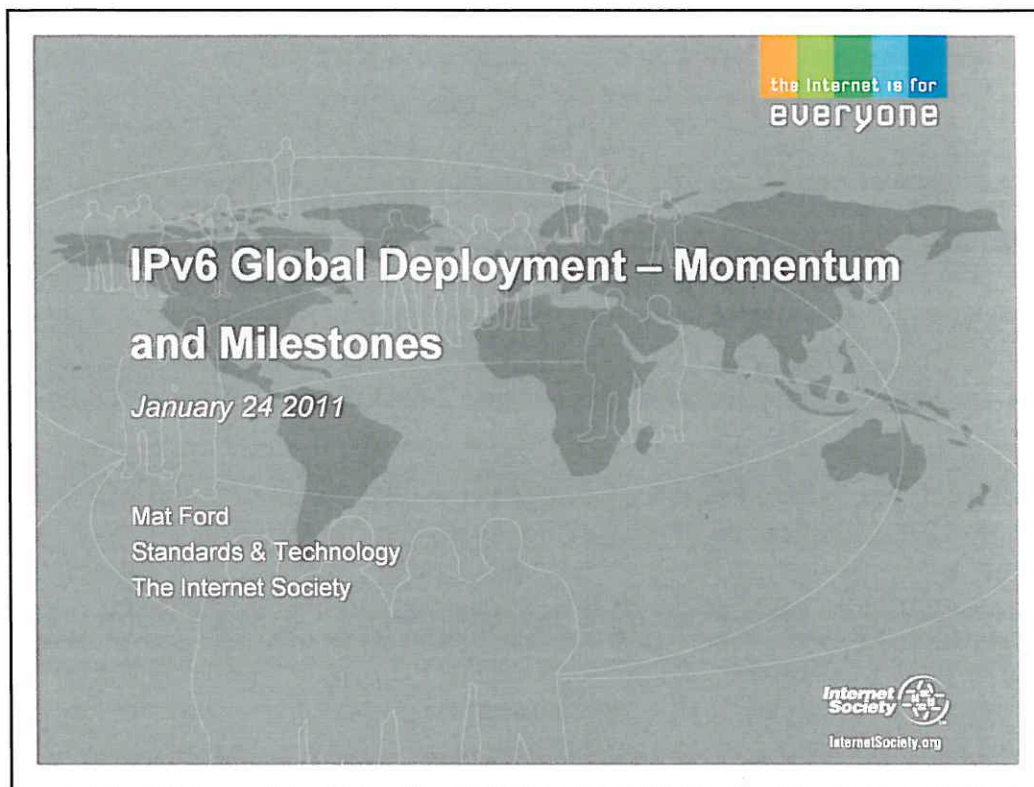
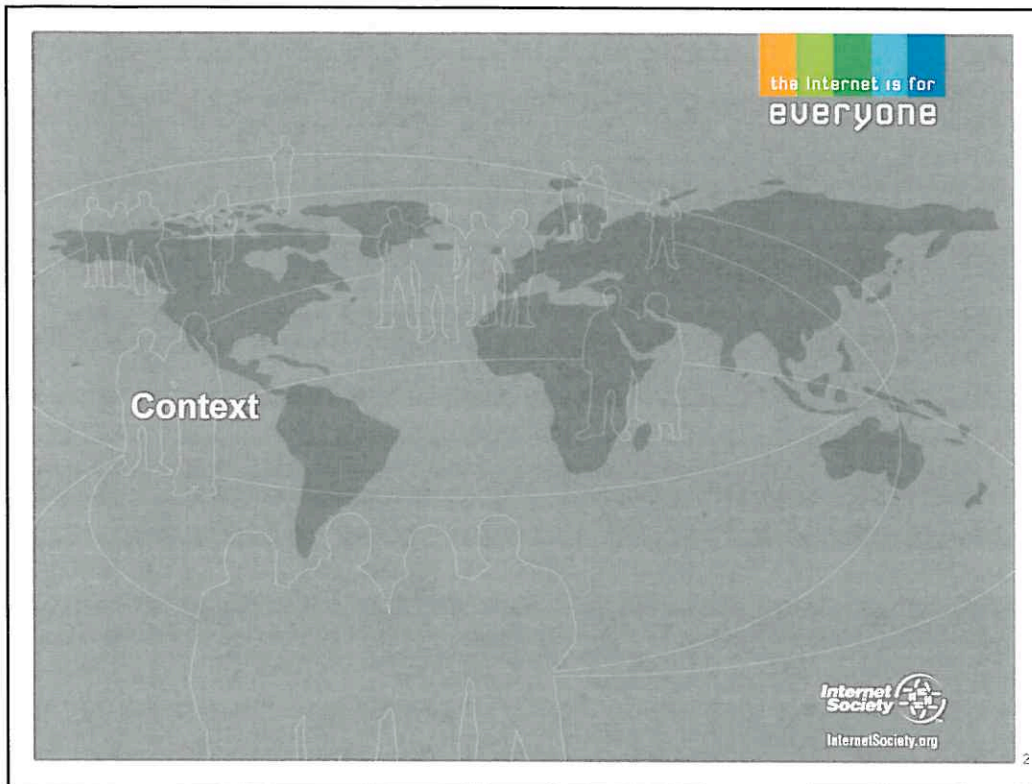




Good afternoon and thank you for this opportunity to speak to you about the Internet Society's view of IPv6 deployment. My name is Mat Ford and I work as part of the Standards and Technology team at the Internet Society. In this brief presentation I'd like to highlight some of the IPv6 deployment milestones that we passed during 2010, and I'd like to emphasise the growing momentum around IPv6 deployment globally as the Internet community in its broadest sense steps up to the challenge of ensuring we still have an Internet for everyone and for everything in the future.



With that by way of introduction, let me set the scene with some context.

The Future Internet – Scale¹

- More than 1.6 billion devices worldwide were used to access the Internet in 2009, including PCs, mobile phones, and online videogame consoles.
- By 2013, the total number of devices accessing the Internet will increase to more than 2.7 billion.
- China continues to have more Internet users than any other country
 - 359 million in 2009
 - expected to grow to 566 million by 2013
- The United States had 261 million Internet users in 2009, a figure that will reach 280 million in 2013
- India will have one of the fastest growing Internet populations, growing almost two-fold between 2009 and 2013.

¹<http://www.idc.com/about/viewpressrelease.jsp?containerId=prUS22110509&sectionId=newsroom&contentType=pressRelease&pageType=SYNOPSIS>



It's all about scale. Since it's inception, the challenge of the Internet and of Internet-related technologies has been one of scale. Over a billion devices were used to access the Internet worldwide in 2009 and that number is set to rise dramatically as more computers, smartphones, and other Internet-connected devices come online. By 2013, the total number of devices accessing the Internet will increase to nearly 3 billion. Of course we should not expect the world's population (currently approaching 7 billion people) to be any limiting factor on this growth, as the number of devices per person, and the prevalence of machine-to-machine communication both continue to grow in parallel with the expansion of Internet connectivity to new communities.

China continues to have more Internet users than any other country and is expected to exceed half a billion users by 2013. The US will exceed a quarter of a billion by the same year. And India is witnessing some of the fastest growth with their Internet population doubling between 2009 and 2013.

The smooth running of the Internet depends on designing and deploying technologies capable of supporting communications at this scale and growth at these rates.

Much of it will be mobile²

- There were more than 450 million mobile Internet users worldwide in 2009
 - a number that is expected to more than double by the end of 2013.
- Driven by the popularity and affordability of mobile phones, smartphones, and other wireless devices:
 - expect the number of mobile devices accessing the Internet to surpass the one billion mark over the next four years.
- The most popular online activities of mobile Internet users are similar to those of other Internet users:
 - using search engines
 - reading news and sports information
 - downloading music and videos
 - sending/receiving email and instant messages

²<http://www.idc.com/about/viewpressrelease.jsp?containerId=prUS22110509&elementId=null&pageType=SYNOPSIS>



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Of course much of the growth today is in mobile Internet users, expected to number around one billion by 2013. And the important thing to realise is that mobile Internet users increasingly expect the mobile experience to mirror the fixed experience. Popular online activities are very similar between user groups whether they are mobile or otherwise – searching for information, reading up on news and sports events, listening to music or watching video, communicating by voice, email and instant messages are all activities that these mobile Internet users expect to be able to engage in. Mobility support is a major challenge to Internet technologies of the future.

The Future Internet, some expectations

- Even though Internet-connected devices are getting smaller and more diverse, users still expect "the Internet"
 - not just a subset of data services
- There will be more Internet hosts than IPv4 addresses well before the end of this decade
 - Even if we could re-use every IPv4 address, there aren't enough

✓ IPv6 is the only answer for a globally-connected future Internet



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As devices get smaller and the range of available Internet connected devices increases and diversifies, the Internet 'experience' becomes more deeply embedded in people's lives. People increasingly come to expect 'the Internet' from all of their devices and not just a subset of data services. The challenge for mobile operators is to provide robust support for Internet service in the presence of massive subscriber growth and handset and application diversity. Restricting the service experience to meet the challenges of scale and mobility will not satisfy users increasingly unwilling to tolerate artificial restrictions to their use of the Internet.

We know there will be more Internet hosts than IPv4 addresses well before the end of this decade. Even if we could re-use every IPv4 address, there aren't enough. We have simply outgrown IPv4 as a solution for global Internet addressing.

IPv6 is the only answer for a globally-connected future Internet. Of course, you already knew that, otherwise you wouldn't be here!



Perhaps more interesting is what we and others are doing about this challenge to the future growth and success of the Internet.

Internet Society Efforts on IPv6

- Working with industry on transition since 2008
- Holding informational meetings
 - “IPv6 Deployment Day” held in April 2010
 - See <http://www.isoc.org/isoc/conferences/ipv6deployment>
 - Preceded by invitational roundtables to share experiences, discuss approaches on key issues
- In 2011 – focused showcase activities
 - Coordinated effort to identify, and focus attention on, any remaining issues for users, content providers, access providers
 - Concrete data beats theory – how real an impact from OS issues, etc?



At the Internet Society, we have been working with industry on transition to IPv6 since 2008. In particular we have been holding a series of invitational roundtable meetings where operators and content providers can share experiences and concerns relating to IPv6 deployment on their networks, and can discuss approaches to key issues and develop solutions to help increase the momentum of IPv6 deployment across the industry. These meetings have really helped to build confidence and understanding as the various interdependent players feel their way forwards. These roundtables culminated last April in an IPv6 Deployment Day and you can find more details about that event by following the link on the slide.

Looking forward to 2011, we are planning some more focused showcase activities around IPv6 deployment with a coordinated effort to identify and focus attention on remaining issues for users, content providers and access providers. The focus will be on hard data to either remove extant concerns regarding IPv6 deployment altogether, or where additional work is required, to clearly identify the effort needed and get it done.

IPv6 Deployment: Operators & Others

Many have made public commitments to IPv6



Most of these are piloting or operating IPv6 backbones and wholesale services



Some have moved into consumer pilots and commercial operation of retail services



Of course the Internet Society can cheerlead for IPv6 deployment but it's really up to others to do the work, and we have already seen many major network operators make public commitments to IPv6. Many are piloting services or operating IPv6 backbones and wholesale service offerings. Some have moved into consumer IPv6 trials and commercial operation of retail services.

Movement on the Global Stage

- OECD
 - 2008: Internet Address Space: Economic Considerations in the Management of IPv4 and in the Deployment of IPv6, Ministerial Background Report, DSTI/ICCP(2007)20/FINAL, <http://www.oecd.org/dataoecd/7/1/40605942.pdf>, pp5-6.
 - To create a policy environment conducive to the timely deployment of IPv6, governments should consider:
 - 1) Working with the private sector and other stakeholders to increase education and awareness and reduce bottlenecks
 - 2) Demonstrating government commitment to adoption of IPv6
 - 3) Pursuing international co-operation and monitoring IPv6 deployment
- APEC TEL
 - TELMIN 8 completed recommendations on IPv6 deployment for regional economies,
 - http://www.apec.org/Groups/SOM-Steering-Committee-on-Economic-and-Technical-Cooperation/Working-Groups/~media/Files/Groups/TEL/2010_APEC-TEL-IPv6-guidelines-FINAL.ashx



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In addition to working with industry, the Internet Society also engages with various inter-governmental organisations to assist with the development of policy supporting IPv6 deployment internationally. For example, the OECD in 2008 issued a detailed report on the management of IPv4 and the deployment of IPv6 as part of the background to the Ministerial meeting on the Future of the Internet Economy, held in Seoul. This recommended that in order to create a policy environment conducive to the timely deployment of IPv6, governments should consider: working with the private sector and other stakeholders to increase education and awareness and reduce bottlenecks; demonstrating government commitment to adoption of IPv6; and pursuing international co-operation and monitoring IPv6 deployment.

The APEC TEL working group completed recommendations on IPv6 deployment for regional economies during their recent ministerial meeting and these are now available online by following the link on the slide.

Headlines from Governments

- 2008
 - EU issues call to action – target 25% by 2010
 - USG publishes IPv6 profile
- 2009
 - Japan publishes its IPv4 address exhaustion plan in October
 - Almost all Japanese ISPs are following this plan and preparing IPv6 service launch in the April 2011 timeframe
 - USG issues a FAR putting the USGv6 program NIST has been developing into the USG procurement rules.
 - <http://edocket.access.gpo.gov/2009/E9-28931.htm>
 - Australia moved up their action dates
 - Pursuing whole government deployment by end of 2012 (moved up from 2015)
 - http://www.ipv6.org.au/summit/talks/DBeauchamp_JHillier.pdf
- 2010
 - Philippine government issues mandate for IPv6
 - <http://www.pregi.net/news/palace-promotes-the-use-of-ipv6/>
 - US CIO issues directive accelerating IPv6 operational deployment in all federal agencies
 - <http://www.cio.gov/Documents/Transition-to-IPv6.pdf>
 - Indonesia publicizes its IPv6 plan at TELMIN8 ministerial
 - <http://www.apectelmin8.go.jp/>
 - Turkish government requires all govt. agencies to IPv6-enable online services by August 2013



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In recent years we have also seen growing momentum from national governments as they seek to stimulate IPv6 deployment within their territories. The US government has strengthened its procurement rules requiring IPv6 compliance in new IT acquisitions; Australia has accelerated its timetable for government deployment and brought it forward to the end of 2012 and Japanese ISPs have been stimulated by their government to prepare for IPv6 service launch later this year. At the very end of last year the Turkish government announced a mandate to require all government agencies to IPv6-enable their online services by the end of August 2013.

In 2010, the Philippine government issued a mandate for IPv6 that requires all government websites to be accessible over IPv6 within 2 years, government procurements will require IPv6, ISPs and content providers operating in the country will use IPv6, and all departments will publish a plan for deploying IPv6.

Headlines from Service Providers (core & access)

- 2007
 - Free (France) turns on IPv6 access – available to every subscriber
- 2009
 - Hurricane Electric expands its IPv6 offering
 - Verizon presses requirement of IPv6 in LTE wireless access specs
- 2010
 - Comcast (US) announces IPv6 production trials
 - Verizon (US) announces IPv6 network trials
 - NTT announces worldwide rollout of a dual-stack IP VPN service
 - Verizon and ATT announce and promote business services on IPv6
 - Quest announces IPv6 offering for all USG customers
 - XS4ALL offers IPv6 to all subscribers
- Expected by 2011
 - DT has announced it will offer dual-stack service to all its DSL subs
 - Japanese ISPs and access networks are IPv6 capable



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The service provider community have been similarly busy with numerous announcements relating to trial and live IPv6 service deployments around the world. In 2007, French ISP Free made IPv6 service available to its entire subscriber base and now boasts one of the largest operational deployments of IPv6 anywhere in the world. More recently, Dutch ISP XS4ALL announced it will provide native IPv6 service to all its subscribers. In the coming year we expect to see Deutsche Telekom in Germany make dual-stack service available to all of their DSL subscribers and as I've already mentioned we also expect to see an uptick in IPv6 service availability in Japan as well.

Headlines from Content Providers

- 2008 Google begins
 - Building a pilot IPv6 network "was not expensive," said [Lorenzo] Colitti, who recommended rolling out IPv6 in stages. "There's nothing inherently unreliable about IPv6."
 - Google is already reaping the benefits of IPv6. "It's refreshingly simple" to look at a network with globally addressable devices, Colitti said.
- 2009
 - Netflix streaming content over IPv6
 - Limelight providing IPv6 services (content delivery network)
- 2010
 - YouTube accessible over IPv6
 - Heise Online goes dual-stack
 - Vg.no goes dual-stack
- Expected by 2011
 - eBay & Facebook
 - Akamai expects commercial IPv6 service for all customers



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Content providers have also been extremely active in deploying IPv6 service recently, particularly some of the largest global content providers.

Google got underway in 2008 and made Youtube accessible over IPv6 in 2010. In 2009, Netflix began streaming video content over IPv6 and the content distribution network Limelight also started providing IPv6 services to their customers. For 2011 we've had announcements from eBay, Facebook and Akamai that they expect to offer commercial IPv6 service. Akamai's move to IPv6 is important because they provide content delivery services to a large number of customers representing a large amount of web content.

With more than 150 million page impressions per month, heise Online is one of the biggest news sites in Germany. Globally, it is also one of the largest sites now running in dual-stack mode, which means that pages can be accessed via both IPv4 and IPv6. Similarly, last October in Norway, a [major newspaper](#) undertook an IPv6 trial. IPv6 was turned on for 24 hours to test the effect it would have. The [test](#) was so successful that the change is now permanent.



It's time for me to conclude with some recommended actions for organisations willing to join the companies and other organisations I've highlighted in this talk and help to lead IPv6 deployment throughout 2011, and contribute to building the growing momentum we already see building around the world.

Recommended Actions for Leading Organizations

- *Make IPv6 a top priority for the organization*
 - With visibility and awareness to the senior executive levels
- *Accelerate IPv6 deployment plans*
 - Commit to being ahead of the curve on your deployment
- *Communicate IPv6 plans and status in public*
 - The rest of the industry will follow the leaders
 - Feed the momentum of IPv6 deployment
 - Create a 'virtuous circle' of mutually reinforcing IPv6 deployment



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Visibility and awareness of IPv6 has to reach all the way to the top of the organisation to ensure the highest priority for the transition, and to help smooth over the roadblocks and organisational politics that can otherwise hinder such an important shift.

As we have seen, several major industrial and public organisations are already advancing detailed IPv6 deployment plans. Leading organisations need to accelerate IPv6 deployment plans to stay ahead of the curve.

Be public about your plans and IPv6 deployment status. Industry needs leaders to follow. As I already mentioned, a large part of what the Internet Society is trying to foster with regard to IPv6 deployment is confidence building and sharing first-mover experiences. By being public with plans and deployment status updates, you can help to build confidence in IPv6 deployment and accelerate the momentum we're seeing around the globe towards an IPv6-enabled future for the Internet. Making plans and updates publicly visible feeds into the momentum of IPv6 deployment and creates a 'virtuous circle'. Organizations of all types and scale are looking around to see what their peers are doing, and this is one area where competitive interests are not served by secrecy. The Internet is an exercise in collaboration and successful IPv6 deployment will be all about collaboration and shared experiences as we move through the period of transition together.



With that, thank you for your attention, and for this opportunity to share ISOC's view of global IPv6 deployment. Thanks!

Additional resources:

- <http://www.isoc.org/educpillar/resources/ipv6.shtml>: ISOC resource page on IPv6, continually updated
- <https://www.arin.net/knowledge/v4-v6.html>: ARIN resource page on IPv6, continually updated
- <http://www.potaroo.net/tools/ipv4/>: detailed information on public IPv4 address exhaustion, continually updated

