

Network Reliability and Interoperability Council VI

Focus Group 4 – Broadband

Report White Papers Recommendations

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(and the surviving FG4 participants)

Network Reliability and Interoperability Council
Focus Group 4
“Broadband”
Final Reports, White papers and Recommendations

Motivation Statement

The United States Federal Communications Commission (FCC) and many others in the U.S. want “broadband” to be made available to consumers in the most ubiquitous and capable extent possible. The FCC defines the goal as the “availability of high-speed, switched, broadband telecommunications that enables users to originate and receive high-quality voice, data, graphics, and video telecommunications using any technology platform.”¹

To this end, the FCC solicits the Network Reliability and Interoperability Council (NRIC)² for recommendations regarding issues affecting broadband’s advancement.

Mission Statement

The original FG4 charter stated:

The Committee will make recommendations concerning the need for technical standards to ensure the compatibility and deployment of broadband technologies and services, and will evaluate the need for improvements in the reliability of broadband technologies and services.

Many national and international groups are already dedicated to developing **technical** standards. However, few are addressing operational standards and methodologies. Therefore with the blessings of the FCC oversight group, the new mission statement is as follows:

The Committee will make recommendations to ensure the compatibility and deployment of broadband technologies and services, and will evaluate the need for improvements in the reliability of broadband technologies and services.

¹ Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996 Act), codified at 47 U.S.C., § 706(b)

² The Network Reliability and Interoperability Council was first organized by the FCC in January of 1992, bringing the telecommunications industry together to study ways to avoid service outages. The Council reconstitutes every two years, taking up new and continuing issues of interest to the FCC and telecommunications industry.

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Executive Summary

The deployment of broadband networks and services have potential capabilities which are so powerful that they threaten to disrupt long standing policy, regulatory and commercial structures. Broadband technologies have been developed and deployed that utilize existing infrastructures (including DSL and Cable), wireless including satellite, and even powerline facilities. The competition between these technologies has stimulated technology advances. Obstacles to broadband proliferation include: consumers' willingness or ability to pay, limited service choice, functionally constrained service offerings, proprietary applications, unavailability of transport systems, incompatibility of applications, return on investment concerns, product cannibalization fears, constrained motivation for application development, limited access to capital, and more.

Many of these obstacles are business issues that are evolving with technological advances, increased economies of scale, innovation in user applications, etcetera. This report focuses on the technical operational issues that can promote broadband compatibility and deployment.

In the spirit of NRIC, we have created a set of voluntary recommendations, which we believe will enhance the user experience of broadband. These recommendations cover the areas of disclosure, network performance, and quality of service. We do not recommend creating legal requirements for network performance or quality. Unlike the "black and white" clarity of whether or not a packet traverses or does not traverse a service provider's infrastructure, network performance is characterized by a multi-variable continuum of behavior. Describing "performance" from a user's perspective is a difficult and subjective endeavor. Furthermore, the existing competitive climate, and continuing uptake of broadband services has fostered lower prices, increased availability, and a high level of performance as a natural outgrowth from market driven conditions.

Categorization of FG4 Issues

Because “broadband” itself is such a nebulous term, the FG4 team is contributing a short white paper describing the **Concepts of Broadband** which explores the nature of broadband deployment from an end user’s perspective. It is recommended that all recommendations concerning broadband be viewed through the concepts described in that document.

To the extent Broadband service falls short of meeting its goals, the focus group concentrated on the following areas:

- ◆ **Access/Onramp Policies**
- ◆ **Service Transparency**
- ◆ **Traffic Policies**

This report divides its discussion and recommendations into these categories. The following are brief introductions to each of these sub-group areas:

Broadband Concepts.

The concept of what is broadband has evolved over the years and is somewhat ill-defined even today. As a historical perspective, here are some *recently published* definitions of broadband:

Newton's Telecom Dictionary (2002): "...greater than a voice grade line of 3 KHz. Some say [it should be at least] 20 KHz."

Jupiter Communications(2001): a network service of at least 256 Kbps.

IBM Dictionary of Computing(1999): A broadband channel is "6 MHz wide."

FCC (2000): Channel that is used to deliver multiple services through one portal, with the upstream and downstream paths supporting rates of at least 200 kilobits per second (Kbps).

High Tech Broadband Coalition: ITI (The Information Technology Industry Council) has categorized the term “current generation” broadband to include the vast majority of broadband services available to consumers today, which generally are configured to provide speeds up to 1.5 megabits per second (“Mbps”) with typical speeds much slower. By contrast, the term “next- generation” broadband is used to refer to those technologies such as Fiber-to-the-User generally not available in today’s market, which are capable of delivering far greater speeds of over 100 Mbps or more. *See* Comments of the Information Technology Industry Council, *Request for Comments on Deployment of Broadband Networks and Advanced Telecommunications*, NTIA Docket No. 011109273-1273-01, at 2 (filed Dec. 19, 2001).

Reading these one is reminded of a few other *service offering* quotes from our history:

Western Union – (1876): This telephone has too many shortcomings to be seriously considered as a means of communication. This device is inherently of no value to us.

Bill Gates – (1981): 640k ought to be enough for anybody

Furthermore it is generally agreed by the populace that Asymmetrical Digital Subscriber Line (ADSL), satellite (VSAT), and cable TV provided Internet access are *broadband*. However in the upstream direction (which doesn't fit the accepted "speed based" definitions) are they really broadband? Before the advent of high-speed Internet connections to the home, this term was used to talk about a single medium that could carry multiple channels of data at the same time. Over the last few years the definition has expanded its meaning to denote the quantity of data a medium can carry. The FCC defines the minimum rate for broadband as 200 Kbps. So under this definition, a 256 Kbps DSL connection would count as broadband while a 56 Kbps dialup modem connection would not. Even more recently, "broadband" has come to refer to particular kinds of huge data packages, audio files, video clips, game software programs, long, heavily formatted text documents, that fill up a lot of bandwidth. When dealing with this kind of content, even a DSL connection is not going to seem very "broadband". The *concepts of broadband* sub-group explores this area and makes recommendations on their findings.

Access Policies

There are many places in the United States that have limited or no Internet access service other than typical dial up service. While T-carrier exists for virtually the entire US, it is generally cost prohibitive. This sub-group explores and makes recommendations on the options and deployment methodologies available.

Service Transparency

The notion of "service transparency" overlays aspects of a similar notion known as "end to end"; both of these notions bear upon the issue of service provider control over the subscribers and subscribers' applications, but the term "end to end" is additionally encumbered with broader implications.

The phrase "end to end" also refers to the energetic and perennial design debate regarding where to embody communication features. I.e., whether "smarts" are best built into network end devices (variably referred to as: hosts, computers, PCs, servers, nodes, clients, ends, instruments, etc.), or built into the network itself. Our view is that the "real" and difficult core issue energizing the "end-to-end debate" is service provider control over subscribers - rather than an engineering optimization.³ We attempt to

³ A reasonable case for the end to end debate being something other than an engineering debate is made by Christian Sandvig in *Communication Infrastructure and Innovation: The Internet as End-to-End Network that Isn't*. (University of Illinois at Urbana-Champaign, 2002).

highlight our particular concern by referring to the issue as one of “service transparency” rather than “end to end.” We discuss below several forms of service transparency constraints as they have emerged in the broadband market.

Traffic Management, Traffic Policy and Quality Issues

The overall "quality" of a broadband service determines what types of applications can be used and how well they will function. Moreover, if the quality is low, it reduces the incentive to develop quality-sensitive applications; and to the extent that quality is “low,” it caps the sophistication possible from applications.

It is generally accepted that the spectrum of reasonable engineering approaches include significant, even fundamental, application of traffic management-- but there are limits to its utility. Service providers should provide adequate capacity to meet user’s needs while traffic management can improve the utilization of the capacity that is available.

When deemed appropriate, enterprises and service providers can utilize traffic management capabilities within packet-based technologies to ensure that one or a small number of users with excessive information rates do not degrade the quality of service observed by others.



ConceptsBB.doc

Concepts of Broadband White Paper



AccessOnRamp.doc

Access Onramp White Paper



SvcTrans.doc

Service Transparency White Paper



TrafficPolicy.doc

Traffic Policy White Paper

Appendix A- FG4 Recommendations

- ◆ Service providers should consider utilizing traffic management mechanisms and technologies to ensure facilities are utilized most efficiently.
- ◆ Equipment suppliers should incorporate traffic management technology into their equipment, as necessary, with the tools necessary to maintain performance of facilities and to manage traffic flows from customers per contracts/SLA's and to prevent degradation of quality of service experienced by network users.
- ◆ Service providers, network operators and equipment suppliers are encouraged to continue to participate in the development and expansion of industry standards for traffic management that promote interoperability and assist in meeting end user quality of service needs.
- ◆ Service providers should consider appropriate means for providing their customers with information about their traffic policies so that users may be informed when planning and utilizing their applications.
- ◆ Service providers, network operators, and equipment providers should work to establish operational standards and practices which support broadband capabilities and interoperability--eg. (point-to-point videoconferencing, telephony, etc.).
- ◆ Service Providers should establish and develop internal controls to administer the network policies associated with protocol or port filtering whereby network security takes precedence in maintaining overall reliability, integrity, and availability of the network and interconnection “peering” or “transit” points.
- ◆ Service Providers should internally establish and develop controls to administer the network policies associated with protocol or port filtering. To wit: a process that defines generic circumstances when dynamic filtering may occur, (i.e. DDOS, Virus) and made available to customers.
- ◆ Service providers should make information available to customers that include content filtering of Static Policies -- those policies which by design are not likely to change.
- ◆ Service providers should make information available to customers that include content filtering for Dynamic Policies.
- ◆ Service Providers should make available meaningful information about expected performance with respect to upstream and downstream throughput and any limitations of the service; best effort services “up to” or unspecified bit rate services should be specified as such in a clearly identifiable manner.
- ◆ Service providers should make available meaningful information about expected performance with respect to upstream and downstream throughput and any limitations of the service. Specified rate services (such as those covered by QoS or similar systems) should be handled by an SLA between the parties.

- ◆ Service Providers, equipment manufacturers, and/or network operators should continue to investigate the process of migration from an IPv4 to an IPv6 environment.
- ◆ Service Providers should encourage users to take steps to protect their systems from unauthorized access.

Appendix B Combined References

This is a reference list for all FG4 documents.

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Appendix C Glossary of Terms

1XRTT: single carrier (1x)radio transmission technology, (also known as CDMA2000) a 3G wireless technology based on the CDMA platform. 1xRTT has the capability of providing ISDN-like speeds of up to 144 Kbps .

ADSL: Asymmetric Digital Subscriber Line. ADSL is a form of Digital Subscriber Line in which the bandwidth available for downstream connection is significantly larger than for an upstream connection.

Broadband Transmission Systems: Services which multiplex multiple information sources on one transport medium.

Cable: Coaxial cable is the kind of copper cable used by cable TV companies between the community antenna and user homes and businesses. Coaxial cable is sometimes used by telephone companies from their central office to the telephone poles near users. It is also widely installed for use in business and corporation Ethernet and other types of Local Area Networks (LAN).

Downstream/Upstream: In telecommunications generally, a transmission from an information server toward an end user is referred to as downstream and a transmission toward the server is referred to as upstream.

DSL: DSL (Digital Subscriber Line) is a technology for bringing high-bandwidth information to homes and small businesses over ordinary copper telephone lines. xDSL refers to different variations of DSL, such as ADSL, HDSL, and RADSL.

Firewall: A firewall is a set of related programs, located at a network that protects the resources of a private network from users from other networks. (The term also implies the security policy that is used with the programs.).

FTP: (File Transfer Protocol) [TCP/IP ports 20 and 21] RFC 959, is protocol that allows users to copy files between their local system and any system they can reach on the network.

Gbps: stands for gigabits per second (billions of bits per second) and is a measure of bandwidth (the amount of data that can flow in a given time) on a data transmission medium.

GPRS: (General Packet Radio Service) a standard for wireless communications which runs at speeds up to 115 kilobits per second.

IP: Internet Protocol

IPv4: The network layer for the TCP/IP protocol suite widely used on Ethernet networks, defined in STD 5, RFC 791. IP is a connectionless, best-effort packet

switching protocol. It provides packet routing, fragmentation and re-assembly through the data link layer.

IPv6: (Also sometimes written as IPng, IP next generation) The most talked about candidate protocol to replace the current Internet Protocol (IPv4). The primary purpose of IPv6 is to solve the problem of the shortage of IP addresses. Its main feature is 16-byte addresses instead of the current four bytes and embedded encryption.

Jitter: The change of latency over time.

Kbps: stands for kilobits per second (thousands of bits per second) and is a measure of bandwidth (the amount of data that can flow in a given time) on a data transmission medium.

LAN: (Local Area Network) is a group of computers and associated devices that share a common communications line or wireless link and typically share the resources of a single processor or server within a small geographic area (for example, within an office building).

Latency: Delay or "lateness" from getting information or signals from origination to destination.

LMDS: (Local Multipoint Distribution Services) is a fixed wireless technology that operates in the 28 GHz band and offers line-of-sight coverage over distances up to 3-5 kilometers

Mbps: stands for megabits per second (millions of bits per second) and is a measure of bandwidth (the amount of data that can flow in a given time) on a data transmission medium.

MMDS: (Multipoint Microwave Distribution System) also known as Multi-channel Multipoint Distribution System, is a wireless broadband technology for Internet access. MMDS uses a microwave distribution system to provide broadband Internet access.

NAT: (Network Address Translation) is the translation of an Internet Protocol address used within one network to a different IP address known within another network.

Node: In a network, a node is a connection point, either a redistribution point or an end point for data transmissions.

Packet: A packet is the unit of data that is routed between an origin and a destination on the Internet.

Port: In programming, a port (noun) is a "logical connection place" and specifically, using the Internet's protocol the way a client program specifies a particular server program on a computer in a network.

End to end: Host computers may communicate directly with each other, i.e. without

necessarily sending their data to an intervening server. In this definition, the routers, switches, and other transport equipment are not construed as “servers.”

Powerline: Powerline technology provides the transmission of data to users over the same lines that bring electric power to homes and businesses.

Satellite: A satellite is a specialized wireless receiver/transmitter that is launched by rocket and placed in orbit around the earth.

SDSL: Single-line Digital Subscriber Line A form of Digital Subscriber Line similar to HDSL but providing T1 or E1 connections over a single twisted-pair copper line.

Server: In general, a server is a computer program that provides services to other computer programs in the same or other computers.

SMTP:(Simple Mail Transfer Protocol) [TCP/IP port 25] RFC 821 is used in sending email. (Note that pop and imap[4] are the receiving side of most email conversations.)

TCP : TCP (Transmission Control Protocol) is a set of rules used along with the Internet Protocol to send data in the form of message units between computers over the Internet.

Traffic: The amount of data that is contained within a specific route on the Internet.

Transparency: (Transparent Broadband) has no standing operational restrictions on connectivity or reach-ability.

UDP: (User Datagram Protocol) is a communications protocol that offers a limited amount of service when messages are exchanged between computers in a network that uses the Internet Protocol.

VDSL: Very High bit-rate Digital Subscriber Line. A form of Digital Subscriber Line similar to ADSL but providing higher speeds at reduced lengths.

Virus: A piece of programming code usually disguised as something else that causes some unexpected and usually undesirable event.

Wireless: Wireless is a term used to describe telecommunications in which electromagnetic waves (rather than some form of wire) carry the signal over part or all of the communication path.

Wireline: Network services term for services provided over a physical electrical or optical connection.