The Challenge of this Meeting

Critical Transition

Broadband Infrastructure Deployment

IPv6

Sharing

15 min presentation
+ 20 min discussion

Near Term Opportunities

Longer Term Opportunities

Further Exploration Warranted

Technology Advisory Council

Broadband Infrastructure Deployment Working Group

Working Group Overview

Charter

- Identify steps advancing the deployment of broadband infrastructure by removing impediments and providing logistical incentives.
- Focus on promoting near-term private investment and creating private-sector jobs.

Members

- Mark Bayliss, Visual Link
- Richard Lynch, Verizon (Chair)
- Paul Mankiewich, Juniper Networks
- John McHugh, OPASTCO
- Harold Teets, tw telecom
- Marvin Sirbu, Carnegie Mellon University

Statement of Work

The working group focused on:

- tower siting,
- federal, state and local rights of way,
- infrastructure build out,
- permit processing and schedules,
- new technologies to facilitate deployment,
- education of state and local officials.

Economic Impacts

- Working Group efforts to accurately assess impacts were stymied.
- Some of the dilemmas:
  - Base or reference points.
  - Indirect investment effects.
  - Alternative investments.
  - Time and resource limits.
- Working Conclusion
  - Acceleration of broadband expansion has net positive value.
  - Each of the Working Group recommendations can have substantial catalytic impact.

Top Ideas for Consideration

- Permits for Federal Rights of Way
- Municipality Survey
- Tower Siting
- Technology Opportunities
- Coordinated Openings
- Other items worthy of FCC consideration are also included; although not part of today's discussion.

Permits for Federal Rights of Way and Antenna Siting

Problem

- Federal agency reviews are lengthy and requirements are inconsistent.
- Manual, paper-based processes dominate reviews.

Proposed Ideas

- Promote standard document format for permitting processes.
- Identify one agency to co-ordinate a unified process for permit approval, with standardized time frames for review and approval.
  - NTIA Federal Rights of Way Working Group report published in April, 2004 which can be used as a starting point.

Next Steps

- FCC-sponsored initiatives to develop inter-agency standardized requirements for antenna siting and rights of way applications.
- Establish a common form and process for acquiring approval from all involved federal agencies, within a specific, reasonable, time frame (e.g., 60 days).
- Ideally, both above steps could be contained within an Executive Order.

Municipality Survey

Problem

- Expeditious deployment of broadband is hindered by lack of uniformity in state, local and municipal compliance with identified best practices.

Proposed Idea

- FCC-sponsored identification and publication of best practices.

Next Steps

- Develop a “road show” to highlight the benefits of adopting best practices.
- FCC-sponsored municipality and service provider surveys to identify cities that are best in class in broadband deployment.
- Using survey results, create an electronic means for municipalities to report data on broadband deployments.

Tower Siting

Problem

- Applications are frequently determined to be incomplete multiple times in the process.
- Environmental Assessment processing timeframes are inconsistent.
- State and local zoning requirements for new builds are unnecessarily being applied to co-locations on existing towers.

Proposed Ideas

- Permitting authority should cooperatively work with applicant to correct incomplete application within a short time frame (e.g., 5 days).
- Establish consistent time frames for Environmental Assessment (EA) reviews which should be completed concurrently with other permit processing.

Next Steps

- Encourage permitting authority to mitigate delays due to insufficient application by working cooperatively with the applicant to correct deficiencies.
- FCC-sponsored workshops to educate permitting authorities about the benefits of expediting approvals, and the negative impacts of ordinances that arbitrarily limit tower height.
- Investigate processes employed in other advanced broadband countries such as exemption from extensive processes when within certain parameters; much shorter approval timeframes.
- The FCC should support short “shot clock” and “co-location by right.”

Technology Opportunities

Problem

- Limiting the variety of new technologies used to deploy broadband and optimize networks causes delay in construction and increases broadband deployment costs.

Proposed Idea

- FCC-sponsored education that offers government and the public an appreciation of the benefits of using these efficient new technologies to optimize networks and deliver content.

Next Steps

- Develop a “road show” to highlight how taking advantage of new technologies can accelerate the deployment of broadband to the consumer.
- Develop a website, with collaboration tool capability, available to all municipalities and governments, to drive understanding and acceptance of new technologies for broadband deployment.

Coordinated Openings

Problem

- Lack of tools for municipalities to communicate future open trenching projects.
- Timely access to underground facilities has a direct bearing on infrastructure costs and deployment.

Proposed Idea

- FCC-sponsored review of existing communication policies and best practices.
  - Steer municipalities toward clear communications to interested parties.
  - Avoid near-term construction moratoriums.
  - Promote processes which provide adequate notification of street openings to utilities (e.g., Reverse One-Call).

Next Steps

- FCC-initiated best practices review of state and local notification processes.
- Develop communication (web or e-mail) process for municipalities to advise providers of planned utility projects.
- Establish a recommended notification window (e.g. 90 days for planned utility projects).

Pole Attachments*

Problem

- High attachment prices inhibit investment in infrastructure and delays deployment.
- Inconsistencies between municipalities in determining rates for attachments.
- Over half of electric utilities are co-ops, which are exempt from pole attachment regulation.

Proposed Idea

- Adopt uniform rate for all broadband providers attaching to a pole.

Next Steps

- The FCC should address these issues in Docket 07-245
- Convene a working group to look at state rate structures to ensure alignment with Federal rules.

* By statute, the term pole attachments actually refers to poles, duct, conduit or rights of way.

State and Local Permitting Process

Problem

- Inconsistent state and local municipality permitting processes and policies result in uncertainty, discouraging and/or delaying investment.

Proposed Idea

- FCC-sponsored education and communication with state and local municipalities to incent support for investment and deployment of broadband.

Next Steps

- Convene workshops to sensitize state and local municipalities to the positive benefit of acceleration.
- Identify and publish best practices for permit requirements and processing.
- Create common communications tools to assist municipalities in implementation of best practices.

RF Emissions

Problem

- Cell site applications are frequently denied on the basis of RF emission concerns.
- Jurisdictions often request studies to confirm site compliance with FCC RF emissions standards; which often results in disputed outcomes and litigation.

Proposed Ideas

- Reiterate and enforce the specific provision in the Act restricting denial due to RF emissions.
- Develop criteria for a certification of compliance with FCC RF emissions limits, to be filed with application.

Next Steps

- FCC-sponsored educational programs to reinforce understanding of RF emission rules.
- Develop standardized RF emissions assessment procedures to certify compliance with FCC RF emissions requirements for submission with applications.
- FCC should create certification process for approved vendors to provide application certification.

Rights of Way Fees

Problem

- Local authorities frequently assess rates and/or impose other costs that raise revenues beyond the cost of the right of way. Localities delay negotiations until providers concede to payment or abandon projects.

Proposed Idea

- Develop adoption of a transparent and predictable model for fee structures and charges.
  - Standards for major requirements, such as insurance.
  - Limit the non-discriminatory fees that localities may charge.
- Develop a FCC-managed certification process for right of way users.

Next Steps

- Establish a working group to develop a transparent and predictable model for right of way fees.

Building Egress

Problem

- Building management policies that are inconsistent and restrictive cause broadband deployment delays and increased costs.

Proposed Idea

- FCC-sponsored education and communication with private land and building owners.
  - Focus on impact to broadband deployment and investment growth and benefits to private owners.
  - Identify best practices for egress.

Next Steps

- Identify best practices and create a common tool to educate building owners.

Middle Mile

Problem

- High cost of middle-mile broadband transport in some areas.
- The USA has the lowest cost of Internet bandwidth in the world until middle mile costs are added.
- Currently, pole attachments and franchise agreements do not allow for middle-mile, transport-only providers to obtain franchises and usage of Pole Attachments and Rights-of-Way agreements.

Proposed Ideas

- FCC should consider establishing the definition of a carrier-neutral, middle-mile provider.
- FCC should consider modification of current rules to add carrier-neutral, middle-mile providers as certified telecom providers.

* ***This topic has not yet been fully vetted by the Working Group***

Technological Advisory Council

Sharing Working Group

30 March 2011

Charter

The purpose of the Sharing Working Group is to identify steps the FCC might take to promote near term private investment and job creation based on sharing techniques, including sharing of spectrum, facilities, or other techniques as the working group may find appropriate.

Statement of Work - Focus Topics

- Spectrum Efficiency Metrics
- Receiver Standards
- Commercial Wireless Applications
- Hybrid Systems
- Emerging Technology Promotion / Deployment
- Additional Topics to be Identified by the Working Group

Working Group Members

- Peter Bloom
- John Chapin
- Richard Currier
- Brian Daly
- Dick Green
- Dale Hatfield
- Ari Juels
- Geoffrey Mendenhall
- Dan Reed
- Jesse Russell
- Paul Steinberg
- John Leibovitz
- Julie Knapp
- Tom Wheeler
- Walter Johnston
- Chris Lewis
- Dennis Roberson

Ideas for Consideration

1. Develop Spectrum Efficiency Metrics
2. Encourage Receiver Standards
3. Create Spectrum Sharing Taxonomy
4. Accelerate Small Cell Deployments and Spectrum Sharing - especially Indoors
5. Leverage Technological Convergence
6. Remove Application Friction Points

Idea #1: Spectrum Efficiency

Problem

- Spectrum efficiencies achieved by wireless systems of all types must improve if the Nation is to accommodate rapidly increasingly demand and stimulate job growth
- There is no single measure of spectrum efficiency that can be applied across all services

Proposed Idea

- Metrics can (and have been) developed that allow efficiency comparisons to be made across some **similar** systems (e.g., bps/Hz/sq. mi for personal communications systems)
- A possible taxonomy of similar systems include **broadcast systems*, personal communications systems*, point-to-point directional systems*, non-communication transmitters/receivers (e.g., radars) , satellite systems, passive listeners (e.g., radio astronomy)** and **short range uses**
- The metrics can be used to stimulate **technical efficiency,** the inherent efficiency of the modulation schemes etc., and **operational efficiency,** reflecting the efficiencies achieved through the practices of service providers and users (e.g., through dynamic loading/sharing)

Economic Impact

- Jobs will be created immediately to design, manufacture, and deploy more efficient technologies and over the longer term as a natural consequence of the economic expansion from greater spectrum use

Next Steps

- Commission should ask the academic / business community to complete the metric definition
- Product / service providers to be encouraged to demonstrate progress against the metrics
- Commission may wish to coordinate with NTIA /other government agencies to encourage research into advanced methods for improved efficiency and positive incentives to encourage efficiency[1]

Note 1: See http://www.ntia.doc.gov/advisory/spectrum/csmac_reports.html for NTIA work in this area.

Idea #2 – Receiver Standards

Problem

- Receivers have become one of the critical limiting factor in optimizing and thereby increasing the use of the spectrum
- Reduced availability of spectrum in turn reduces the opportunity to deploy new wireless application thereby reducing economic deployment opportunities

Proposed Idea

- Identify all receiver related spectrum usage challenges through delivery of a study
- Initiation a “Living Document” that establishes the best practices for ever improving receiver specifications, particularly in spectrum selectivity, sensitivity and linearity

Economic Impact - Action should stimulate the creation of high paying jobs

- Research and development on receivers meeting the ever improving specifications
- Deployment resources needed for replacement of out-dated and highly inefficient receiver equipment
- Enhanced spectrum utilization will free up more spectrum allowing new wireless application to be more rapidly deployed

Next Steps

- Initiate the proposed receiver impact study to determine the scale of the opportunities, and the depth of the challenge and the targets for initial actions to be provided by the Working Group at the next TAC meeting

Idea #3: Spectrum Sharing Taxonomy

Problem

- More spectrum sharing will be needed to meet the Administration and FCC goal of finding 500 MHz for Broadband
- Sharing of allocations typically reflects incremental decisions, not an overall strategy

Proposed Idea

- Create a "sharing taxonomy" that identifies successful examples of sharing and proposes co-existence opportunities

Economic Impact

- Enabling more sharing can accelerate and expand the mobile broadband ecosystem, creating jobs in the network and at the edge of the network

Next Steps

- Review and publish a taxonomy of existing spectrum co-allocations and studies to find co-existence patterns for the next TAC meeting
- Stage II of this effort will include:
  - Examination of opportunities to enhance services to enable sharing
  - Creation of a distilled patterns to a matrix and put out for public comment

Idea #4: Encourage Small Cell Deployment

Problem

- How to accelerate deployment of fast, reliable integrated narrowband / broadband wireless solutions (e.g., femtocells, Wi-Fi, DAS, etc.) to meet breadth of demand and off-load high use spectrum (e.g. cellular network)?
- Challenges include siting, interference, quality of service, and incentives to deploy

Proposed Ideas

- Explore mechanisms, working with federal agencies, to expedite siting requests within federal lands and buildings
- Provide spectrum assignment/allocation for carriers, premise owners, and/or third party entities to install and operate in-building 4G LTE networks, including "provider agnostic" infrastructure

Economic Impact

- Potentially create a large number of high-paying jobs for design, installation, and operation of systems (e.g. in-building)
  - Over 2 million commercial buildings greater than 5k Sq Ft in the U.S. (with 60 million workers)

Next Steps

- Convene a work group of federal (state / local?) agencies and service providers (e.g. in-building) to explore ways to increase deployments on federal property
- Convene industry-led (providers, vendors, standards groups, building owners, etc.) investigation:
  - Technology issues such as the status of Wi-Fi offload, femtocells, and potentially feasibility of an architecture for in-building nodes that can support multiple providers
  - Business aspects include private enterprise access for installation of in-building systems
- Report at next TAC Meeting

Idea #5- Reducing Application Friction Points

Problem

- Friction Points are potential inhibitors to enabling public and private applications to be developed and deployed on wireless carrier networks. Public and private applications include, but are not limited to:
  - Utilities (electric, gas, water, …)
  - Enterprise (education, energy/natural resources, healthcare, manufacturing, professional & consumer services, retail/hospitality, telecom/media, transportation/logistics, wholesale …)
  - Public Safety (police, fire, emergency services, …)

Proposed Idea

- Reduce / Eliminate barriers for various applications and usages: Privacy, Security, Robustness, Geographic Coverage, Survivability & Disaster Recovery, Certification.

Economic Impact

- Reduction of Friction is a step toward Engendering Innovation, Economic Development and Job Creation

Next Steps

- Convene FCC Sponsored Forum – Detailed Plan by next TAC Meeting
  - Wireless carriers (including satellite), commercial and state and local government users, service providers and consumers, and especially wireless entrepreneurs
  - Entrepreneurs / users Bring ideas on “Applications”
- Generate Taxonomy of Application Opportunities

Technology Advisory Council

Accelerating Transitions Working Group

30th March, 2011

Working Overview

Charter

- To identify & evaluate high impact opportunities to accelerate transitions from legacy information & communication systems

Statement of Work

- Identify and screen legacy transitions to identify suitable candidates for acceleration
- Gather information and perform option analysis
- Make recommendations

Working Group Members

- Shahid Ahmed – Accenture
- Lynn Claudy – National Association of Broadcasters
- Adam Drobot(Co-Chair) – 2M Companies
- Tom Evslin – Vermont Telecommunications Authority
- Lisa Gelb – FCC
- Russ Gyurek – Cisco
- Greg Lapin – American Radio Relay League (ARRL)
- Roberto Padovani – Qualcomm
- Andrew Setos – Fox
- Doug Sicker – FCC
- David Tennenhouse (Co-Chair) – New Venture Partners
- Bud Tribble - Apple
- Robert Zitter -HBO

Transition Projects

- Acceleration of the PSTN transition is intended to be the first of a series of "Legacy Transition" Projects.
- Future transition candidates under consideration include:
  - Acceleration of Spectrum User/Usage Relocation
    - First Responders? Utilities? DoD?
  - TV / Radio ➔ Internet
    - Transition has been underway for some time but appears to be accelerating
    - Significant industry and social implications
  - *"Cutting the Cord beneath the Cord"*
    - Wireless is becoming an alternative to DSL/Cable for all Internet services (not just telephony) used by some consumers/small businesses
    - What segments of the population is this likely to extend to over the planning horizon? What are the implications and potential benefits of acceleration?

Transition from the PSTN to an all IP Network (and future technologies)

Telephony 'Cord-cutting' is happening at impressive rates.

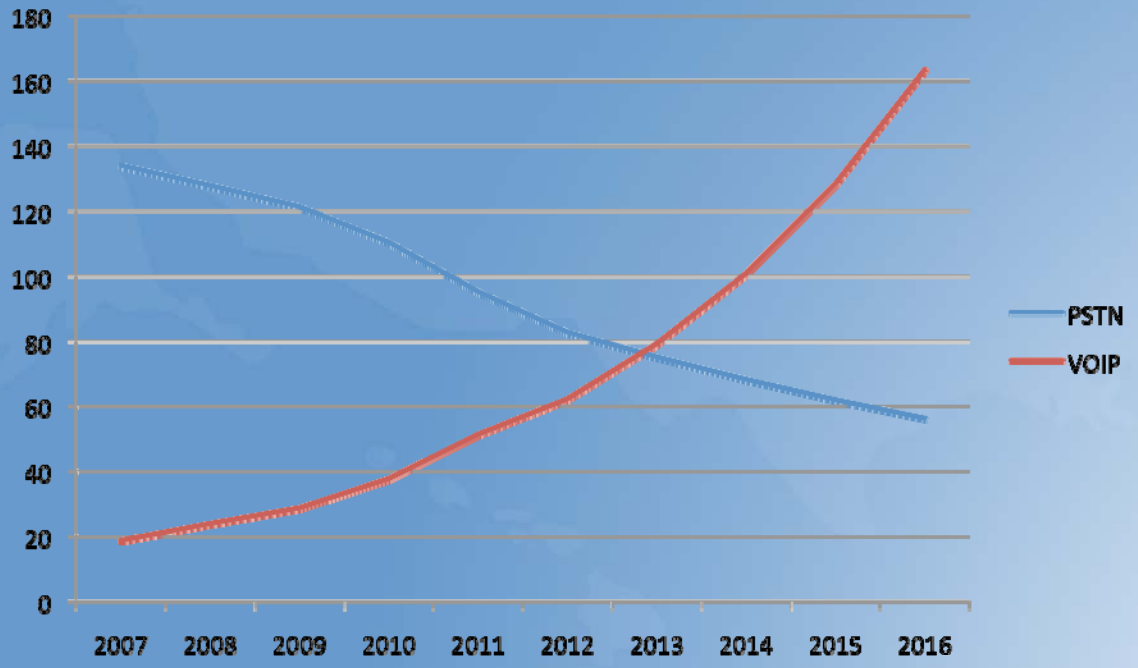
- We are experiencing two major trends:
  - Wire-line to Wireless displacement
  - IP based network replacement/substitution (VoIP)
- How could this transition be accelerated? What are the benefits of doing so? What are the unintended consequences?

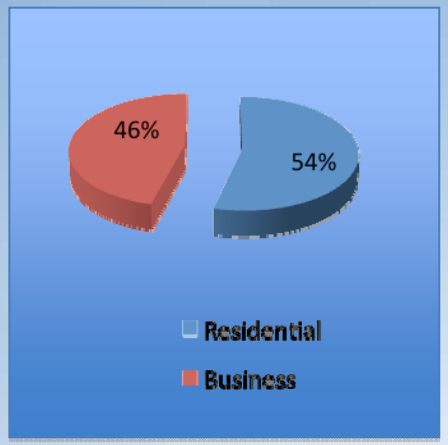
<u>Work Items</u>

- Quantifying the scale/scope of the transition
- National competitiveness and benchmarking
- Quality standards during and after transition
- Dealing with stranded investment
- Regulatory impacts and changes required

Quantifying the PTSN transition

VOIP subscribers will surpass PSTN in 2013. PSTN is expected to decline at 9 % annually while VoIP grows at 27%





In-Sat and Accenture Estimate

US PSTN vs. VoIP Subscribers (M)

Quantifying the PTSN transition

Problem

- What is the scale of the transition – along multiple dimensions (including economic?

Proposed Idea / Specific questions

- Determine the size of the PSTN substitution market? Quantify the size and cost of the transition!
- Since VoIP transition is already in play, how can FCC accelerate this process?
- What is the size / scope / cost associated with the transition or retirement of non-voice (M2M) applications that use modems, such as fax, alarms, ATMs, PoS terminals, etc.

Economic Impact

- Near term: capex, opex and R&D to support transition
- Long-term impact of transition to packet-based networking:
  - Performance doubles in less than a year.
  - Significantly lower capital, provisioning and maintenance cost than PSTN, legacy voice (circuit) equipment
- Carriers have large investments in PSTN, legacy equipment (see “stranded investment”)

Next Steps

- Forecast number of PSTN lines and current displacement rates
- Identify the transition value chain – determine the market size of all new elements
- Determine scope / scale of non-voice applications e.g. machine to machine
- Identify ecosystem and economic structure
- Pursue stimulation of the transition on a priority basis of need and impact!

National Competitiveness and Benchmarking

Problem

- How to compare with -- and learn from – PSTN transitions in other countries?

Proposed Idea

- Develop metrics for apples to apples comparison with other countries / regions
- Capture the lessons learned by other countries
- Create a set of parameters that characterize best practices for the transition

Economic Impact

- Accelerate the transition by informing decisions and improving understanding for build-out and investment

Next Steps

- Gather information and data
- Perform analysis
- Determine important parameters, metrics, and best practices
- Complete report

Idea: Quality – Beyond Bits per Second

Problem

- A successful PSTN transition will require a strong focus on reliability, quality, and usability. The PSTN has created expectations for these aspects of the network. What will be required for PSTN substitutes?
- What are appropriate goals (and their measurement) for a digital ecosystem which: encompasses many modes beyond voice; offers robustness through diversity; and has different quality characteristics than the PSTN?
  - e.g., wireline broadband plus a smart phone may provide a better public safety solution than PSTN.

Proposed Idea

- Make sure that network quality is included in goals and tracked during and after the transition.
- Identify ways to measure and track quality with respect to:
  - Robustness: reliability, availability, survivability – including up-time, time-to-repair, DNS availability, etc.
  - Performance (e.g., latency, sustained vs. burst throughput)
  - Usability (design of networks and devices to simplify operation for the consumer).

Economic Impact

- Quality of the network, beyond speed, will impact how effective it will be at meeting and hopefully exceeding the value of the PSTN network for communication, public safety and national competitiveness.
- The amount of investment (infrastructure, R&D) needed to provide a high quality digital network may exceed that necessary simply to provide “high bandwidth”.

Next Steps

- Can existing efforts to track network performance (such as a Broadband Measurement Advisory Council) be expanded to include tracking of network robustness, quality and usability?
- Examine regulatory definition, measurement & disclosure of network robustness (see “regulatory impacts”).

Dealing with Stranded Investment

Problem

- Homes & businesses have many devices that depend on specific characteristics of the PSTN.
  - Fax machines, Auto-dialers, Alarm systems, ATMs, PoS terminals, Legacy modems, etc.
  - Maintaining the PSTN for an ever smaller (but critical) base of these functions will become untenable.
- Carriers have a huge investment in PSTN equipment and their balance sheets may be hurt by sudden write-offs.
  - Copper wire; Switches; Pole space; Software

Proposed Idea

- Encourage early deployment of devices needed to provide functionality (or better) of PSTN devices and encourage deployment ASAP.
- Look for recycling opportunities for obsolete assets (eg. Bundled copper for highspeed broadband, reuse of prime pole space, etc.)

Economic Impact

- In the absence of acceleration, a sparsely used PSTN will reduce investment available for new infrastructure / services, leaving the US economy less competitive than it should be.

Next Steps

- Quantify problems. Identify possible solutions and whether government has a role to play.
- Identify steps government should take to get its own house in order and to help develop the market for next gen devices through its own purchases

Regulatory Impacts of the PSTN Transition

Problem

- The PSTN transition will render numerous current regulations obsolete.
- Too much regulation can limit the ways in which new technology can be used to spur innovation.

Proposed Idea

- Suggest guidelines for the "right" amount of regulation that protects both consumers and the overall communications system but does not further limit innovation.
- Examine the regulatory and policy environments which impact the definition, measurement and disclosure of network quality and robustness (reliability, availability and survivability).

Economic Impact

- Appropriate regulation would spur innovation, increasing investment in new technologies.
- Development and sales of IP-based (or future technology) products that conform to the new regulations; replacement of legacy equipment.
- Full employment for the technologists and (numerous) lawyers who write the new regulations ;)

Next Steps

- Identify FCC regulations that could be retired and determine their impact.
- Survey regulations from other organizations that depend on the PSTN (*e.g.* IEEE, NFPA) and suggest changes compatible with new technology.
- Determine which Quality of Service parameters should be regulated to ensure reliable service.
- Determine reliability standards necessary for Public Safety (*e.g.* maximum time to connect, minimum power-fail backup time, E911 location information).
- Determine a reasonable time period for the transition.

Accelerating Transitions Working Group

Thank You!

Technological Advisory Council

IPv6 Transition Working Group

Working Overview

Charter

- The purpose of the IPv6 Transition Working Group is to outline the issues confronting the US Internet infrastructure as it evolves to a new IPv6 addressing system, define baselines associated with the transition that can be used to more effectively gauge progress and provide comparison with other global regions, develop goals for key sectors that can be used to accelerate this transformation and identify major cost and market drivers controlling investment in this infrastructure

Statement of Work - Focus Topics

- Internet architecture and transition changes for IPv6
- Market /Industry sectors impacted by transition
- Benchmarks that can serve to better gauge the transition and form a comparison with other regions
- Sector cost issues and market drivers
- Beneficial goals for key sectors that would aid transition

Working Group Members

- Nomi Bergman
- Charlotte Field
- Erwin Hudson
- Kevin Kahn
- Hilton Nicholson
- Jack Waters
- kc claffy
- Mark Gorenberg
- Walter Johnston
- Brian Markwalter
- Randy Nicklas

Work Structure

- Organized as three groups
  - Benchmarking
  - Recommendations/Guidelines
  - Costs/Drivers
- Leverage expertise of workgroup and other TAC members
- Seek input from external authorities
- Avoid duplication of effort but add expert perspective

Current Perspective

- Critical Internet infrastructure providers have taken initial steps in transition
  - IPv4 address exhaust will not produce a crisis for larger ISPs but may be a problem for smaller ISPs with little to no IPv4 address inventory; however the IPv4 exhaust will change how IPv4 content and services are consumed
  - Transition will remain a technical challenge
    - Problems will likely be encountered as theory meets reality/Need to be transparent to the users
    - IPv6 Day (6/8/2011) will be first global test of readiness
- The pace of transition is being driven by market forces
  - Many sectors will see little initial benefit in IPv6 or be impacted; however the avoidance of large scale NATs will be a clear benefit.
  - Total transition is expected to take decade or longer in US
- Some concern that accommodations to IPv4 may slow transition to IPv6
  - "No pain – no gain"
  - *IPv6 is about business continuity, not new applications*
    - *Although there is a potential for eliminating today's usage of NAT which can yield benefits (reduced complexity and cost; better scalability; better accommodation of peer-to-peer applications (Skype); eliminates reputation challenges associated with shared IP addresses).*
- Acceleration of transition if desired will require policy initiatives or other non-market based drivers
  - E.g. some global sectors have policy based goals for transition
  - E.g. Industry wide goals and coordination
  - Microsoft/Nortel transaction suggests market price may be prohibitive for smaller companies
- Transition phase will increase complexity of Internet and impact innovation
  - Different sectors/applications will be impacted different
  - Transition Technologies/Approaches add complexity
  - Early concern that m2m communications will be more complex: e.g. smart grid

Operator Readiness/Challenges for IPv6*

Home Readiness | **MSO Network Readiness** | **Service Readiness**

Customers will not have a transparent experience if we do not address IPV6 challenges across multiple areas

Technical Challenge

IPv4 and IPv6 do NOT communicate

Dual Stack is the transition state before becoming native IPv6

Dual Stack tries IPv6 first and then falls back to IPv4

The world has to migrated services and users to the new Internet

Timing Challenge

World IPv4 Networks = 36,792
World Dual Stack Networks = 3,058
Only 8.5% are Dual Stack !!!

World IPv4 Web Domain = 1,446,367
World Dual Stack Web Domain = 4,273
Only 3% are Dual Stack !!!

Examples: IPv6.cnn.com or IPv6.Netflix.com

* Global Pv6 routing table growth 100 % since beginning of 2010

Sectors Considered

- ISPs/Network Service Providers
- Consumer/Business
- CE vendors
- Small/Medium Business
- Enterprise
- Content providers
- Application providers
- Government

Benchmarking Areas/Details

- Network
  - Overall Internet Traffic IPv4 vs. IPv6
  - Provider Based Traffic IPv4 vs. IPv6 by category
  - Homes passed enabled by service provider
- Content Providers that are IPv6 enabled
  - Government
  - Education
  - Commercial
  - Not for Profit

Benchmarking Areas/Details (cont.)

- Consumer (CPE) Devices
  - Modems
  - Emta/Edva (customer premise voice devices)
  - Wireless Routers
  - Gaming consoles
  - Other devices
- Industrial
  - Embedded Industrial Systems
  - Machine to Machine transactions by wireless and wireline breakdown
  - Health Care
  - Energy including smart grid management

Recommendations/Guidelines

- Focus on critical sectors
- Identify major objectives associated with each sector
  - Identify opportunities to accelerate transition
    - E.g. develop greater awareness of IPv6 as value brand
  - Identify potential harm if objective not met
- Benchmarking activities provide discussion point with external groups
  - Link benchmarks to sector goals

Cost/Benefit

- Focus on qualitative perspective
  - What are major investments required of stakeholders in transition?
  - Why must these investments be made?
  - What timeframes are involved?
  - What benefits derive to the stakeholder?
  - What benefits may derive to others?
  - Are any sectors unfairly disadvantaged?
  - Any impacts to innovation and competition?

Targeted Potential External Discussions

- Intel
- Microsoft
- Google
- Health care
- Universities
  - MIT, USC, ….
- Energy
- ISOC
- NANOG
- CAIDA
- ARIN
- NTIA
- NIST
- Smaller ISPs
- Automotive
- Consumer Electronics
- Others?

Timeline

- Timeline
  - Discussions with key industry (April-early May)
  - Drafts (June to August)
    - Initial proposed Benchmarking Areas: evaluate/define sources – private or public
    - Recommendations/Guidelines: Target key sectors, identify readiness/drivers
    - Cost/Benefit: Identify key investments and triggers
  - Working drafts (August)
  - Review Documents with key industry/educational Leaders (September/October)
  - Refine Recommendation and finalize (November)