JAPAN

HIROSHI MIYATA

He graduated from the Faculty of Science, the Hokkaido University in
1988. He joined Yokogawa Electric Corporation in 2001. He has been working for TAHI Project (1) since 1998 to research the testing technologies for IPv6. He leads the TAHI Project. He also has been working for IPv6 Ready Logo Committee as the Technical leader and Asian officer since 2002. He has been working for Certificatioin Working Group in IPv6 Promtion council as a vice-chair since 2002.

Also he has been researching on IPv6 adaptation to industry automation which requires high reliability and real-time communications.

ABSTRACT

This presentation introduces the IPv6 deployment status in Japan as well as the strategy how Japan has been working on IPv6.
In Japan, the industry and government has started the preparation for the IPv4 address shortage. And some applications like sensor network is being deployed.
This presentation also introduces the study of IPv6 adaptation to industry automation system.

IPv6 Strategy & Deployment Status in Japan

Hiroshi Miyata
Manger, Corporate R&D Center, Yokogawa Electric Corporation
IPv6 Forum Fellow
Vice Chair, Certification WG, IPv6 Promotion Council

Agenda

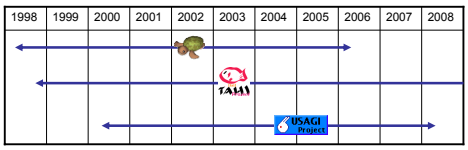
- The Strategy of Japan
- Product, Application and Service
- Challenge for the future of industry automation
- Conclusion

The Strategy of Japan

R&D (WIDE Project)
Promotion (IPv6 Promotion Council, Japan)
Government

Reference Code & Test System

- KAME Project (Apr. 1998 - Mar. 2006)
  - Reference Code for *BSD
- USAGI Project (Apr. 2000 - Mar. 2008)
  - Reference Code for LINUX
- TAHI Project (Oct. 1998 -)
  - Test Tool for all IPv6 Implementation



IPv6 Promotion Council (1/2)

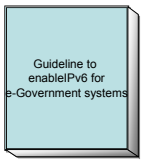
- Established
  - October, 2000
- Members
  - 170+ organizations, corporation, individuals
  - From, ISP, ASP, vendor, users, etc…
- Objective
  - Establishment and Implementation of Basic Strategies to promote IPv6 domestically and globally
  - Establishment and Implementation of IPv6 Transition Environment
  - Verification and certification of IPv6 products and services
  - R&D on advanced functions with IPv6 platform
  - Development of applications and services over IPv6 platform
  - Professional quality testbed operation
  - Development of human resources for IPv6 deployment

IPv6 Promotion Council (2/2)

- Activity
  - Research
    - Strategy WG
    - Application WG
    - Transition WG
    - Certification WG
    - Diplomacy WG
  - Promotion
    - Holding the events
    - Participating to the events
    - Showroom
      - Galleliav6
        - » 2001 - 2008
        - » Tentatively closed

e-Government (1/2)

- **The Guideline to enable IPv6 for e-Government systems**
  - The Ministry of Internal Affairs and Communications(MIC) Published in Apr. 2007
  - Contents
    - Planning of Migration to IPv6
    - Network design
    - Application
    - Security
    - Example

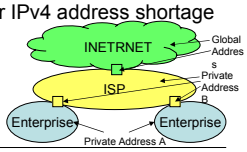


e-Government (2/2)

- **Optimization Plan for "e-Government"**
  - Japanese Government stated optimization plan in "e-Government implementation plan"
    - Each ministry stated their IPv6 introduction plan
      - Cabinet Office
        - » Start IPv6 introduction from FY2007
        - » Explicitly require IPv6 in RFP
      - Ministry of Finance
        - » Require Information-communication device to support IPv6 by FY2008
      - Ministry of Health, Labour and Welfare
        - » Explicitly require IPv6 in RFP
      - Ministry of Economy, Trade and Industry
      - Ministry of Foreign Affairs
      - Ministry of Agriculture, Forestry and Fisheries

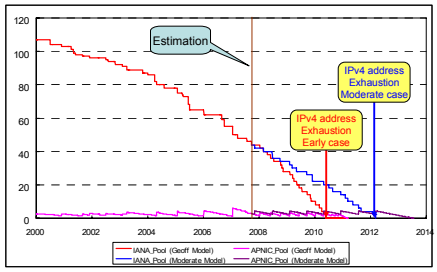
Study of smooth migration (1/3)

- MIC organizes the study group
- Members are from
  - ISP, Career, Academic, Industry, User, etc..
- The report (candidate) is under public review
- Contents
  - They estimated the exhaustion date by themselves
  - Proposal solution to get over IPv4 address shortage
    - Combining two approach
      - Dual IPv4 NAT/NAPT
      - Gradual migration to IPv6
  - Recommended action plan



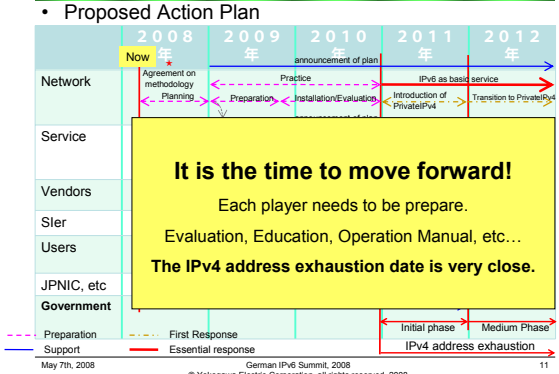
Study of smooth migration (2/3)

- The estimated time is almost same as Geoff's
  - 2010 - 2012



Study of smooth migration (3/3)

- Proposed Action Plan



It is the time to move forward!

Each player needs to be prepare.

Evaluation, Education, Operation Manual, etc…

The IPv4 address exhaustion date is very close.

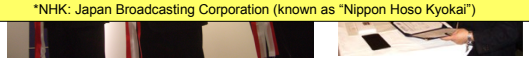
IPv6 Certification Center

- JATE Joined to IPv6 Ready Logo Program in November 2007
- JATE launched *IPv6 Certification Center* on April 2008

JATE

MIC officially announced to consumer to choose IPv6 marked(IPv6 Ready Logo) devices when they buy the new devices for further compatibility.
And the announcement was broadcasted on NHK* News.

*NHK: Japan Broadcasting Corporation (known as "Nippon Hoso Kyokai")

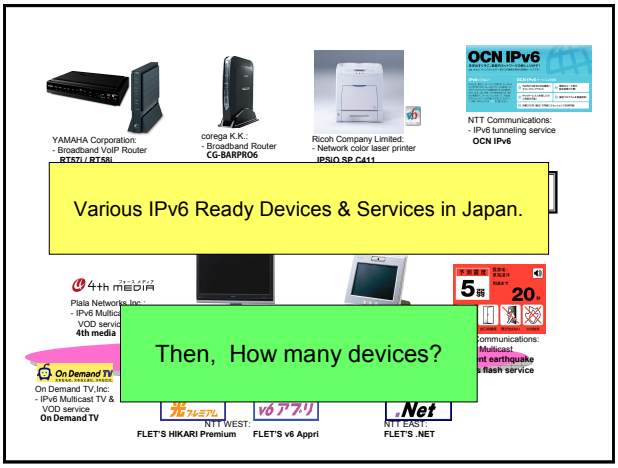


JATE: Japan Approvals institute for Telecommunications Equipment

The Ministry of Internal Affairs and Communications supports this!

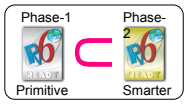
Products, Applications & Services

IPv6 Ready Products
Environmental activities
- Live E!
- Facility Management



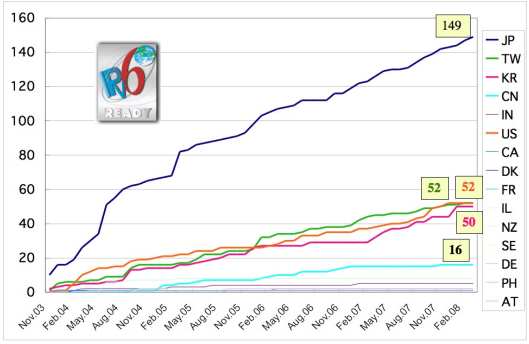
What is IPv6 Ready Logo Program

- Objective
  - **Message of the readiness of IPv6**
  - **Improve interoperability of IPv6 implementations**
  - **Totally: Make users to feel easy to use IPv6**
- Operation
  - IPv6 Ready Logo Committee
    - Sub-committee of IPv6 Forum
- Two kinds of Logo
  - Phase-1
    - Focusing on Interoperability between IPv6 implementations
  - Phase-2
    - Focusing on Professional Use
- Fee
  - Totally Free of Charge!



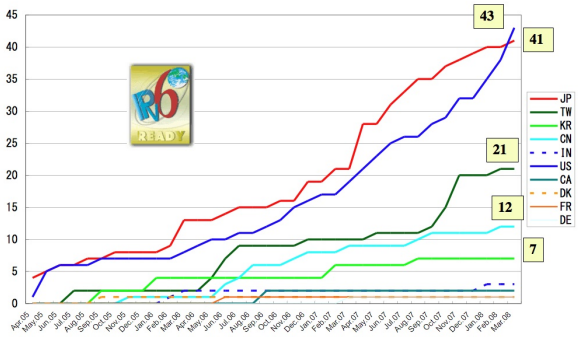
Phase1 Logo Trend

as of March 31st, 2008



Phase2 Logo Trend

as of March 31st, 2008

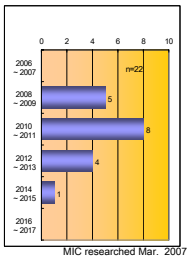


IPv6 Commercial Service in Japan

Available services

Corporation	For Individual	For corporation
NTT Communications	IPv6 Internet	IPv6 Internet
NTT East	IPv6 Closed Network	IPv6 VPN
NTT West	IPv6 Closed Network	IPv6 VPN
KDDI		IPv6 Internet
IIJ		IPv6 Internet
Nifty	IPv6 Internet	
FreeBit	IPv6 Internet(Tunnel)	
IIJ mio	IPv6 Internet(Tunnel)	
NTT-ME(XePhion)		IPv6 Internet

When more than 50%
Of ISP will fully support IPv6?



MIC researched Mar. 2007

Environmental Activities

"Live E!" Project
-- Sensor network for the earth --

http://www.live-e.org/

Facility Management
- Facility management trial
- Tokyo Metropolitan Gov.
- Daiei
- Green-UT Project

The environmental situation in Japan

- Energy Saving and Preserving the EARTH is "Global agenda"
- Kyoko Protocol
  - Goal of Japan : -6% by 2012
  - as of 2006 : +6.4% (12.4% difference)
- Japan is "Heat Island"
  - Tokyo is becoming SUBTROPICAL ZONE

Subtropical Butterfly can live in Tokyo.
http://miyuken.com/ken/archives/2006/08/post_1071.php

Subtropical Plants are increasing.
http://www.tokyo-gas.co.jp/env/essay/200709/esy1.html

Subtropical Fishes are breeding around Tokyo.
http://miyuken.com/ken/archives/2006/08/post_1071.php

And More….

Live E! : Environmental Information System

- Live E! is a consortium that promotes the deployment of new infrastructure that can generate, collect, process, and share all the "Environmental Information", associated with the Earth
- As the first step, we picked up "Digital Weather Station"
- Individuals, non-commercial and commercial organization install sensor nodes, and let the information available from anyone on the Internet.
- Larger number of participation leads richer information and for all, and creates innovative applications and usage of information.
- Single information can be used multiple purposes

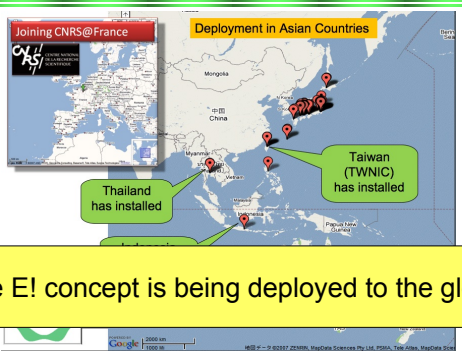
Multiple purposes

- Education Materials
- Public services
- Business applications

Digital Weather Station

Wind gage
Rain gage
Air gage

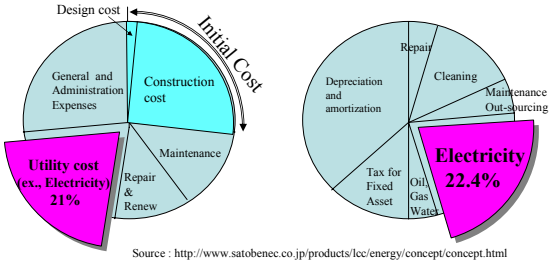
Live E! : Digital Weather Station deployment



Live E! concept is being deployed to the glove!

Why Facility Management is focused?

Life-time cost in Building System

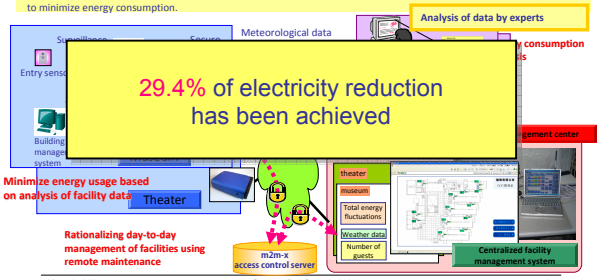


Source : http://www.satobenec.co.jp/products/lcc/energy/concept/concept.html

Facility management Trial

by NTT Communications

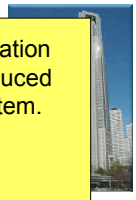
IPv6 based P2P control of facilities
- Status of elevators, AC or ventilators, movement of guests in the museum, temperature of rooms, surveillance camera images may be monitored in a facility management center.
- Shared use of networks among IP phone, Internet access and facility management.
- Cost reduction
- Where experts' analysis of data on the number of guests in respective rooms and temperatures are available, it is possible to minimize energy consumption.



29.4% of electricity reduction has been achieved

Tokyo metropolitan government

- The study group formed to discuss on updating "Management system of Tokyo metropolitan government building" (Apr. 2004)
- Installing the remote management system of air conditioning system to high school belonging to Tokyo metropolitan government (FY2007)



Through the discussion and demonstration Tokyo metropolitan government introduced IPv6 based Facility Management system. They have realized the effect. Now they are expanding the system to their legacy facility.

Daiei (Super-market-Store in Japan)

- Objective
  - Energy (Electricity) saving in their chain-stores
- Target
  - All facilities in the store
- What they did
  - Real-time displaying of volume of electricity consumption at each section.(Started in January. 2006)
- Result
  - 12 % of electricity saving

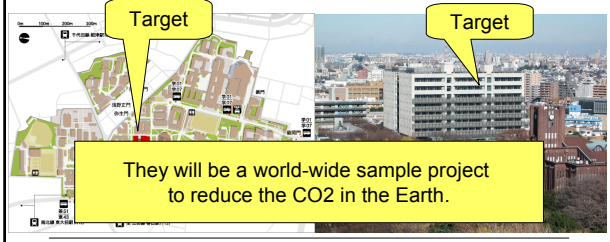
Just visualizing the consuming Energy is effective for energy saving!

Green-UT Project (1/2)

- Objective
  - Research how to save the energy by using ICT
- Background
  - UT(The University of Tokyo) is one of the biggest electricity consumer in Tokyo area
  - UT President committed (April 11th , 2008)
    - Reduce amount of CO2 emission
      - 15% until (2012)
      - 50% until (2030)
- Players
  - Joint Effort of v6PC Japan and University of Tokyo

Green-UT Project (2/2)

- Building No. 2 of Engineering Department, Hongo Campus
  - 12 floor high, R&D and R&E activities



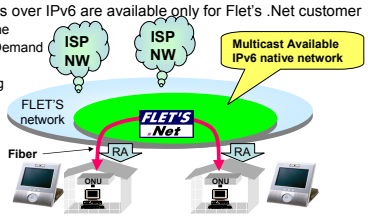
They will be a world-wide sample project to reduce the CO2 in the Earth.

Facility Networking Interoperability Consortium (FNIC)

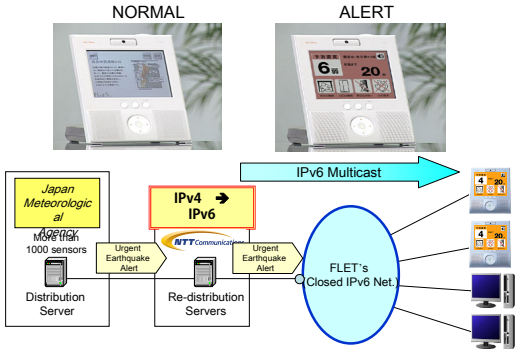
[Founders]
Keio Univ.
Univ. of Tokyo
WIDE Project
Yokogawa
Echelon
Panasonic(MEW)
Shimizu
NTT Data
NTT East
NTT Facilities
Yamatake
Toshiba
Daidan
NTT Communications
IRI Ubiteq
Furukawa
Intec Netcore
Johnson Control
Siemens Bldg Tech.
Broadband Eng.

FLET'S .NET by NTT-EAST

- "FLET'S" is the access line for ISP
  - NTT-EAST covers eastern half of Japan
- ".Net" is IPv6 native network
  - More than 126K subscribers (as of Mar. 2007)
  - Closed network
  - Multicast available
  - Some Services over IPv6 are available only for Flet's .Net customer
    - Video Phone
    - Video On Demand
    - Broadcast
    - File Sharing
    - Etc…

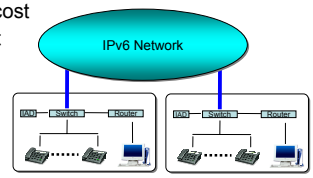


Urgent Earthquake Alert system by NTT Communications



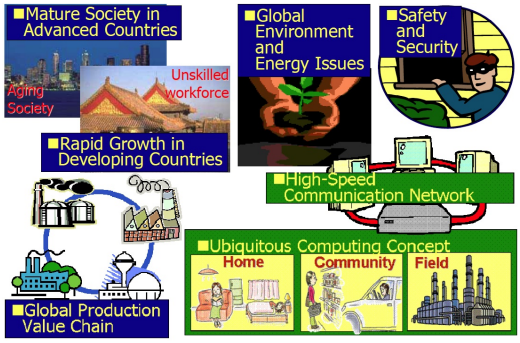
Nation Wide IP-Phone by FreeBit

- Almost 30K terminals
- Pure IPv6 Network
- Dormitory IP-phone system
- Benefit
  - Reduce network design cost
  - Reduce installation cost
  - Reduce running cost
  - Configuration Free



Challenges for the future of Industry automation

Future trend in industry automation and ICT



Requirement for Industry Network

- Essential Requirement (3R)
  - Absolute **R**eliability
  - Deterministic **R**esponse Time
  - Deep **R**eal Time
- Advanced Requirement
  - Security
  - Flexibility
  - Introducing new technologies
  - Reduce the wire
- Lifetime
  - 10 - 30 years

Resetting Culture
Best Effort Culture
} **UNACCEPTABLE**

IP installation to Industry Automation

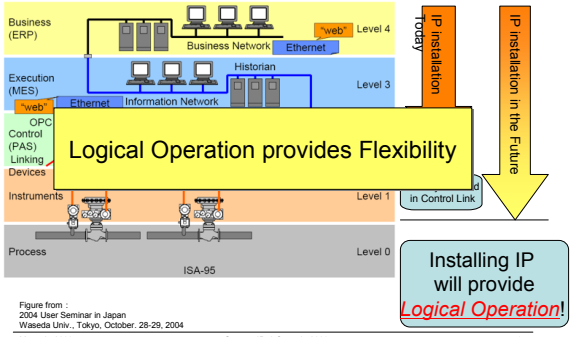
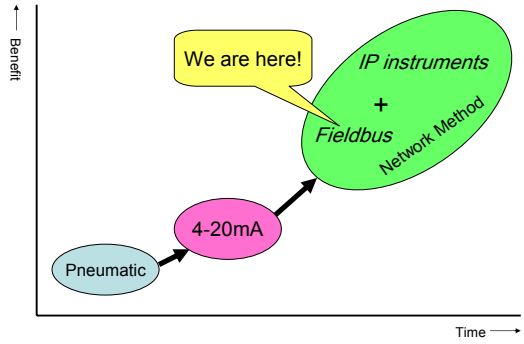


Figure from :
2004 User Seminar in Japan
Waseda Univ., Tokyo, October. 28-29, 2004

Innovation in the Industry Automation



Issues for IP Instrumentation

- Reliability
- Real-time Communication
- Compatibility with existing system
- Electric Power Restriction
- Wire Length
  - 2KM
  - (Maximum length of Ethernet : 100M)
- Resource Restriction
  - Memory size (e.g., 512Kbyte)
  - CPU Power (e.g., H8 20MHZ)
- Security
  - Confidentiality
  - Authentication

IP Instrumentation requires offlink communication as well as onlink communication

IPv6 Chip w/ Encryption Authentication

+

Kerberized Internet Negotiation of Keys (KINK)

+

IPsec

Road to IP Instrumentation

Stage 1: Fieldbus

Mutual supplement will cause the new innovation!

Stage 2: IP Instrumentation

Overcome shortcomings of IP

IP Instrumentation World

Break plant instrumentation up into a lot of right pieces and rearranging them on the internet world

adapt the business models and operational philosophy to the new platform

physical plants will start adapting to the new age

IP instrumentation will realize collaborative production over the Internet world

- outsourcing of asset management services
- centralized operation from the skyscrapers

Conclusion

Conclusion

- Various IPv6 products and services are available in Japan
- Government and Industry are seriously working to get over IPv4 address shortage
- Environmental activity is the latest hot agenda
- Industry automation will require additional innovation which complements Fieldbus. And IPv6 is expected to be a fundamental technology for it

Danke Schön

IPV6 STRATEGY & DEPLOYMENT STATUS IN CHINA

PROF. WU HEQUAN

Professor Wu Hequan was born in 1943 in Guangzhou, China, and graduated from the Wuhan Post and Telecommunications Institute in 1964. He then worked for the China Academy of Post and Telecommunications (CAPT) of Ministry of Information Industry (MII).

He was Vice-President and Chief Engineer of China's Academy of Telecommunications Technology (CATT) in 1997-2003. He has undertaken studies on optical fi bre transmission systems and broadband networks and has managed R&D projects for a long time. He has been in charge to study the development strategy on NGN and NGI as well as 3G in recent years.
He was elected Academician of the Chinese Academy of Engineering (CAE) in 1999 and has been Vice-President of CAE since June 2002. He was assigned as Vice-Director of the China Advisory Committee for State Informatization.

He was Vice-Director of an Executive Council of China Institute of Communications and an Adviser of Communication S&T Committee of MII. He is currently Director of the Experts Committee of China's Next Generation Internet (CNGI) project. He is a senior member of IEEE.

IPV6 STRATEGY AND DEPLOYMENT STATUS IN KOREA

DR. EUNSOOK KIM

Dr. Eunsook Kim studied computer science at Sookmyung Women's university in Seoul, South Korea, where she received her BS, MS, and Ph.D degrees. After her Ph.D on reliable multicast, she has been working at the Electronics and Telecommunications Research Institute (ETRI), Korea as a senior researcher since 2001. She was engaged in the work on group management for multicast for a year. From 2002 to 2004, she involved in various research projects on IP multimedia systems using SIP. In 2005, she also gained a year of experience as a guest researcher at the National Institute of Standards and Technology (NIST), Gaithersburg, USA. Her role was to design and implement a system for emergency telecommunication. Since 2007, she is actively working on development and standardization on Ubiquitous Sensor Networks (USN) issues. She is an editor of ITU-T SG13 and active member of IETF standardization. Her area of interest includes USN, Next Generation Networks, Low-power Mesh routing, and Multimedia communications.

ABSTRACT

This presentation will introduce IPv6 strategy and deployment status in Korea. Korean government has been strongly supporting IPv6 deployment with IPv6 promotion policy. It supports IPv6 by four categories: IPv6 equipments development, diffusion of IPv6 applications and services, facilitation of IPv6 public/commercial networks, IPv6 Pilot project: KOREAv6. With this policy and project, Korea wants to make All-IPv6 networks until 2010. The presentation explains some examples of IPv6 pilot project and results from it. Also, it introduces Daedeok innoPlois where will be an IPv6 cluster. Korea has a good IT infrastructure and wants to combine innovated services with promotion of IPv6. We are making IPv6 in our lives.

IPv6 Strategy & Deployment Status in Korea

Eunsook "Eunah" Kim
(eunah@etri.re.kr)

May 7, 2008

German IPv6 Summit

Contents

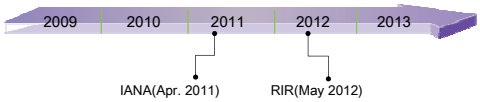
IPv6 Forum Korea

- Role of IPv6 Forum Korea
  - To share information on IPv6
  - To bring up IPv6 experts
  - To work on IPv6 standards, etc.
- IPv6 forum Korea Structure

Title	Working Group
IPv6 over WiBro	Mobile WG
IPv6 over low power WPAN	Convergence WG
Security for one to many multicast service	Security WG
Voice over Internet protocol version 6 reference model 2.0 for public sector	Service transition WG

Countdown …

- IPv4 Exhaustion
  - IPv4 address says to be exhausted in several years



Ref) Geoff Huston, "IPv4 Address Report," 2008

IPv4 Countdown

Regional registry IPv4 address exhaustion in…

1582 Days, 23 Hours, 27 Minutes, 54 Seconds.

[http://penrose.uk6x.com, 2008.4.8]

[http://entne.jp/tool/toollist/000101.php, 2008.4.8]

IPv4/IPv6 global statitics

Global IPv4 allocation			
			Date : 2007. 05. 28
rank	Country	code	IPv4
1	USA	US	1,388,466,720
2	Japan	JP	154,277,632
3	EU	EU	120,679,900
4	China	CN	116,341,504
5	UK	UK	78,159,354
6	Canada	CA	72,915,968
7	Germany	DE	64,659,120
8	France	FR	59,978,528
9	S. Korea	KR	55,160,576
10	Australia	AU	32,283,904

Global IPv6 allocation			
			Date : 2007. 05.28
rank	Country	code	/32
1	Germany	DE	9,569
2	France	FR	8,232
3	Japan	JP	7,273
4	EU	EU	6,155
5	S. Korea	KR	5,189
6	Italy	IT	4,129
7	Australia	AU	4,109
8	Taiwan	TW	2,308
9	Poland	PL	2,088
10	Netherland	NL	564

Contents

IPv6 Promotion Policy

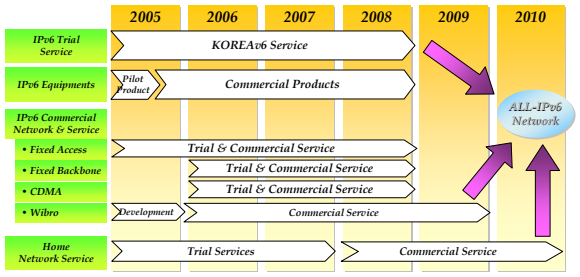
IPv6 Equipments Development
- To accelerate development of commercial IPv6 equipments
- To develop IPv6 equipments competitive in global markets

Diffusion of IPv6 Appls & Services
- To accelerate IPv6 application development
- To provide various pilot services for the activation of IPv6

Facilitation of IPv6 Public/ Commercial Network
- To migrate the Public & Commercial Network to the IPv6 networks

IPv6 Pilot Project : KOREAv6
- To verify developed IPv6 equipments & services
- To drive use of IPv6 into commercial market by KOREAv6 (Nationwide IPv6 test network)

Roadmap of IPv6 Adoption in Korea



* IPv6 Adoption Roadmap (2005.3)

Deployment of IPv6 in Korea

- Early on, ISPs were reluctant to invest for IPv6
  - IPv6 market was not formed at that time
- Government has actively encouraged IPv6 market ready
  - Organizing IPv6 Strategy Committee
  - Building up IPv6 Adoption Roadmap
  - IPv6 deployment in public sector
  - IPv6 pilot project : Lead ISPs' investment on IPv6

→ primary market has been formed

→ extensive investment from the ISPs & Vendors is expected to be continued

Contents

IPv6 Pilot Projects (2004~2006)

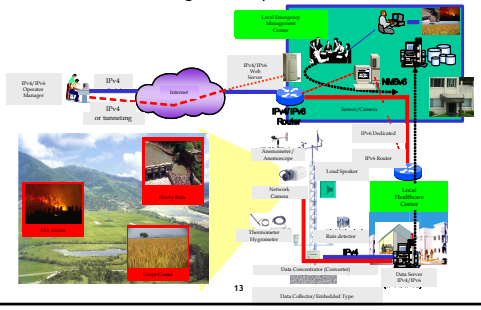
- Pilot Project '04
  - Provided VoDv6, VoIPv6, IPv6 internet gateway service etc.
  - Tested 39 IPv6 equipments such as routers, switches, etc.
- Pilot Project '05
  - Expanded IPv6 network to the public sector
  - Converted IPv4 informational sites and applications into IPv6 based sites
- Pilot Project '06
  - Supported the commercialization of IPv6 WiBro contents and applications
  - Facilitated the use of IPv6 internet services in the public sector

IPv6 Pilot Project (2007)

- IPv6 Pilot Project '07
  - IPv6 Public security trial service
    - Crime report service based on IPv6
    - Video surveillance System using IPv6 camera with face recognition system
    - VoIPv6 for police administration
  - IPv6 u-blue city trial service
    - Prevention of disaster using IPv6 camera and sensors
    - Monitoring forest fire and abnormal weather condition
  - IPv6 UCC portal service
    - Providing video contents by IPv6
    - 40,000 users
  - VoIPv6 service for local governments
    - VoIPv6 service for Daegu city hall
  - IPv6 u-city service for rural area
    - Water quality monitoring
    - Travel information

Disaster Prevention by IPv6-sensors

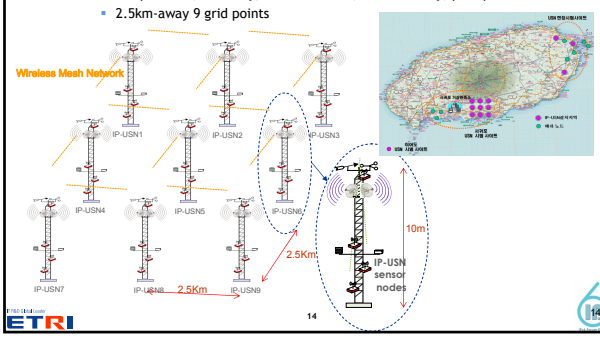
- Develop IPv6 & USN base disaster prevention solution
  - Construct IPv6 network with measuring sensors
  - Establish disaster monitoring center & provide web service



13

IP-USN based meteorological/oceanic observation system

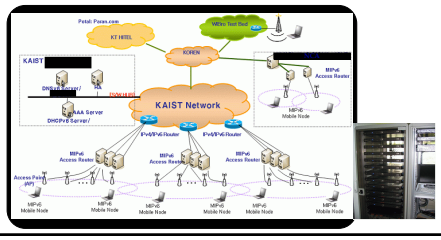
- IP-USN for seoguipo-area(jeju island) meteorological observation
  - temperature, humidity, wind direction, wind velocity, precipitation
  - 2.5km-away 9 grid points



14

IPv6 for Wibro service

- Network configuration
  - WIBro IPv6 at KAIST
  - Mobility: Mobile IPv6/Fast Handoff
  - IPv6 base user authentication, sec. tech.
  - IPv6 service test on WiBro and WLAN integrated network
- IPv6 Applications/Contents Service
  - Transfer existing portal into IPv6
    - Windows platform
    - Paran (KT), use NAT-PT
    - Guideline for adoption of IPv6
  - Use for IP mobility test and verification



IPv6-WiBro Test : KAIST Building and Outdoor place

16

UCC Portal Service on IPv6

- KOREAv6 2007 project : NIA & freechal.com

17

IPv6 Portal Site

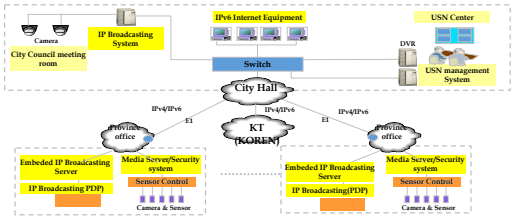
- www.ipvsix.co.kr :
  - 30,000 users
  - Open date : 2006. 09.01
  - Services
    - Cinema VoD service,
    - English lecture service
    - Internet Broadcasting
    - Cartoon service etc.
    - Total: 15 services

- www.vsix.net
  - 51,000 users
  - Open date : 2004. 03. 01
  - services
    - web mail, web hard, web hosting etc.
    - Total: 8 services

18

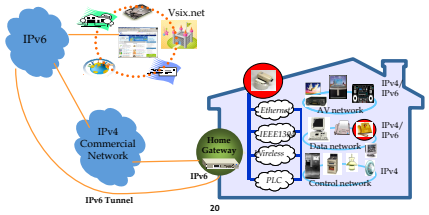
U-City, Gangleung

- Participants : KT, Gangleung City Hall, A&D
- Providing u-Administrative Service with Users(1,000) of Public sectors (4 office, Gangleung City hall)
- Implementing USN Sensor, IP Broadcasting Service, and VoIPv6



IPv6 for Home Networks

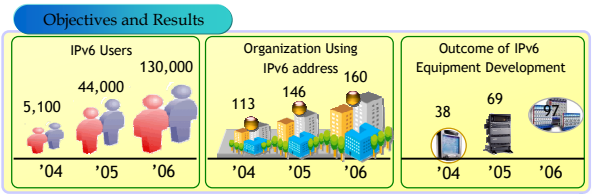
- IPv6 Home gateway
  - IPv6 Tunneling
  - Various PLC based protocol
  - Wireless LAN (IEEE 802.11 a/b/g)
  - Sufficient & Various Interfaces
  - Service Quality test & maintenance
- IPv6 Applications
  - VoIPv6 Service Supp. wired/Wireless
  - VoIP Phone
  - IPv6 Network camera offered real time
  - monitoring
  - IPv6 Portal Site contact support



Results of IPv6 Trial Projects

- Enlarging Korea Core Competence from IPv4 market to IPv6 market
- Increasing internet users using IPv6 addresses
- Making an early market for IPv6 Network equipment and services

Objectives and Results



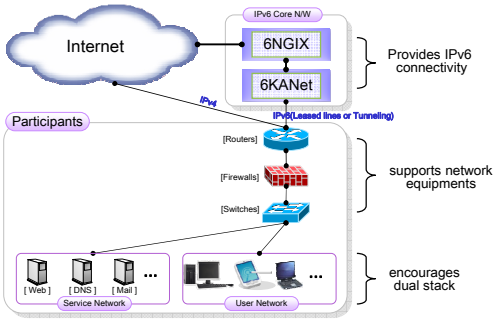
Contents

2008 - Continuous effort

- 6NGIX(IPv6 Next Generation Internet eXchange)
  - Provides ISP level interconnections among 10 Foreign countries: CNNIC(China), HINet(Taiwan), CBN(Indonesia)
  - Domestic : KT, SK Telecom, KREONET, KINX, KOREN, Samsung Networks, Server Bank, etc.
- 6KANet(IPv6 Korea Advanced Network)
  - provides IPv6 connectivity to IPv6 ready organizations

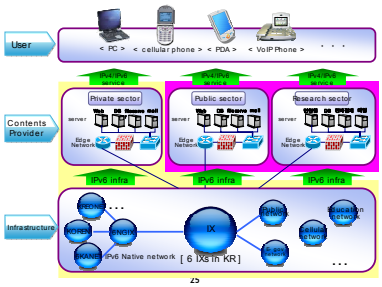
2008 - Continuous effort

- Budget support in public sectors



2008 - Continuous effort

- Plans to provide network equipments to 10~20 public sectors.



2008 - Continuous effort

- vsix.net
  - Since 2003, IPv6 informational site has been running to provide various information about IPv6
  - Vsix.net has been providing several IPv6 only services such as webmail, web disk, blog etc.
  - About 70,000 subscribers

[http://www.vsix.net]

IPv6 Deployment in DAEDEOK INNOPOLIS

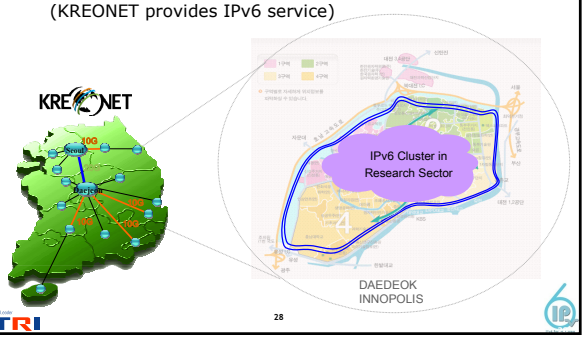
- DAEDEOK INNOPOLIS is specialized in R&D
- Until 2010, Build IPv6 cluster
  - IPv6 conversion for research centers and universities in the DAEDEOK INNOPOLIS

MAIN PLAN

Selection of target Institutions (research centers and Universities) → Support IPv6 equipments (Router, F/W) and construct IPv6 networks → Technical supporting and consulting

IPv6 Deployment in DAEDEOK INNOPOLIS

- IPv6 Cluster is deployed in KREONET (KREONET provides IPv6 service)



Contents

Outlook

- Nobody knows yet when the IPv4 address will be really depleted
- IPv6 has been deploying very slowly so far
  - ISPs hesitated to invest for IPv6 due to the cost
- Korean government has actively encouraged IPv6 market ready
  - primary market has been formed
  - extensive investment from the ISPs & Vendors is expected to be continued
- U-Society needs IPv6
- IPv6 is coming into our lives


ETRI
Thank you.
Any Question?
Contact: eunah@etri.re.kr

IPV6 DEPLOYMENT EXPERIENCES IN GREEK SCHOOL NETWORK

ATHANASSIOS LIAKOPOULOS

Athanassios Liakopoulos holds Diploma in Elect. & Comp. Eng. from Nat. Tech. Univ. of Athens - NTUA (1996), MSc in Telematics from Univ. of Surrey (1998) and PhD in Computer Eng. from NTUA (2005). Since 2000, he joined GRNET S.A. and involved in the operation and development of the Greek research network. Today, he is responsible for the national-wide networking and GRID infrastructure. He has contributed to multiple R&D projects as technical engineer or coordinator. He is awarded for his performance during his academic studies and published several articles in recognized technical journals. He is actively involved in IPv6-related projects in academic and commercial environments.

ABSTACT

The Greek School Network (GSN) interconnects approximately 15.000 primary/secondary schools and administrative units in Greece. It also provides IT services for thousands of users and supports educational purpose applications. Since 2004, design studies related to IPv6 were initiated and trials / pilot phases were successfully completed. Today, the backbone network supports IPv6 interconnection services while multiple services are fully supported over dual stack servers. In the following months, the GSN upgrades a major part of the access network allowing thousands of schools to be connected to the IPv6 Internet. The IPv6 upgrade of internal school PC-labs still remains a challenge. The presentation discusses all these deployment experiences the last few years.

http://www.grnet.gr

IPv6 Deployment Experiences in Greek School Network

Athanassios Liakopoulos
Greek Research & Technology Network

German IPv6 Summit
May' 08, Postdam

Agenda

- Description of the Greek Schools Network
- IPv6 Deployment in GSN
- Upgrade plans
- Experience & Expected Benefits

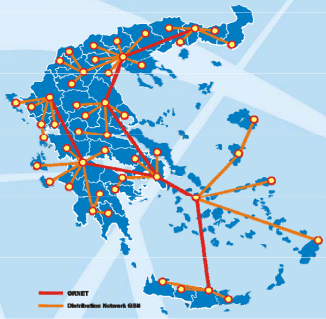
Network Architecture

Backbone:
Based on 8 PoPs of GRNET

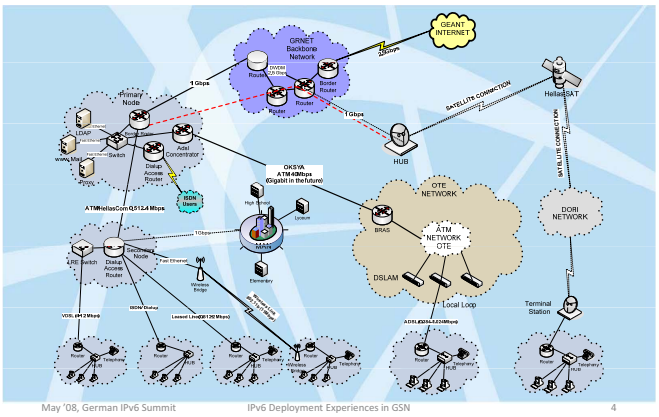
Distribution Network:
51 nodes
(8 main, 43 secondary)

Access Network technology:
- Dialup (ISDN, PSTN)
- ADSL
- Leased Lines (SDSL, VDSL),
- Wireless

Number of connected schools:
- 14.390 primary & secondary schools
- 2.811 administration offices



Network Infrastructure



Services

- **Basic Services**
  - Broadband / dial-up access
  - e-mail (POP3, IMAP, web-mail)
  - Instant Messaging
  - Forums
  - Portal (www.sch.gr)
  - Web-Hosting
  - Web-Filtering
  - Web-Page Generator
  - Proxy/Cache
  - News
- **Advanced Services**
  - E-learning
  - VoD
  - Secure Content Delivery
  - Real time services
  - Teleconference
  - Voice over IP
- **Infrastructure Services**
  - DNS, Directory Service (LDAP)
  - User registration service
  - Statistics (sch.gr/statistics)
  - Help-Desk (sch.gr/helpdesk)
  - GIS, Remote control

Why to move to IPv6?

- IPv6 removes the limitations imposed by the IPv4 address shortage
  - Every school has a NAT / PAT gateway due to address shortage
  - Difficult to debug interconnection problems
  - IPv6: Enough address space for every school and pupil!
- P2P applications do not work with servers behind PAT
  - Multimedia e-learning and peer-to-peer virtual collaboration applications
  - IPv6: Easier P2P application development

Why to move to IPv6

- Management and security issues
  - Deployment procedures in large numbers (auto-configuration of CPE routers and PCs)
  - Address fragmentation resolved
  - Easier aggregation of classes of users
  - Security (based on ACLs) simplified using the IPv6 addressing schema
- Innovation – Expose to new technologies
  - Today's school pupils are the future engineers
  - IPv6 allows the development of new advanced services that exploit features unique to IPv6 environments, such as enhanced security, multicast or mobility
  - Multiply the impact of other IPv6-enabled networks in Greece

Addressing

- Assigned a /35 address space from the LIR (2001:648::/35)
  - Allows for 8,192 x /48 prefixes or 536,870,912 LANs (/64)!!!
- Multiple of /48 for every PoP
- Separate address space for broadband users
- At this point, a /62 is assigned per school
  - 4 x /64 for: router address (loopback), student lab, administration office, server LAN

IPv6 Deployment in GSN

- All PoPs have been upgraded (dual-stack) to IPv6
  - Established IPv6 peering with GRNET
  - Internal routing fully supports IPv6 (OSPFv3)
- Secondary distribution nodes not supporting IPv6 due to
  - Lack of memory and CPU
  - Access servers aggregate dialup connections
  - Old equipment in the access network (ISDN routers not supporting IPv6)

Access Network & School LANs

⇒ Decision to deploy IPv6 only to schools with broadband connection (currently ADSL) where the CPEs are new equipment

- Started with 50 schools as a testbed
  - Create standard CPE configuration file
  - Design and test IPv6 address assignment scheme
    - Easy IPv6 address management and dynamic assignment for every school CPE (using DHCP prefix delegation)
  - Need to design a plan for remotely enabling IPv6 in schools servers and PCs (inside schools labs)
- Moving to 300 schools

Services

- First upgrade servers to dual-stack
- Second upgrade services to support IPv6
  - Email (SMTP, IMAP, POP3)
  - Web hosting
  - GSN Web portal (www.sch.gr)
  - Web proxy / web filtering
  - AAA (Radius software and attributes)
  - Instant Messaging
  - Directory service (LDAP)
- Final step upgrade DNS service and update DNS entries

Backbone Network

- Equipment upgrade for backbone network nodes (4thQ of 2006)
- On all 8 PoPs
  - Core routers for:
    - Peering with GRNET on Gbps rate in all PoPs
    - Interconnection with Optical MANs to provide Ethernet aggregation of schools
  - All core routers will fully support IPv6
- On all 43 distribution network nodes
  - New routers for interconnection with Optical MANs to provide Ethernet aggregation of schools
  - All routers will fully support IPv6
- New datacenters with IPv6 capable server farms

Access Network

- Upgrade school connections
  - Estimated on 4th quarter of 2006
  - Shift from ISDN to ADSL access technology
  - More than 3,000 schools
  - New access network routers (ADSL CPEs) with IPv6 support
  - IPv6 enable upgraded schools on site
- Design and deploy a plan to remotely enable IPv6 inside school labs (PCs and servers)
  - 200 schools already have commercial Remote management software
  - currently implementing an open source remote management tool

Experiences

- **IPv6 deployment should start with pilot projects in order to**
  - Locate and diagnose possible escalation problems
  - Gain technical experience and become familiar with IPv6
  - Decide on deployment strategy
- **Helpful if IPv6 deployment coincides with equipment upgrade**
- **Learned and in some way proved that:**
  - IPv6 deployment in a large and complicated network is achievable with reasonable cost (in terms of equipment and man power)
  - IPv6 technology is mature and can be deployed without the fear of network collapse
  - There are no impacts on IPv4 services if they use open source software
- **Gained technical experience in IPv6 allowing to make the IPv6 implementation complete and universal**

Expected benefits

- Eliminate IPv4 limitations on address shortage
- Eliminate NAT and its problems at the provision of advance services (like teleconference)
- Resolve address aggregation issues and simplify routing scheme
- Use IPv6 to extend the security related functionalities
- Autoconfiguration reduces the administration cost (easy IPv6 address assignment on the access network)

http://www.sch.gr/

Athanassios Liakopoulos
aliako@grnet.gr

IPV6 NETWORK MOBILITY AND IST USAGE

JEAN-MARIE BONNIN

Jean-Marie Bonnin is born in 1968 in Paris/France. After a PhD degree in computer science at the University of Strasbourg in 1998, he came to TELECOM Bretagne for a research position.

He is currently associate professor in the "Networks, Security and Multimedia" department where he leads the Mobility research team.
Since September 2001, he is mainly interested in the convergence between IP networks and mobile telephony networks, and therefore in heterogeneous handover. More recently he has been involved in projects dealing with the mobility of the networks and its application to ITS (Intelligent Transportation System).

He is involved in several collaborative research projects at European level and through international academic collaborations (mainly with Asia and North Africa).

Since he finished his PhD study, he belongs to the G6 (a French IPv6 support group) participating actively to the IPv6 adventure. He considers IPv6 as one of the premises of his works regarding terminals and networks mobility.

ABSTRACT

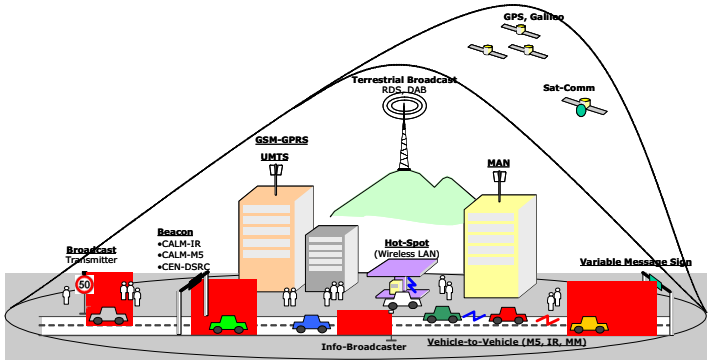
The tremendous deployment of numerous heterogeneous wireless technologies and the availability of new networked devices and services bring new opportunities to ITS stakeholders. IPv6 is doubtless the only way to benefit from the Internet flexibility to ease the development of various services (from security to infotainment). This is why ISO has designed the CALM architecture relying on IPv6 mobility protocols (Mobile IPv6 and NEMO).

Toward fully networked cars

Jean-Marie Bonnin
(IT/TELECOM Bretagne/GERME)
JM.Bonnin@telecom-bretagne.eu

Summary

Introduction
Telecommunications in ITS



Source [CALM HB]

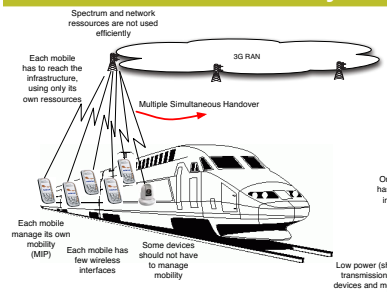
Introduction
Evolution in telecommunications

- **Development and deployment of various wireless access networks**
  - IEEE 802.11a/b/g WLAN, IEEE 802.15 PAN, IEEE 802.20 MBWAN, or 3G WWAN…
  - Could be for dedicated purposes or public for generic purposes
- **More diverse mobile computers/terminals**
  - Smart-phones, PDAs, laptops, tablet PCs…
  - Specialized Hardwares (mobile routers)
  - But also various type of sensors and cameras
- **Much more advanced mobile services**
  - e.g., mobile commerce, tele-working, adaptive and self-configuring services, context awareness services...
  - That people need to access anytime, anywhere…

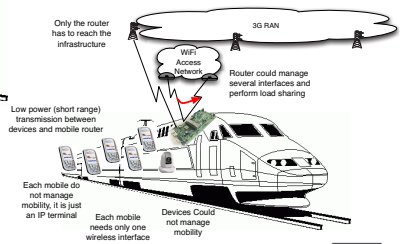
Introduction
Toward fully networked cars

- **Support of Internet services**
  - Navigation systems (update map, traffic information)
  - Entertainment (games, video, music)
- **Support of traditional ITS applications**
  - Vehicle tracking
  - Traffic assessment (upload speed information)
- **Support of next generation applications:**
  - Major push in Vehicle Safety Communication
  - v2v communications :
    - collision avoidance :-) ... Cooperative collision warning
    - Transit vehicle priority ...
    - Electronic brake light, collision warning ...
  - New commercial applications
    - made possible by high data rate & long range.

Introduction
Is network mobility management necessary?



- **Network mobility (on a router)**



- **Host mobility (MIP on teminal)**

Introduction
Is IPv6 mandatory?

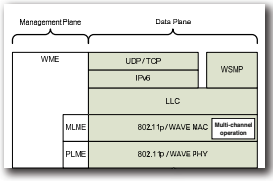
- **Yes, for adress space concerns**
  - Number of devices
    - 2.5 billions of mobile phone over the world
    - much more non-mobile devices
      - temperature sensor, wireless tyre gauge, security camera, ...
      - heart rate monitor, ...
  - Number of vehicules
    - 600 millions of cars today
    - 3 billions forecast in 2050 (IMF)
- **Yes, for service deployability**
  - It remains possible to deploy IPv4 service
    - Impossible to evolve
    - Need to configure all the transmission chain (MR, HA, ISP network) for new services/applications

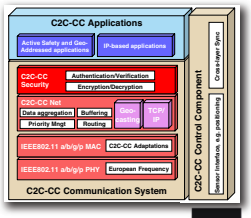
Summary

- Introduction
- Standardization
- NEMO Basic Support
- Work in progress related to NEMO
- NEMO in operation
- Conclusion
- References

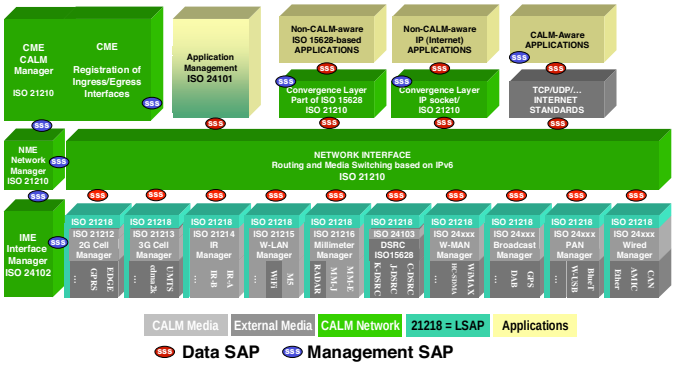
What about standardization bodies?

- **Work at IETF**
- **IEEE develops WAVE architecture**
- **C2CC**
- **ISO develops CALM architecture**





CALM architecture
ISO TC204 WG16

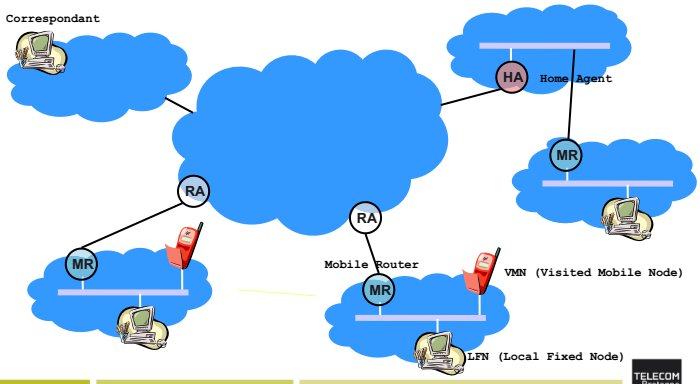


Source [CALM HB]

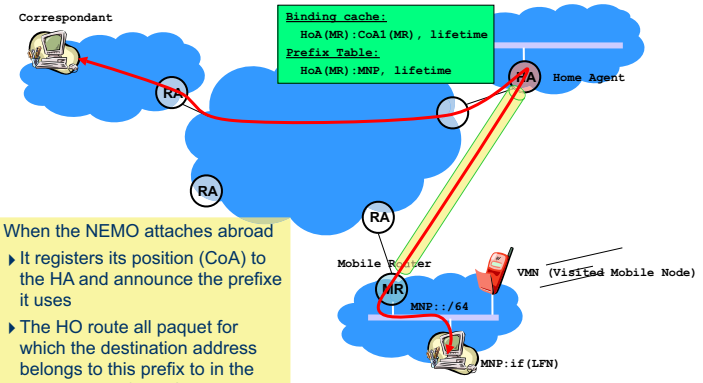
Summary

- Introduction
- Standardization
- NEMO Basic Support
- Work in progress related to NEMO
- NEMO in operation
- Conclusion
- References

NEMO highlights



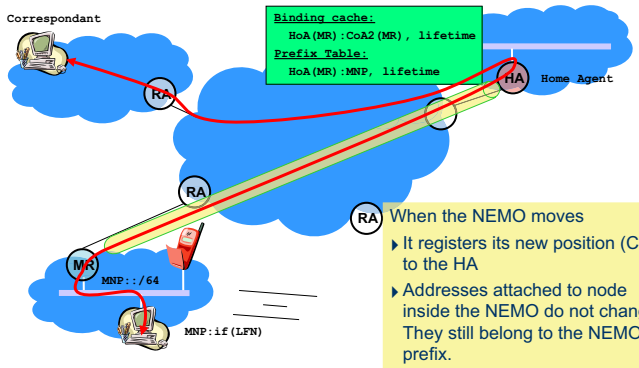
Simple NEMO scenario



When the NEMO attaches abroad

- It registers its position (CoA) to the HA and announce the prefixe it uses
- The HO route all paquet for which the destination address belongs to this prefix to in the tunnel to the CoA of the router.

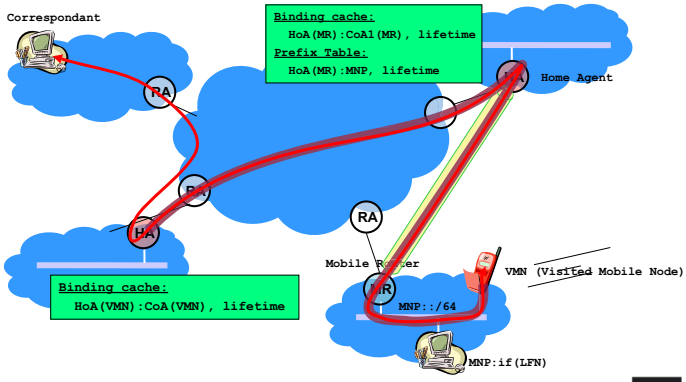
Simple NEMO scenario



When the NEMO moves

- It registers its new position (CoA) to the HA
- Addresses attached to node inside the NEMO do not change. They still belong to the NEMO prefix.

Nested mobility with NEMO



NEMO limitations

- **What is missing to meet CALM specification requirements?**
  - Route optimization
  - QoS (for next CALM specifications)
    - QoS-aware routing and resource allocation
  - Specialized interface management
    - Management of DSCR, M5, Millimeter wave ...
    - Some of them introduce ad-hoc networking
    - ➡ Modification of the CALM architecture to introduce CALM FAST
  - Multiple MR management
    - Connectivity maintenance
    - Distributed flow binding decision
  - Distributed/Centralized ressource allocation
    - Is the fully centralized architecture a good solution?
    - What about nested network?

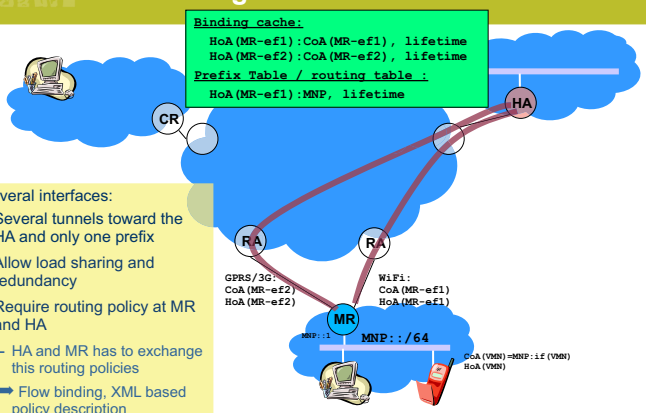
Summary

- **Introduction**
- **Standardization**
- **NEMO Basic Support**
- **Work in progress related to NEMO**
- **NEMO in operation**
- **Conclusion**
- **References**

NEMO and MANET: MANEMO

- **An adhoc network (MANET) attaches to a NEMO**
  - Example, in order to reduce energy consumption in a train
- **Few adhoc network nodes behave as NEMO MR**
  - All together or each one at its turn (save energy)
- **Adhoc networking instead of imbricated network**
  - All together or each one at its turn (save energy)
- **Nested NEMO instead of mesh or adhoc networking**
  - LoCoSS project

Multihoming and NEMO



Several interfaces:

- Several tunnels toward the HA and only one prefix
- Allow load sharing and redundancy
- Require routing policy at MR and HA
  - HA and MR has to exchange this routing policies
  - ➡ Flow binding, XML based policy description

Summary

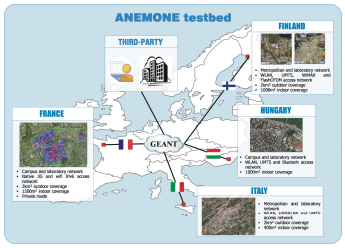
- Introduction
- Standardization
- NEMO Basic Support
- Work in progress related to NEMO
- NEMO in operation
- Conclusion
- References

Conformance in interoperability

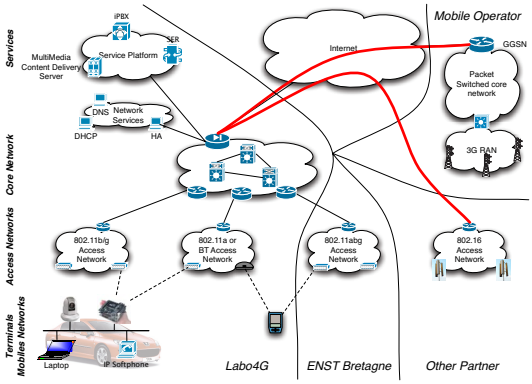
- **Conformance and Interoperability testing**
  - ETSI
    - IPv6 test specifications and methodology (based on TTCN3 new testing language)
    - Plugtests
  - TAHI IPv6 and Moonv6 interoperabili ty events
  - European Commission and associated projects
    - STFs (236, 256, 276)
    - Go4IT, ANEMONE projects, …
  - IPv6 Logo Program Word-Wide Initiative
    - 5 teams in the technical committee (v6LC) linked to the IETF: Asia (TAHI, BII, TTA), USA (IOL-UNH), Europe (IRISA)
    - NEMO Basic Support in Gold logo
- **Current trend in EC projects is towards IPv6 (& NEMO)**
  - a testbed is needed for evaluating scenarios and solutions in real-life conditions
  - setting up required components of testbed is cumbersome

The ANEMONE project

- **FP6 STREP**
  - First large-scal e IPv6 mobility-oriented testbed in Europe
  - http://www.ist-anemone.eu
- **Variety of test sites**
  - Wide-area outdoor & Indoor
  - Types: Campus / Metropolitan
- **Multiple IPv6 access technologies**
  - 802.11 a/b/g, HiperLan, UMTS, GPRS, WiMAX
- **Mobility services**
  - NEMO / MIP6 / MCoA
  - HA (with HA-HA)
- **IPv6 multimedia services**
  - Web, Voice over IP, IP TV, Video on Demand
  - Experimental IP Multimedia Subsystem
- **Security & Access control mechanisms**
  - TLS / IPsec

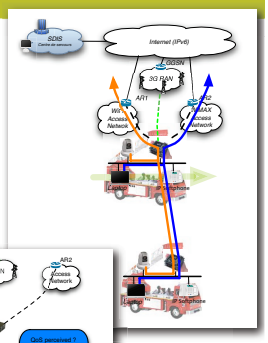


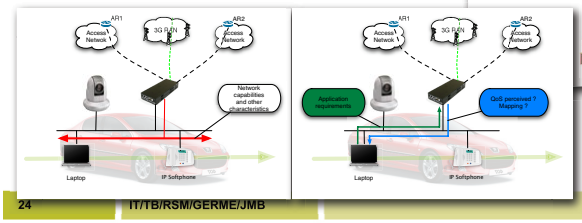
The ANEMONE platform



Few NEMO related projects

- **LoCoSS project**
  - Leverage on public wireless infrastructures to providing Internet connectivity to Firemen in operation
- **NEMO and applications: The REMORA project**





The CVIS project

- **Cooperative Vehicle-Infrastructure System**
  - http://www.cvisproject.org
  - From Feb. 2006 till Feb. 2010
  - 61 partners / 12 countries / Total Budget: 41 Millions Euros
- **Objectives**
  - Develop, trial & demonstrate
    - Inter-operable architecture for vehicular communications
    - Novel applications for:
      - Cooperative traffic and road network monitoring
      - Cooperative road & traffic network management & control
      - Cooperative logistics & fleet management
      - Cooperative public transport & intermodality
- **Vision**
  - Use and extend existing standards (especially CALM)
  - Produce open design and software (mainly base on Linux)
  - Output intended to be reused by other EC projects

Summary

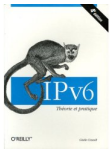
- **Introduction**
- **Standardization**
- **NEMO Basic Support**
- **Work in progress related to NEMO**
- **NEMO in operation**
- **Conclusion**
- **References**

IP*v6* and ITS

- **ITS market**
  - Use to be well organized around car manufacturers
  - Has to build vehicles operational for tens of years
  - Communications
    - Use different proprietary solutions/communication systems
    - Opening the market could reduce the cost and liberate the innovation
- **ITS stakeholders and IPv6**
  - No experience in IPv6 deployment and operation
  - Do not aware of limitations related to IPv4
  - Think that IPv6 is transparent to their concerns
  - IPv6 is not an option for wide deployment
  - IPv4 will limit the development of an ecosystem
    - Service and connectivity providers have to remain stick together
- **ISO defines the CALM architecture**
  - Use IETF open standards (IPv6, NEMO)

IPv6 initiatives in France

- **French academics have been involved in the IETF specifications since the very beginning**
  - INRIA has developed the first IPv6 stack
- **G6**
  - Association set up 10 years ago to ease IPv6 deployment between universities
  - IPv6 is fully operational within RENATER
  - IPv6 training (tutorial)
  - IPv6 book (in French)
- **IPv6 task force France**
  - Launched at the Sénat in September 2002
  - Part of the G6 since 2007: http://www.g6.asso.fr/tff
  - Still not enough involvement from the industry



When beginning to work with IPv6?

- **Now !**
  - Strong incentive for EC to move to IPv6 in research project and in deployment
- **IPv4 address space exhaustion date has been recently revised**
  - IANA count down has been set to December 2009
    - http://www.potaroo.net/tools/ipv4/
    - http://xkcd.com/c195.html
    - http://www.arin.net/statistics/statistics.pdf
    - http://www.arin.net/announcements/20070521.html
- **Deployment and ITS related development**
  - Do consider IPv6 in the early stage of the design
  - Large testbed and operational IPv6 network are available
  - IPv6-only services could start very fast
  - All new application development should be IPv6 compliant

TELECOM Bretagne

Questions or comments ?

Summary

- Introduction
- Standardization
- NEMO Basic Support
- Work in progress related to NEMO
- NEMO in operation
- Conclusion
- References

IPV6 - RÜSTZEUG FÜR OPERATOR & ISP
IPV6 DEPLOYMENT UND STRATEGIEN DER DEUTSCHEN TELEKOM

HENNING GROTE

Henning Grote, Dipl.-Ing., deutsch, Jahrgang 1963
Deutsche Telekom Technischer Service GmbH, Leiter Portfoliomanagement für IP-Serviceprodukte
Herr Grote hat in den letzten 20 Jahren in verschiedensten Funktionen in Technik, Betrieb und Produktbereichen das Online- und Internetgeschäft der Deutschen Telekom mit gestaltet. Hinzu kamen diverse Tätigkeiten im Umfeld der Internet Governance. Gegenwärtig leitet Herr Grote u.a. auch das internationale Expertengremium des Konzerns Deutsche Telekom, welches die technisch-betrieblichen Aspekte einer konzernweiten Migration in die IPv6-Welt vorbereitet und begleitet.

ABSTRACT

Die Präsentation wird unter anderem diskutieren, in welcher Weise ein großer Operator und ISP die Herausforderung technischer Weiterentwicklung annimmt, und welches die ausschlaggebenden Beweggründe sind. Weiterhin wird aufgezeigt, mit welchen Ansätzen Lösungen verfolgt und auch umgesetzt werden. Zu guter Letzt werden mit dem Auditorium ebenfalls die bereits gemachten Erfahrungen geteilt werden.

German IPv6 Summit – Potsdam, 8. Mai 2008.
Inhalt

- Motivation für IPv6
- Vorgehensweise der Deutschen Telekom bei der Einführung von IPv6
  - Zeitschätzung
  - Strategieentwicklung
  - Adresskonzept
  - Konzernarbeitsgruppe
  - Welche technischen Herausforderungen existieren noch?
- Status Quo der IPv6 Einführung der Deutschen Telekom
  - IPv6 Pilot von T-Home
  - Produkte und mehr
- Lessons learned

"Die Zukunft ermöglichen".

IPv6 - Rüstzeug für Operator & ISP

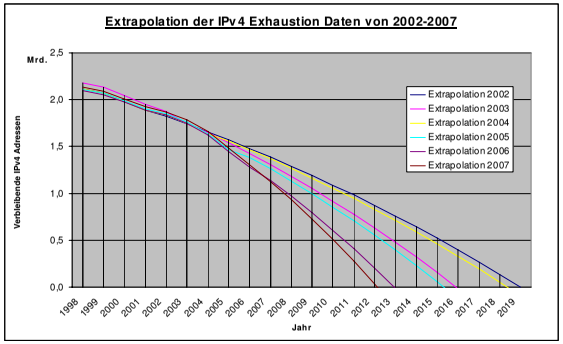
Henning Grote, Deutsche Telekom AG, TCC – Leiter Arbeitsgruppe IPv6.
German IPv6 Summit, Potsdam, 08. Mai 2008.

Motivation für IPv6.

Inhalt.

IPv6 - Rüstzeug für Operator & ISP.
Motivation für IPv6 - statistisch

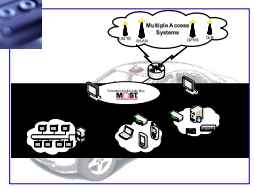
- Warum?



- Wir erwarten die Erschöpfung der globalen Ressource „IPv4 Adresse“ spätestens Ende **2012**.

IPv6 - Rüstzeug für Operator & ISP.
Motivation für IPv6 - konstruktiv

- Innovative, neue Internet Dienste, Trends und Netzwerkszenarien fordern IPv6!
  - Echte Ende-zu-Ende Dienste mit IP-Security.
  - Ambient Networks.
  - Ad-hoc Netzwerke.
  - Communities (Gaming, Peer-2-Peer, ...).
  - Mobile IP.
  - Zählerstanderfassung in Echtzeit. (Wasser, Elektrizität etc.)
  - Vernetzung im Heimbereich.



Vorgehensweise der Deutschen Telekom bei der Einführung von IPv6.

IPv6 - Rüstzeug für Operator & ISP.
Motivation für IPv6 - destruktiv

- Stellen Sie sich vor, es ist 2012 und die Deutsche Telekom ...
  - ... kann aufgrund von Adressmangel und Gleichzeitigkeitsverkehr keine DSL Neukunden mehr bedienen.
  - ... kann keine neuen und innovativen IP Produkte implementieren.
  - ... kann ihre Geschäftskunden nicht mehr mit zukunftssicheren Lösungen überzeugen.
  - ... büßt den Tier-1 Status im Transitbereich ein.

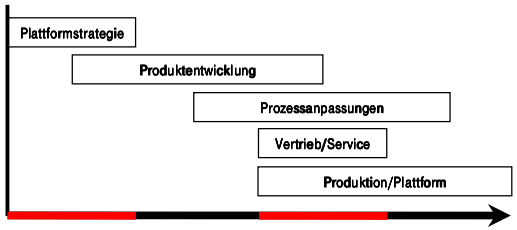
Braucht es noch mehr Motivation?

IPv6 - Rüstzeug für Operator & ISP.
Vorgehensweise der Deutschen Telekom

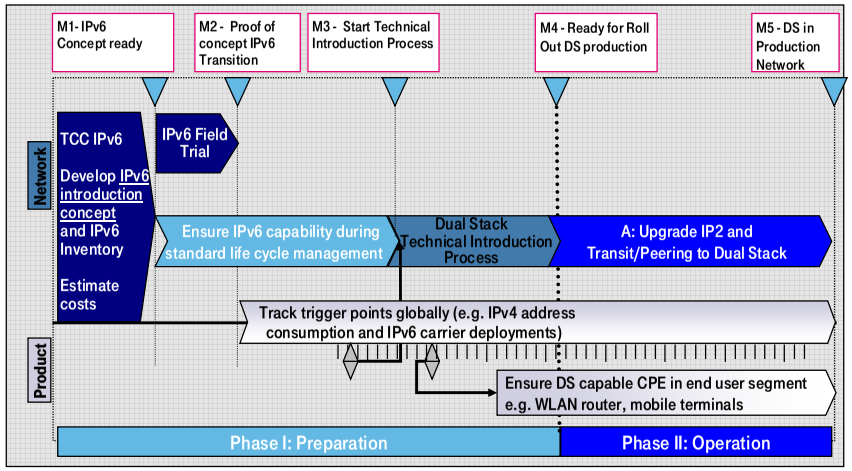
- Deutsche Telekom hat frühzeitig die Notwendigkeit von IPv6 erkannt.
- Über 10 Jahre Track Record im Themenfeld IPv6:
  - Standardisierung
  - F&E Projekte (intern, national, EU Umfeld)
  - Konzepterstellung und Technikevaluierung
- Bereits in 2003 Erarbeitung eines Strategiekonzeptes zur IPv6 Einführung
  - Technischer Ansatz zur Migration
    - MPLS-basiertes Kernnetz: 6PE (IPv6 at Provider's Edge)
    - Sonstige Zugangsnetze und Dienstebereiche: Dual-Stack
- Erkenntnis: IPv6 ist ein Zukunftssicherungs- und Infrastrukturthema:
  → ein herkömmlicher Business Case greift hier nicht!

IPv6 - Rüstzeug für Operator & ISP.
Herleiten der Vorlaufzeiten

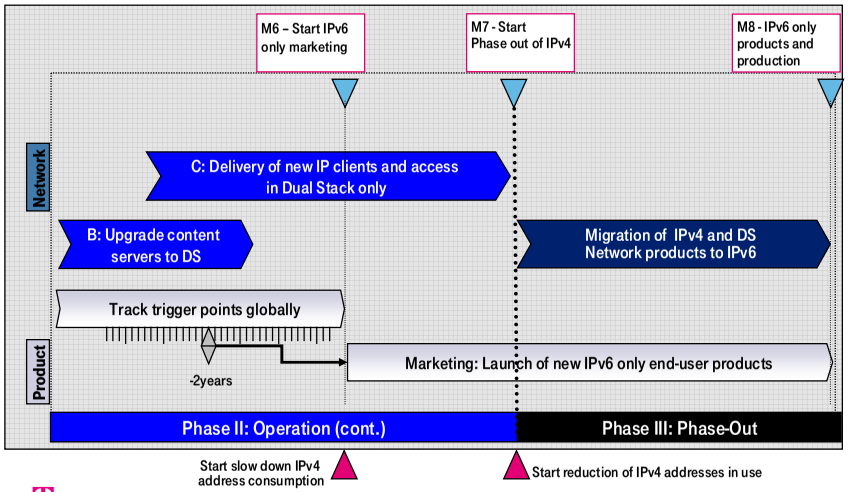
- Migration zu IPv6 bedarf relativ langer Vorlauf– und Umsetzungszeiten:
  - Erarbeiten einer Plattformstrategie.
  - Produktdefinition.
  - Technik- und Konzeptevaluation.
  - Vorbereitung der Prozesse und des Provisioning.
  - Einweisen Vertrieb.
  - Technikschulung / Aus- und Weiterbildung.
  - Umsetzung / Produktion.



IPv6 - Rüstzeug für Operator & ISP.
Deutschen Telekom Strategie zur IPv6 Migration



IPv6 - Rüstzeug für Operator & ISP.
Deutschen Telekom Strategie zur IPv6 Migration



IPv6 - Rüstzeug für Operator & ISP.
Technologische Herausforderungen = Aktuelle Arbeiten

- „Auslaufen“ des IPv4 Adressraumes bevor eine komplette Dual-Stack Realisierungen erfolgt ist.
  - Kommunikation IPv4 only ⇔ IPv6 only Systeme.
  - Ggf. wird in den späteren Phasen NAT-PT erforderlich.
- Dual-Stack Strategie hat verschiedenste technologische Implikationen.
  - Ggf. parallele IPv4 und IPv6 Datenströme identischen Inhalts (z.B. Videokanäle bei T-Entertain im DSL Zugangsnetz).
  - Erhöhte Speicher- und Prozessoranforderungen an CPE Equipment.
- Fehlendes IPv6-fähiges low-cost CPE für den Massenmarkt.
  - Kaum ein Hersteller hat bereits eine Spezifikation für IPv6-fähigen CPE.
  - Produktspezifische Anforderungen seitens DT.

IPv6 - Rüstzeug für Operator & ISP.
Adresskonzept

- Mit der Plattformstrategie wurde frühzeitig ein IPv6 Adresskonzept erstellt:
  - Führte zur Zuordnung des 2003::/19 durch RIPE in 2005.
  - Basierte auf den Rahmenrichtlinien von RIPE und IETF:
    - /48 für Endkunden.
    - Strikte Aggregation und Hierarchisierung zwecks Einhaltung des HD-Ratio und Optimierung des internen Routing.
  - Gegenwärtig in Überarbeitung wegen neuer RIPE Empfehlungen:
    - /56, /60 oder /64.
    - „Neuer“ HD Ratio basierend auf /56.
  - Input für Standardisierung in der IETF und den RIPE Policies.

Status Quo der IPv6 Einführung der Deutschen Telekom.

IPv6 - Rüstzeug für Operator & ISP.
TCC, WG IPv6 – Der IPv6 Synchronisationspunkt der DT

- Mit der Erarbeitung und Umsetzung der entsprechenden Plattform-strategie wurde eine konzernübergreifende Arbeitsgruppe beauftragt:
  - Technology Competence Center, WG IPv6.
  - Mitarbeiter aus allen Geschäftseinheiten.
  - Einige Aufgaben (Auszug):
    - Erarbeiten und Abstimmung gemeinsamer Vorgehensweisen.
    - Synchronisationspunkt zum Strategieabgleich.
    - Unterstützung der Migrationsteams der einzelnen Geschäftsfelder.
    - Überwachen bestimmter Triggerelemente (Markt, Kunde, Technik).
    - Statistiken und Prognosen zur IPv4 Adressraumentwicklung.
  - Erster Anlaufpunkt bei neuen Anforderungen.

IPv6 - Rüstzeug für Operator & ISP.
Status Quo IPv6 in der DT: Produkte und mehr

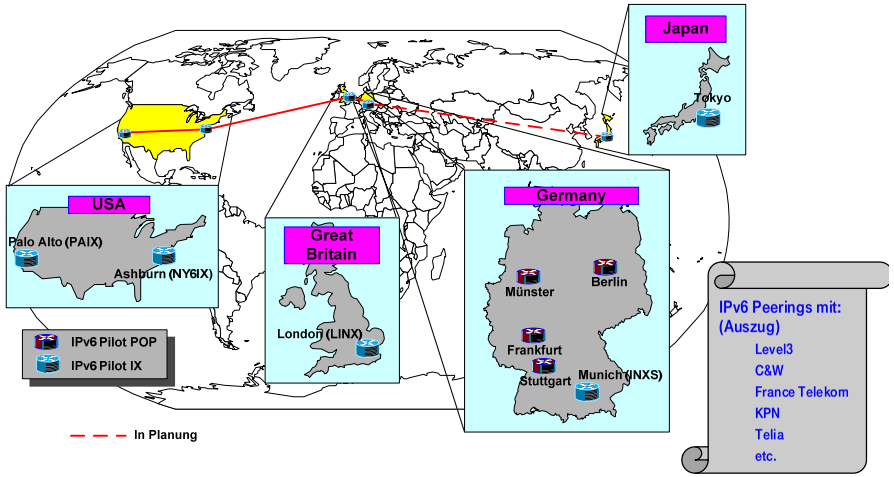
- Aktuell bereitet sich jede Geschäftseinheit der Deutschen Telekom gezielt auf den Übergang zu IPv6 vor
- Alle wesentlichen IP-basierten Services/Produkte werden rechtzeitig auf IPv6 bzw. Dual Stack migriert; Reihenfolge abhängig von diversen Randbedingungen
- Im Lösungsgeschäft sind gegenwärtig bereits kundenspezifische Produkte in der Technikevaluierung bzw. der Realisierung:
  - 6VPN-Pilotnetz aufgebaut und in Betrieb
  - Fokus auf IPv6 Connectivity innerhalb MPLS-VPNs und Internet Access
  - "Proof of Concept" Phase bis Ende 2008
- Peering- und Transit-Services z.Z. im Übergang vom Pilot- zum Regelprodukt

IPv6 - Rüstzeug für Operator & ISP.
Status Quo IPv6 in der DT: T-Home IPv6 Pilot

- Zur Verifizierung der Vorgehensweise zur IPv6-Integration in das Netzwerk der T-Home wurde in 2004 der „IPv6-Pilot“ gestartet und bis heute erfolgreich im Wirknetz der Deutschen Telekom betrieben.
  - 3 Phasen:
    - 1. Phase: IPv6 Integration in das Backbone der DT (Transit und Peering). Nationale Ausrichtung.
    - 2. Phase: Internationalisieren des Piloten. Erhöhen der Zahl der Standorte. Heterogenes Equipment.
    - 3. Phase: Endkunden-Szenarien (z.B. DSL). Weitere Netzdienste (QoS, VPN).
  - Gegenwärtig nähert sich der Pilot dem Ende von Phase 2.

Lessons Learned.
Zusammenfassung.

IPv6 - Rüstzeug für Operator & ISP.
Status Quo IPv6 in der DT: T-Home IPv6 Pilot



IPv6 - Rüstzeug für Operator & ISP. Schlussbemerkung

- Die Deutsche Telekom 2010 ...
  - ... bietet ihren Kunden die bekannten Dienste auch auf der Basis von IPv6 in der gewohnten Qualität an.
  - ... wird ihr Portfolio marktgerecht um völlig neue IPv6-only Produkte und Services erweitern.

- Die IPv6 Integrationsstrategie der Deutschen Telekom ist

  ... eine Grundlage für die Zukunftsfähigkeit der Deutschen Telekom.

  ... ein wichtiger Bestandteil der gesamten Plattformstrategie.

  ... auf dem Weg zu einer termingerechten Umsetzung!

IPv6 - Rüstzeug für Operator & ISP. Lessons learned

- Zwecks Nachhaltigkeit sehr lange Vorbereitungs- und Vorlaufzeiten erforderlich.
- Teilweise interne „Henne/Ei-Probleme“ (z.B. Produktdesign ⇔ Technische Realisierung ⇔ Hardwareanforderungen an Hersteller)
- Frühzeitiges Einbinden der Hersteller erforderlich.
- Mangelnde Marktdurchdringung von IPv6 im Applikationsbereich.
- IPv6 Unterstützung durch DNS ist ein „Muss“.
- Es existieren auch heute noch harte, offene (prozess-) technische Fragestellungen.

➢ IPv6 – Prinzipiell kein Problem, jedoch: „Der Teufel steckt im Detail!“

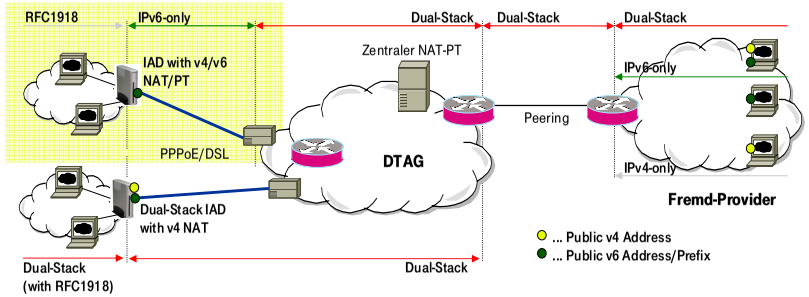
Vielen Dank für Ihre Aufmerksamkeit!

IPv6 - Rüstzeug für Operator & ISP. Ausblick 2012

- Was wird 2012 sein?
  - IPv6 hat nahezu alle Endsysteme erreicht und es existiert eine starke Nachfrage im Consumer Bereich getriggert durch neue Applikationen und Nutzungsszenarien (P2P, Gaming, ...).
  - Das IPv6-basierte Internet ist aus dem täglichen privaten und beruflichen Leben nicht mehr wegzudenken.
  - IPv6 ist die Netzwerktechnologie in nahezu allen öffentlichen und privaten Netzen und Infrastruktur Bereiche. (Bsp. DOI, Landesverwaltungsnetze, ...)
  - Neue Internet Dienste und Anwendungen auf der Basis von IPv6 ermöglichen die nahtlose Kommunikation über alle Zugangsmedien hinweg.
  - Die Weiterentwicklung des Internet auf der Basis von IPv6 ist gesichert.

IPv6 - Rüstzeug für Operator & ISP.
Herausforderungen bei der Migration von IPv4 zu IPv6.

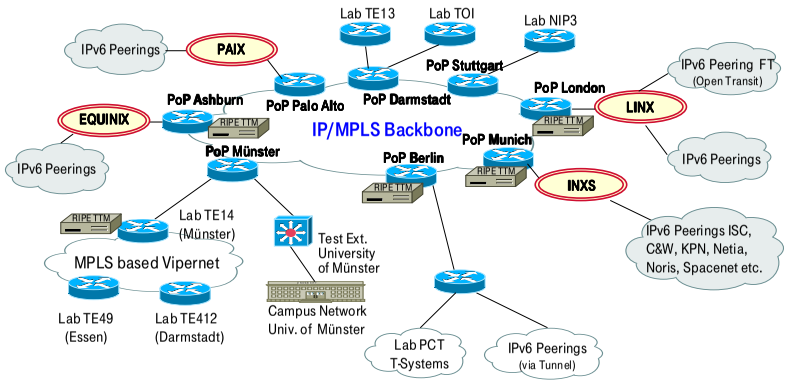
- Auslaufen der IPv4 Adressen erzwingt zusätzliche NAT-PT Funktionalität.
  - Welche NAT-PT Funktionalität benötige ich wo im Netzwerk?
    - Dezentral z.B. im IAD
    - Zentral an Netz- und Infrastrukturübergangspunkten



Zu technisch? JA!

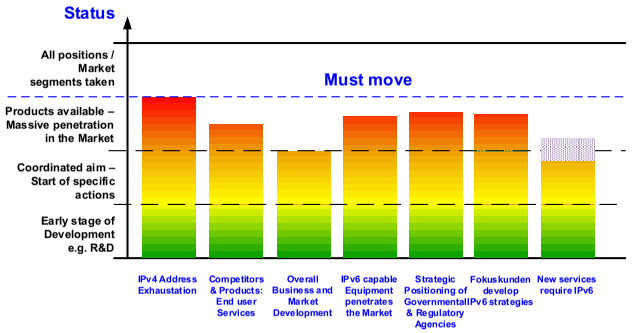
Backup.

IPv6 - Rüstzeug für Operator & ISP.
Status Quo IPv6 in der DT: T-Home IPv6 Pilot



IPv6 - Rüstzeug für Operator & ISP.
Zu überwachende Triggerelemente für IPv6.

- Zum Erkennen des richtigen Zeitpunktes für eine IPv6 Migration aus Sicht der DTAG wurden und werden durch die TCC IPv6 WG verschiedenste Triggerelemente identifiziert und permanent überwacht.



VIEW FROM THE IPV6 DEPLOYMENT FRONTLINE.

YVES POPPE

Yves Poppe, born in 1948 in Belgium, Canadian resident, has spent his more than 35 years career in data communications. Representing Teleglobe on the Canarie (Canadian R&E network) Policy Board, Yves supported the early deployment of high speed intercontinental R&E connections and the early IPv6 efforts including the creation of 6TAP in Chicago. He represents the Corporation at the IPv6 Forum and is steering committee member of the North American IPv6 taskforce (NAV6TF).

Yves Poppe represents Tata Communications at TERENA, Internet2, Canarie and APAN. He is a frequent presenter on the evolution of telecommunications, the internet and the key role of IPv6. He also regularly covers the evolution of subsea communication capacity and international telecommunications at sessions of TEMIC (Telecommunications Executive Management Institute of Canada).
VSNL international, part of the Tata Group acquired Teleglobe in February 2006 and since February 2008 the Company operates under the name Tata Communications.

ABSTRACT

This presentation is meant to share some views and experience gained by the early adoption and integration of IPv6 support in a world spanning tier1 IP network as well as the persistence needed in the nearly a decade of a consistently receding horizon of adoption and transition toward IPv6. With the looming IPv4 address depletion and the advent of the mobile internet, the horizon no longer recedes.

TATA COMMUNICATIONS

View from the IPv6 deployment front line

Early mover advantage?

CORPORATE

German IPv6 Summit
Potsdam
May 7-8th 2008

Yves Poppe
Director Bus. Dev.
IP Services

TATA

TATA COMMUNICATIONS

TATA

Member of the Tata Group

125-year old largest private sector group

$29 billion in revenues

Acquired VSNL in February 2002
- VSNL acquired Tyco in Nov 2004
- VSNL acquired Teleglobe in Feb 2006

Teleglobe, Tyco, VSNL and VSNL International become Tata Communications on February 13th 2008

Tata Consultancy Services (TCS)

CORPORATE

1

TATA COMMUNICATIONS

TATA

International Lines of Business

Wholesale Voice
- 21bn minutes of voice traffic p.a
- VoIP and TDM transport

Mobile
- 400 wireless operators
- GSM to CDMA conversion
- First link with North America

Data
- Tier 1 global backbone
- Peering with all other major carriers
- Low Latency, Shortest-path global transit routing
- Content Data Network

Enterprise Services
- IPL, IP, MPLS, Ethernet, VPN
- Managed services: VPN, VoIP VPN
- Enterprise Network
- Management Services
- Managed Hosting

Global transport services
- International capacity from DS3 to 10 gigabit wavelengths
- Major investor in undersea cable capacity

CORPORATE

2

TATA COMMUNICATIONS

TATA

„The internet is rapidly becoming a key ingredient in our economic infrastructure – akin to electricity and roads – as well as our social structures »

OECD Forum Conference
Paris, May 22-23th 2006

CORPORATE

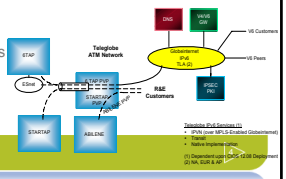
3

TATA COMMUNICATIONS

TATA

Tata Communications as IPv6 traiblazer

- Teleglobe provides the first NGI intercontinental connection in 1995 for the Brussels G7 summit.
- A member of the Canarie Policy Board, Teleglobe promotes the experimentation of IPv6 and the 6bone/6TAP initiative
- Teleglobe hosts the first IPv6 node for Surfnet connection to the Chicago 6TAP located at STARTAP.
- Teleglobe facilitates the world 's first intercontinental native IPv6 connection in 1998 between CRC(Communication Research Centre) in Ottawa and Berkom in Berlin.
- Teleglobe becomes a founding member of the IPv6 forum in 1999.
- Teleglobe presents its original IPv6 plans at the Telluride March 2000 IPv6 Forum.
- 2003: Teleglobe starts an IPv6 pilot
- January 2004: service introduction



CORPORATE

4

TATA COMMUNICATIONS

TATA

The promises of IPv6

Solves address shortage
Restores p2p communication
Mobility
- Much easier roaming
- Better spectrum utilization
- Better battery life!

Security
- IPsec mandatory

Multicast
Better QoS (flow labels)

Auto configuration
- Mobile Ad-Hoc networking
- Mobile networks
- Sensor networks
- Plug and Play networks

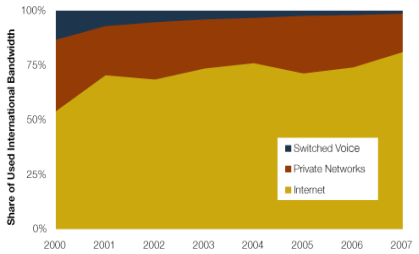
Permanent addresses
- Identity (CLID)
- Traceability (RFID)
- Addressability!
- IP address based billing

CORPORATE

5

TATA COMMUNICATIONS

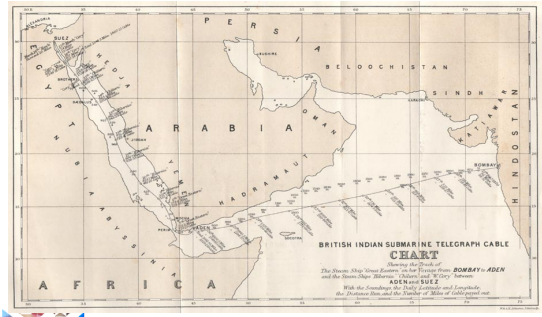
Close to 80% of int'l bandwidth is for internet!



CORPORATE 6

TATA COMMUNICATIONS

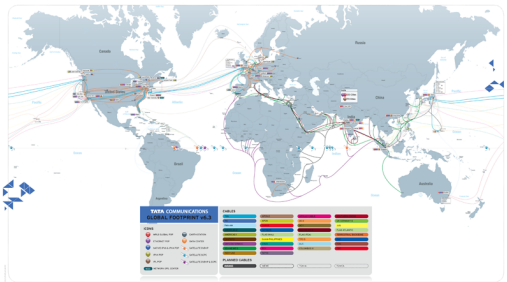
Once upon a time 1870 : Bombay-Aden-Suez telegraph cable



CORPORATE 7

TATA COMMUNICATIONS

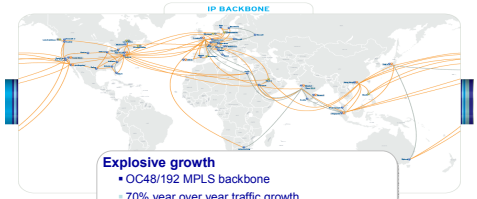
TATA COMMUNICATIONS



CORPORATE 8

TATA COMMUNICATIONS

AS6453 as Global IP network: Circling the Globe



Explosive growth

- OC48/192 MPLS backbone
- 70% year over year traffic growth
- Courtesy of User generated Content and p2p Youtube, Myspace etc

IP Network at a glance

- 700+Gbps of Backbone Capacity
- Carries around 400 Petabits globally per month;
- 500+Gbps of customer connectivity

9

TATA COMMUNICATIONS

IPV6 network availability AS6453

LEGEND

IP Links | IPv4 PoP | IPv6 PoP | Earth Station | NOC

CORPORATE 10

TATA COMMUNICATIONS

IPV6 network availability AS6453

LEGEND

IP Links | IPv4 PoP | IPv6 PoP | Earth Station | NOC

11

TATA COMMUNICATIONS

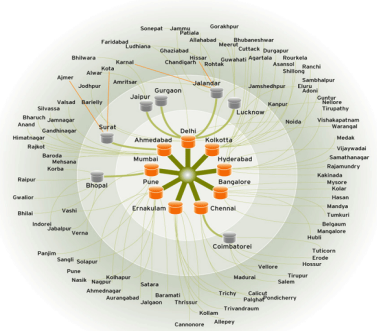
IPV6 network availability AS6453

LEGEND

IP Links | IPv4 PoP | IPv6 PoP | Earth Station | NOC

TATA COMMUNICATIONS

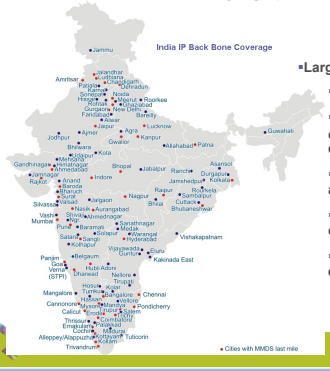
AS4755 India IP Backbone



- 120 POP locations across India.
- 3-tier Hierarchical topology for better management.
- IPv4 and IPv6 access in Tier 1 and tier 2 cities
- 6PE deployment

TATA COMMUNICATIONS

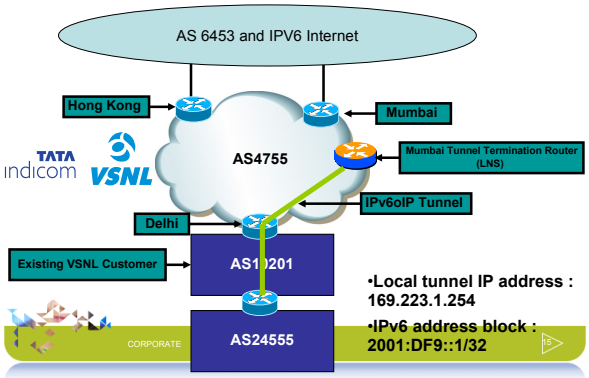
AS4755 geographic coverage



- Largest IP Backbone in India:
  - Cisco powered network
  - More than 80+ ISPs of India are connected to Tata Communiation for domestic & International Transit.
  - Almost all major content providers are hosted in Tata IDC:
  - more than 3000 enterprise customers.
  - Millions of on net customer eyeballs

TATA COMMUNICATIONS

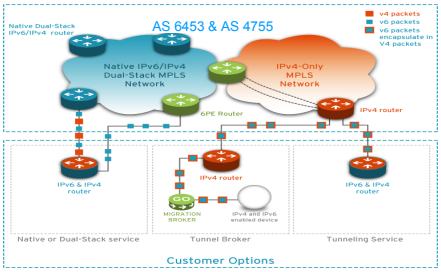
IPv6 connectivity at SANOG 10 in New Delhi Sept 2007



- Local tunnel IP address : 169.223.1.254
- IPv6 address block : 2001:DF9::1/32

TATA COMMUNICATIONS

IPv6 connectivity options



dual stack, tunneling & tunnel broker access.

IPv6 AAAA DNS look up service.

customer prefixes /48 or larger size.

RFC 2858 IPv6 BGP-4 as EGP.

Dual stack IPv4/IPv6 in 56 locations globally including 8 sites in India: Mumbai, Chennai, Delhi, Bangalore, Hyderabad, Pune and Ahmedabad

IPv6 « slash 32's » from ARIN, APNIC, RIPE and Afrinic

TATA COMMUNICATIONS

AS 6453 as tier 1 carrier's carrier network

- IPv6 traffic still minimal
- IPv6 traffic growth depends on adoption in tier 2 networks
- This in turn depends on IPv6 support on the application level.

- What will be the catalyst?
  - Windows Vista ?
  - Exhaustion of IPv4 addresses?
  - Mobile internet?
  - Google?

TATA COMMUNICATIONS

Did our early emphasis on IPv6 pay off?

Visibility, early mover advantage and differentiator in the marketplace

- If carrier A offers IPv4 only and carrier B offers both IPv4 and IPv6, other criteria being similar, who would a tier 2 ISP carrier base go for?
- 40+ of our major customers connect in both IPv4 and IPv6

IPv6 support is becoming a must to win a bid

- Of around 60 major RFQ's for IP transit answered both in 2006 and 2007, about 50 included questions on IPv6 support, roughly half gave points to IPv6 support in their response evaluation and 10 had IPv6 support as mandatory or exclusion factor if not compliant.

Next step: stimulate growth of the IPv6 component of the overall IP traffic.

TATA COMMUNICATIONS

What is still missing?

Comprehensive DNS support

- TLD DNS support still patchy: only 5 of the 13 roots support IPv6?!
- Support in DNS servers; Where is Linksys?

IPv6 accessible content

- All major content providers see IPv6 support as problematic and to cause major problems for load balancing !?

Clarification or enhancement of some operational aspects:

- Security: Firewalls? Teredo?
- Network Management support

Some application level catalysts

- Vista? mobile push services? Secure VPN? Grid ? First responder? Sensor networks? IMS? IP address based billing?

IPv6 deployment on the access side

- refresh cycle for DSLAM's and cablemodems, 3G, WiMax

TATA COMMUNICATIONS

IPv6 and the mobile internet: joined at the hip for the next growth phase

The future growth of the Internet lies in the hands of mobile phone users, not computers, …

…while the Internet population has exploded from 50 million to 1.1 billion since 1997, it still only reaches a sixth of the world's population.

the jump to the next (sixth) version of the Internet Protocol IPv6 is "desperately needed if we are to reach the world's 4 billion people, who are now untouched by the Net."

Vint Cerf in Bangalore, February 20 th 2007, as reported by Pronetworks and The Hindu

TATA COMMUNICATIONS

Coming soon : Morphing phones and a morphed IP network?

MORPH

Nokia's concept phone

flexible and transparent materials,

self-cleaning and self-preserving

Charging by solar absorption

Info about environment and ourselves through Integrated sensors

This morphing phone might need a morphed IP network with lots and lots of IP addresses ;-)

http://www.nokia.com/A4852062

TATA COMMUNICATIONS

In conclusion

Deploy IPv6 as part of the upgrade cycle; the business case for IPv6 per se does not exist

It is not that difficult or expensive at least in core.

The short term motivation to expand to tier 2, enterprise and consumer level is the looming IPv4 address exhaustion as well as some government mandates.

The profusion of addresses, enhanced mobility support and autoconfiguration features will ultimately unleash real IP convergence and new streams of revenue. IPv6 is a footnote.

The one recommendation:

- Audit your network for IPv6 upgradeability and mandate immediate IPv6 support in all IT procurements: services, products and applications

Farther is the place where value is born.

TATA COMMUNICATIONS

« These days all competitive advantages are fleeting. So the smartest companies are learning to create new ones – again and again and again »

Robert D. Hof , Business Week,

BUSINESS www.tatacommunications.com

DEPLOYING IPV6 IN MOBILE ENVIRONMENTS

WOLFGANG FRITSCHE

Wolfgang Fritsche received his Diploma in Electric Engineering at the Technical University of Munich. He currently works as head of IABG's Internet Competence Center. Wolfgang Fritsche has been responsible for several national and international projects in the Internet and cellular communication field, mainly in the areas of IPv6, IP Security, IP Mobility, IP over Satellite, IP Multicast and 3G cellular networks.

Some of his recent activities are leading the ESA studies on "Programmable Active Networks for Next Generation Multimedia Services" and "IPv6 over satellite", the ESA project for establishing a demonstrator for "IP Security over satellite", and IABG's involvement in the European Commission funded ENABLE, RUNES, SEINIT, 6WINIT and 6INIT projects. He leads IABG's development of the ad-hoc networking solution Highly Mobile Network Node (HiMoNN) and coordinates its sales activities. He participates in the standardization work of IETF, 3GPP and ETSI since several years, and contributes to the adoption of IPv6 within the NATO project INSC. Wolfgang Fritsche represents IABG as founding member in the Global IPv6-Forum and the German IPv6 Task Force.

ABSTRACT

IPv6 offers many benefits specifically for mobile application environments, e.g. a sufficiently large address range and an efficient autoconfiguration capability. In order to operationally deploy IPv6 in mobile environment certain aspects have to be considered. This presentation summarizes the key results of the ENABLE project, which focused on operational Mobile IPv6 deployment, and reports about deployment opportunities of mobile ad-hoc networks for security forces.

AUTOMOTIVE INFOCOM TRANSPORT & ENVIRONMENT AERONAUTICS SPACE DEFENCE & SECURITY

Deploying IPv6 in mobile environments

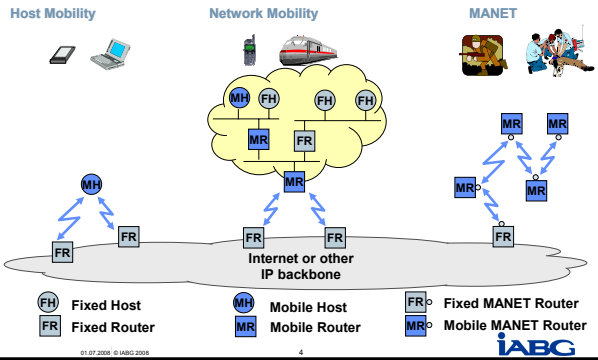
German IPv6 Council meeting, 7-8 May 2008

Overview

- Different mobility scenarios
- Operational deployment of Mobile IPv6 (ENABLE project)
- Operational deployment of mobile ad-hoc networks (U-2010 project)
- Conclusion

Different mobility scenarios

Overview of IP mobility scenarios

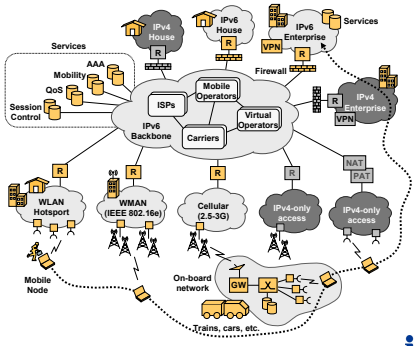


Operational deployment of Mobile IPv6

Host mobility – what the user wants

- Growth of the Mobile Internet
  - Growing number of mobile Internet users
  - Growing diversity of mobile Internet devices (PDA, cellphone, smartphone, …)
  - Increasing heterogenity of access networks (GSM, 3G, WLAN, WiMax, …)
- Efficient support of mobility in the Internet required
- Importance of transparency
  - Mobility support should be transparent to users and applications
- MIPv6 approach
  - MIPv6 offers this transparent mobility support by influencing the routing of IP packets

Reference scenario



Overview of ENABLE project

- **ENABLE at a glance**
  - Research project funded by the European Commission
  - 8 European and one Chinese partner
  - Duration: 2006 – 2007
  - Budget: 3,792 M€
- **Goal of ENALBE**
  - Enable deployment of efficient and operational mobility as a service in large scale IPv6 network environments
  - Taking into account also the transition from current IPv4 networks
  - Research and contribution to standardization fora (IETF, 3GPP, etc.)
  - Validation through laboratory experiments (prototypes, testing, etc.)
- **More information**
  - ENABLE project web site http://www.ist-enable.org

Requirements for operational deployment of MIPv6

- **Improvement of Mobile IPv6 scalability**
  - Dynamic provisioning of configuration data on terminals and HAs
  - Load-sharing across Home Agents (HAs)
- **Improvement of reliability**
  - Solutions for HA failover (no single point of failure)
- **Control of mobility service**
  - Service authorization based on a AAA infrastructure
- **Enable offering of "premium" network features**
  - On-demand and secure activation of fast handovers, QoS, etc.
- **Integration of Mobile IPv6 in real-life environments**
  - Coexistence with middle-boxes (firewalls, VPN concentrators, etc.)
  - Deployment of Mobile IPv6 in IPv4-only accesses

Example results – Home Agent load sharing and redundancy

- **Introduction of redundancy for Home Agent (HA) functionality**
- **Redundant HA Set consists of**
  - One Active HA
  - One or more Standby HAs
- **Provision of reliability by Redundant HA Set**
  - All HAs (Active and Standby) are available at MN bootstrapping
  - Active HA serves MNs for a home address/prefix
  - Switch to Standby HA in case Active HA fails
  - Switch between HAs should be transparent to applications
- **Two modes for HA reliability**
  - One mode completely transparent for MN (HA Virtual Switch)
  - One mode requiring to inform the MN about HA switch (HA Hard Switch)
- **A HA selection process allows a Mobility Service Provider to efficiently share the load between multiple Active HAs**

Example results – Proxy Mobile IPv6

- **Main goals of PMIPv6**
  - Support host mobility even for Mobile Nodes (MNs) without MIPv6 functionality / software
  - Remove MIPv6 signaling from air interface
  - ⇒ *Move control of mobility support from host to network*
- **PMIPv6 domain appears to the MN as single home link**
  - The MN sees on each link its Home Network Prefix
    - Throughout the whole PMIPv6 domain the MN can use its Home Address for communication
  - Mobility handling on behalf of MN is done on access router
    - This mainly keeps using MIPv6 mechanisms
- **PMIPv6**
  - is currently standardized in IETF
  - has been already adopted by 3GPP and WiMax Forum

Operational deployment of mobile ad-hoc networks

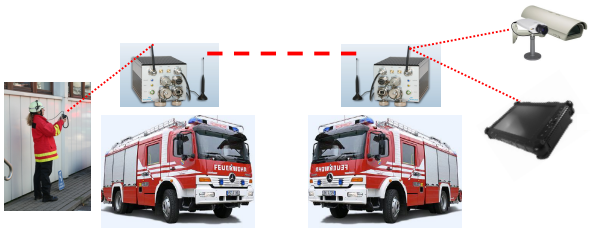
Overview of U-2010 project

- U-2010 at a glance
  - Research project funded by the European Commission
  - 16 European partner
  - Duration: Mai 2006 – July 2009
  - Budget: 4 M€ EC contribution
- Goal of U-2010
  - Provide efficient communication facilities for Public Safety Communication scenarios
  - Deployment of secure mobile ad-hoc networks for Public Safety Communication
  - Strong focus on IPv6
- More information
  - U-2010 presentation later this day
  - U-2010 project web site http://www.u2010.org

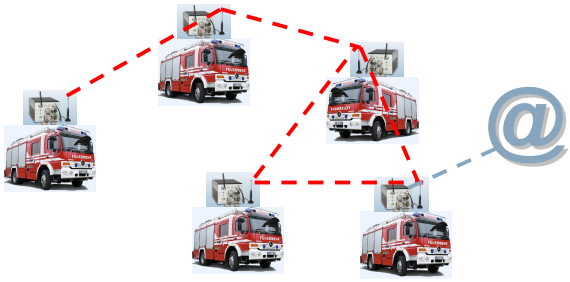
Why do we need secure mobile ad-hoc networks?

They provide communication solutions for scenes without infrastructure or where infrastructure has been destroyed

Functional overview – User access



Functional overview – relay and Wide Area Network connection



Key benefits

- Flexible, mobile communication system
  - Ad-hoc networks don't require pre-installed infrastructure
  - Ad-hoc networks optimize the communication solution dynamically, also for mobile users
- U-2010 ad-hoc network is based on WLAN technology
  - Up to 6,5 Mbit/s between ad-hoc nodes
  - Up to 16 Mbit/s at stationary use
- Integrated security solution
  - Strong security (IPsec) deployed between single ad-hoc nodes
  - Deployment of BSI guideline „Secure WLAN" for user access
- Wide range due to amplification
  - Ranges of typically 1-2 km between neighboring ad-hoc nodes
  - Relay functionality of nodes allow bigger distances between sender and receiver

Examples scenarios

- Surveillance of mass events
- Communication during crisis situtations and catastrophies
- Surveillance of critical infrastructures (industry, ports, tunnel, …)
- Emergencies in skylines / tunnel
- Mobile Operation (control tour, vehicle chase, escort, …)

HiMoNN product used for ad-hoc networking

- HiMoNN (Highly Mobile Network Node) supports IPv6 for
  - Routing information exchanged
  - Security established between HiMoNN nodes
  - User data transmission
  - Address configuration of attached user devices
- HiMoNN is able to connect to different Wide Area Networks
  - directly via terrestrial networks, UMTS or satellite
  - via gateways, e.g. Cisco Mobile Access Router
- HiMoNN provides monitoring application showing
  - current positions of HiMoNN ad-hoc nodes
  - quality of connections between HiMoNN nodes
- More information about HiMoNN
  - http://www.himonn.de

Conclusion

Conclusion

- IPv6 adds important key benefits for mobile scenarios
  - Sufficient address space for high number of mobile devices
  - Efficient and automatic addressing capabilities for mobile nodes
  - Mature mobility support functions standardized in relevant Standardization Bodies (e.g. IETF, 3GPP, WiMax Forum)
- Deployment of IPv6 based host mobility
  - Mature Mobile IPv6 functionality standardized in IETF
  - Network based variant Proxy Mobile IPv6 adopted by 3GPP and WiMax Forum
- Deployment of IPv6 based ad-hoc networks
  - Core mobile ad-hoc networking functionality standardized in IETF
  - Adoption in military environment and recently also in Public Safety Communication sector

Contact

Contact

Wolfgang Fritsche
Head of Internet Competence Center

Phone: +49 89 6088-2897
Email: fritsche@iabg.de

PRODUCTION READY IPV6 FROM CUSTOMER LAN TO THE INTERNET

LUTZ DONNERHACKE

Lutz Donnerhacke studied physics and mathemetics. Main interests are Internet deployment (Multicast, IPv6, mobile IP), privacy and free speech (Fitug e.V., Religio), cryptography (OpenPGP, DNSSEC), network security (Firewall, VPN, Certification Authority), software safety (proofable correct code), and esoterical programming languages (Haskell, SPARK).

As one of the founders of IKS GmbH (https://www.iks-jena.de/) he is working for this company since 1996 as a network administrator and programmer. IKS GmbH is a regional ISP with providing the full chain from Internet access over hosting, housing, application hosting up to full outsourcing.

ABSTRACT

How is a regional business ISP involved in practical IPv6 deployment? Starting from typical problems of business customers, solutions involving IPv6 are discussed. Deployment of IPv6 from the customer desktop to the Internet routing is sketched out following some important mile stones. The presentation is finished with some success and failure stories.

Produktives IPv6
vom LAN bis zum Internet

IKS GmbH
Lutz Donnerhacke

db089309: 1c1c 6311 ef09 d819 e029 65be bfb6 c9cb

IKS 1

IKS GmbH Jena

- Regionaler ISP, gegr. 1996
- Ausgerichtet auf Geschäftskunden
- Volles Angebot in Richtung Internet
  - Anschluß, Standortkopplung
  - Rechenzentrum: Hosting, Housing
  - Systeme: Linux, Microsoft, ASP, Miete
  - Projektmanagement, Sharepoint, CRM, CMS
  - Sicherheitsberatung, Softwareentwicklung

IKS 2

Problemfälle mit IPv4

- Adressdopplung bei privaten Adressen
  - Zusammenschluß von Zweigstellen
  - Ausgründungen mit SAP-Zugriff auf alte Jahre
- (Web)Entwicklungen für Kunden
  - Prototypenzugriffe auf Entwicklersysteme
  - Internes Kurzzeit-Hosting
- Zugriffserlaubnis- und -beschränkung
  - Herkunftsnachweis im Extranet
  - Zugriff auf Clients für Fernwartung

IKS 3

Problemfälle mit IPv4

- Laptop Roaming
  - Rechte unabhängig vom (Kunden)-Netz
  - Verbindungsabbrüche beim Umherlaufen
  - Zugriff auf Heim-Exchange beim Kunden
- Abrechnung & Mißbrauch
  - Verursacher hoher Daten-Volumen
  - Versender von Spam, Viren, Würmer
  - Roamingabrechnung in Fremdnetzen

IKS 4

IPv6 beim ISP

- Adressen beantragen und bekommen
- Router IPv6 fähig machen
  - Teuer, teilweise keine Software verfügbar
  - Zweite Infrastruktur, andere Topologie
- Abrechnung
  - Änderung der Meßmittel- und Werkzeuge
- Schulung von Personal
  - Vertrieb, Buchhaltung und Technik

IKS 5

IPv6 zum Kunden

- Keine Zusatzkosten verursachen
  - Router auf eigene Kosten aktualisieren
- Verzicht auf manuelle Tunnel
  - Debugbarkeit, Stabilität, Accounting
  - Routing per OSPF3 automatisieren
- Notfallplan: Automatische Tunnel
  - 6to4 und Teredo Relay für kurze Pfade
  - netsh int ipv6 teredo client teredo.iks-jena.de

IKS 6

IPv6 beim Kunden

- Konsequente Autokonfiguration (+ Filter)
- Linux & Windows Server umstellen
  - Linux i.d.R. problemlos, manchmal patchen
  - Windows i.d.R. problemlos, aktuelle Software auf 2008 laufen lassen, da API Änderung: (IIS(...), MSSQL, DNS, rDesktop, Exchange)
- Clients hinzunehmen
  - Protokoll aktivieren: Fertig
  - Statt DHCP site-local- oder Multicast-DNS

IKS 7

Gute Erfahrungen mit IPv6

- Killerapplikationen
  - RemoteDesktop für Fernwartung
  - öffentliche Prototypen auf Entwicklerrechnern
- Marketing
  - Nutzerprofile anhand von IPs
  - Sonderaktionen nur für IPv6
- Admins
  - Vereinfache Netzplanung & Routing
  - IPs werden lesbar (VLAN, Kunde, Etage, ...)

IKS 8

Gute Erfahrungen mit IPv6

- Managerfreuden: Roaming im Kundennetz
- Teleworker: Automatisches VPN, Intranet
- Buchhaltung: Schnellere Klärung von Rechnungseinsprüchen bei Volumentarif
- Mitarbeiter: Wechselnde IPs als Schutz
- Programmierer: einfachere API
- Schnell und tut: DNS, E-Mail, Web

IKS 9

Schlechte Erfahrungen mit IPv6

- IPv6 extrahiert Probleme: Fordert Lösung
  - Bekannte Fehler werden nicht mehr umschifft
- Aktuelle Microsoft Produkte auf Win2003
  - Unklare Fehlerbilder, defektes Kerberos, ...
- Hardware nicht IPv6 fähig
  - Zusätzliche Updates und Tests
- Unverständnis bei den Beteiligten
  - „Patentrezept“: IPv6 auschalten

IKS 10

Kundengespräch

Gut

- Funktion erhalten
- Gut strukturieren
- Proxies v4/v6 bauen
- Umstellungen feiern
- Persönlicher Ehrgeiz
- Aktiv selbst nutzen
- IPv6 primär ausgeben
- Kurze Adressen X::1

Schlecht

- Erwartungen
  - Kundenbindung
  - Leichtes Renumber
- Drohungen
  - IPv4 – Knappheit
  - Nichterreichbarkeit
- Ausreden
  - IPv6 verteufeln
  - Fehler abschieben

IKS 11

Produktives IPv6

Fragen?

IKS 12

IPV6 - DIE BASIS FÜR NETZWERKZENTRIERTE OPERATIONSFÜHRUNG (NETOPFÜ) IN DER BUNDESWEHR HERAUSFORDERUNGEN - ANWENDUNGSFALLBETRACHTUNGEN - AKTIVITÄTEN

CARSTEN HATZIG

Dipl.-Ing (FH) Carsten Hatzig, Jahrgang 1968, studierte Nachrichtentechnik in Hamburg. Nach dem Studium war er einige Jahre als Projektingenieur im Bereich mobile Funkmelde- und -Ortungsanlagen in der freien Wirtschaft tätig, bevor er 1997 zum Bundesamt für Wehrtechnik und Beschaffung (BWB) wechselte. Seine Aktivitäten an der Wehrtechnischen Dienststelle für Informationstechnologie und Elektronik (WTD 81) begannen 1998 im Bereich IV&V für Führungs-Informations- und -Waffeneinsatzsysteme.

2002 wechselte er in den Bereich taktischer Kommunikationssysteme und ist mit Unterbrechung seither im Bereich Software Defined Radio (SDR) national und international aktiv. Parallel war er 2003-2004 Vorhabeningenieur im Projekt SATCOMBw und hat seit Mitte 2003 national die technische Leitung in den konsekutiven NATO F&T-Projekten INSC (Interoperable Networks for Secure Communications) und CoNSIS (Coalition Networks for Secure Information Sharing) inne, die auf die sichere Kommunikationsfähigkeit in heterogenen IPv6-basierten Netzwerkverbünden zielen.

Seit 2004 ist er Mitglied der Arbeitsgruppe Migration IPv4->v6 unter Leitung des Bundesamtes für Informationsmanagement und Informationstechnik der Bundeswehr. In diesem Rahmen hat er Teile des nationalen IPv6-Migrationsrahmenkonzeptes und das IT-Adressierungskonzept der Bundeswehr mit gestaltet. Gegenwärtig liegen seine Schwerpunkte im Bereich sichere ad-hoc vernetzte Kommunikation und Realisierbarkeit von NEC (Network Enabling Capabilities).

ABSTRACT

In der statischen, homogenen Netzwerkumgebung von LANs und WANs macht IPv6 vieles einfacher, einheitlicher und effizienter. Seine wahren Vorzüge kommen jedoch erst zur Geltung, wenn Networking im Verbund von heterogenen Netzen mit mobilen Teilnehmern und Teilnetzen sicher und mit dediziertem Quality-of-Service erfolgen muss. Dies ist die Herausforderung bei der Verwirklichung von NetOpFü, der Netzwerk-zentrierten Operationsführung in der Bundeswehr. Es werden die hierfür benötigten Netzwerkfunktionalitäten vorgestellt, die nur vermittels des konsequenten Einsatzes von IPv6 realisiert werden können.

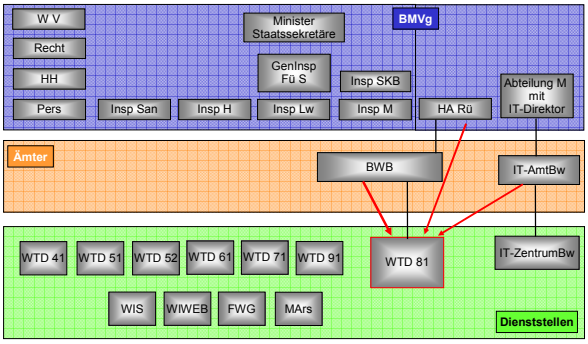
IP v6

Die Basis für Netzwerkzentrierte Operationsführung (NetOpFü) in der Bundeswehr – Herausforderungen – Anwendungsfallbetrachtungen – Aktivitäten

Übersicht

1. Die Bundeswehr und ihr Rüstungsbereich – die WTD 81
2. „Waffen unserer Zeit“
3. Anforderungen des Gefechtsfelds auf dem Weg zur Netzwerkzentrierten Operationsführung (NetOpFü)
4. Vorzüge von IPv6 auf dem NetOpFü-fähigen Gefechtsfeld
5. Technische Hürden für „All-IP“ in Taktischen Operationen
6. IPv6-Fähigkeit in der Bundeswehr

Organisation des Rüstungsbereichs der Bundeswehr



Die Wehrtechnische Dienststelle für Informationstechnologie und Elektronik (WTD 81) in Greding

Ltg 001
Direktor WTD 81

Stab 010

TBS 100
Technisch-betrieblicher Service

WAS 900
Wirtschaftlich-administrativer Service

GB 200 Informationsübertragung/-verarbeitung	GB 300 Informationsgewinnung	GB 400 Sondergebiete, Elektronik
GF 210: IT-Sicherheit **GF 220: Kommunikation** GF 230: Führungsinformationssysteme, Führungs- und Waffeneinsatzsysteme GF 240: Simulationsinfrastruktur	GF 310: Zielsuch- & Aufklärungstechnik GF 320: Sensortechnologie & Robotik GF 330: Eloka & Wehrmaterial anderer Staaten	GF 410: Elektromagnetische Effekte (EME)/ EMV GF 420: Feuerleittechnik; Modellbildung & Simulation GF 430: Navigation GF 440: Prüftechnik, Messmittel & Systemtechnik

Übersicht

1. Die Bundeswehr und ihr Rüstungsbereich – die WTD 81
2. „Waffen unserer Zeit“
3. Anforderungen des Gefechtsfelds auf dem Weg zur Netzwerkzentrierten Operationsführung (NetOpFü)
4. Vorzüge von IPv6 auf dem NetOpFü-fähigen Gefechtsfeld
5. Technische Hürden für „All-IP“ in Taktischen Operationen
6. IPv6-Fähigkeit in der Bundeswehr

Was früher die alles überlegende Waffe war …ein Beispiel:

Heckler&Koch G3
Kaliber 7,62x51mm (wie AK47, M60),
Kadenz 550/min

Heckler&Koch G36
Kaliber 5.56x45mm,
Kadenz 750/min

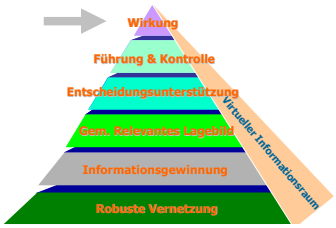
Waffen sollen „interoperabel“ sein!

Warum Wechsel? - Weil sich Anforderungen ändern!

Die überlegenste Waffe unserer Tage: Information!

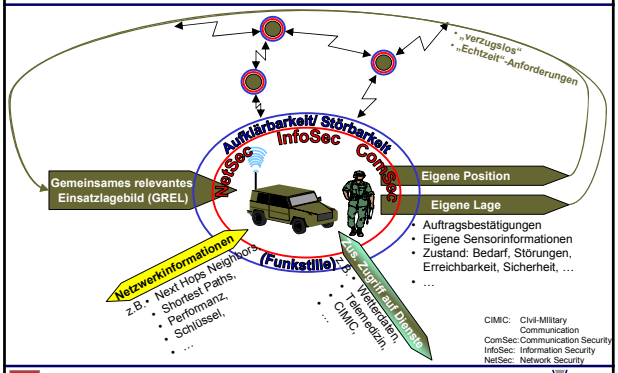
7

Viele Formate – Viele Transportmechanismen –
Der heute gebräuchlichste, vielseitigste Transportmechanismus:



Der Soldat als Netzwerkelement

8



Übersicht

9

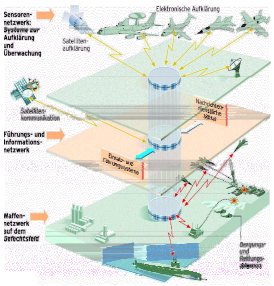
1. Die Bundeswehr und ihr Rüstungsbereich – die WTD 81
2. „Waffen unserer Zeit"
3. Anforderungen des Gefechtsfelds auf dem Weg zur Netzwerkzentrierten Operationsführung (NetOpFü)
4. Vorzüge von IPv6 auf dem NetOpFü-fähigen Gefechtsfeld
5. Technische Hürden für „All-IP" in Taktischen Operationen
6. IPv6-Fähigkeit in der Bundeswehr

Anforderungen des Gefechtsfelds?

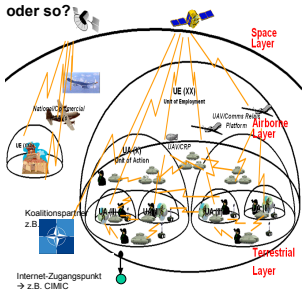
10

Wie sind die Netzwerke und Dienste auf dem Gefechtsfeld organisiert?

… So?

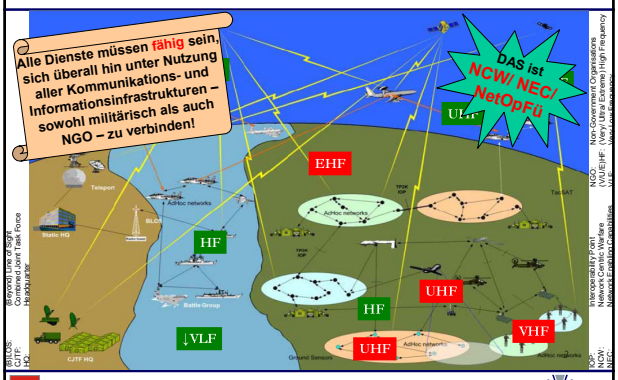


oder so?



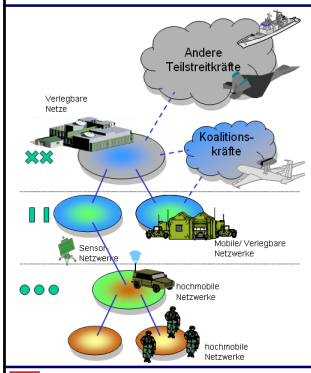
Anforderungen des Gefechtsfelds!

11



IST-Zustand

12

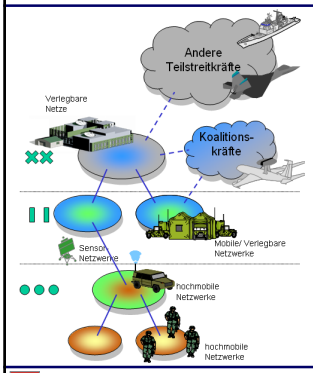


Die Einschränkungen der eingeführten („Legacy") Systeme müssen berücksichtigt werden.

- Unterschiedliche Kommunikations-Architekturen und -Protokolle auf den verschiedenen Führungsebenen.
  - Nicht alle Systeme „sprechen" IP,
  - Keine einheitliche Sicherheits-Architektur.
- Die horizontale Kommunikation erfordert i.d.R. Gateways oder Bridging/ Routing.
- Nutzer können i.d.R. nicht ohne Konfigurationsänderung von einer Gruppe in eine andere wechseln.
- „Geschlossene Nutzergruppen" auf den jeweiligen Führungsebenen.
- Begrenzte Interoperabilität nicht nur im Koalitionsrahmen, sondern auch innerhalb des Systemverbunds einer Nation.

Der erste Schritt zu netzwerkzentrierten Operationsführung: IP

13



- **IP kann nicht in allen Kommunikations-systemen eingeführt werden – bis auf weiteres müssen einige Nicht-IP-fähige Enklaven aufrecht erhalten werden:**
  - Z.B. Tactical Data Links (LINK11/16/22),
  - Gateways stellen die Verbindung IP ⇔ non-IP her.
- **IPv4 oder IPv6?**
  - Die IPv4-Protokollfamilie stellt alle in einer militärischen Netzwerkumgebung benötigten Funktionalitäten bereit – jedoch i.d.R. nicht auf die am einfachsten zu managende Weise.
- **Warum IPv6?** u.a. …
  - Bessere Unterstützung dynamischer Ende-zu-Ende Sicherheitsbeziehungen durch einen großen verfügbaren Adressraum,
  - Quality-of-Service Unterstützung,
  - Mobilitätsunterstützung.

Übersicht

14

1. Die Bundeswehr und ihr Rüstungsbereich – die WTD 81
2. „Waffen unserer Zeit“
3. Anforderungen des Gefechtsfelds auf dem Weg zur Netzwerkzentrierten Operationsführung (NetOpFü)
4. Vorzüge von IPv6 auf dem NetOpFü-fähigen Gefechtsfeld
5. Technische Hürden für „All-IP“ in Taktischen Operationen
6. IPv6-Fähigkeit in der Bundeswehr

Vorzüge von IPv6 (1/6): Adressraum

15

IST:
Nationale IPv4-Adressierungspläne, die gekennzeichnet sind durch …

- Begrenzte Verfügbarkeit von öffentlichen = global routebaren Adressen,
- Unkorrelierte Mehrfachnutzung des privaten Adressraums (auf Führungsebenen/ im Koalitionsrahmen),

… führen zu überlappenden Adressierungsplänen, deren Behebung einen hohen Management-Aufwand erfordert.

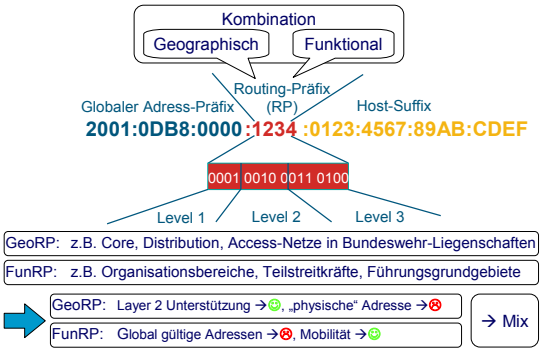
→ Lösung: Network Address Translation (NAT) – Ein NAT-Gateway muss an jedem Übergang zwischen Koalitionsdomänen platziert werden, das die in dynamischen Szenarien benötigte Flexibilität einschränkt.

SOLL:
Konfliktfreie konsistente Adressierungspläne mit global gültigen IPv6-Adressen bieten

- Durchgängige IP-Kommunikation
- Möglichkeit der sicheren Ende-zu-Ende-Kommunikation zwischen den Informationssystemen aller Führungsebenen und Koalitionspartner.

Vorzüge von IPv6 (2/6): Adressraum

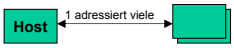
16



Vorzüge von IPv6 (3/6): Multicast und Anycast

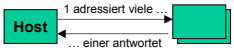
17

Multicast:



- Wesentliches Element für die dynamische Bildung von Gruppen mit gemeinsamen Informationsaustauschbeziehungen.
- Multicast-Gruppen können sich über eine spezifische Koalitionsdomäne hinaus erstrecken.
- Neuartige Bereichseinschränkung für Multicast im IPv6-Header.

Anycast:



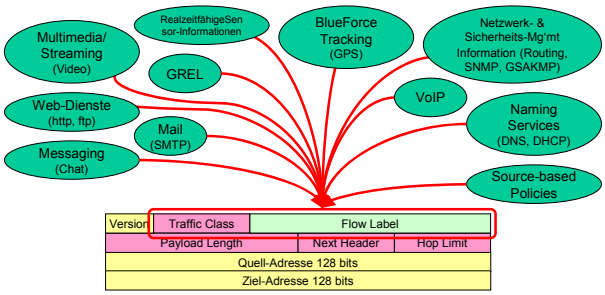
- Teilnehmer können vermittels nur eines Aufrufs mit einer Adresse auf Dienste zugreifen, die von mehreren redundanten Servern bereitgestellt werden.
- Anycast-Adressierung unterstützt Service-Orientierte Architekturen (SOA).

Operationeller Mehrwert:

- **Das Netzwerk berücksichtigt die beschränkte Ressource Übertragungskapazität!**

Vorzüge von IPv6 (4/6): Unterstützung von Quality-of-Service

18

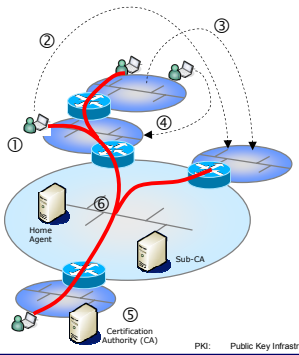


Priorisierungsregeln müssen aufgestellt werden nicht nur in Bezug auf die genutzten Applikationen, sondern auch in Bezug auf die Rolle des Nutzers, der kommunizieren will.

Vorzüge von (5/6): Mobilitätsunterstützung

19

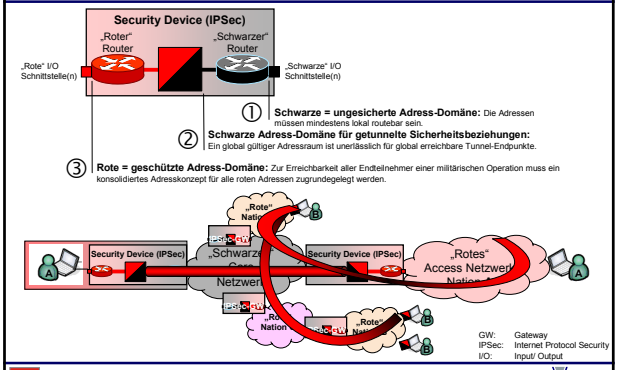
1. MANET (Mobile Ad-hoc NETworking) Fähigkeit einzelner Funkknoten, als Router zu agieren.
2. Mobile IP (gibt es auch für IPv4).
3. NEMO (NEtwork MObility) Fähigkeit mobiler Netzwerke, sich mit beliebigen anderen Netzen zu verbinden.
4. Kombination von MANET und NEMO Funktionalitäten (Nested Mobility).
5. Sichere MANET-/ NEMO-Domänen in einer PKI.
6. Sichere Multicast-Kommunikation im MANET.



PKI: Public Key Infrastructure

Vorzüge von IPv6 (6/6): Sichere Ende-zu-Ende-Kommunikation

20



GW: Gateway
IPSec: Internet Protocol Security
I/O: Input/ Output

Übersicht

21

1. Die Bundeswehr und ihr Rüstungsbereich – die WTD 81
2. „Waffen unserer Zeit"
3. Anforderungen des Gefechtsfelds auf dem Weg zur Netzwerkzentrierten Operationsführung (NetOpFü)
4. Vorzüge von IPv6 auf dem NetOpFü-fähigen Gefechtsfeld
5. Technische Hürden für „All-IP" in Taktischen Operationen
6. IPv6-Fähigkeit in der Bundeswehr

Realisierbarkeit von „All-IP(v6)" in Taktischen Kommunikationssystemen (1/2)

22

Auch IPv6 bietet noch keine fertigen Lösungen an für die ideale Unterstützung der NetOpFü unter Berücksichtigung aller eingeführten Kommunikationssysteme der Bundeswehr.

Es besteht Forschungs-/ Entwicklungs- und Untersuchungsbedarf in Bezug auf:

1. Anbindung/ Integration von **Legacy-Systemen** durch interoperable Gateways (siehe deutsche Beteiligung in den NATO-Projekten TACOMS POST 2000 und CoNSIS)
2. Nutzbares Potenzial der **Anycast**-Adressierung zur Unterstützung von **SOA**,
   - **Service Discovery Protokolle** wie z.B. das IPSec Discovery (IDP, siehe NATO-Projekte INSC und CoNSIS) müssen standardisiert werden;
3. Eine **global gültige/ Koalitions-weite IP-Sicherheitsarchitektur** muss sowohl verlegbare als auch hochdynamische Netzwerk-Domänen und -Teilnehmer unter Berücksichtigung beliebiger Mobilität und Netzanbindung, Verbindungsverfügbarkeiten und -bandbreiten unterstützen.
   - Skalierbare **Tactical PKI**, z.B. eine CA mit verteilten Sub-CAs,
   - **Trust Sharing**-Konzepte und -Mechanismen zwischen verchiedenen Koalitionspartnern,
   - **CiMiC** (Cicil Military Communications) dürfen die Koalitionssicherheit nicht kompromittieren;

CA: Certification Authority
CoNSIS: Coalition Networks for Secure Information Sharing
INSC: Interoperable Networks for Secure Communications
SOA: Service-Orientierte Architekturen
TACOMS Post 2000: Tactical Command Post „nach 2000"

Realisierbarkeit von „All-IP(v6)" in Taktischen Kommunikationssystemen (2/2)

23

Es besteht Forschungs-/ Entwicklungs- und Untersuchungsbedarf in Bezug auf (Forts.):

4. **Optimierung von MANET** Routingmechanismen,
   - Es muss ein Kompromiss gefunden werden zwischen dem geringen Management-Overhead bei reaktivem Routing und sofortiger Routenverfübarkeit bei proaktivem Routing,
   - Echtes **Multicast-Routing in der mobilen Domäne**,
   - **Intrusion Detection** Mechanismen für MANETs.
5. **QoS**, welcher die Verschiedenartigkeit der verbundenen Netzwerkdomänen (z.B. in Bezug auf Bandbreite und Laufzeit) und die dynamische Verfügbarkeit von Kommunikationsverbindungen angemessen berücksichtigt,
   - Zu standardisierende **Service Interoperability Profiles**,
   - Netzwerk-Ressourcen-Management unter Berücksichtigung von Funkstille (EmCon)
6. **IPv6 (multicast) unterstützende Applikationen**.

EmCon: Emission Control
MANET: Mobile Ad-hoc NETworking
QoS: Quality of Service

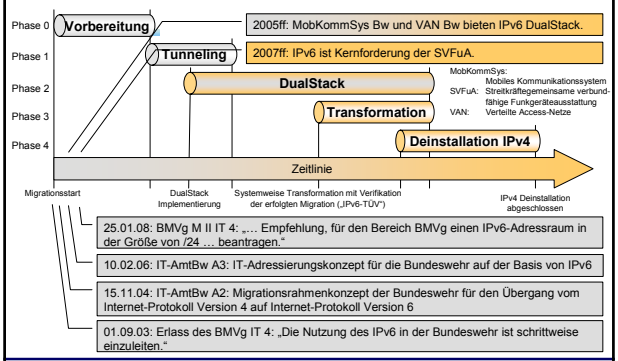
Übersicht

24

1. Die Bundeswehr und ihr Rüstungsbereich – die WTD 81
2. „Waffen unserer Zeit"
3. Anforderungen des Gefechtsfelds auf dem Weg zur Netzwerkzentrierten Operationsführung (NetOpFü)
4. Vorzüge von IPv6 auf dem NetOpFü-fähigen Gefechtsfeld
5. Technische Hürden für „All-IP" in Taktischen Operationen
6. IPv6-Fähigkeit in der Bundeswehr

Der lange Weg zu IPv6 Bw

25



Bundesamt für Informationsmanagement und Informationstechnik in der Bundeswehr

Bundeswehr

Es gibt viel zu tun. – Wir packen es an!
Danke für Ihre Aufmerksamkeit!

IT-AmtBw

Kontakt:

- IT-Direktor des Bundesministeriums der Verteidigung, BMVg M II, Bonn
- Bundesamt für Informationmanagement und Informationstechnik in der Bundeswehr, IT-AmtBw A3, Koblenz
- Wehrtechnische Dienststelle für Informationstechnologie und Elektronik, WTD 81- GF 220, Greding

WINDOWS VISTA & IPV6

BERNARD OURGHANLIAN

Bernard Ourghanlian joined Microsoft France in 1999 as the Chief Technical Officer and has been appointed as the Chief Technology Officer and Chief Security Officer for Microsoft France since 2001. As a CTO and CSO, Bernard leads the subsidiary's strategy for Technology and Security. He is also in charge of managing Microsoft France technical risks, especially on large projects. He also has strong links with Microsoft Corporation product engineering and Microsoft Research and actively participates in Microsoft products and solutions design. He is a member of the joint INRIA-Microsoft Research research laboratory executive committee.

Bernard holds a PhD in Mathematics and has authored several articles and books about computer science and mathematics. Bernard also continues to give lectures and training courses in various French universities and schools.

ABSTACT

Both Microsoft Windows Vista and Windows Server 2008 include the Next Generation TCP/IP stack, a redesigned TCP/IP protocol stack with an integrated version of both Internet Protocol version 4 (IPv4) and Internet Protocol version 6 (IPv6). The goal of this presentation is to give an overview of the new Windows Vista network architecture, to present some IPv4 to IPv6 Migration issues and how to solve those.

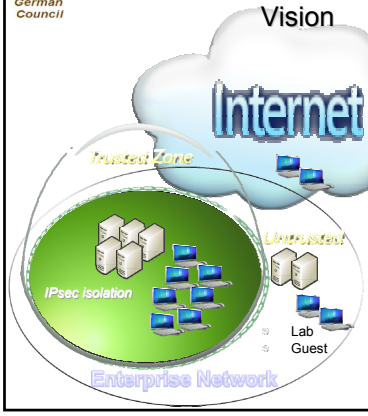
Windows Vista, Windows Server 2008 & IPv6

Bernard Ourghanlian

Chief Technology & Security Officer

Microsoft France

The Seamless Networks Vision

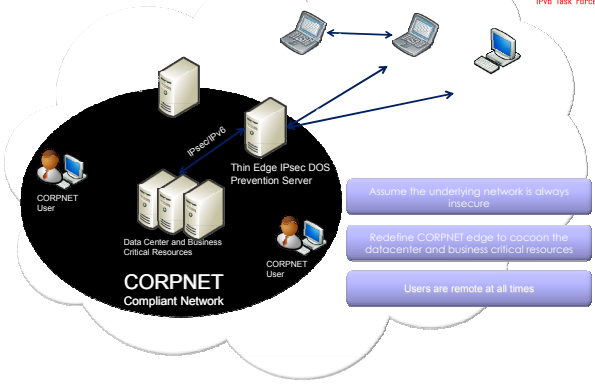


- Internet IS your network
- Applications just work
- All communications authenticated
- Trust boundaries defined by policy instead of topology

IPv6 is a Key Building Block

- The seamless network demands new paradigm
  - Ease of connectivity
  - Security
  - Mobility
- IPv6 is required to support the new network

How am I using IPv6 today ?



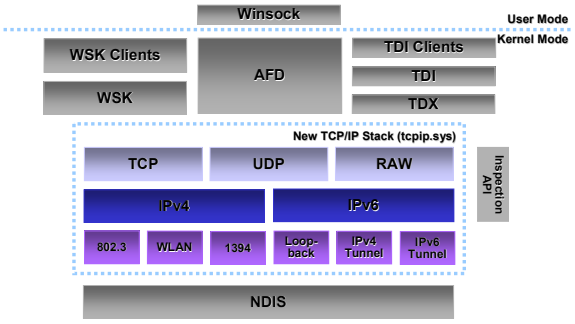
IPv6 Enabled in Vista and Windows Server 2008

- All Vista and Windows Server 2008 components are IPv6 capable
  - Some components are IPv6 only
- IPv6 is on by default, and preferred
  - Controllable via Group Policy
- All Microsoft products in "Wave 2008" are IPv6 capable
- GUI-based configuration
- Full support for IPsec

A lot of new networking features in Vista and Windows Server 2008

- **New TCP/IP Stack**
- Domain Name System
- Quality of Service
- Server Message Block 2.0
- Http.sys enhancements
- WinINet enhancements
- Windows Sockets enhancements
- Network Device Interface Specification (NDIS) 6.0 and 6.1
- Network Awareness
- Windows Peer-to-Peer Networking enhancements
- Windows Firewall enhancements
- Internet Protocol security (IPsec) improvements

Windows Vista Networking Architecture



Dual IP Layer architecture for IPv6

- IPv6 in Windows XP and Windows Server 2003 is a dual stack architecture
  - For IPv6 support, you have to install a separate protocol through the Network Connections folder. The separate IPv6 protocol stack had its own Transport layer that included Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) and its own Framing layer. Changes to protocols in either the Transport or Framing layers had to be done to two Windows drivers; Tcpip.sys for the IPv4 protocol stack and Tcpip6.sys for the IPv6 protocol stack
- The new TCP/IP stack supports the dual IP layer architecture in which the IPv4 and IPv6 implementations share **common Transport and Framing layers**
  - The new TCP/IP stack has both IPv4 and IPv6 enabled by default
  - No need to install a separate component to obtain IPv6 support

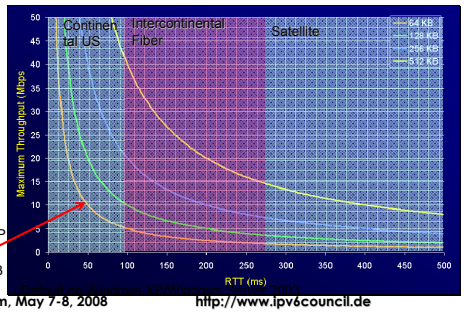
Performance!

- Major improvements
  - Receive Window Auto Tuning
  - Compound TCP (CTCP) for very fast LANs
  - ECN (Explicit Congestion Notification)
    - Overloaded routers can mark packets so that nodes slow down and packet loss is reduced
  - Better support for lossy networks (e.g. wireless in congested areas):
    - RFC: 2582, 2883, 3517, 4138
  - Some great IPv6 features retrofitted into IPv4, e.g.: Neighbour Unreachability Detection

Receive Window Auto Tuning

- The TCP receive window size is the amount of data that a TCP receiver allows a TCP sender to send before having to wait for an acknowledgement. To correctly determine the value of the maximum receive window size for a connection based on the current conditions of the network, the new TCP/IP stack supports Receive Window Auto-Tuning.
  - Receive Window Auto-Tuning continually determines the optimal receive window size on a per-connection basis by measuring the bandwidth-delay product (the bandwidth multiplied by the latency of the connection) and the application retrieve rate, and automatically adjusts the maximum receive window size on an ongoing basis.
- With better throughput between TCP peers, the utilization of network bandwidth increases during data transfer.
  - If all the applications are optimized to receive TCP data, then the overall utilization of the network can increase substantially, making the use of Quality of Service (QoS) more important for networks that are operating at or near capacity.

Receive Window Auto Tuning

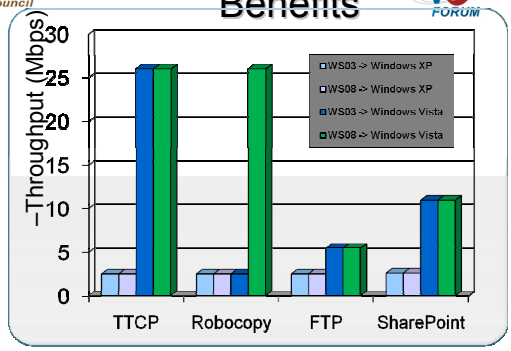


Default on Windows XP Windows Server 2003

Compound TCP

- For TCP connections with a large receive window size and a large bandwidth-delay product, Compound TCP (CTCP) in the new TCP/IP stack aggressively increases the amount of data sent at a time by monitoring the bandwidth-delay product, delay variations, and packet losses.
- CTCP also ensures that its behavior does not negatively impact other TCP connections.
  - In testing performed internally at Microsoft, large file backup times were reduced by almost half for a 1 Gigabit per second connection with a 50 millisecond round-trip time. Connections with a larger bandwidth-delay product can have even better performance.
- Receive Window Auto Tuning optimizes receiver-side throughput and CTCP optimizes sender-side throughput. By working together, they can increase link utilization and produce substantial performance gains for large bandwidth-delay product connections.
- CTCP is enabled by default for computers running Windows Server 2008 and disabled by default for computers running Windows Vista.
- You can enable CTCP with the **netsh interface tcp set global congestionprovider=ctcp** command and disable CTCP with the **netsh interface tcp set global congestionprovider=none** command.

Example of Auto-Tuning Benefits



Between Microsoft Datacenters in Redmond, United States and Sydney, Australia.

ECN Support

- When a TCP segment is lost, TCP assumes that the segment was lost due to congestion at a router and performs congestion control, which dramatically lowers the TCP sender's transmission rate.
- With Explicit Congestion Notification (ECN) support (RFC 3168) on both TCP peers and the routers in the routing infrastructure, routers experiencing congestion mark the packets as they forward them.
  - TCP peers receiving marked packets lower their transmission rate to ease congestion and prevent segment losses.
  - Detecting congestion before packet losses are incurred increases the overall throughput between TCP peers. Windows Server 2008 and Windows Vista support ECN, but it is disabled by default.
  - You can enable ECN support with the **netsh interface tcp set global ecncapability=enabled** command.

Enhancements for High-loss Environments

- The new TCP/IP stack supports the following RFCs to optimize throughput in high-loss environments:
  - RFC 2582: The NewReno Modification to TCP's Fast Recovery Algorithm
    - The NewReno algorithm provides faster throughput by changing the way that a sender can increase their sending rate when multiple segments in a window of data are lost and the sender receives a partial acknowledgement (an acknowledgement for only part of the data that has been successfully received).
  - RFC 2883: An Extension to the Selective Acknowledgement (SACK) Option for TCP
    - SACK, defined in RFC 2018, allows a receiver to indicate up to four noncontiguous blocks of received data. RFC 2883 defines an additional use of the fields in the SACK TCP option to acknowledge duplicate packets. This allows the receiver of the TCP segment containing the SACK option to determine when it has retransmitted a segment unnecessarily and adjust its behavior to prevent future retransmissions. The fewer retransmissions that are sent, the better the overall throughput.

Enhancements for High-loss Environments

- RFC 3517: A Conservative Selective Acknowledgment (SACK)-based Loss Recovery Algorithm for TCP
  - The implementation of TCP/IP in Windows Server 2003 and Windows® XP uses SACK information only to determine which TCP segments have not arrived at the destination. RFC 3517 defines a method of using SACK information to perform loss recovery when duplicate acknowledgements have been received, replacing the fast recovery algorithm when SACK is enabled on a connection. The new TCP/IP stack keeps track of SACK information on a per-connection basis and monitors incoming acknowledgements and duplicate acknowledgements to more quickly recover when multiple segments are not received at the destination.
- RFC 4138: Forward RTO-Recovery (F-RTO): An Algorithm for Detecting Spurious Retransmission Timeouts with TCP and the Stream Control Transmission Protocol (SCTP)
  - Spurious retransmissions of TCP segments can occur when there is a sudden and temporary increase in the round trip time (RTT). The F-RTO algorithm prevents spurious retransmission of TCP segments. The result of the F-RTO algorithm is that for environments that have sudden and temporary increases in the RTT, such as when a wireless client roams from one wireless access point (AP) to another, F-RTO prevents unnecessary retransmission of segments and more quickly returns to its normal sending rate.

Enhancements for High-loss Environments

- RFC 3042: Enhancing TCP's Loss Recovery Using Limited Transmit
  - With Limited Transmit, when TCP has additional data to send on a connection and two consecutive duplicate ACKs have been received, TCP can send additional segments on the connection when the receiver's advertised window allows the transmission of the additional segments and when the additional segments contain data that is within two segments beyond the current congestion window. The ability of TCP to send additional segments helps ensure that fast retransmit can be used to detect segment losses, rather than waiting for an RTO timer expiration.

Neighbor Unreachability Detection for IPv4

- Neighbor Unreachability Detection is a feature of IPv6 in which a node tracks whether a neighboring node is reachable, providing better error detection and recovery when a neighboring node suddenly becomes unavailable. The new TCP/IP stack also supports Neighbor Unreachability Detection for IPv4 traffic by tracking the reachable state of IPv4 neighbors in the Address Resolution Protocol (ARP) cache.
  - IPv4 Neighbor Unreachability Detection determines reachability through an exchange of unicast ARP Request and ARP Reply messages or by relying on upper layer protocols such as TCP.
  - With IPv4 Neighbor Unreachability Detection, IPv4-based communications benefit by determining when neighboring nodes such as routers are no longer reachable.

Fail-back Support for Default Gateway Changes

- Dead gateway detection in TCP/IP for Windows Server 2003 and Windows XP provides a fail-over function, but not a fail-back function in which a dead gateway is tried again to determine whether it has become available.
- The new TCP/IP stack provides fail-back for default gateway changes by periodically attempting to send TCP traffic through the previously detected unavailable gateway.
  - If the TCP traffic sent through the previous gateway is successful, the new TCP/IP stack switches the default gateway back to the previous default gateway.
  - Support for fail-back to primary default gateways can provide faster throughput by sending traffic through the primary default gateway on the subnet.

Changes in PMTU Black Hole Router Detection

- Path maximum transmission unit (PMTU) discovery, defined in RFC 1191, relies on the receipt of Internet Control Message Protocol (ICMP) Destination Unreachable-Fragmentation Needed and Don't Fragment (DF) Set messages from routers containing the MTU of the next link.
- However, in some cases, intermediate routers silently discard packets that cannot be fragmented. These types of routers are known as black hole PMTU routers. Additionally, intermediate routers might drop ICMP messages because of configured packet filtering rules.
- The result is that TCP connections can time out and terminate because intermediate routers silently discard large TCP segments, their retransmissions, and the ICMP error messages for PMTU discovery.

Changes in PMTU Black Hole Router Detection

- PMTU black hole router detection senses when large TCP segments are being retransmitted and automatically adjusts the PMTU for the connection, rather than relying on the receipt of the ICMP Destination Unreachable-Fragmentation Needed and DF Set messages.
- With TCP/IP in Windows Server 2003 and Windows XP, PMTU black hole router detection is disabled by default because enabling it often yielded false positive results, lowering the MTU unnecessarily and decreasing performance.

Changes in PMTU Black Hole Router Detection

- With increasing use of packet filtering rules on routers to drop ICMP traffic, the new TCP/IP stack enables PMTU black hole router detection by default to prevent TCP connections from terminating and uses an improved method of detecting PMTU black home routers.
- PMTU black hole router detection is triggered on a TCP connection when it begins retransmitting full-sized segments with the DF flag set.
  - TCP resets the PMTU for the connection to 536 bytes and retransmits its segments with the DF flag cleared.
  - This maintains the TCP connection, although at a possibly lower PMTU size than actually exists for the connection.
- This behavior also applies to IPv6 traffic. For IPv6, the PMTU is set to 1220 bytes if a PMTU black hole router is detected.

Network Diagnostics Framework Support

- The Network Diagnostics Framework is an extensible architecture that helps users recover from and troubleshoot problems with network connections. For TCP/IP-based communication, the Network Diagnostics Framework prompts the user through a series of options to eliminate possible causes until the root cause of the problem is identified or all possibilities are eliminated. Specific TCP/IP-related issues that the Network Diagnostics Framework can diagnose are the following:
  - Incorrect IP address
  - Default gateway (router) is not available
  - Incorrect default gateway
  - Network Basic Input/Output System (NetBIOS) over TCP/IP (NetBT) name resolution failure
  - Incorrect Domain Name System (DNS) settings
  - Local port is already being used
  - The Dynamic Host Configuration Protocol (DHCP) Client service is not running
  - There is no remote listener
  - The media is disconnected
  - The local port is blocked
  - Low on memory

ESTATS Support

- The new TCP/IP Stack supports the "TCP Extended Statistics MIB" Internet draft (draft-ietf-tsvwg-tcp-mib-extension-15.txt), which defines extended performance statistics for TCP.
- By analyzing ESTATS on a connection, it is possible to determine whether the performance bottleneck for a connection is the sending application, the receiving application, or the network.
- ESTATS is disabled by default and can be enabled per connection.
- With ESTATS, third-party independent software vendors (ISVs) can create powerful diagnostics and network throughput analysis applications. Tcpanalyzer.exe, available in the Windows Vista SDK, is a diagnostic tool based on ESTATS

New Packet Filtering Model with Windows Filtering Platform

- The Windows Filtering Platform (WFP) is a new architecture in the new TCP/IP Stack that provides APIs so that third-party ISVs can participate in the filtering decisions that take place at several layers in the TCP/IP protocol stack and throughout the operating system.
- WFP also integrates and provides support for next-generation firewall features such as authenticated communication and dynamic firewall configuration based on applications' use of the Windows Sockets API (application-based policy).
- ISVs can create firewalls, anti-virus software, diagnostic software, and other types of applications and services.
  - Windows Firewall and IPsec in Windows Server 2008 and Windows Vista use the WFP API.

Teredo enhancements

- The Teredo client in Windows Vista is enabled but might be active or inactive, depending on the computer's configuration.
- The Teredo client in Windows Server 2008 and Windows Vista uses the 2001::/32 prefix as assigned by IANA and uses unused bits in the Flags field of the Teredo address to help prevent address scans of Teredo addresses.
- Teredo can now be manually enabled for domain member computers and can work if there is one Teredo client behind one or more symmetric network address translators (NATs).
- A symmetric NAT maps the same internal (private) address and port number to different external (public) addresses and ports, depending on the external destination address (for outbound traffic).
  - This new behavior allows Teredo to work between a larger set of Internet-connected hosts.

Integrated Ipsec support

- In Windows Server 2008 and Windows Vista, IPsec support for IPv6 traffic is the same as that for IPv4, including support for Internet Key Exchange (IKE) and data encryption.
- The Windows Firewall with Advanced Security and IP Security Policies snap-ins now support the configuration of IPsec policies for IPv6 traffic in the same way as IPv4 traffic.
- For example, when you configure an IP filter as part of an IP filter list in the IP Security Policies snap-in, you can now specify IPv6 addresses and address prefixes when specifying a specific source or destination IP address.

LLMNR

- Link-Local Multicast Name Resolution (LLMNR) allows IPv6 and IPv4 hosts on a single subnet without a DNS server to resolve each other's names.
- This capability is useful for single-subnet home networks and ad hoc wireless networks

Support for ipv6-literal.net Names

- Windows Vista and Windows Server 2008 support the use of *IPv6Address*.ivp6-literal.net names. An ipv6-literal.net name can be used in services or applications that do not recognize the syntax of normal IPv6 addresses.
  - To specify an IPv6 address within the ipv6-literal.net name, convert the colons (:) in the address to dashes (-). For example, for the IPv6 address 2001:db8:28:3:f98a:5b31:67b7:67ef, the corresponding ipv6-literal.net name is 2001-db8-28-3-f98a-5b31-67b7-67ef.ipv6-literal.net. To specify a zone ID (also known as a scope ID), replace the "%" used to separate the IPv6 address from the zone ID with an "s". For example to specify the destination fe80::218:8bff:fe17:a226%4, the name is fe80--218-8bff-fe17-a226s4.ipv6-literal.net.
  - You can use an ipv6-literal.net name in the computer name part of a Universal Naming Convention (UNC) path. For example, to specify the Docs share of the computer with the IPv6 address of 2001:db8:28:3:f98a:5b31:67b7:67ef, use the UNC path \\2001-db8-28-3-f98a-5b31-67b7-67ef.ipv6-literal.net\docs.

IPv6 over PPP

- The built-in remote access client and the Routing and Remote Access service now support the IPv6 Control Protocol (IPV6CP), as defined in RFC 2472, to configure IPv6 nodes on a Point-to-Point Protocol (PPP) link.
- Native IPv6 traffic can now be sent over PPP-based connections.
  - For example, IPV6CP support allows you to connect with an IPv6-based Internet service provider (ISP) through dial-up or PPP over Ethernet (PPPoE)-based connections that might be used for broadband Internet access.

Random Interface IDs for IPv6 Addresses

- To prevent address scans of IPv6 addresses based on the known company IDs of network adapter manufacturers, Windows Server 2008 and Windows Vista by default generate random interface IDs for non-temporary autoconfigured IPv6 addresses, including public and link-local addresses.
- Windows XP and Windows Server 2003 use Extended Unique Identifier (EUI)-64-based interface IDs for autoconfigured IPv6 addresses.

DHCPv6 support

- Windows Server 2008 and Windows Vista include a DHCPv6-capable DHCP client that will perform stateful address autoconfiguration with a DHCPv6 server.
- Windows Server 2008 includes a DHCPv6-capable DHCP server.

TCP Chimney Offload

- Managing TCP connections can involve a significant amount of processing, which includes:
  - Parsing the fields of the TCP header (validating the TCP checksum and processing sequence and acknowledgement numbers, TCP flags, and source and destination ports).
  - Creating and sending acknowledgements for data received.
  - Segmentation for data sent.
  - Copying of data between memory locations for the receive window, the send window, and applications.
  - Managing timers for TCP retransmission behavior.

TCP Chimney Offload

- By offloading this processing to dedicated hardware, a server computer's CPU can be used for other tasks. TCP Chimney Offload in Windows Server 2008 and Windows Vista provides automated, stateful offload of all TCP traffic processing to specialized network adapters that implement a TCP Offload Engine (TOE).
  - Rather than offloading individual tasks, the TOE-capable network adapter maintains state for the significant attributes of a connection, such as IP address, the TCP ports, and segment sequence numbers. This allows the network adapter to perform all of the processing of the TCP traffic without impacting the server's CPU. The benefit of offloading all TCP processing is most pronounced when TCP Chimney Offload is used for long-lived connections with large packet payloads, such as TCP connections for file backup and multimedia streaming.
  - By moving these TCP processing tasks to a TOE-enabled network adapter, the server's CPU is freed for other application tasks, such as supporting more user sessions or processing incoming requests faster.

Domain Name System

- Windows Server 2008 includes the following changes and enhancements to the Domain Name System (DNS) Server service:
  - **Background zone loading** DNS servers that host large DNS zones that are stored in Active Directory Domain Services are able to respond to client queries more quickly when they restart because zone data is now loaded in the background.
  - **IPv6 support** The DNS Server service now fully supports forward and reverse lookups for IPv6 and DNS traffic over IPv6.
  - **Support for read-only domain controllers (RODCs)** The DNS Server role in Windows Server 2008 provides primary read-only zones on RODCs.
  - **Global single names** The DNS Server service in Windows Server 2008 provides a new zone type, the GlobalNames zone, which you can use to store single-label names that can be unique across an entire forest. The GlobalNames zone provides single-label name resolution for large enterprise networks that do not deploy WINS and where using DNS name suffixes to provide single-label name resolution is not practical

Main Benefits of this new TCP/IP stack

- Other than IPv6, of course: ☺
  - Much simpler programming model and API (especially in kernel mode)
  - Strong Host Model – breaks many attacks
  - New API for filtering and monitoring
    - Windows Filtering Platform
  - Support for stack offload
    - Useful for servers and network devices, so really for Windows Server 2008
  - Multiprocessor scalability
    - Packets are distributed across processors (this was not possible in the past because of NDIS 5.1 limitations)!

Some Conveniences of this new TCP/IP stack

- For the system manager:
  - No restart or reboot needed when configuring
  - Auto-configuration and self-tuning of IPv4
  - Policy-based QoS
- For the user:
  - Roaming in IPv4 and (better) in IPv6
  - Home network support simplified
  - Efficient multicasting

QoS

- In Windows Server 2003 and Windows XP, quality of service (QoS) functionality is made available to applications through the QoS APIs. Applications that used the QoS APIs could access prioritized delivery functions.
- In Windows Server 2008 and Windows Vista, there are new facilities to manage network traffic for both enterprise and home networks.

Policy-based QoS for Enterprise Networks

- QoS policies in Windows Server 2008 and Windows Vista allow IT staff to either prioritize or manage the sending rate for outgoing network traffic and can be confined to applications (by executable name or by application folder path), source and destination IPv4 or IPv6 addresses, source and destination TCP or UDP ports, and a range of ports.
- QoS policy settings are part of User Configuration or Computer Configuration Group Policy and are configured with the Group Policy Object Editor and linked to Active Directory containers (domains, sites, and organizational units) with the Group Policy Management Console.
- QoS policies can be applied to users or computers that are members of a domain, a site, an organizational unit, or filtered within an Active Directory container for a security group.

Policy-based QoS for Enterprise Networks

- To manage the use of bandwidth, you can configure a QoS policy with a throttle rate for outbound traffic. Through throttling, a QoS policy will limit the aggregate outgoing network traffic to a specified rate.
- To specify prioritized delivery, traffic is marked with a configured Differentiated Services Code Point (DSCP) value.
  - The routers in the network infrastructure can place DSCP-marked packets in different queues for differentiated delivery. For Wi-Fi Multimedia (WMM)-enabled wireless networks, DSCP values are mapped to WMM Access Categories.
  - Both DSCP marking and throttling can be used together to manage traffic effectively.
  - Because the throttling and priority marking is taking place at the Network layer, applications do not need to be modified.

Policy-based QoS for Enterprise Networks

- Advanced policy-based QoS settings allow you to indirectly control incoming TCP data by specifying the maximum size of the TCP receive window (default size of 16 MB) and to specify whether applications can set DSCP values (allowed by default).
- Advanced QoS settings are only available for Computer Configuration Group Policy.

qWave and QoS2 APIs for Home Networks

- Because home networks are increasingly being shared by both data and audio/video (A/V) applications, a QoS solution is needed so that time-dependent A/V traffic can be given preferential treatment over data traffic.
  - Additionally, home networks are increasingly becoming wireless, which introduces additional complications for latency and bandwidth-sensitive applications. Windows Vista supports Quality Windows Audio/Video Experience (qWave), a collection of QoS-related software components that address the network challenges introduced by A/V applications and wireless networks. qWave is integrated into the networking stack as part of the QoS subsystem and works with multiple network and data link layer packet priority technologies to support multiple A/V streams (real-time flows requiring QoS) and data streams (best-effort flows, such as e-mail or file transfers) simultaneously over a home network, while providing a high-quality user experience.

qWave and QoS2 APIs for Home Networks

- The collection of qWave technologies detect and monitor LAN bandwidth, discover the QoS capability of the home network, and provide distributed admission control for fair and consistent usage of network bandwidth.
- These technologies enable advanced A/V streaming techniques so that applications can dynamically adapt to variable network conditions.

Server Message Block 2.0

- Server Message Block (SMB), also known as the Common Internet File System (CIFS), is the file sharing protocol used by default on Windows-based computers. Windows includes an SMB client (the Client for Microsoft Windows component installed through the properties of a network connection) and an SMB server (the File and Printer Sharing for Microsoft Windows component installed through the properties of a network connection).
- SMB in versions of Windows prior to Windows Server 2008 and Windows Vista, known as SMB 1.0, was originally designed 15 years ago for early Windows-based network operating systems such as Microsoft LAN Manager and Windows for Workgroups and carries with it the limitations of its initial design.

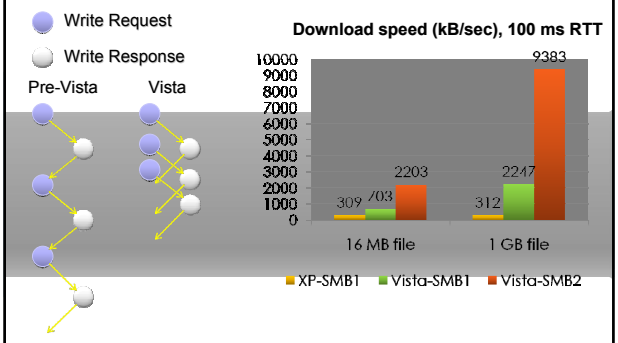
Server Message Block 2.0

- SMB in Windows Server 2008 and Windows Vista also supports SMB 2.0; a new version of SMB that has been redesigned for today's networking environments and the needs of the next generation of file servers. SMB 2.0 has the following enhancements:
  - Supports sending multiple SMB commands within the same packet. This reduces the number of packets sent between an SMB client and server, a common complaint against SMB 1.0.
  - Supports much larger buffer sizes compared to SMB 1.0.
  - Increases the restrictive constants within the protocol design to allow for scalability. Examples include an increase in the number of concurrent open file handles on the server and the number of file shares that a server can have.
  - Supports durable handles that can withstand short interruptions in network availability.
  - Supports symbolic links.

Server Message Block 2.0

- Computers running Windows Server 2008 or Windows Vista support both SMB 1.0 and SMB 2.0.
- The version of SMB that is used for file sharing operations is determined during the SMB session negotiation
  - See matrix on http://technet.microsoft.com/en-us/library/bb726965.aspx

SMB 2.0 Streaming Improvement



Security

- Still, as of today, full resistance to all TCP/IP-level denial of service attacks
  - Fingers crossed
- IPv6 for more security

IPv4 to IPv6 Migration Issues

- Two key issues when moving to IPv6
  - Application migration
  - Infrastructure migration
- These are separate issues. Do not need to be solved simultaneously
  - Applications can migrate without infrastructure upgrade
  - Transition technologies allow for gradual infrastructure migration

Application Migration Drivers

Problem	IPv6 solution	Details
NAT Traversal	Large address space and Teredo	Solution allows application to function unchanged with or without NAT present
Instant on networking	Instant network	Applications can transition from ad-hoc to connected seamlessly Provides more robust ad-hoc solution than IPv4
Privacy	Large address space (temporary addresses)	Application can use a unique IP address per-application or per-connection
Real time mobility	Mobility support	Mobility transparent to application Possible to implement without infrastructure upgrade

Infrastructure Migration Drivers

Problem	IPv6 solution	Details
Proliferation of addressable devices	Large address space	Solves device addressing for communication companies and US DoD
Network consolidation	Large address space	Solves addressing conflicts created by corporate mergers/acquisitions
Deployment agility	Instant network	Partial motivation for US DoD
Preventing man-in-the-middle attacks	Enhanced security	Partial motivation for US DoD Interesting to financial institutions
Reliable mobile data services	Large address space Mobility	Nokia, Qualcomm, Sony Ericsson and many others all driving IPv6 as potential new revenue source

Simplicity of one network fabric drives upgrades over time

Application Migration to IPv6

- Not all applications face migration barriers
  - Applications using higher level abstractions face few or no problems
  - .NET Frameworks, RPC, WinInet, DPlay, plus others abstract IPv6
- Applications with migration barriers face the following
  - Dependency on size of address
  - Dependency on size/syntax of names
  - UI that displays IP addresses
  - IP address based configuration
  - Protocols that embed IP addresses into the message
- We provide tools and APIs to make migration easy
  - PreFast plugin to identify problem areas
    - Found 5000 bugs in 17 paths for Windows Vista
  - IPv6-only stack configuration available for Windows Vista
  - Backward compatible Winsock APIs extensions
- Application testing is often biggest effort in migration
  - Data from past migrations:
    - IIS 6.0: ~3 weeks dev, ~3 months test
    - WMS: ~1 month dev, ~4 months test

Application Migration: Testing

- Testing cost varies
  - Low impact for higher level applications
  - Higher impact for components with complex network dependencies

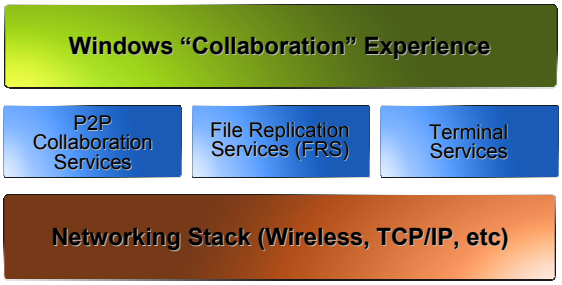
Summary of test issues & feedback

Issue	Initial support	Feedback	Planned improvements
New concepts (scopes, multiple IP addresses)	Documentation, brown bags	Initial learning curve steep	Documentation simplification Increased training
Lab infrastructure setup	Documentation on setting up routers, etc	Need tools & IPv6 enabled infrastructure (DNS, AD)	Scripts to automate setup Provide IPv6 infrastructure early IPv6 only build
Test code & test cases	Documentation on differences between v4 and v6	Initial learning curve steep	Education on Prefast for test code Targeted brown bags

Moving From v4 to v6

	Deployment Method Descriptions	Deployment Requirement	Relative Cost	Today's Availability
Option 1	Deploy transition technologies	ISATAP 6to4	**$**	Win2003 6to4 & ISATAP HW & SW support available
Option 2	Dual-stack with native IPv6	Infrastructure upgrade	**$$$**	HW support available
Option 3	Native IPv6 only	IPv6 connectivity	**$$$$**	Newer network equipment with hardware forwarding Connectivity is available in Asia & Europe.

Windows Collaboration Experience Architecture



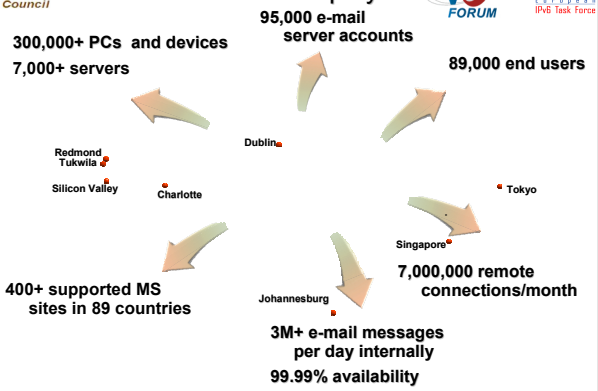
Peer to Peer Framework in Vista

- Framework for building distributed, serverless applications
- P2P components are all built on IPv6
  - Discovery and presence
  - Naming and lookup
  - Invitation and session initiation
  - Multi-party communication

Windows Collaboration

A simple, lightweight tool enabling face-to-face and intranet collaboration at any time,
in any place

Microsoft IT IPv6 Deployment



Lessons Learned

- Moving applications is the first step
- Impact of IPv6 is low for migrating applications
  - Using Port Proxy (Win2003), Terminal Server & NATPT to allow IPv6 clients to talk to down level servers
  - Many applications unaware of v6: .Net, IE, RPC
- Transition technologies work well
  - ISATAP is cost effective and works great
  - Truly native deployment requires many elements of infrastructure
- Phased approach necessary

Microsoft®
Your potential. Our passion.™

IPV6 & HOME NETWORKING TECHINCAL AND BUSINESS CHALLENGES

DR. TAYEB BEN MERIEM

Dr. Tayeb BEN MERIEM gained his Telecommunications Engineering degree from (Ecole Nationale Supérieure des Télécommunications: ENST) of Paris.

After 5 years in the industry, he joined France Telecom R&D in 1981. Here he was put in charge of the first studies into WDM systems and to participate in the European satellite "Olympus" project. This looked at propagation in 20-30 GHz domains.

Tayeb was a Professor in the University of Paris in packet transmission domain, SDH and WDM systems & Networks and the director of Research Lab in the Management of IP/SDH and IP/WDM network. He has directed doctorates thesis.

Tayeb has been working in France Telecom’s Network Business Unit and was responsible for equipment transmission policy. He participated in the European ACTS project in optical networks. He also directed France Telecom’s QoS project in transmissions and SDH networks. He also was involved in France Telecom’s synchronization project as the manager of this project. Since 2000, he returned to France Telecom’s R&D Division as the head of France Télécom's R&D Division IPv6 Skills Centre. This is a trans-organizational IPv6 structure dedicated to all of the France Telecom Group.
.
Tayeb has been France Telecom’s delegate at ITU-T in SDH, WDM, and network management, durinf10 years during 10 years.
He has also published several papers and communications. He has published a book on SDH in 2000 in France Telecom scientific edition with Springer.
Tayeb is

- Member of IPv6 Forum
- Member of European IPv6 Task Force Steering Committee
- VP of French IPv6 Task Force Steering Committee
- Vice-Chair of IPv6 promotion Council of China
- President of French IPv6 Summit (2006)

ABSTACT

This presentation aims at highlighting the main benefits that IPv6 could bring to the homenetworking services from the European IPv6 Task Force Steering Committee‘s standpoint.

Within the European IPv6 Task Force Steering Committee work plan, the question related to Home network is a key topic. It is for this reason, a study surveying the Home networking ecosystem from technical, industry, and business and standardisation perspective has been carried out.
The IPv6 Task Force Steering Committee has been working alongside the major fora addressing the issue of Home networking. Liaisons with CENELEC, SmartHouse Forum, HGI, DLNA, North American IPv6 Task Force and the IPv6 promotion Council China have been established.
Home IP services integrate Voice over IP or more generally Triple plays, game on line or remote controlling for instance. Since an ISP has to be able to provide a wide area of services to its customer, it has to think about the right solution for such networks. Indeed, the current solutions based on IPv4 protocol are suffering limitations.
Therefore, it appears that IPv6 can fill in the gap! It provides some features that allow the set up of networks very easily and it integrates some characteristics that ease the deployment of value added services such as mobility, integrity of data in the home and auto-configuration of all home devices (plug & play manner).
Moreover, one of the main challenges is linked to the installation cost; it can be overcome by eliminating cumbersome cables thanks to wireless installation. Thus, it becomes possible to install wireless sensor networks IPv6-based allowing an IP global connectivity through internet as well as a remotely management of the services. Therefore, such cost effective solutions open up new opportunities for the home networking market and can help to make "Internet of Things" happen.

IPv6 & Homenetworking Business & Technical challenges

German IPv6 Summit
May 8th 2008
Potsdam

Tayeb Ben Meriem
European IPv6 Task Force
Steering Committee member

Agenda

- European IPv6 Task Force Steering Committee Methodology & Approach in IPv6 & Home Networking study
- IMS & Home Networking
- Home Networking applications from ISP's perspective
- Home Networking & IPv6 Wirelesss Sensor Networks: the challenge of "Internet of Things"

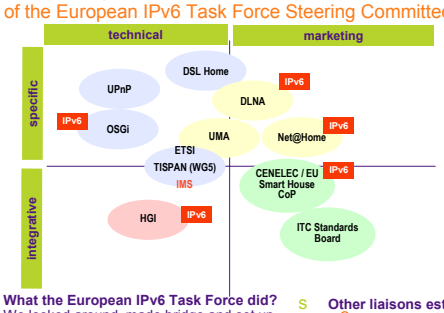
IPv6 Task Force Steering Committee perspective

- **Assess/address challenges contributing to slow uptake in Europe** by:
  - Identifying key industry sectors that can benefit from IPv6
  - Gathering emerging industry experience and evaluate from a market and business perspective
  - It's an Application-driven approach
  - We considered Direct Challenges ie linked to IPv6 and we rated according to 4

Standardization	**Operational**
Policies & regulations	**Business model**
Equipment development	**Services**
Market	

- **Create of "Master Resource" for decision makers**, from a business and technical perspective, highlighting the main trends and the role of Home Networking, as an enabler in the acceleration of IPv6 deployment
- **Highlight main issues and make recommendations** to overcome these challenges

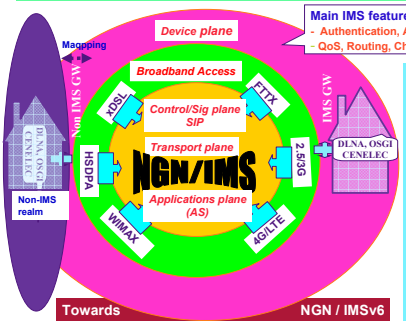
Home Networking standards bodies & industry fora and IPv6: Role of the European IPv6 Task Force Steering Committee



- **What the European IPv6 Task Force did?**
- We looked around, made bridge and set up liaisons with:
  - CENELEC,
  - Smarthouse Forum,
  - Net-atHome,
  - DLNA (IPv6 Task Force)
- **Other liaisons established**
  - IPv6 Promotion Council China
  - NAv6 Task Force (US)

Home Networking within IMS architecture (TISPAN/

- **Specifications on the Home Network architecture and interfaces are based on existing standards**
- ***DSL Forum, HGI Forum, Open IPTV Forum, 3GPP, DLNA, IETF***



Main IMS features for Home Networking
- Authentication, Authorization, Session negotiation
- QoS, Routing, Charging, Identity management

-TISPAN Home Networking specifications
- ***TR 185 004:*** Customer Network Architecture
- ***TS 185 005:*** Service Requirements for Customer Devices
- ***TS 185 003:*** Customer Network Gateway Architecture
- ***TS 185 006:*** Customer Network Devices
- ***TR 185 007:*** Protocols

Home Networking challenges: From ISPs perspective

- Most ISP's are now under strong pressure to gain market shares in the Home Networking
- Multi-play applications, along with associated services are at the heart of their broadband strategy.
- Home gateway is not only a VoIP, TV over ADSL enabler or internet WiFi router.
- Home gateway will be a new home usage enabler for services such as music sharing, home automation with remote video monitoring (security), gaming, and others related to alternative home devices apart from PC's, fixed or mobile devices.

What can IPv6 bring to Multi-play applications

Multi-play applications are characterised by very low margins.

In order to build a viable business model, the solution consists of:

- Implementing all technologies leading to save CAPEX and OPEX;
- Deploying these services on a very large scale (it's a mass market characteristic);
- Bringing innovation to the market by providing new advanced services easy to deploy and ready to use.

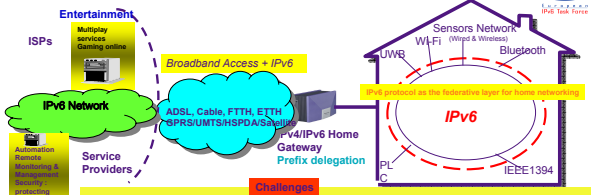
IPv6 is the appropriate scenario to achieve this objective

- **Item 1**: IPv6 will lead to the design and implementation of a very simple end-to-end architecture, without NAT boxes, or servers. It is cost effective, with reduced CAPEX, easy to exploit and maintain with a reduced OPEX.
- **Item 2**: The large penetration of the applications or services needs a huge number of IP addresses. IPv6 will easily cater for this.
- **Item 3**: The use of IPv6 addresses provides through automatic configuration mechanisms, giving the flexibility to address this category of customer and also exploit the seamless mobility.

GermanPv6 Summit May 8th 2008

D7 - 01/07/2008

Home Networking main challenges



Challenges

- How to do name resolution in the absence of DNS
- How to allocate IP addresses to HGW and Home devices
- How to auto-configure services
- How to auto-configuration router
- How to bridge between different network technologies
- Sensor Networks in the Home

- Multicast
- Security
- Multi-homing
- Home Gateways

IPv6 can bring answers to these questions

GermanPv6 Summit May 8th 2008

D8 - 01/07/2008

Home Networking Router auto-configuration challenges

Requirements & Challenges to overcome

- **Router Auto-configuration is needed**
- Fully plug & play capability reached when both devices & routers can be auto-configured
- Only Hosts auto-configuration is achieved by IPv6 so far
- Routers are still manually configured
- **Alternative solutions**
- Bridging all layer 2 technologies together to form a single link IPv6. Edge router announces the prefix (by NDP) and autoconf of home devices. It needs Spaning Tree Protocol (STP) to avoid loops
- Trill (*Transparent Interconnection of Lots of Links*).IETF WG defining RBridges. Based on IS-IS and the frames are tunneled between RBridges. No need of STP
- Routing is more generic solution. Transparent to L2 technologies
- NAP (Non Administration Protocol) algorithm to auto-configure a complete network. It's integrated in OSPF

Home Networking & IPv4 addresses exhaustion forecast

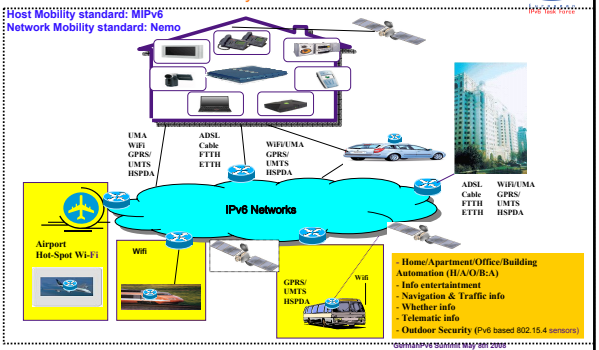
- The IANA pool of available addresses is now reduced to 44 /8 (44 times16 million @)
- The consumption trend over the last three years was between 10/8 and 12/8 annually and is now increasing
- According to the recent IANA's forecast, these unallocated IPv4 addresses blocks will be unavailable from **2010**
- The question for the Internet Community is no longer "should we move to IPv6?"
- but rather "how do we prepare for IPv6?"
- Alternative scenarios

As immediate consequence:
The first and major services impacted by this address exhaustion are Internet Services *(Home Networking)*

D10 - 01/07/2008

Home Networking extension within "Fixed & Mobile" convergence in Host & Network IPv6 mobility environment

Host Mobility standard: MIPv6
Network Mobility standard: Nemo



D11 - 01/07/2008

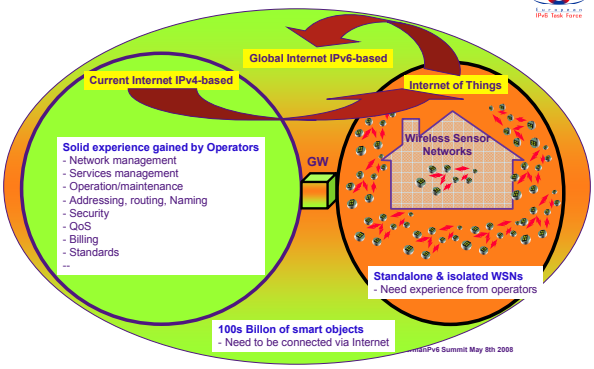
GermanPv6 Summit May 8th 2008

IPv6 Wireless Sensor Networks in the home: challenges

Requirements & Challenges to overcome

- **Installation cost & management cost**
  - Lower the installation cost by eliminating cumbersome cables:
  - **Achieved by Pv6-based WSN deployment and remotely access to devices & applications through global IPv6 @**
- **Technological challenges**
  - Sensors are constrained devices in terms of energy and CPU
  - We need to include these devices and sensor networks in the global Internet network
  - How to port to IPv6 these constrained communication sensors.
  - **Some early implementations were released in 2006; Industry: Arch Rock, RUNE, U-2010 European projects, Tiny6 project (France, China, India, Korea)**
- **Routing & Networking challenges**
  - Existing routing protocols not adapted
  - *OSPF & IS-IS* are very scalable protocols (no need of this constraint in the Home network environment)
  - *AODV*: Ad-hoc On Demand Vector Routing
  - DSDV: Destination Sequenced Distance Vector
  - DSR: Dynamic Source Routing OLSR: Optimized Link State Routing
  - **Design Routing protocols for WSNv6 to the Home: RL2N (Routing in Low power and Lossy Networks)** (IETF WG)

Internet of Things & IPv6: How to pave the way



GermanPv6 Summit May 8th 2008

Conclusion

- IPv6 should be deployed along with Broadband (xDSL, FTTX, WiMAX, 3G, HSDPA, 4G6/LTE, IMS….) for Internet Access Services to the Home
- IPv6 should be a key driver of Home Networking applications (mass market requiring a huge IP @ consumption) in the context of IPv4 @ exhaustion
- Internet of "Things" through IPv6 WSNs (Wireless Sensor Networks) is a new driver of Home Networking
- Huge number of applications and use cases in Home environment at large (Habitat, Hospital (Health care), Super Mraket, Environment, Car Industry, Transportation..) based on WSNv6 will open a new market and lowers the CAPEX & OPEX

GermanPv6 Summit May 8th 2008

D14 - 01/07/2008

Thank you

GermanPv6 Summit May 8th 2008

D15 - 01/07/2008

DNS AND DHCP FOR DUAL STACK NETWORKS

LAWRENCE HUGHES

Lawrence E. Hughes is a visionary in the information technology and computer security fields, with particular interest in secure digital communication and IPv6. An expert, with more than 35 years' experience in creating and developing security products, Mr. Hughes has a long history of being a valued consultant in various global security companies.

Mr. Hughes founded InfoWeapons to create high quality, simple-to-use, end-user tools as a responseto the general lack of secure communication and IPv6 Ready tools currently available. He has authored the book "Internet E-mail: Protocols, Standards and Implementations", having been heavily involved with Internet e-mail security for many years. His book is still one of the leading books on E-mail. Prior to founding InfoWeapons, he was the co-founder (along with Jay Chaudhry) and initial CTO of CipherTrust in the US. CipherTrust is the maker of the IronMail™ Hardened E-mail Proxy appliance. Before that, he was a Senior Security Consultant at VeriSign where he created and taught their certification courseware internationally. All throughout his career, he has been constantly creating products and courseware in the areas of cryptography, digital signatures, digital envelopes, digital certificates, Public Key Infrastructure (PKI), secure transport protocols and secure E-mail, as well as hardened security appliances to protect digital communication.

Mr. Hughes' extensive technical background includes world-class skills in data security, cryptography, PKI, UNIX operating systems, Internet Protocols, IPv6, and software development in C/C++ and various assembly languages. He has a Bachelor of Science degree in pure mathematics, with a minor in physics, from the Florida State University. In addition, Mr. Hughes has been a member of Mensa International, which is a society of people whose IQ is in the top 2% of the population, since 1973.

ABSTACT

DNS and DHCP are critical infrastructure components for dual stack networks. DNS is like the phone book for the Internet, which maps names like www.xyz.com to IP addresses. DHCP assigns addresses to nodes at power-up and can be used to disseminate other network information (such as the network's DNS server). Both require major changes to support IPv6.

This presentation discusses what those changes are, how they can be implemented, and the new issues and challenges that must be faced as the world migrates to dual stack networking. It also shows how purpose-built DNS/DHCP network appliances play an essential role in this transition.

DNS and DHCP in Dual Stack Networks

Lawrence E. Hughes

Chairman, InfoWeapons Inc.

Your Speaker

- 35+ years in IT field, including:
  - 2 years with VeriSign (PKI, crypto)
  - Co-founder CipherTrust (e-mail security)
  - Founder InfoWeapons (IPv6 Infrastructure)
- I've personally invested US$5M+ in IPv6
- Built team with large number of IPv6 and security experts (development, testing, Q/A, etc.)
- Member of US IPv6 Consortium
- My company (InfoWeapons) has been running production dual stack in-house networks for 4 years (mostly using our own designs and products)
- Many future IPv6 products planned (VoIP, translator, etc.)

What is DNS?

- DNS = Domain Name System (RFC1034/5 with updates)
- Invented by Paul Mockapetris, November 1987
- Basically maps Fully Qualified Domain Names (FQDNS) to and from numeric IP addresses

What is DNS?

- Also publishes name of key servers for a given domain (MX record for e-mail, SRV record for LDAP, SIP, etc.)
- Implemented as a globally distributed database and database engine, managed by thousands of admins
- The Internet today could not exist without it
- Even more critical for IPv6 networks than IPv4 (ever try typing in 32 hex digit numeric address in a browser?)

How is DNS used?

- Every node on the Internet that can use FQDNs (e.g. www.xyz.com) must have a DNS client ("resolver") that can query a DNS server to translate any node's FQDN into a numeric IP address (which is what is actually used as destination in packets)
- Implements tree-like hierarchical name space
- If the DNS server you query doesn't have the answer (is "authoritative" for that domain, or has "cached" that data from a previous query), that server can either point you to the right server (referral), or obtain the data on your behalf (recursive)
- No single database could accomplish this, or keep data current. Only a distributed database could hope to perform this function. There are parts of this database scattered all over the Internet.

DNS and IPv6

- 'A' records map FQDN to IPv4 address, 'AAAA' for IPv6
- 'A6' records now deprecated, not needed
- PTR records map IPv4 and IPv6 address to FQDN

AAAA record fields

NAME	Domain name
TYPE	AAAA (28)
CLASS	Internet (1)
TTL	Time to live in seconds
RDLENGTH	Length of RDATA field
RDATA	String form of the IPV6 address as described in RFC 3513

DNS and IPv6

- Client->server (query) and server->server (zone transfer) connections can be over IPv4 or IPv6
- This has been in BIND since version 9 (good since 9.3.2)
- In a dual stack appliance, web management, NTP, SNMP and all other protocols should also be dual stack
- A given node may have zero or more IPv4 and zero or more IPv6 addresses defined (but at least one address of some kind)
- Clients should be ready to accept multiple addresses for a given node query, and if the client should try any returned IPv6 addresses first, then fall back to IPv4

DNS Root Server Issues with IPv6

- Root servers are the top of the global DNS pyramid – there are "13" around the world
- As of 2/4/2008 at least six of them support IPv6 for pure IPv6 DNS queries to work
- Currently the K root server is measuring 100 IPv6 queries per second (IPv4 typical 9000/sec)
- Note that due to longer IPv6 addresses, a single 512 byte UDP packet will no longer hold 13 root server addresses
  - One solution is EDNS0 (RFC 2671)
  - Can also fail over to TCP (may cause FW issues)
  - *Names* of all 13 root servers can fit with no problem

What is DHCP?

- DHCP = Dynamic Host Configuration Protocol (RFC 2131, plus updates)
- A way for clients to obtain an IP address and other network info (DNS server address, gateway, netmask, etc.) at power-up time
- DHCPv4 depends on broadcast, can only supply IPv4 data
- Addresses can be assigned first come first servers from an address pool
- Often used to serve more users than you have valid IPv4 addresses (not simultaneously) as "dynamic addresses"
- Can assign fixed addresses to specific nodes (e.g. servers) keyed to their MAC address

What is DHCPv6?

- Replacement for DHCPv4 that supports IPv6 – RFC 3315 (with updates)
  - Does not use broadcast (uses multicast)
  - Can supply IPv6 address info
  - "Stateless" and "Stateful" operating modes
  - Relay agents not needed in each subnet

Stateless DHCPv6

- Works in conjunction with IPv6 stateless autoconfiguration (which supplies IP addresses to client nodes)
  - Client gets prefix from Router Advertisement Daemon
  - Low 64 bits typically derived from client MAC address
  - No way to "cluster" addresses by group (e.g. acctng, devel, support) which complicates FW rules
  - Limited number of MAC addresses make scans possible
- DHCPv6 server only supplies "stateless" data (things that are the same for every node), such as DNS server addresses, gateway address, etc.
- Currently DHCPv6 is the only way for a client to learn IPv6 addresses for DNS servers

Stateful DHCPv6

- Client nodes get stateless data *and* a unique IPv6 address from the DHCPv6 server
  - Possible to assign address keyed to MAC address, so clustering of addresses by group is possible, vastly simplifying firewall rules, Network Access Control
  - Possible to generate low 64 bits randomly, which makes subnet scans impossible
  - Can be integrated with DNS to publish assigned addresses
- Will probably be used in most medium or large networks (>50 nodes), versus stateless autoconfig and DHCP
- Many early DHCPv6 servers don't yet support stateful operation (IW SolidDNS™ 2.0 does)

Client Support for DHCPv6

- Microsoft Vista includes client support
- Clients available for Windows XP (SolidDNS™ includes GUI DHCPv6 client)
- Most *NIX derivatives have clients available (FreeBSD, Linux, Solaris, etc.)

Automated Network Renumbering

- Requires integrated dual stack DNS/DHCPv6 server
- Possible to renumber entire networks periodically (once a day?), transparently to rest of world (so long as DNS is used)
- Depends on clever use of “deprecated but still functional” attribute of IPv6 addresses and DNS “Time to Live” values
- If low 64-bit generated randomly, can lead to very strong security (resistance to scanning, hackers have to rediscover nodes constantly, etc.)
- Planned for future release of SolidDNS™

END

CAR INDUSTRY: GERMAN EXPERIENCE WITH IPV6

AMARDEO SARMA

Amardeo C. Sarma was born on 27 December 1955 in Kassel, Germany. He received his Bachelor of Technology degree from the Indian Institute of Technology, Delhi, in 1977 and his Master's degree (Diplom-Ingenieur) from the Technical University of Darmstadt in 1980, both in Electrical Engineering. He is currently at NEC Laboratories Europe in Heidelberg, where he is responsible for the areas Identity Management, Security and Inter-Vehicle Communication. Amardeo is IEEE Senior Member, Steering Board member of the WWRF (Wireless World Research Forum) and in charge of the "Global Architecture and Scenario based design" Work Package of the EU IST Integrated Project "Daidalos" and Technical Project Manager of the EU IST "SWIFT" project.

ABSTACT

Vehicular communication is a great application area for IPv6 with a potentially huge range of application for road safety, traffic efficiency and infotainment. The talk introduces a system based on WLAN and ad hoc routing technology, which is currently developed by the Car-to-Car Communication Consortium (C2C-CC) and combines geographical ad hoc routing and IPv6 for infotainment applications. Particular focus of the talk is on integration of IP mobility support (Mobile IPv6, NEMO) and ad hoc routing.

Empowered by Innovation NEC

Car Industry: German Experience with IPv6

A. Festag, R. Baldessari, A. Sarma

{festag | baldessari | sarma}@nw.neclab.eu

NEC Laboratories Europe

1st German IPv6 Summit, 8 May 2008, HPI Potsdam

IPv6 German Council

Networked Vehicles

C2C Communication took off with FleetNet

Core Technology developed by NEC:
Position-based Router → Prototypes

market

Europ. Field Trial?

SIM-TD (Field Trial)

ETSI Standardization

Standardization

C2C-CC (Car-to-Car Comm. Consortium)

EU Projects

FP6 Projects

FP7: GeoNet, Pre-Drive, ...

BMBF NoW (Network on Wheels)

FleetNet

German R&D Projects

2003 2004 2005 2006 2007 2008 2009 2010 2011 2012+

Project Network on Wheels (NoW)

- German R&D project
  - Duration: 06/'04 - 05/'08
- Objectives
  - Development & specification of communication protocols based on WLAN
  - Submission of results to C2C-CC
  - Support of EU frequency allocation
- Technical challenges
  - Scalable and reliable communication system
  - Active safety and deployment applications
  - Security concept and protocols
  - Strategies for market introduction
- NEC reference implementation
  - Communication system enabling safety and infotainment applications
  - Used by partners from C2C-CC, related research projects and partners from industry

DaimlerChrysler, NEC, Fokus, carmeq, TUM, embedded wireless..., TMST, Universität Karlsruhe (TH)

Funded by: Bundesministerium für Bildung und Forschung

ITS EU FP6 Related Projects

- Focus on eSafety: in 2005 40000 people died, 1.2 M injured in road accidents
- 16 B€, ~ 8%=300 M€ for eSafety*
- Selected EU FP6 projects
  - ADASIS Forum — Advancing map-enhanced driver assistance
  - AIDE — Safer roads with adaptive driver assistance
  - eSafety Forum — Progressing preventive and active safety
  - GST — Creating easy access to dynamic safety services
  - HeavyRoute — Supporting quicker and safer freight transport
  - PReVENT — Supporting the driver, preventing accidents
  - SAFESPOT — Supporting smart vehicles on safe roads
  - SpeedAlert — Keep drivers informed of speed limits at all times
  - CVIS — Helping vehicles and infrastructure cooperate

* http://europa.eu.int/information_society/activities/esafety/index_en.htm

Car-2-Car Communication Consortium

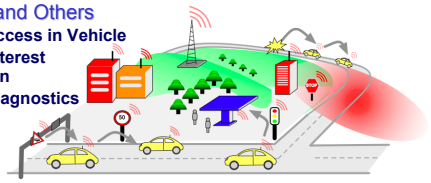
CAR 2 CAR COMMUNICATION CONSORTIUM

- Industrial consortium mainly of car manufacturers and electronics suppliers operating in Europe
- Goals:
  - European standard for vehicular communication
  - European infrastructure for ITS applications with other bodies
- "CAR 2 CAR Communication Consortium Manifesto", download at www.car-2-car.org

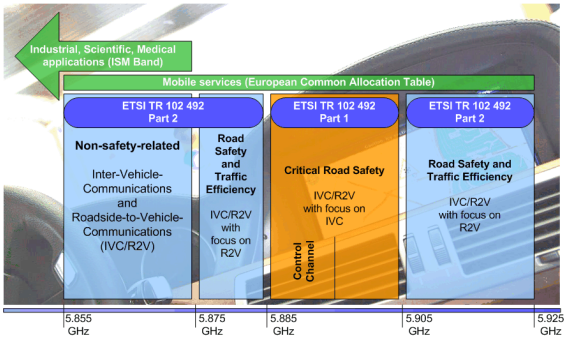
Audi, BMW Group, DaimlerChrysler, NEC, DENSO, FIAT, HONDA, HITACHI, EPCOS, VOLKSWAGEN, RENAULT, OPEL, Autoliv, ALPINE, lesswire, LastMile … and others

C2C-CC Use Cases (CAR-2-X)

- Safety
  - Cooperative Forward Collision Warning
  - Pre-crash Sensing/Warning
  - Hazardous Location V2V Notification
- Traffic Efficiency
  - Enhanced Route Guidance and Navigation
  - Green Light Optimal Speed Advisory
  - V2V Merging Assistance
- Infotainment and Others
  - Internet Access in Vehicle
  - Point of Interest Notification
  - Remote Diagnostics

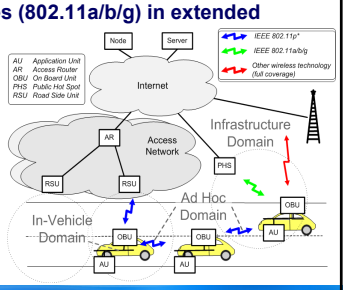


Frequency Allocation for CAR-2-X in Europe



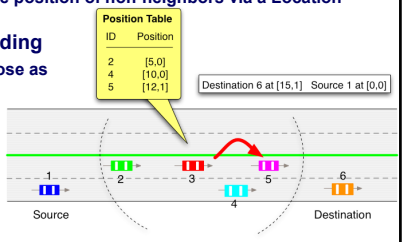
Vehicular communication based on IEEE 802.11

- Ad hoc networks supporting safety and non-safety applications
- Dedicated technology (802.11p) in basic systems
- Additional technologies (802.11a/b/g) in extended systems
- Issues:
  - High mobility
  - High number of nodes
- Internet-based applications
  - Beneficial for safety purposes
  - Fundamental for non-safety purposes



IVC Routing and Forwarding

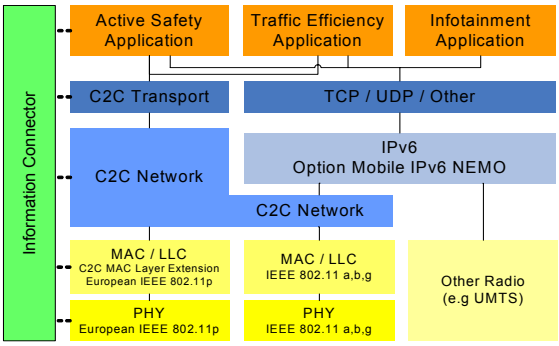
- Position-based routing
- Assumptions
  - Nodes know their own positions through GPS
  - Nodes know positions of their direct neighbors
  - Node can acquire position of non-neighbors via a Location Service
- "Greedy" forwarding
  - Forwarders choose as next hop the node closest to the destination



CAR-2-X and IP

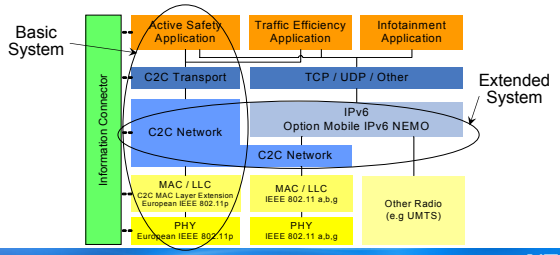
- IP is de-facto standard for communication
  - New communication systems must interoperate with IP
- IPv4 is a no-go for CAR-2-X
  - Lack of IPv4 addresses + NAT issues
  - For CAR-2-X, very high number of addresses needed (cars, road-side units, active traffic signs, …)
  - Also, clear benefits of IPv6: Extension headers, address auto-configuration, built-in support for IPsec, QoS, Multicast, etc.
  - However, backward compatibly to IPv4 applications and IPv4 access networks needed

C2C-CC Protocol Architecture: On-Board Unit



C2C-CC Basic and Extended System

- Basic system
  - Minimal configuration required to support cooperative applications for critical road safety
- Extended system
  - Enhanced applications for road safety, traffic efficiency, and comfort
  - Multiple network interfaces



C2C-CC Network Layer

Geo-Routing as Sub-IP Layer

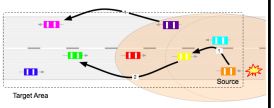
- Mobile ad hoc network: **wireless multi-hop, frequent topology changes**
- Unicast **(non-safety)**
  - **Each node aware of its position & position of 1-hop neighbors**
  - **Location Service maps node IDs to current geographic position**
  - **Forwarding on the fly**
- Broadcast/Flooding **- efficient, reliable (Safety applications)**

Safety

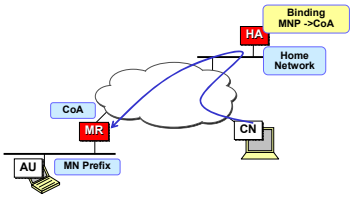
Periodic single hop broadcast

BL = Beacon load, MBL = Maximum Beacon Load

Event-driven geocast



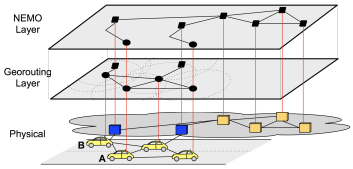
Background: IETF NEMO (RFC 3963)



- **IP Mobility in the router (OBU), not necessarily in terminals (AUs)**
- **Terminals attached to Mobile Router (MR), not aware of movements**
- **AUs believe to be always attached to the same network identified by the Mobile Network Prefix (MNP)**
- **AU can**
  - **Run IPv6 only: it is the default option in this scenario**
  - **Run Mobile IPv6 (nested mobility): a double tunneling occurs and the routing can be very far from the optimal**

Usage of NEMO in CAR-2-X

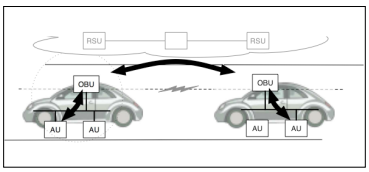
- **GeoRouting is implemented as sub-IP protocol and provides connectivity between vehicles and attachment points**
- **NEMO runs on top, relying on the default route provided by the underlying routing protocol**



*See also: R. Baldessari, T. Ernst, A. Festag, M. Lenardi, "*draft-ietf-mext-nemo-ro-automotive-req-00*", Internet Draft, February 2008, Work in Progress*

Functional Issues

- **Direct Vehicle-to-Vehicle** communication
- Vehicles reachable at the **same identifier**, via the Internet or directly
- IPv6-based applications utilize capabilities for **geographic addressing**



- Data **security** implemented for safety applications must not be affected
- **Privacy** of drivers and passengers must be protected to reasonable extend
  - Safety applications adopt "revocable anonymity" through pseudonyms

Performance Issues

- **Bandwidth is the dominant factor for performance**
  - → Minimize control traffic
- **Networking**

  1. **Georouting is a** reactive routing scheme**, which establishes routes on demand, and has significantly less signaling overhead than** pro-active **scheme**

  2. **IP mobility support for handover among road-side units/hot spots and for global reachability must cope with the nodes' high velocity**

Conclusions

- **Vehicular communication fits well with IPv6**
- **Potentially huge range of application**
- **Deployment scenarios initially based on WLAN and ad hoc technology, but later data will be delivered via different media (GPRS, 3G, WLAN)**
- **Traditional IP-based protocol suite not applicable for safety applications**
  - **Specific requirements of vehicular communication has led to Georouting for safety and non-safety applications**
- **Integration of GeoRouting and IPv6 + NEMO allows for clean, modular integration**
- **Networking solutions are being standardized at newly formed ETSI TC ITS**

Empowered by Innovation

NEC

IPV6 & AUTONOMIC NETWORKING

RANGANAI CHAPARADZA

His involvement with IPv6 is as follows: worked in ETSI-STF (Specialist Task Force)-276, in writing Standardized Interoperability Test Specifications for IPv6 Protocols. His current activities include: Technical Manager role and researcher for the FP7-EFIPSANS project. EFIPSANS stands for: Exposing the Features in IP version Six protocols that can be exploited/extended for the purposes of designing/building Autonomic Networks and Services. Ranganai is also participating in the FP6 ANA (Autonomic Network Architecture) Project. Main research interest: Autonomic Network Engineering for Self-Managing Networks. He can be reached on e-mail address: ran4chap@yahoo.com.

ABSTACT

The talk addresses the following issues: IPv6 and its Extensions towards engineering Autonomic Networks (Self-Managing Networks)—a research subject being addressed by the FP7-EFIPSANS project; The impact of Autonomic Networking on the architectures of Future Networks (Future Internet); The requirement for standardized Specifications of Autonomic/Self-Managing network behaviors and architectures; Evolution path for IPv6 and Extensions towards Autonomic Network Engineering.

IPv6 and Autonomic Networking

FP7 – EFIPSANS Project: Exposing the Features in IP version Six protocols that can be exploited/extended for the purposes of designing/building Autonomic Networks and Services

Ranganai Chaparadza - Fraunhofer FOKUS, Germany
Ranganai.Chaparadza@fokus.fraunhofer.de; ran4chap@yahoo.com

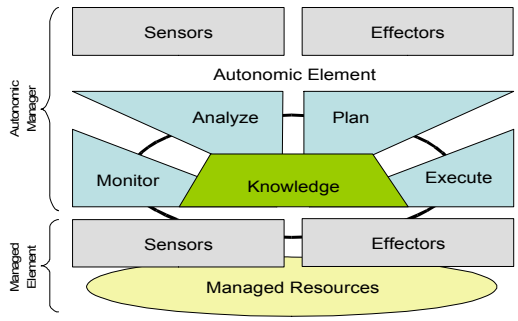
Outline of the Vision on "IPv6 and Autonomic Networking"

- Background
  - IPv6 offers a lot of rich communication features and extensible communication possibilities beyond what is available in IPv4. To mention a few: *auto-configuration, neighbor discovery, dynamic network re-numbering, improved routing mechanisms, improved QoS (Quality of Service) handling, improved transport efficiency, improved security and flexible protocol extensions etc.*
  - The research area of Autonomic Networking (Self-Managing Networks) is becoming hot and hot across the industry and academia.
  - *The Speed of Migration (Transitioning) to IPv6* hinges on having a *richer insight* ***(currently lacking!!)*** into the benefits of IPv6 and the potential doors to new communication paradigms IPv6 protocols can open. EFIPSANS envisions that the extensibility of the IPv6 protocol framework opens the door to engineering autonomicity (self-managing properties) in systems, services and networks.
- The EFIPSANS Innovation and the Research Strategy
  - Explore and bring IPv6 into other strongly promising avenues and stir up hot research issues around the hidden potential benefits of migration, given that EFIPSANS seeks to produce a *rich insight* into the role of IPv6 and its extensions in engineering "autonomicity" in networks, systems and services.
  - Produce Extensions to IPv6 (IPv6++) and the corresponding network architectures required for engineering autonomicity in systems and networks.

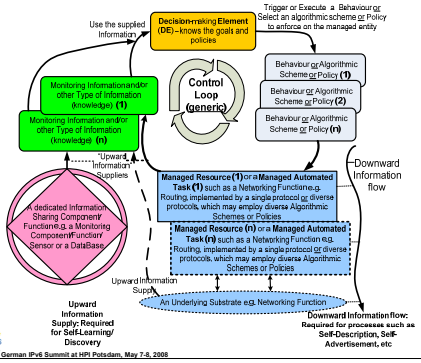
Outline of the Vision on "IPv6 and Autonomic Networking"

- The EFIPSANS Research Outcome
  - A set of Specifications, Technical Reports and/or new Complementary Draft RFCs consisting of: *the identified exploitable IPv6 features*; *propositions for extensions to the IPv6 protocols*; *concrete feature-combination scenarios for engineering autonomicity*, and *Experimental Results*. The new Extensions to IPv6 features and network architectures imply New Complementary RFCs, which imply IPv6++ (IPv6 with Autonomic Flavours).
- Potential Strong Impact on Industry&Global Market related to IPv6 Evolution[Benefits and Who benefits]
  - The Specifications, Technical Reports and new complementary RFCs will give a *richer documented insight* into the benefits of migrating to IPv6. For manufacturers, the specifications, reports and new complementary RFCs give an opportunity to implement novel extensions to IPv6 protocols in order to offer extended features in their products.
  - For network providers, service providers, researchers and other potential users of IPv6, the Specifications, Technical Reports new complementary RFCs give a good picture on how to view IPv6 and extended features as a platform for designing/building autonomic networks and services and, this also gives them a chance to think and contribute innovative ideas on the use of IPv6 protocols. Essentially, this will also help in *closing the gap between IPv6 and autonomic networking*.

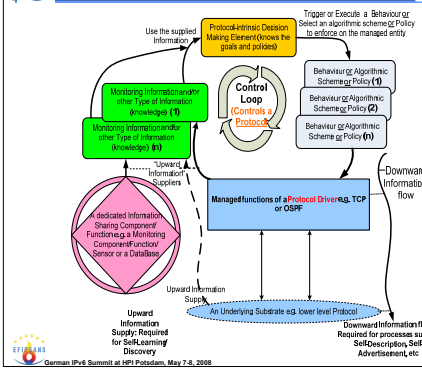
Autonomic Systems Engineering: Basic Concepts



Autonomic Systems Engineering: Concepts

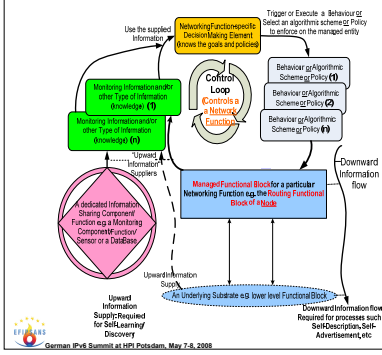


Protocol-intrinsic Decision Making Element



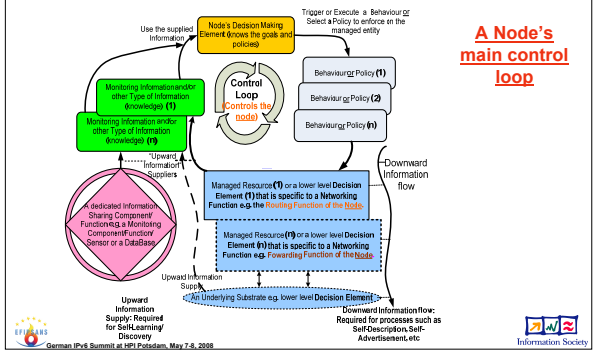
A protocol-intrinsic Control Loop

NetworkingFunction-specific Decision Making Element



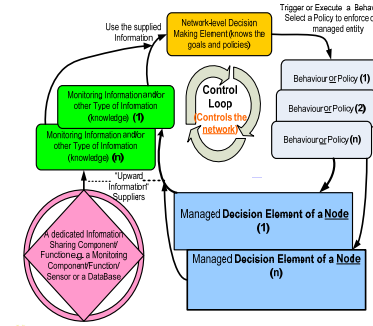
A NetworkingFunction-specific Control Loop

The Decision Making Element for the node



A Node's main control loop

Network-level Decision Making Element



A distributed Network – level Control Loop

A distributed Control Loop

Requirements for a Generic Autonomic Network Architecture (GANA) that allows for the production of Standardizable Autonomic Behaviour Specifications

Having Standardized Autonomic Behaviour Specifications, we should then try to see what role IPv6 can play and what *Extensions* can we introduce to IPv6 as necessitated by *Autonomicity*.

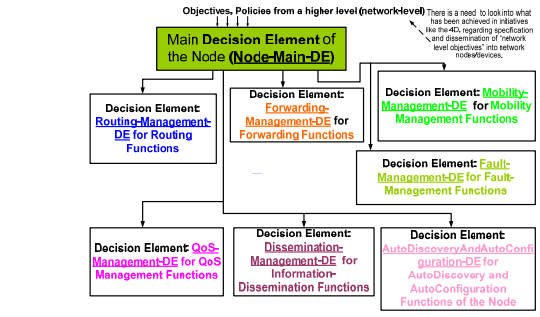
Overview and Problem Statement (1)

- The quest for Self-Managing Networks or Autonomic Networks is what is mainly calling for a re-visitation of today's networking models, architectures and paradigms.
- Autonomicity is an enabler for self-manageability of networks, meaning that autonomic elements, which automate network operations based on realizing (implementing) control loops, and being instrumented in the nodes is what should power a self-managing network.
- **Problem-Statement:** Whether an evolutionary approach or revolutionary approach is taken, there is a requirement for a Generic Autonomic Network Architecture (GANA) that allows for the production of Standardizable Specifications of Autonomic Behaviors i.e. Self-* functions (expect them to be complex) for diverse networking environments, bearing in mind that the Autonomic Behaviors (Self-*) must be testable and verifiable (a challenge). [a holistic approach is required].
  - Self-managing/autonomic properties of a network node or the network as a whole, at different levels of abstracted networking or system functions such that we should be able to talk about, for example, *Autonomic Routing, Autonomic QoS-management, Autonomic Forwarding, Autonomic Information/Knowledge Dissemination, etc.*
  - Hierarchical levels of Control Loops and their associated Decision-making Elements (DEs) for self-manageability/autonomicity, including peering DE relationships (to allow for distributed self-management/autonomic behaviors).
  - Issues that require centralization of some of the autonomic decision-making processes should be captured.

Problem Statement (cntd)

- **The point is:** by separating issues of concern for different well-defined levels of autonomic decision-making processes i.e. control loops, the architecture (GANA) would allow for the production of standardizable specifications of autonomic behaviours including their coupling and interactions.
- The Generic Autonomic Network Architecture should allow for Modeling and Validation of the captured (specified) Autonomic Behaviors using Formal Description Techniques (FDTs) such as the well-known and successful SDL.
- **With well-defined Standardizable Specifications** of Autonomic Behaviors (Self-*) as part of the Generic Autonomic Network Architecture, an evolution path for today's networking models, architectures and paradigms i.e. the Future Internet can emerge (or can be easily defined).
- Some of the input to producing Specifications of Autonomic Behaviors for diverse networking environments should come from what has been achieved in isolated cases of autonomic networking of which the information is currently scattered in scientific conference, workshop and journal papers, Projects.

Decision Elements (DEs) Hierarchy in a Node

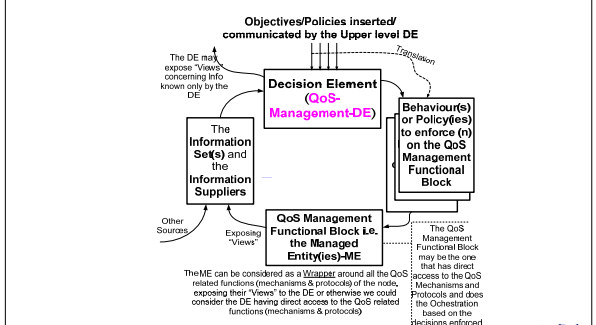


German IPv6 Summit at HPI Potsdam, May 7-8, 2008

Information Society

13

An Example of a DE (inside a node)

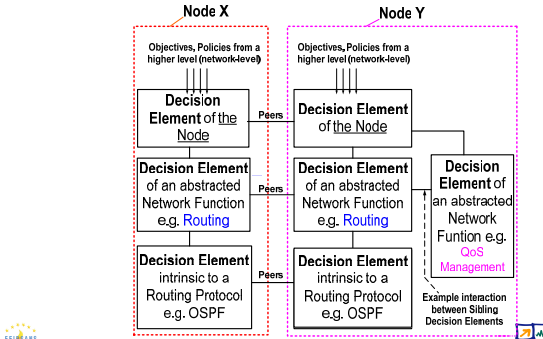


German IPv6 Summit at HPI Potsdam, May 7-8, 2008

Information Society

14

Hierarchy, Peering & Sibling Relations between



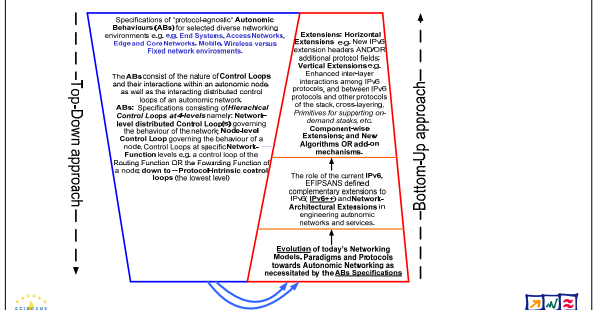
German IPv6 Summit at HPI Potsdam, May 7-8, 2008

Information Society

15

EFIPSANS Vision

EFIPSANS Vision: Produce standardizable, protocol-agnostic **Autonomic Behaviour Specifications (ABs)** for selected diverse networking environments that use the **ABs** to create and drive an evolution path for today's Networking Models, Paradigms and Protocols, **in particular IPv6**, towards Autonomic Networking.



German IPv6 Summit at HPI Potsdam, May 7-8, 2008

Information Society

16

In a nutshell: Main Objectives, Further Research Issues & Consortium

- **EFIPSANS OBJECTIVES**
  - **Capture and Specify *desirable* autonomic(self-*) behaviours e.g. self-diagnosing, self-healing for diverse environments e.g. End Systems, Access Networks, Mobile, Wireless versus Fixed network environments. [Autonomic Behaviour Specifications (ABs) i.e. Control Loops & Interactions, and Requirements Specifications (RQs) will be produced].**
  - **Appropriate IPv6 Protocol and/or Network Architectural Extensions that enable the implementation of the captured desirable *autonomic behaviours* will be sought, designed and specified. [Recommendations Reports or Draft RFCs will be produced].**
  - **Pursue for Standardization and Industrialization of the produced Autonomic Behaviour Specifications, the identified exploitable IPv6 features and "EFIPSANS-defined" new Protocol and Architectural Extensions.**

Manufacturers

ERICSSON, Telcordia Technologies, Alcatel-Lucent, FUJITSU

Research Organisations:

FOKUS, grnet

Network Operator - Service Provider

Telefónica, velti

Universities

UNIVERSITÉ DU LUXEMBOURG, ICCS, ULB

German IPv6 Summit at HPI Potsdam, May 7-8, 2008

Information Society

17

P2P & GRID USING IPV6 AND MOBILE IPV6

DR. LATIF LADID

Dr. Latif Ladid is Chair, European IPv6 Task Force; President, IPv6 FORUM; on the IPv6 Ready Logo Program Board, and an independent international consultant. He is a researcher on a number of European Commission Next Generation Technologies IST Projects:

- 6INIT: www.6init.org - First Pioneer IPv6 Research Project
- 6WINIT: www.6winit.org
- Euro6IX: www.euro6ix.org
- Eurov6: www.eurov6.org
- NGNi: www.ngni.org
- Project initiator of the first IPv6 Security & Privacy project called Security Expert Initiative (SEINIT) see www.seinit.org
- Project initiator of the first European Security Task Force project, called SecurIST: www.securitytaskforce.org
-

He is also a member of 3GPP PCG, member of 3GPP2 PCG , Vice Chair, SuperComm EntNET 2005, member of UN ICT Task Force Policy WG, member of IEC Executive Committee and member of the ITU-T Informal Forum Summit.

ABSTRACT

P2P and GRID computing have been both implemented during the days when NAT has been heavily promoted and therefore P2P was designed as an overlay architecture which makes sense since IP addresses were no more constant and predictable. GRID was designed with the vision not to rely on IP as an end to end model for the same reasons. But NAT was also introduced into GRID and any lamda shooting thru a NAT will just not be efficiently processed as expected by GRID computing.

Back in a 2005 meeting of the GRID e-IRG meeting http://www.e-irg.org/meetings/2005-NL/
I presented the results of a discussion I had with Ian Foster (Father of GRID), Brian Carpenter, Jim Bound, Peter Kirstein and many other GRID luminaries that indeed IPv6 can add the end 2 end model very much needed for GRID especially for the Mobile GRID to come. The same value can be added to P2P bringing back the notion of native P2P.

Mobile IPv6 is a routing protocol that will play a crucial role when mobile

IPv6 devices become dominant and keeping the sessions when moving from one network to another network becomes a business proposition. This is about the dual roaming of IP layer and layer 2 to give end-users full transparency of the networks and what counts is the application sustainability across IP networks.

Mobile IPv6 GRID-2-GRID Peer-2-Peer

The New Internet

Symmetric Ressource Sharing

Filesharing &

Instant Communication

Interactive

Collaborative Computing

Wide Open Again for INNOVATION

Is GRID IPv6 Ready?

Toolkit 4

DEISA

eGee Enabling Grids for E-science in Europe

TERAGRID

Solid Earth and Environment GRID

Data GRID

EUROGRID

KREONet2

KiSTi

6Grid Project

GSI-SFS for IPv6

Do P2P Apps use IPv6?

SETI@home

napster

KaZaA

skype

BitTorrent YES

Project JXTA

gnutella.com

Jabber SoftwareFoundation

icq

groove NETWORKS

P2P & GRID

P2P

- Anonymous individuals
- No implicit incentives for good behavior

Impact:

- No trust
- Free ride
- Implicit incentives to cheat: Seti@home, music sharing

GRID

- Established communities
- Good behavior:
  - –Implicit incentives
  - –Means to enforce it

Impact:

- Trust
- Well-defined "tax base"
- Less flexibility?

P2P & GRID Resources

P2P

- Computing cycles
- Less powerful
- Intermittent participation
  - –Gnutella: avg. lifetime 1h ('01)
  - –MojoNation: 1/6 users always on
  - –Overnet: 50% nodes available 70% of time over a week ('02)
- Variably connected
- Some technical support as community effort

Impact:

- Ease of integration of new resources an early priority

GRID

- More diverse (in type):
  - –Files, storage, computing power, network, instruments
- More powerful
- Good availability
- Well connected
- Technical support

Impact:

Costly resource integration

P2P & GRID Applications

P2P

- Some
  - –File sharing
  - –Number crunching
  - –Content distribution
  - –Measurements
- "Toy" applications only?
  - – Albeit very popular "toys"!

Impact:

- –Complexity often derives from scale

GRID

- Often complex & involving various combinations of
  - – Data manipulation
  - – Computation
  - – Tele-instrumentation
- Wide range of computational models: - Embarrassingly ||
  - - Tightly coupled
  - - Workflow

Impact:

- – Complexity often inherent in the application itself
- – (Inevitably?) Complex infrastructure to support apps

P2P & GRID Scale & Failure

P2P

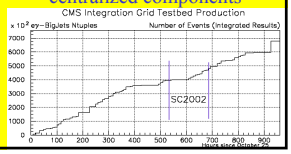
- Large numbers of entities:
  - –Millions of users
- Moderate activity
- 1-2 TB in Gnutella ('01)
- Diverse approaches to failure
  - –Some centralized (SETI, ...)
  - –Some highly self-configuring

eDonkey2K	3,390,821
FastTrack	2,655,327
Gnutella	1,343,576
Overnet	688,128
DirectConnect	320,310
MP2P	251,137
Filetopia	4,265

(www.slyck.com, April 20, 2005 - 23:00

GRID

- *Moderate number of entities*
  - *–10s institutions, 1000s users*
- *Large amounts of activity*
  - *–4.5 TB/day (experiment)*
- Approaches to failure reflect assumptions
  - – centralized components



P2P & GRID Service & Infra.

P2P

- Each application defines & deploys completely independent "infrastructure"
- JXTA, BOINC, XtremWeb?
- Efforts started to define common APIs, albeit with limited scope to date
- Use of NAT !
- NO IPv6 !

Impact:

- New install per application
- Interoperability & code reuse not achieved
- No Scaling !

GRID

- Standard protocols (Global Grid Forum, etc.)
- De facto standard software (open source Globus Toolkit)
- Shared infrastructure (authentication, discovery, resource access, etc.)
- Use of NAT !
- NO IPv6 !

Impact:

- No End to End security
- Interoperability not achieved
- No Scaling !

What Can GRID Learn From P2P ?

P2P

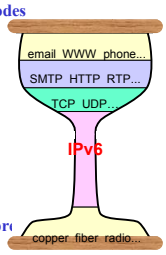
- Scalability
- Autonomy
- Light-weight implementations
- Inclusion of desktop and smaller resources
- Intermittent operation, highly dynamic connectivity

GRID

- Well some Security – more than encryption
  - –Authentication, access control, trust models, virtual organizations, cross organization interactions, etc.
- Naming and binding
- "Industrial strength" architectural support (OGSA)
- Resource management strategies
- Policy negotiation

Benefits of IPv6 to Grid/P2P

- Bigger Address Space
  - – Massive scaling potential >> 4 Billion(IPv4) nodes
- End-to-end addressing
  - – Reduce need for NATs, Proxies etc
  - – Enables full network level security (IPsec)
- Auto-configuration, renumbering
  - – Simplifies network (re)configuration
- Complete Mobility Solution
- Modular design with clean extensibility
  - – Streamlined processing, effective header compr
- Additional hooks for QoS – Flow Label



< Source: Steve Deering, 'IPv6 Addressing the future', Global IPv6 Summit Korea, 2003>

Aktuelle Technische Berichte des Hasso-Plattner-Instituts

Band	ISBN	Titel	Autoren / Redaktion
23	978-3-940793-42-3	**Proceedings of the 2nd. Ph.D. retreat of the HPI Research School on Service-oriented Systems Engineering**	Alle Professoren des HPI
22	978-3-940793-29-4	**Reducing the Complexity of Large EPCs**	Artem Polyvyanyy, Sergy Smirnov, Mathias Weske
21	978-3-940793-17-1	**"Proceedings of the 2nd International Workshop on e-learning and Virtual and Remote Laboratories"**	Bernhard Rabe, Andreas Rasche
20	978-3-940793-02-7	**STG Decomposition: Avoiding Irreducible CSC Conflicts by Internal Communication**	Dominic Wist, Ralf Wollowski
19	978-3-939469-95-7	**A quantitative evaluation of the enhanced Topic-based Vector Space Model**	Artem Polyvyanyy, Dominik Kuropka
18	978-939-469-58-2	**Proceedings of the Fall 2006 Workshop of the HPI Research School on Service-Oriented Systems Engineering**	Benjamin Hagedorn, Michael Schöbel, Matthias Uflacker, Flavius Copaciu, Nikola Milanovic
17	3-939469-52-1 / 978-939469-52-0	**Visualizing Movement Dynamics in Virtual Urban Environments**	Marc Nienhaus, Bruce Gooch, Jürgen Döllner
16	3-939469-35-1 / 978-3-939469-35-3	**Fundamentals of Service-Oriented Engineering**	Andreas Polze, Stefan Hüttenrauch, Uwe Kylau, Martin Grund, Tobias Queck, Anna Ploskonos, Torben Schreiter, Martin Breest, Sören Haubrock, Paul Bouché
15	3-939469-34-3 / 978-3-939469-34-6	**Concepts and Technology of SAP Web Application Server and Service Oriented Architecture Products**	Bernhard Gröne, Peter Tabeling, Konrad Hübner
14	3-939469-23-8 / 978-3-939469-23-0	**Aspektorientierte Programmierung – Überblick über Techniken und Werkzeuge**	Janin Jeske, Bastian Brehmer, Falko Menge, Stefan Hüttenrauch, Christian Adam, Benjamin Schüler, Wolfgang Schult, Andreas Rasche, Andreas Polze
13	3-939469-13-0 / 978-3-939469-13-1	**A Virtual Machine Architecture for Creating IT-Security Labs**	Ji Hu, Dirk Cordel, Christoph Meinel
12	3-937786-89-9 / 978-3-937786-89-6	**An e-Librarian Service - Natural Language Interface for an Efficient Semantic Search within Multimedia Resources**	Serge Linckels, Christoph Meinel
11	3-937786-81-3	**Requirements for Service Composition**	Prof. Dr. M. Weske, Dominik Kuropka Harald Meyer