

NRIC VII

September 21, 2005

FOCUS GROUP 4

Broadband Architectures,
Best Practices & Service Features for the
Increased Deployment of High-Speed
Residential Internet Access Service

Final Report

DRAFT - For Discussion Only

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1 Results in Brief

The FCC chartered NRIC VII to present recommendations to increase the deployment of high-speed residential Internet access service. As part of the overall recommendations, Focus Group 4 was asked to develop industry Best Practices and Service Features that increase the deployment of broadband networks.

Reference Model Architectures

In order to accomplish this work, for its first task, the Focus Group produced a set of reference model architectures that illustrate all current, generally available alternatives to provision high-speed residential Internet access service. These diagrams were used to set the terminology and the scope that the Focus Group would use throughout the other deliverables. The final diagrams are included in Appendix 7.1 of this report.

Best Practices

Initially, the Focus Group identified the 13 NRIC Best Practices that were developed by the NRIC VI Broadband Focus Group. These Best Practices, related to the deployment of broadband networks, were reviewed to identify those areas that required updates, deletions, or referral to another Focus Group. The results were as follows:

- 2 Best Practices were modified in order to ensure the subject matter is up to date.
- 3 Best Practices were recommended for deletion as they are no longer relevant or have been superseded by other documented NRIC Best Practices.
- 5 Best Practices related to cyber security and were referred to Focus Group 2B for evaluation.
- 3 Best Practices remain unchanged from their previous version.

In addition, the team developed new Best Practices specifically aimed at the deployment of residential Internet access service.

- 10 new Best Practices currently being used within the industry were added.

All of the Best Practices that we considered for modification or deletion, as well as the new Best Practices are included in Appendix 7.2.

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Service Features

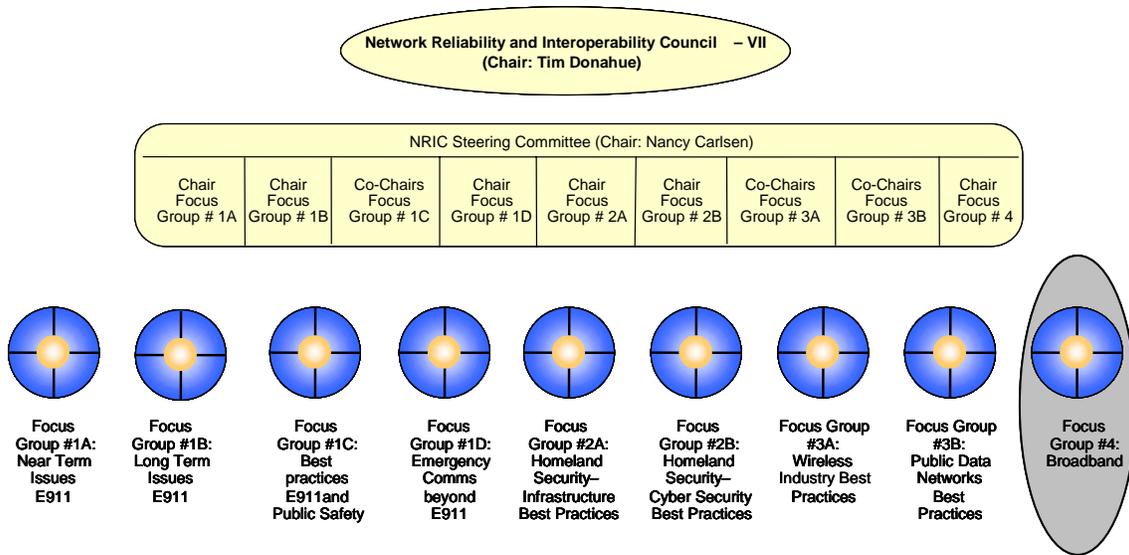
The Focus Group developed a list of 10 Service Features that promote increased deployment of high-speed residential Internet access. The Focus Group adopted the user’s perspective to identify features of Broadband services that enhance a user’s experience. Service features range from ease of installation and availability of troubleshooting assistance to network capabilities and security.

2 Introduction

This report documents the efforts undertaken by the Network Reliability and Interoperability Council (NRIC) VII Focus Group 4 with respect to its recommendations to increase the deployment of high-speed residential Internet access service.

2.1 Structure of NRIC VII

The structure of the Network Reliability and Interoperability Council is as follows:



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2.2 Focus Group 4 Team Members

Focus Group 4 consists of 36 members. The group was further segmented into six sub teams to focus on the following areas of broadband service delivery: Digital Subscriber Line (DSL), Fiber to the Premises (FTTP), Cable, Satellite, Broadband over Powerline (BPL), Wireless, and Fixed Wireless.

Focus Group 4 Members:

Mark Beehee, Motorola	Kenny Kopta, Sprint
Fouad Brahim Boumakh, Digital Wireless Telecomm, Inc.	Dave McDysan, MCI
Charles Cerino, Comcast New Media Development	Doug McMurray, IDACOMM
John Chapa, SBC	Lori Messing, CTIA
John Colombo, Verizon	Jim Mollenkopf, Current Technologies
Doug Cooper, Catena/Cienna	Mark Niebert, Intelsat
Roger Deville, CenturyTel	Mike Petry, MCI
Victor DeVito, AT&T	Carl Posthuma, Lucent
Dave Gould, Motorola	Art Reilly, Cisco
Jeff Hubbard, Qwest	Mary Retka (Chair), Qwest
Jim Johnson, BellSouth	Jim Runyon, Lucent
Jim Katzman, AOL	Randy Sharpe, Alcatel
Kevin Kearns, APCO	Tom Soroka, USTA
Rick Kemper, CTIA	Matt Trainor, Nortel
John Kenyon, Hughes Network Systems	Tim Walden, CenturyTel
Brett Kilbourne, United Telecom Council	Dave Waring, Telcordia
	Brian White, CenturyTel
	Albert Young, Cox Communications
	David Young, Verizon
	Pete Youngberg, Sprint

The sub teams included:

DSL: Jeff Hubbard (lead), Randy Sharpe, Carl Posthuma, Pete Youngberg, John Chapa, Doug Cooper, Jim Johnson, David Young

FTTP: Randy Sharpe (lead), Jeff Hubbard, Pete Youngberg, Doug Cooper, Jim Johnson, Carl Posthuma, David Young, Roger Deville, Tim Walden

Cable: Charles Cerino (lead), Albert Young, Victor DeVito

Satellite: John Kenyon (lead), Tolga Ors, John Chapa

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BPL: Brett Kilbourne (lead), John Chapa, Jeff Hubbard, Randy Sharpe, Jim Mollenkopf, Doug McMurray

Wireless: Mark Beehee (lead), Rick Kemper, Jim Runyon, Dave Gould

Fixed Wireless: Jim Johnson (lead), John Chapa, Randy Sharpe, Jeff Hubbard, Jim Runyon, Pete Youngberg, Rick Kemper

These sub teams worked on both the Reference Models and Best Practices for the Focus Group, and were segmented based on their subject matter expertise. The Service Features were developed in meetings of the full Focus Group.

Focus Group 4 Members contributing to the content of this final report:

John Bassett, Motorola	Rick Kemper, CTIA
Charles Cerino, Comcast New Media Development	Brett Kilbourne, United Telecom Council
John Columbo, Verizon	Carl Posthuma, Lucent
Doug Cooper, Catena/Cienna	Mary Retka (Chair), Qwest
Roger Deville, CenturyTel	Randy Sharpe, Alcatel
Victor DeVito, AT&T	Matt Trainor, Nortel
Jeff Hubbard, Qwest	Albert Young, Cox Communications
Jim Johnson, BellSouth	Pete Youngberg, Sprint

3 Background

The Network Reliability and Interoperability Council was originally established to study the causes of service outages and to develop recommendations to reduce their number and their effects on consumers.¹ NRICs I-V focused on reliability concerns across multiple modes of telecommunications service. However, at that time there was little specific focus on the deployment of broadband services. The broadband focus has since changed with the greater adoption of the technology, applicability to commerce and daily life, and interest by the Government.

Recognizing the importance of a national goal to increase the availability of broadband services, the Broadband Deployment Group was chartered by NRIC VI in December 2001 to develop recommendations concerning the need for technical standards to ensure compatibility and deployment of broadband technologies and services. In NRIC VII, the FCC again chartered a Broadband

¹ www.nric.org

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Focus Group in support of the increasing focus on deployment of high-speed residential Internet access in the United States. The following quote from President Bush underlines the importance of the Focus Group 4 efforts.

“This country needs a national goal for broadband technology, for the spread of broadband technology. We ought to have a universal, affordable access for broadband technology by the year 2007, and then we ought to make sure as soon as possible thereafter, (that) consumers have got plenty of choices when it comes to purchasing the broadband carrier.”

– President George W. Bush
Farmington, New Mexico
March 26, 2004

Additionally, the FCC released the following information regarding deployment of high-speed residential Internet access in the U.S.

High-speed connections to the Internet increased 34% during 2004 for a total of 38 million lines in service.

– High-Speed Services for Internet Access: Status as of December 31, 2004
Federal Communications Commission, Wireline Competition Bureau

NRIC VII Focus Group 4 considered the broadband White Paper and Best Practices developed during NRIC VI and emerging industry documentation as a base and has updated and expanded on that work through its modifications and creation of new Best Practices and Service Features.

4 Objective, Scope, and Methodology

4.1 Objective

The NRIC VII Council has been charged with developing recommendations to increase the deployment of high-speed residential Internet access service. In order to accomplish this, the Charter specifies that:

“The Council shall include Best Practices and service features that are, and will be, technology-neutral. The Council’s recommendations shall be prepared in such a way as: (1) to ensure service compatibility; (2) to facilitate application innovation; and (3) to improve the security, reliability

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and interoperability of both residential user systems and service provider systems.”²

4.2 Scope

This document is the Focus Group’s final report. It presents the results of the three key tasks that the Focus Group has undertaken towards the fulfillment of its Charter.

Reference Model Architectures

The group first developed reference model architectures illustrating all current, generally available alternatives to provision high-speed residential Internet access service. The reference models, included in Appendix 7.1 of this document, depict the most commonly known architectures for the deployment of high-speed residential Internet access deployment.

Best Practices

The Focus Group used the reference models as the basis for its second key task – the development of broadband Best Practices for the deployment of high-speed residential Internet access service.

With regard to this task, this report contains the following:

- Analysis of existing NRIC Best Practices from NRIC VI related to broadband.
- Recommended modifications and deletions to those existing Best Practices.
- Identification and addition of new broadband Best Practices for the deployment of high-speed residential Internet access service.
- Analysis of existing NRIC Best Practices related to infrastructure on which broadband could be deployed.

Service Features

The group also examined commonly available Service Features that might increase users’ interest in adopting broadband services. The group concentrated on technology neutral service offerings that are common across multiple service providers for this deliverable.

While we were doing this work, the following was released by the Federal Communications Commission:

² NRIC VII Charter, www.nric.org

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The Federal Communications Commission today adopted a policy statement that outlines four principles to encourage broadband deployment and preserve and promote the open and interconnected nature of public Internet: (1) consumers are entitled to access the lawful Internet content of their choice; (2) consumers are entitled to run applications and services of their choice, subject to the needs of law enforcement; (3) consumers are entitled to connect their choice of legal devices that do not harm the network; and (4) consumers are entitled to competition among network providers, application and service providers, and content providers.

– Federal Communications Commission Policy Statement
August 5, 2005

4.3 Methodology

The following is the methodology that Focus Group 4 followed to develop the Reference Model Architectures, Best Practices, and Service Features contained in this report:

Reference Model Architectures

- 1) The Focus Group developed a Master Reference Model consistent with the group's definition of high-speed residential Internet access.
- 2) Sub teams were assigned based on expertise.
- 3) The sub teams developed commonly deployed reference model architectures that were approved by the full Focus Group.

The type of infrastructure deployed segmented the reference models, reflecting today's existing environment. They depict only those components of the architecture required to provide high-speed residential Internet access service. While some of the reference models are geographically bounded, others, such as satellite, fixed wireless, and cellular are not.

Best Practices

- 1) The Focus Group received training on developing and drafting Best Practices.
- 2) A sub team identified the broadband-specific Best Practices from NRIC VI and conducted an analysis to determine the need for modifications, deletions, or referral to another Focus Group.
- 3) The Focus Group developed the criteria for establishing new Best Practices. The criteria was created from a set of guidelines used across all of the NRIC VII Focus Groups and met the following checklist items:

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- Best Practices are short and focus on WHAT, not "how" something is done
 - The proposed Best Practice:
 - i. is currently being done.
 - ii. is viewed by those in the industry to be the best means.
 - iii. is about the deployment of high-speed residential Internet access service.
 - iv. increases the deployment of high-speed residential Internet access service.
 - v. is technology neutral, improves security, reliability, and interoperability.
 - vi. references and relates to the Master Reference Model included in Appendix 7.1.

The Reference Model Architecture Categories are:

 - ISP and Connection to the Internet Demarcation Interface.
 - Broadband - Providing routing, aggregation, protocol management and signal carriage.
 - Aggregation and Transport - Providing routing, aggregation, protocol management and signal carriage.
 - Connection - Linking to transport and aggregation devices, and connecting to the Customer Demarcation Interface.
- 4) The sub teams of experts from the Reference Model Architecture generated Best Practices based upon their skill set and experience. The sub teams adhered to the common criteria developed by the full Focus Group.
 - 5) The Focus Group reviewed all Best Practices developed by the sub teams and made final edits to reach consensus on the new Best Practices to be sent to the Council. Each Best Practice was formatted for inclusion into the website database and numbered accordingly.
 - 6) Existing Infrastructure Best Practices were reviewed for applicability to broadband deployment given that broadband is deployed over existing infrastructure.

Building on the body of work from previous NRIC Broadband Focus Group efforts, the NRIC VII Focus Group reevaluated and made recommendations on the continued efficacy of existing high-speed residential Internet access Best Practices. Additionally, The Focus Group performed a gap analysis to determine areas where new high-speed residential Internet access Best Practices may be required. The Focus Group concentrated these efforts solely on those Best Practices that ensure service compatibility, facilitate application innovation, and improve the security, reliability and interoperability of both residential user and service provider systems, to ensure alignment with the Council's stated charter.

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Service Features

In addition to the above criteria, the Focus Group gave a lot of consideration to the Charter direction to ensure technology neutrality. Technology neutrality was concluded to be related to the expectation of the end-user who migrates between providers without awareness of infrastructure variations. The end-user has expectations of aspects and features of the service regardless of the provider. The Focus Group relied on this assumption to develop its list of Service Features.

1. The Focus Group conducted brainstorming sessions to define "Service Features" and identify common service offerings that are effective for customer acquisition and retention.
2. The members presented the definition and service offerings for additional input from other experts within their own companies.
3. The members researched similar work by other industry and government forums.
4. The complete list of Service Features was finalized and approved by the full Focus Group.

5 Analysis and Findings

Focus Group 4 developed Reference Model Architectures in order to have reference material to develop Best Practices related to the current available means of deploying residential Internet access. To begin this work, the group defined residential Internet access and determined an approach to develop the architectures in order to set the parameters by which the group would work. The definition and the Reference Models served as focal points throughout the development of Broadband Best Practices and Service Features.

Defining High-Speed Residential Internet Access

The NRIC VII Focus Group 4 Charter required recommendations to increase the deployment of high-speed residential Internet access service. To begin that effort, the Focus Group centered on the meaning of Residential Internet Access.

The term Residential Internet Access encompasses the many different commercially available ways for Residential Consumers to access the Internet. It is not application specific, as the consumer may have a number of different application needs that require Internet access. Web browsing and mail services are the most common of these applications in the consumer community today. However, as more high-bandwidth content becomes available, web browsing and email will likely be a basic requirement of any high-speed service.

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Residential Internet Access is then considered a pathway from the subscriber to the public Internet.

While Residential Internet Access may be available through many different technologies, a logical segmentation would differentiate the access technology as either dial-up or broadband. The characteristics of a dial-up technology require the user of the service to actively initiate and terminate an Internet session with the service provider through a phone/data connection after the particular Internet capable device is turned on. It generally has transmission speed bandwidth of no higher than a 56 Kbps modem, and may provide satisfactory performance for a number of Internet based applications.

Broadband technology, on the other hand, has differing characteristics. The NRIC VI Broadband Focus Group indicated that broadband technology should be viewed in terms of having sufficient bandwidth to provide satisfactory performance while accommodating a wider range of customers, applications and technological requirements. This view is also endorsed by the current NRIC VII Broadband Focus Group. It is an always-available access technology so long as the user's Internet device is turned on, and requires no additional user activity to function. Broadband access also has sufficient bandwidth to support multiple applications simultaneously³. The area of concentration for this Focus Group is to offer recommendations to further advance the domestic use of broadband technology for Residential Internet Access.

Many viable and emerging technologies are commercially available today, offering last mile service for broadband Residential Internet Access. These transmission methods include, but are not limited to, Coax Cable, DSL, Mobile Wireless, Fixed Wireless, Fiber to the Premises (FTTP), Satellite, and more recently Powerline. While each technology maintains its own characteristics in terms of bandwidth, latency and jitter, each is considered a viable broadband technology. Just as consumers' Residential Internet Access desires and requirements can vary greatly based on applications and affordability, so may their choice of the broadband application. Users may desire to experience a number of Internet applications including but not limited to Web Browsing, Mail Services, File Sharing, Gaming, Streaming Audio/Video, and Voice & Video communications. Experiencing an available, reliable, cost efficient and acceptable quality of service for the particular application usage desired will be influential

³ This report envisions broadband access bandwidths as sufficient to support multiple high-speed applications simultaneously. As such, no specific bandwidth value is provided as defining broadband. However, as noted by NRIC VI, broadband access generally is available in a variety of transmission speeds, depending on user preference and particular application requirements, and may cost more than a Dial-up alternative.

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in a consumer's choice of the various broadband or dial-up Residential Internet Access services.

5.1 Reference Model Architectures

The Broadband Focus Group identified and developed reference model architectures that illustrate all current generally available alternatives to provision high-speed residential Internet access service. The reference models, reflecting today's existing environment, were segmented by the type of infrastructure deployed. These alternative architectures varied by provider. A common description of the key elements that support each of the reference models is also provided.

These reference models depict only those components of the architecture required to provide high-speed residential Internet access service. The Focus Group recognized that these baseline architectures may similarly provide transport facilities for other residential services, such as voice telephony, or cable television. These other residential services were deemed by the Focus Group to be outside of its scope. Thus, only those components serving the high-speed residential Internet service are shown.

The Focus Group acknowledged that residential consumers may have multiple reference model architecture choices that offer high-speed Internet access service. Additionally, the reference models have taken into consideration that a customer's equipment may be mobile or stationary. Some residential consumers may select more than one of these Internet access services to meet their needs.

The reference model architectures provided were those determined by the Focus Group to be the most commonly known methods for high-speed residential Internet access deployment. These depictions were limited to the current environment and included common functional references and demarcations, so that the reference models would serve as the basis for future Focus Group Best Practice evaluation and recommendation efforts.

The Reference Model Architecture diagrams are included in Appendix 7.1 of this document.

5.2 Best Practices

The Focus Group reviewed existing Broadband Best Practices and made recommendations to maintain the status quo, change, or delete each Best Practice. New Best Practices for the deployment of high-speed residential Internet access service were also developed. The Focus Group included

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additional comments and references for many of the Best Practices as well, in order to maintain the rationale for the action to pass on to future NRICs.

Focus Group 4 reviewed the 13 Best Practices developed by the NRIC VI Broadband Focus Group to identify those areas that required updates, deletions, or referral to another Focus Group. The results were as follows:

- 2 Best Practices were modified in order to ensure the subject matter is up to date.
- 3 Best Practices were recommended for deletion as they are no longer relevant or have been superseded by other documented NRIC Best Practices.
- 5 Best Practices related to cyber security and were referred to Focus Group 2B for evaluation.
- 3 Best Practices remain unchanged from their previous version.

In addition, the team developed new Best Practices specifically aimed at the deployment of residential Internet access service.

- 10 new Best Practices currently being used within the industry were added.

All of the Best Practices that the Focus Group considered for modification or deletion, as well as the new Best Practices are included in Appendix 7.2.

The Best Practices that were identified from the existing Infrastructure Best Practices were analyzed by the Focus Group to determine applicability to the infrastructure on which broadband can be deployed. The Focus Group identified at least 97 Best Practices that have a relationship to the currently deployed infrastructure on which broadband networks rely. Thus, these Best Practices became an existing basis for the deployment of broadband and do not require additional efforts by Focus Group 4 for this Charter.

One Best Practice that was submitted in the June report from Focus Group 4 has been revised for this report after coordination with Focus Group 3A. Upon approval of this report by the Council, Best Practice 7-7-0805 would read:

Service Providers, Network Operators and Equipment Suppliers should work to establish operational standards and practices that support broadband capabilities and interoperability (e.g., video, voice, data, wireless).

This change was agreed to by the members of both Focus Groups.

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5.3 Service Features

Defining Service Features

In line with the NRIC Focus Group 4 scope, the team identified technology neutral Service Features which promote increased deployment of high-speed residential Internet access. These Service Features are not meant to be all inclusive of a service provider's capabilities for potential offerings. They are however, features from a user's perspective, which relate directly to the user's quality of experience. Features that are illustrative of this are reflected in characteristics such as responsiveness, security and trust-worthiness, ease of use, fidelity of information, and dependability of the application service from any provider-each of which contribute to the overall customer experience.

A user's quality of experience is improved by the presence of these service features which should promote increased adoption of high-speed residential Internet access. Residential customers will more likely use high-speed Internet access service if these service features are available from all providers regardless of technology or architectural differences. Users can choose additional enhanced application services to meet their unique needs. These autonomous decisions are attractive to users, and provide a growing market for broadband services, thus speeding the deployment of broadband and increasing the availability of the service.

The following technology neutral service features are capabilities of high-speed residential Internet access that should attract users to high-speed residential Internet access service.

Service Features

The following items are the Service Features recommended by the Focus Group as features that broadband providers should offer to increase the deployment of Residential Broadband Internet Access:

- Rapid Service Provisioning - Service should be turned-up quickly to the end user, with minimal user effort in a reasonable amount of time.
- Help Desk - Knowledgeable, trained representatives who are conversant in the customer's language and have good communications skills should be available toll-free domestically during general business hours with readily available access information and a reasonable wait period.
- Self Installation - Customers should have the option of a kit that has a simple, transparent process with clear instructions and diagrams for the user to perform basic diagnostics and to complete the task in a reasonable timeframe. Materials should be provided in a timely manner and should include contact information for problem solving

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with representatives who are kept up to date with information about auto configuration of the Customer Premises Equipment (e.g. “plug and play”).

- Ease of Troubleshooting - Customers should be provided with basic diagnostic information, clear instructions, and contact information to the Help Desk for use when problem solving. Guide information and documentation at various levels of detail should be available to ensure appropriate data about the customer and their service is available to the Help Desk.
- Access to Service (24x7 availability) – Service should always be on except for scheduled maintenance windows and unanticipated events.
- Scheduled Maintenance Window – Service Providers should identify specified times and intervals for maintenance. It is recommended that maintenance be done in times of least user demand and in the shortest time possible.
- Appropriate Latency – The access network should be capable of supporting normal Internet applications.
- Ability to Access the Internet - Customers should have all capabilities that are expected of a broadband connection (e.g., email, surf the web, large file transfers, photo sharing, gaming, work at home).
- Transparency of Application Presentation – Service connections should be enabled with presentation of applications with the same “look and feel” regardless of the broadband residential Internet service provider.
- Security – Service should include a level of protection to avoid unauthorized access to individual accounts and content.

Service Feature Recommendations

During the course of the Service Features discussion, Focus Group 4 identified a number of issues that do not fit into constructs of the Service Features but are directly related. These ideas are captured in the following recommendations:

- Service providers should incorporate suggested service features to increase high-speed residential Internet access adoption and customer satisfaction, and increase security across all platforms on an equitable basis regardless of technology or architecture.
- An ISP should not intentionally restrict legitimate, supported standard applications and/or protocols (e.g. VoIP, VPN) unless required by local, state, or federal regulation

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Also, though it fell outside of the scope of the Service Features, the Focus Group felt it important to note that an attractive feature of many Broadband services is the ability to operate the other underlying services across the same architecture. Thus, the operation of the Internet often does not preclude the use of another telecommunications service as was often the case with legacy narrowband Internet access technologies.

6 Conclusion

During the considered discussions that Focus Group 4 conducted to fulfill the NRIC VII Charter, the members determined Reference Model Architectures, Best Practices, and Service Features that we hope will help with the important work that this nation is undertaking to increase the deployment of high-speed residential Internet access service. As a result of these discussions, the experts on the Focus Group also came to several conclusions that are important enough to be submitted for consideration by the Council, the FCC, the Congress, industry, and the American people. These additional considerations are:

- In order to boost the U. S. Broadband penetration and growth rate, Congress should consider enacting some form of tax benefit legislation to stimulate broadband Internet access by creating a financial incentive for using broadband facilities (e.g., an individual tax credit).
- Technical references (i.e. ITU-T Y 1541) should be used by providers for network performance.
- Consumers should consider security needs, hardware and software capabilities, and ISP options in their choice of high-speed residential Internet access service.

7 Appendices

Appendix 7.1 Reference Model Architectures

Focus Group 4 developed a set of Reference Model Architectures to illustrate all current, generally available alternatives to provision high-speed residential Internet access service. The models have served and will continue to serve as reference points as the group completes its work. An excerpted version of the following presentation was delivered as an interim update to the NRIC Council on December 6, 2004.

NRIC VII Focus Group 4 – Broadband

First Deliverable –
Reference Model Architectures for the
Deployment of Residential Internet
Access Service
9/2/04 Version

9/2/04

Completed Draft Deliverable for
9/7/04

1

SCOPE

- For the total Scope of this effort, see the full Scope document.
- NRIC VII Focus Group 4 will identify and develop reference model architectures illustrating all current generally available alternatives to provision high speed residential Internet access service.
- These reference models will be the most commonly known methods for high-speed residential Internet Access deployment.
- The reference models, reflecting today's existing environment, are to be segmented by the type of infrastructure deployed
- These reference models will depict only those components of the architecture required to provide high-speed residential Internet access service.
- While some of the reference models may be geographically bounded, others will not be geographically bounded.

9/2/04

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9/7/04

2

Residential Internet Access

- For the total view of Residential Internet Access, see the full document.
- The term Residential Internet Access encompasses the many different commercially available ways for Residential Consumers to access the Internet.
- The use of this term in the context of this deliverable is not application specific.
- Residential Internet Access is considered to be a pathway from the subscriber to the public Internet.
- Broadband technology should be viewed in terms of having sufficient bandwidth to provide satisfactory performance while accommodating a wider range of customers, applications and technological requirements.
- It is viewed to be always-available access technology so long as the user's Internet device is turned on, and requires no additional user activity to function.
- It has sufficient bandwidth to support multiple applications simultaneously.
- The area of concentration for this focus group is to offer recommendations to further advance the domestic use of broadband technology for Residential Internet Access.

9/2/04

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9/7/04

3

Reference Models

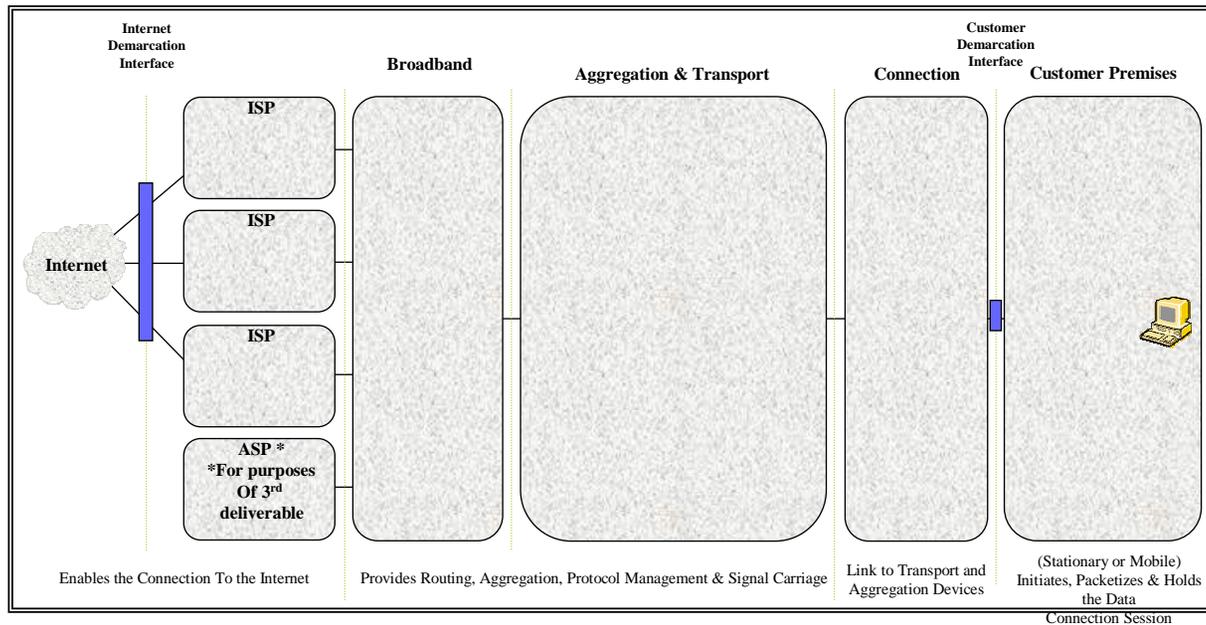
(Slides 5 through 22)

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9/7/04

4

Master Reference Model



9/2/04

Completed Draft Deliverable for
 9/7/04

5

Master Reference Model

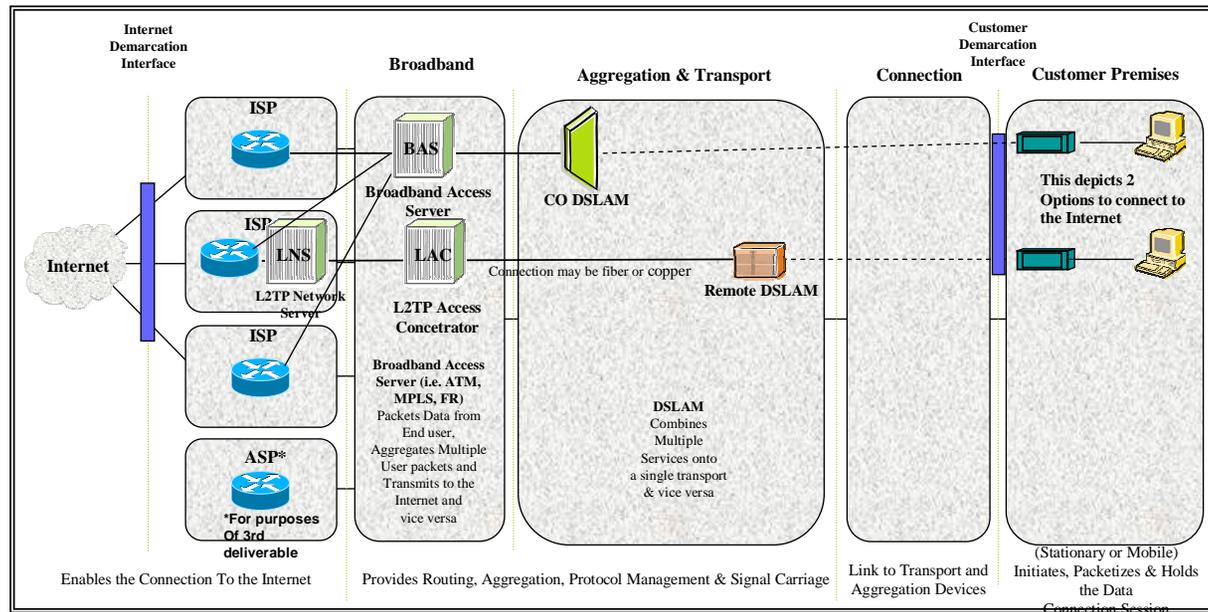
- The NRIC VII Focus Group 4 on Broadband has been charged to present a high level plan and architecture that describes how best to deploy high speed residential Internet access service.
- Focus Group 4 has approached this effort by developing reference models of the various architectures used in the deployment of high speed residential Internet access service.
- In all models, the data transport uses TCP/IP to connect to the Internet.
- The Focus Group has decided to define the models up to the customer demarcation point.

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DSL



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7

DSL

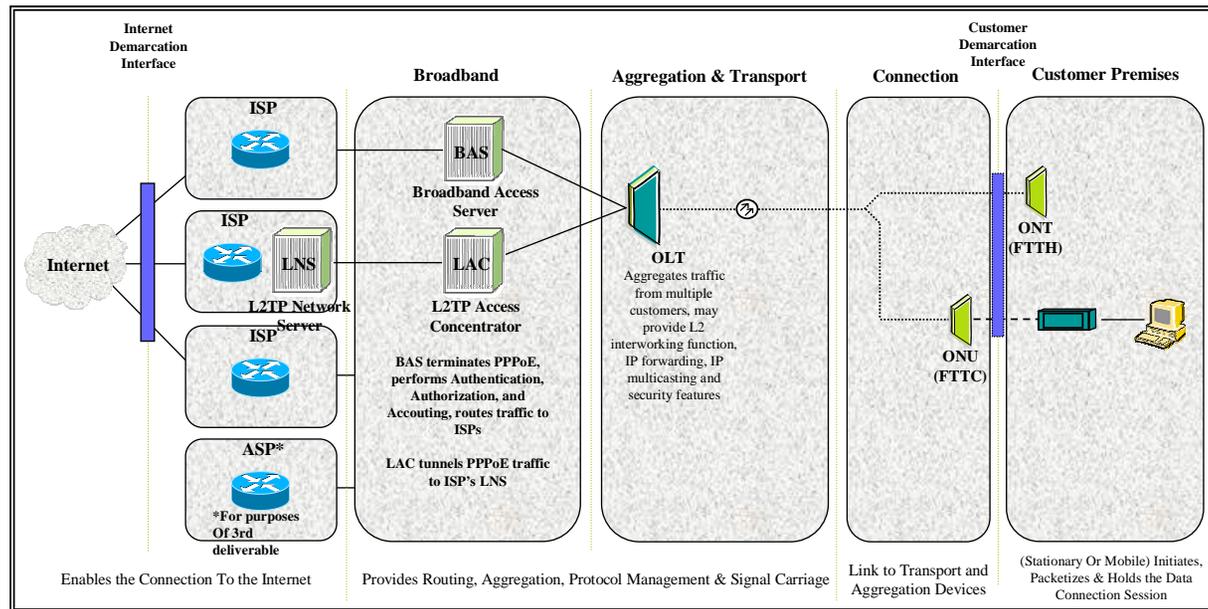
- DSL (Digital Subscriber Line) is used in the wire line based deployment of high speed residential Internet access service. Data access, and transport, are provided over the telephony wire line facility. The residential user's ISP is also connected to the wire line provider, via a hosting service, completing the residential user's connection to the Internet.
- The data is sent in packets, as a function of the operating system in the computing device. The user's modem facilitates the path to the DSLAM for the data. The computing device is generally connected to a DSL modem or gateway which is connected to the DSLAM.
- The data set up uses Point to Point protocol to connect to the Internet. Point to Point Protocol is commonly used to connect between the DSL gateway and the BAS or LNS.

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FTTP/C



9/2/04

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 9/7/04

9

FTTP/C

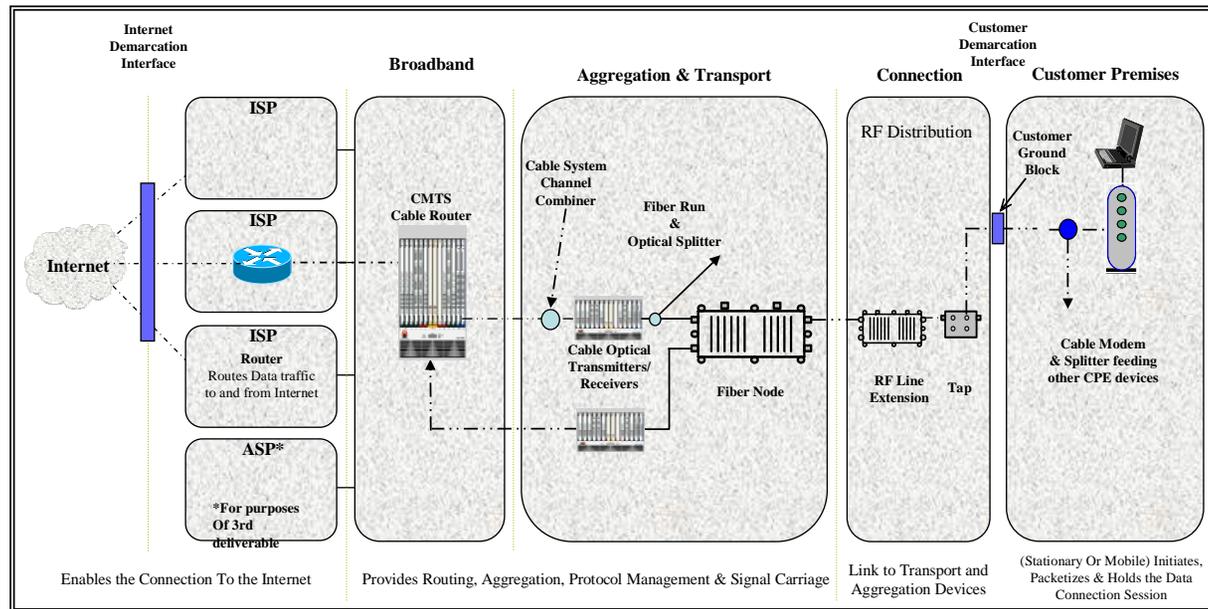
- FTTP/C (Fiber to the Premises/Curb) is used in the fiber based deployment of high speed residential Internet access service. Network access and transport is provided over the fiber facility. The residential user's ISP is also connected to the network provider via a hosting service, completing the residential user's connection to the Internet.
- The data is sent in packets, generally over ethernet from the computing device to the ONT. In the case of FTTC the computing device is generally connected to a DSL gateway which is connected to the ONU via DSL.
- Point to Point Protocol over Ethernet (PPPoE) is commonly used to connect between the ONT or DSL gateway and the BAS or LNS.

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10

Cable HFC



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11

Cable

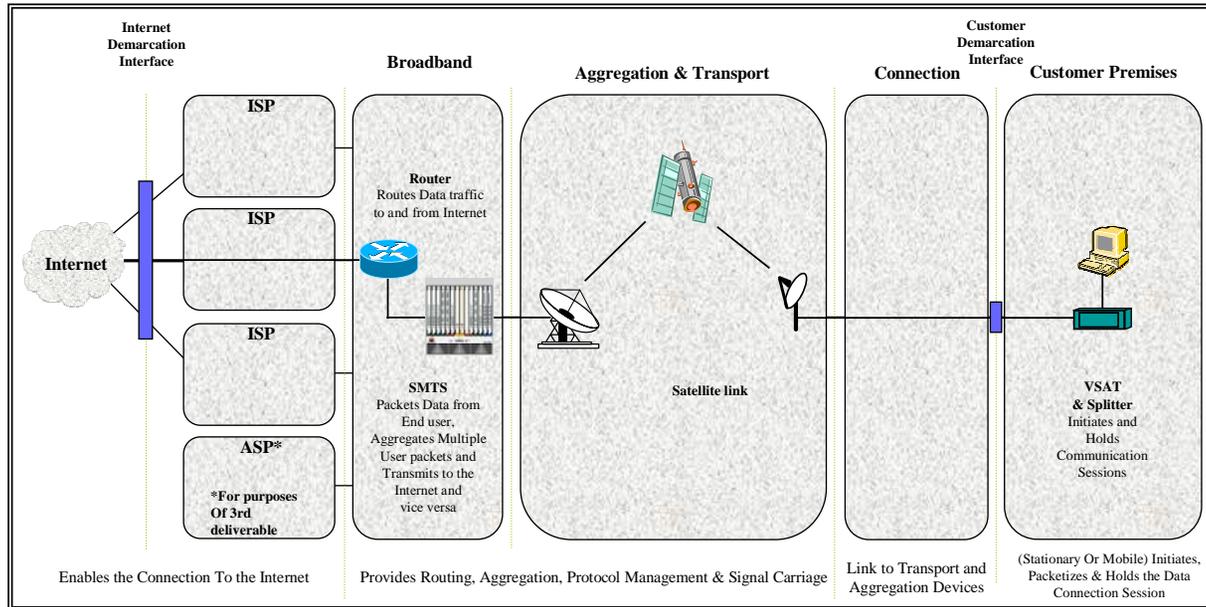
- In the cable based deployment of high speed residential Internet access service, the underlying facility is the cable TV infrastructure. Data access, and transport, is provided over the facility, with the cable operator acting as the ISP.
- The data is transmitted as an additional carrier on the cable system. It is encrypted and managed via the CableLabs DOCSIS™ specification.
- The data transport uses TCP/IP to connect to the Internet.

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Satellite



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Satellite

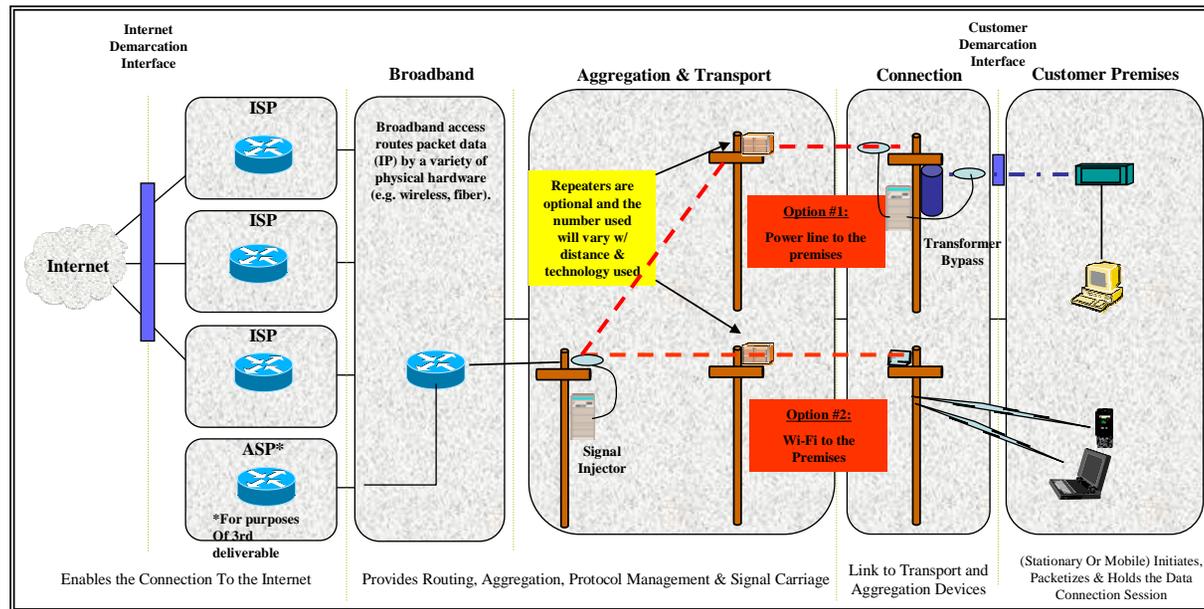
- In the satellite based deployment of high speed residential Internet access service, the underlying facility is the satellite infrastructure. Data access, and transport, are provided over the facility, with the residential user's ISP also connecting to the satellite infrastructure, via a host service.
- The data is sent in packets as a function of the operating system in the computing device. The user's modem facilitates the path to the SMTS. The satellite is a pass through device in the provision of high speed residential Internet access service.
- The data set up uses gateway protocol to connect to the Internet.

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Broadband Over Power Line



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Broadband Over Power Line

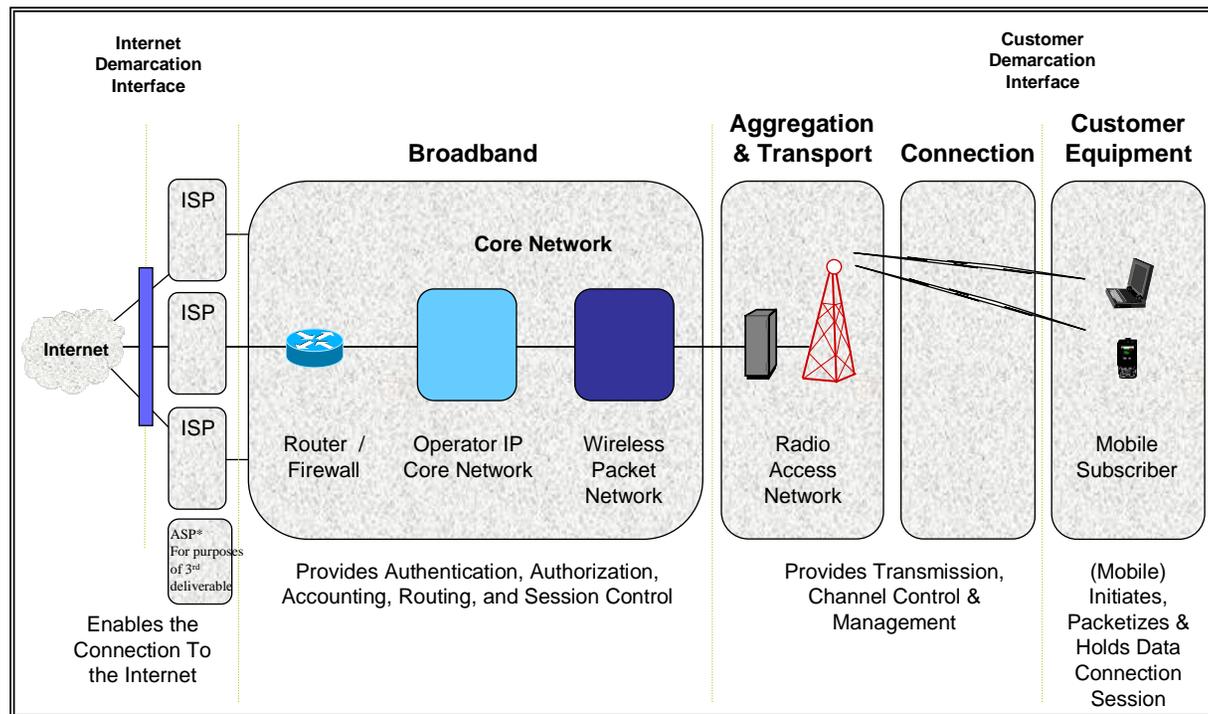
- In the BPL deployment of high speed residential Internet access service, the underlying facility is the power utility infrastructure. Data access, and transport, is provided over the utility infrastructure, and then is backhauled to a point-of-presence which is the access point for the Internet.
- The data is sent in packets, as a function of the operating system in the computing device. The data is modulated and encrypted to ensure reliable and secure communications. The data signal is also injected and extracted from the power lines safely and effectively using couplers attached to the wires.
- The final connection to the customer is completed either through low voltage power lines or Wi-Fi.
- The data set up uses TCP/IP protocol to connect to the Internet.

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Broadband Mobile Wireless Data



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Broadband Mobile Wireless Data

- **Mobile Subscriber (MS)**
 - The Mobile Subscriber (MS) element defines the customer end point for services. The MS is responsible for the initiation services. It also processes service request from the network for the establishment of services initiated by other end devices. The MS operates a set of procedures to enable the management and control of services with the system, such as Registration.
- **Radio Access Network (RAN)**
 - The Radio Access Network (RAN) provides the wireless connection between Mobile Subscribers and the Core Network, local control and management functions associated with processing Subscriber Device services. This involves the management and control of establishing the Subscriber on to the Radio Channel along with establishing procedures with the Core and Packet Data Network. Radio Access follows one of three technology paths as depicted in the Wireless Technology Evolution diagram (see next slide).
- **Wireless Packet Network**
 - The Wireless Packet Network elements provides the functional responsibility for establishing sessions into IP Networks for Packet Data Oriented Services. The Wireless Packet Network performs the subscriber authentication, authorization, accounting, and location functions.
- **Operator IP Core Network**
 - The Operator IP Core Network elements provides routing, control, and security functions between the wireless network and operator applications servers or external Internet servers.

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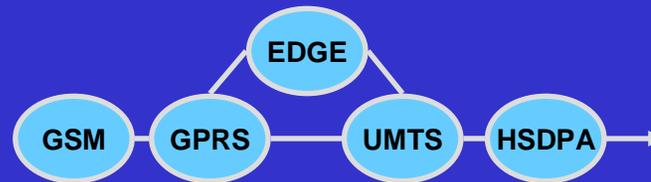
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Wireless Technology Evolution

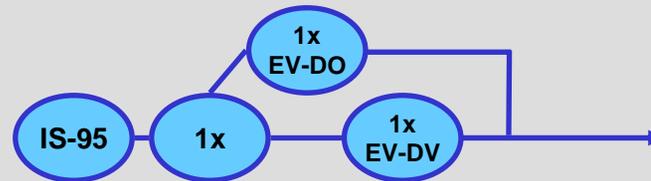
GSM

Global System for Mobile communication is an ETSI standard that follows 3GPP specifications in its evolution to broadband



CDMA

Code Division Multiple Access is an ANSI standard that follows 3GPP2 specifications in its evolution to broadband



iDENtm

Integrated Digital Enhanced Network technology evolves to Wideband iDEN to enable broadband

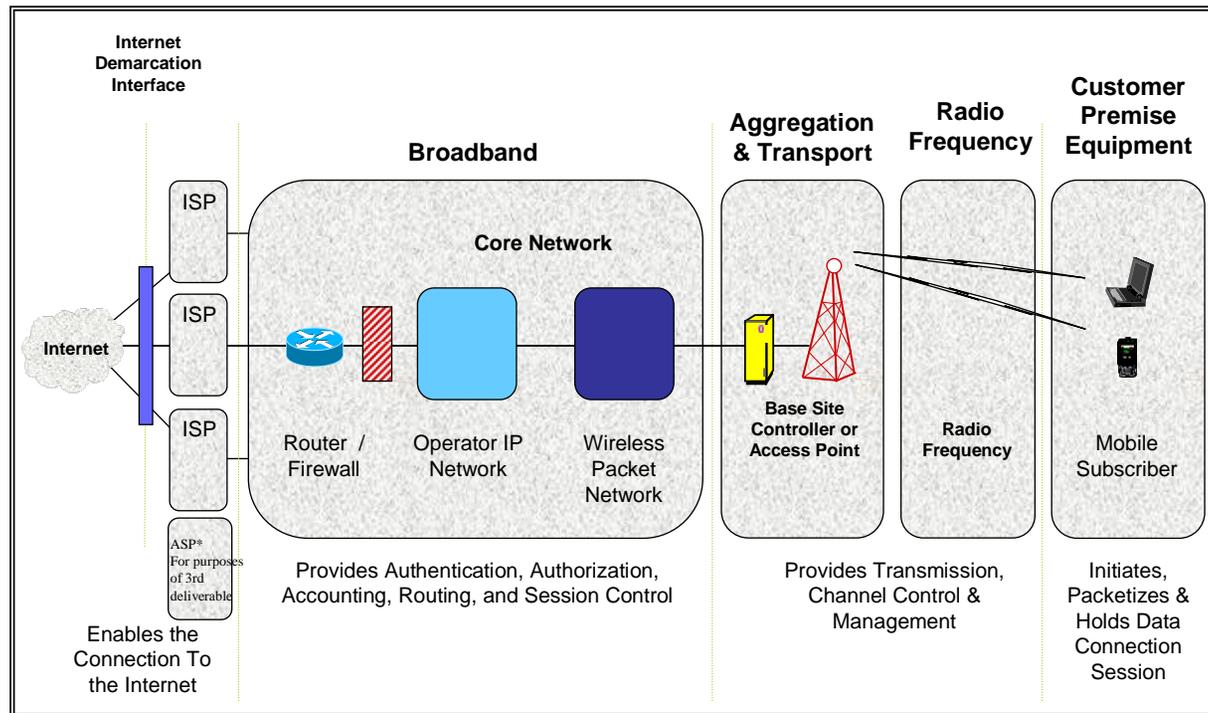


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Fixed Wireless



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Fixed Wireless

- Fixed Wireless access is the use of wireless technology to replace copper or fiber to connect subscribers to the Public Switched Telephone Network (PSTN).
http://www.citi.columbia.edu/wireless/citi_fw.htm
- Companies place wireless hubs in a central area and then work to secure roof rights and install antennas, radios and interface equipment to connect to the hubs (line-of-site is required between hubs and antennas).
- 39GHz has been reserved for last mile communications to extend fiber networks. Fixed Wireless targets business customers in areas where buildings do not have access to fiber.
- LMDS (Local multipoint distribution service) - This band (27.5GHz to 28.35 GHz, 29.1GHz to 29.25 GHz and 31GHz to 31.3 GHz) is being used for point-to-multipoint applications similar to the 39GHz band - Internet access and telephony. LMDS, though, has a 3-mile coverage radius and uses TDMA (Time-Division Multiple Access) so that multiple customers can share the same radio channel.
- MMDS (Multichannel multipoint distribution service) - This band, located at 2.5GHz, was initially used to distribute cable television service. Currently MMDS is being developed for residential Internet service.
- UNII (Unlicensed National Information Infrastructure) - Bands between 5.15GHz and 5.35GHz, 5.470 and from 5.725GHz to 5.825GHz have been reserved by the FCC for unlicensed use. Although the spectrum is not licensed, the FCC has outlined some requirements for providers to follow. For instance, power requirements are set in order to minimize interference between providers. Devices are also limited to wide-bandwidth, high- data-rate digital operations to ensure equipment manufacturers have the flexibility to design and manufacture a variety of broadband devices using different technologies and modulation techniques. <http://www.wave-report.com/Tutorials/FixedwirelessTutorial.htm>©

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Glossary

- 1x - Third Generation CDMA digital cellular technology. Also known as CDMA 1x Radio Transmission Technology or CDMA 1x RTT.
- 1xEV-DO - CDMA 1x Evolution Data Only
- 1xEV-DV - CDMA 1x Evolution Data and Voice
- 3GPP - Third Generation Partnership Project
- 3GPP2 - Third Generation Partnership Project 2
- ANSI - American National Standards Institute
- ASP - Application Service Provider
- BAS- Broadband Access Server
- CDMA - Code Division Multiple Access
- CMTS – Cable Modem Terminal Server
- CPE – Customer Premise Equipment
- DOCSIS – Data Over Cable Service Interface Specification
- DSL – Digital Subscriber Line
- DSLAM – Digital Subscriber Line Access Modem
- EDGE - Enhanced Data rates for GSM Evolution
- FTTP/C - Fiber to the Premises/Curb
- GPRS General Packet Radio Service
- GSM Global System for Mobile communication

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Glossary

- HFC – Hybrid Fiber Coax
- iDEN[™] - Integrated Digital Enhanced Network
- IP – Internet Protocol
- IS-95 - Standard for CDMA digital cellular also known as cdmaOne
- ISP – Internet Service Provider
- LAC – Layer 2 Tunneling Protocol Access Concentrator
- LNS – Layer 2 Tunneling Protocol Network Server
- OLT – Optical Line Terminal
- ONT – Optical Network Terminal
- ONU – Optical Network Unit
- PPPoE – Point to Point Protocol over Ethernet
- RAN - Radio Access Network
- RF – Radio Frequency
- SMTS - Satellite Modem Terminal Server
- TCP/IP – Transfer Control Protocol / Internet Protocol
- UMTS -Universal Mobile Telecommunications System
- VSAT – Very Small Aperture Terminal
- WiFi – Wireless Fidelity

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Appendix 7.2 Broadband Best Practices

NRIC VII Best Practice Number	NRIC VII Best Practice	NRIC VII BP References/Comments	NRIC VII (New/Changed/Unchanged/Deleted)
6-6-0801	Service Providers should consider utilizing traffic management mechanisms and technologies to ensure facilities are utilized most efficiently.	Duplicative of 6-6-0764.	Deleted
6-6-0802	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.	Duplicative of 6-6-0811.	Deleted
7-7-0803	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.		Unchanged
7-7-0804	Service Providers should consider means for providing their customers with appropriate information about their traffic policies so that users may be informed when planning and utilizing their applications.		Changed
7-7-0805	Service Providers, Network Operators and Equipment Suppliers should work to establish operational standards and practices that support broadband capabilities and interoperability (e.g., video, voice, data, wireless).		Changed
6-6-0806	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.	Reassigned to NRIC VII Focus Group 2B (Cybersecurity).	Sent to FG2B (Deleted)
6-6-0807	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.	Reassigned to NRIC VII Focus Group 2B (Cybersecurity).	Sent to FG2B (Deleted)
7-7-0808	Release Filtering Information/Policies to Customers: Service Providers and Network Operators should make information available to customers about traffic filtering (both static and dynamic), where required by law.	Reassigned to NRIC VII Focus Group 2B (Cybersecurity).	Sent to FG2B (Changed)
6-6-0809	Service Providers should make information available to customers that include content filtering for Dynamic Policies.	Reassigned to NRIC VII Focus Group 2B (Cybersecurity).	Sent to FG2B (Deleted)
7-7-0810	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.		Unchanged

NRIC VII Best Practice Number	NRIC VII Best Practice	NRIC VII BP References/Comments	NRIC VII (New/Changed/Unchanged/Deleted)
7-7-0811	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.		Unchanged
6-6-0812	Service Providers, Network Operators and Equipment Suppliers should continue to investigate the process of migration from an IPv4 to an IPv6 environment.	Not a Best Practice. Should be considered in future NRIC topics.	Deleted
6-6-0813	Service Providers should encourage users to take steps to protect their systems from unauthorized access.	Reassigned to NRIC VII Focus Group 2B (Cybersecurity).	Sent to FG2B (Deleted)
7-P-0814	For the deployment of Residential Internet Access Service, Broadband Network Operators should design in the ability to take active measures to detect and restrict or inhibit any network activity that adversely impacts performance, security, or usage policy.		New
7-P-0815	For the deployment of Residential Internet Access Service, Broadband Network Operators should select and properly install hardware that is designed for the expected environmental conditions.		New
7-P-0816	For the deployment of Residential Internet Access Service, in a shared media environment, Service Providers should design Broadband systems that provide appropriate privacy and access restriction to the data packet information (eg. DOCSIS, PON).		New
7-P-0817	For the deployment of Residential Internet Access Service, Broadband Network Operators should select, implement and locate equipment within the operator's architecture to provide residential internet access to the most users where economically and technically feasible.		New
7-P-0818	For the deployment of Residential Internet Access Service, Broadband Network Operators should deploy equipment that can report alarms.		New
7-P-0819	For the deployment of Residential Internet Access Service, Network Operators should provide backup power for broadband network equipment when economically and technically practical.		New
7-P-0820	For the deployment of Residential Internet Access Service, Network Operators should deploy networks in a manner to mitigate the effects of harmful interference from other sources, and to mitigate harmful interference into other services.		New

NRIC VII Best Practice Number	NRIC VII Best Practice	NRIC VII BP References/Comments	NRIC VII (New/Changed/Unchanged/Deleted)
7-P-0821	For the deployment of Residential Internet Access Service, a Broadband Network Operator should ensure that network deployment and equipment installation does not physically impair the operation of other collocated communications networks/equipment in the connection network (eg. shared space in the outside plant).		New
7-P-0822	For the deployment of Residential Internet Access Service, a Broadband Network Operator should incorporate multilevel security schemes for network data integrity, as applicable, in the network design to prevent user traffic from interfering with network operations, administration, and management use.		New
7-P-8023	For the deployment of Residential Internet Access Service, Network Operators, Service Providers and Equipment Suppliers should design, build, and operate broadband networks considering performance aspects of the data facilities employed, such as: packet loss ratio, Bit Error Ratio, latency, and compression, where feasible.		New