IPv6 Convergence Conference

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Summary Report

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In this report we begin with a set of ten key messages drawn from the event, as a form of summary of the key issues, and conclude with a selection of interesting quotes taken from the speakers at the event. We also summarise the issues that were conveyed by the speakers at the IPv6 Convergence Forum. These issues fall into five broad categories:

- IPv6 developments
- Benefits
- Opportunities
- Applications
- Challenges

From these general categories we present a suggestion for next steps to be undertaken.

1. Key Messages

The key messages from the event can be summarised as follows:

1. IPv6 is a mature technology with significant deployment experience worldwide. The majority of deployment is in academic networks but commercial deployment is now growing, particularly in the Far East.

2. IPv6 has clear technical advantages but these need to be translated to business advantages for various sectors, with detailed but clear business models. This is a task for economists rather than standards developers and implementers.

3. IPv6 supported fully by Microsoft; they have deployed it in their own worldwide enterprise network, and Windows Vista will ship preferring use of IPv6 by default.

4. A number of companies have decided to support IPv6 as a core strategy, building products and services in advance of demand (e.g. Microsoft, NTT, KDDI).

5. A wide range of new IPv6 application scenarios is available to be exploited; many of these are green field scenarios (e.g. supply chain, sensor networks or transport networks) that can use IPv6 from the outset.

6. IPv6 networks can enrich educational experiences, with the right support and vision. The Greek schools network serves as an example.

7. IPv6 can facilitate convergence both between delivery platforms and between business sectors. This has the potential for streamlining services.

8. Commodity IPv6 devices are required for consumer (SOHO) deployment, in particular there are no IPv6 DSL routers available to the European market; this hinders ISP deployment.

9. For IPv6 to be widely deployed in all commercial sectors, the immediate and realistic market needs need to be addressed, in particular site multi-homing and ISP independence, but also IPv6 capability in OSS and management tools.

10. Training and education capacity needs to be increased. Best practice, roadmap and guidance documents are still required (e.g. defining 'IPv6 capable' for those making public sector IT procurements).

More detailed comments on the threads and themes of the event follow in the next sections.

2. IPv6 Developments

The talks included status and updates on recent developments in IPv6 deployment:

Stable standards: IPv6's standards were often referred to as stable standards; these have been hardened in the IETF over many years, to the extent that the IPv6 WG at the IETF is at the point of being closed.

Many implementations: from all the presentations it was also clear that many IPv6-based implementations already exist, though almost universally dual-stack.

Hardened interoperability tests: apart from the standardisation and implementation, the interoperability tests are also a strong point regarding IPv6. Very well known interoperability and conformance sessions have already taken place several times by organisations such as ETSI, TAHI and GO4IT.

Proven testbeds: extensive testbeds like 6NET, Euro6IX and INSC have proven IPv6's reliability and readiness for global usage.

Good research funding: research is also a strong axis for IPv6 – the European Commission already funded 14 European IST IPv6 projects, from 2000 to 2005. This fact boosted the deployment of IPv6 in academic networks, and one of the speakers said that the IPv6 topic is not today one of the targets of these communities, simply because they already have it in place.

Widespread academic deployment: GEANT, ABILENE and CERNET (China) are probably the best examples of continent-wide IPv6 deployment. Deployment in end sites (campuses) remains a challenge however.

EC consultation in Feb 2006: the EC also performed a wide consultation about IPv6 in February/2006, which caught the attention of 260 responders.

Microsoft's enterprise network IPv6 enabled: from the Microsoft European CTO's speech, the audience learned that the company had deployed the largest IPv6-enabled network in the world for internal use, and that was crucial for developing and validating knowledge for MS products.

Vista to ship January 2007 with IPv6 on by default and preffered: Windows Vista, with IPv6 activated by default and preferred. Some P2P applications will be exclusively IPv6-enabled.

Defence sector moving forward: the defence sector is keeping its plans for IPv6 in progress. The NATO speaker transmitted once again the message that some countries' MoDs have issued their will to extensively deploy IPv6. This includes major members of the Atlantic Alliance, such as the US, France and Germany.

School networks deploying IPv6: for the near future, the forum heard a glimpse about large-scale deployment on school networks, which included the 50 schools trial in Greece, and the plans to deploy also a trial in Portuguese schools till the end of 2006.

3. Benefits

The well-known strategic benefits of deploying IPv6 were again mentioned in this forum by a number of speakers:

Strategic advantages: the Internet expansion capability through IPv6 will be a key factor in favour of IPv6, when the IPv4 free address pool becomes exhausted in the next years (studies indicate 2010 will see significant pressure[1]). The only way the Internet can grow in a sustained way if using the global addressability offered by IPv6. End-to-end transparency and connectivity will also be seen more as a strong driver towards IPv6. Economic studies also take ground from IPv6's improved plug and play capabilities to point out that the new protocol can enable easier use of devices. One other factor is NAT removal, which will benefit application developers who no longer have to build NAT traversal solutions and overly complex architectures.

Better service support: IPv6 offers a better service support, through simplified multicast, improved mobility (including media handover) for both hosts and networks, and built-in security (with mandatory IPSec support) which allows for end-to-end security

Reduced OPEX: some characteristics of IPv6 were mentioned as leading to a reduced operational expenditure: Easier installation and maintenance, simpler service design, reduced misconfiguration probability, easier troubleshooting (in part through avoiding private IP space being used in ISP networks), and more flexibility in terms of network mergers and reconfigurations.

[1] http://www.cisco.com/web/about/ac123/ac147/archived_issues/ipj_8-3/ipv4.html

Single, scalable platform for convergence: in the long run, the benefits depicted above will be widely used in scalable and convergent platforms, such as Triple Play (through cable or DSL) for voice, video and data and satellite delivery through Digital Video Broadcasting (DVB).

4. Opportunities

A wide range of opportunities for IPv6 were mentioned during the course of the two-day event, including:

Long-term strategies: many companies have embraced IPv6 as the Right Thing To Do, and as such are progressing development in advance of consumer demand, e.g. Microsoft, NTT and KDDI. This will give these companies an advantage.

Innovation: new services and applications can be developed using IPv6 as the basis, e.g. using direct connectivity into IPv6-enabled home networks. This can open up new revenue streams.

Business opportunities: a number of business opportunities were mentioned, including the potential for ISP/ASP convergence, cost reductions and better long-term return on investment (RoI). These have yet to be proven however.

Richer education environments: the potential for IPv6 to enhance educational environments was presented. This may be through school deployments removing Network Address Translation (NAT) devices and enabling applications to be run easily between schools (and children) or by providing educational resources, e.g. IPv6-enabled environmental sensors, or flexible GRID facilities.

New delivery platforms: these offer new opportunities for IPv6 deployment, some 'green field', e.g. high-speed DSL, cable modems, DVB Phase II, WiMAX or satellite.

Massive mobile, always-on networks: as networks and devices evolve, IPv6 offers an opportunity to provide scalable networking for billions of mobile, always-on devices that can communicate on a peer-to-peer basis. Seamless mobility is also important – information at any time, anywhere.

New low-cost devices: as devices become more commodity in nature and cost, they will become more pervasive, and IPv6 enables them to be networked in a scalable way.

The PC in the lounge: the growth in home networking offers new potential for services, by networking multiple PCs and devices, and also providing 'PC-like' functions in living areas rather than a dedicated PC in another room. A holistic networking solution is required.

Defence networks: a large focus has been placed on network-centric warfare.

5. Applications

There are a number of application areas that are already being explored with initial developments:

Peer-to-Peer: including direct host-to-host communication that is only possible without NATs, but also enhanced peer-to-peer networks. Existing architectures such as BitTorrent are hampered by NATs, since these prevent nodes in a BitTorrent swarm from offering/uploading chunks of data to other nodes.

Home networking: many streaming and media oriented applications, with seamless, easy-to-deploy networks required.

Digital IP-TV: a wider range of media players for such (multicast) services is required.

SIP-based voice over IP (VoIP): IPv6 SIP applications are emerging, e.g. NTT deployed 20,000 IPv6 terminals in its Japanese network.

Online gaming: IPv6 can enable bidirectional communication to enhance gaming environments.

In addition there are also new areas, with new devices that will all need to be networked, driving up the requirements for IP address space, and thus for IPv6:

Supply chain management: tracking parcels, luggage, etc.

Ad-hoc networks: in scenarios such as disaster recovery and management.

Utility sectors: water and power metering, potentially deployed via IPv6 "community of interest" networks (using MIPv6).

Transport networks: IP based services, monitoring, telemetry and management in cars, trains, buses, aircraft and public transport systems.

Environmental monitoring: through sensor networks, such as the Live E! project in Japan.

Sensor networks: for predictive modelling, disaster warnings or for educational purposes.

Public safety networks: for search and rescue, as under study in the U-2010 project.

These applications will see IP usage move away from 'PC' type devices to a wide range of embedded and device-to-device scenarios.

6. Challenges

A number of challenges were touched upon and discussed during the event:

Making money from IPv6: there needs to be an emphasis on "making money" besides the well-known "saving money" argument for IPv6.

Short-term OPEX rise during transition: there is the possibility short-term higher OPEX during the transition phase, as both IPv4 and IPv6 needed to be managed.

Need economists to build business models: economists should build and enhance business models, and not technology geeks – the latter are with no doubt helpful, but their job is mostly done.

Knocking holes in walled gardens: one other aspect is that the walled garden model associated with IPv4 favours the status quo, not innovation. Innovation with IPv6 has risen mainly from the research sector, and now is the time to start driving that output to commercial production networks, which traditionally have a level of user 'lock-in'.

Lack of customer demand: this is also a big challenge, however, the customers should be viewed as ISPs and enterprises, and not end-users - they only care about transparent, hassle-free, low-cost (as possible) service. End users shouldn't need to know about IPv6.

IPv6 will happen anyway: there is also a "mental barrier" on some people that believe IPv6 will happen in the future without their cooperation in the present. However, these people may be those last to consider IPv6 and thus be disadvantaged. It is thus important for 'buy-in' for IPv6 to happen at all levels in organisations.

Limited training capacity: the training and education capacity for IPv6 in Europe is currently low; an improved capability for education about the new Internet protocol is something that also needs to be in place.

Management tools: in terms of vendor cooperation, there are still some management issues – IPv6 is supported in the OS/router products, but often is not supported in the management and OSS tools required to operate them. This issue has to be address to improve the capability to deploy.

Commodity CPE devices: one other challenge is also the availability of commodity CPEs with IPv6 support. There is still no cheap IPv6 DSL router product available in Europe for home networking, thus ISPs have no driver to enable the service for SOHO customers.

Asymmetric networks: IPv6 facilitates peer-to-peer and connectivity into networks, but existing networks favour download over upload, in particular commodity ADSL. ISPs may find enabling symmetric capability a challenge.

Multicast deployment challenges: there are unique advantages for Multicast when deployed over IPv6, but the market is wary of multicast from experience with IPv4 Multicast. The IPv6 advantage needs to be demonstrated.

7. Next Steps

The IPv6 community has some tasks ahead, to aid a faster adoption of IPv6.

Show business models: there is a need for models, authored by economists who understand such models, to be documented that highlight potentials for additional revenue and operational savings, and to show that IPv6 is affordable with proportionate costs.

Define 'IPv6 capable': this is an important requirement for public procurements, to assist those authoring the procurements to specify solutions that will support IPv6 operation when required, even if IPv6 will not be used initially on the solutions.

Identify and stimulate delivery of new applications: innovative applications that may use IPv6 are required. The search for an IPv6 killer-application is oft-quoted, but it is more likely to be applications whose architectures are NAT-free, and that embrace global addressability that come to the fore. These may be scenarios with no use of IP at present.

Promote development of IP version agnostic applications: it is important that new applications designed for just IPv4 operation are written in an IP version agnostic way. Guidance for common development environments/languages should be promoted. This will minimise costs of deploying the applications in future IPv6 networks.

Show best practice: Showing best practices is also important, for example from the Greek schools network experience, or showing how to undertake a non-disruptive transition (with cost analysis), or how IPv6 can functionally replace the perceived benefits of NAT while offering richer connectivity.

Supply roadmaps: industry bodies need guidance and roadmaps, as well as an enhanced training capacity available to them.

Document social aspects: this includes areas such as privacy issues.

Collaborate internationally: one particular topical area is that of the UN's new Internet Governance Forum (IGF) and where IPv6 fits into that picture.

Financial support: there could be some incentives for IPv6 development for European industry, though mandating IPv6 is not desirable.

8. Event Quotes

Some notable quotes from participants were presented at the summary session, as follows:

Hiroshi Esaki (Univ. Tokyo):

- "IPv6 is not only for IT industries, but for all, through improving RoI."

Gabriella Paolini (audience/GARR):

- "IPv6 is intended to do what IPv4 does, but better. GRIDS is an example."

Jonas Persson (Microsoft):

- "Seamless Networking – IPv6 can reduce complexity, and you can save money by reducing it."

Patrick Grossetete (Cisco):

- "IPv6 in India is intended to create new jobs, business opportunities & services, and we need to do the same in Europe."

Urich Reimers (BTU):

- "Engineers are working in the migration to IPv6 – We are NOT sleeping, but only acting slowly."

Helmut Leopold (Telekom Austria):

- "I believe tremendously on decreasing complexity to the customer."

Patrick Grossetete (Cisco):

- "Don't try to sell IPv6 to end-users. Applications must go IP agnostic."

Eivan Cerasi (Eurocontrol):

- "IPv6 is IP, it's not another protocol."

Emmanuel Varvarigos (GCTI):

- "IPv6 technology is mature and can be deployed without the fear of possible network collapse."