

# Broadband Strategy and the Virtual Broadband Gateway

Extending Network Intelligence to the  
Customer Premise

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# BROADBAND STRATEGY AND THE VIRTUAL BROADBAND GATEWAY

## Delivering Choice and Flexibility to the Customer

Assuming that businesses perform best when they listen to and respond to the interests of customers, it follows that the nation's broadband infrastructure should be strategically positioned as a platform for continuous innovation and new service creation for the customer. To achieve this, a shift in the way broadband is conceived and utilized is needed.

### Current Broadband Assumptions:

- Broadband = Internet and Internet = Broadband, meaning that Internet traffic is the only thing that will ever run over a broadband connection;
- The telecom and cable industry is philosophically opposed to net neutrality;
- Having multiple Internet providers guarantees competition;
- Each Internet provider builds out their own physical network;
- All services should be equal as all packets on the Internet should be treated equal (net neutrality);
- Having multiple physical networks is sustainable.

### Proposed Shift in Assumptions:

- Although the Internet is an essential part of Broadband, Broadband  $\neq$  Internet and Internet  $\neq$  Broadband;
  - Broadband naturally allows for additional networks along-side the Internet ;
  - These additional networks (not Internet) can accommodate differentiated services, i.e. services requiring Quality of Service (QoS);
- Having multiple Internet Service Providers available to the consumer will allow the consumer to decide net neutrality issue;
- Transport and Services are separated;
  - The transport is open to all service providers;
  - Transport providers are compensated for carrying traffic for service providers;
- Broadband infrastructure is a natural monopoly;
  - The maximum efficiency of the broadband infrastructure is realized through a single supplier;
  - The economics behind broadband infrastructure will tend to move to a single supplier;
- Broadband should be a universal service available to all areas in the U.S.;
  - Certain rural areas will have to be subsidized to provide universal broadband services.

This paper will outline the benefits of both a shift in broadband strategy and the assumptions which govern the industry as well as the role of a next generation broadband gateway in this strategy. In summary, these benefits include the following: 1) An open broadband infrastructure will provide for a more dynamic platform for innovation resulting in a myriad of new services that will be available to customers over time; 2) The sustainability and financial viability of broadband transport providers will improve; 3) There will be a significant improvement in the utilization and optimization of broadband networks; 4) The ideal of net neutrality for the Internet will be preserved and additional networks which require QoS will also be accommodated; and 5) The security of broadband networks will be enhanced.

## 1. Innovation and Service Creation

If the Telecommunications industry can move toward an open and ubiquitous set of interface standards for the virtualization of broadband networks, it will set the stage for the next move forward in innovation and service creation. "Standards provide a pyramid of knowledge, but more important, they free people to come up with the real value, which is in services," said Michelle Blank, vice president of global marketing for RADVision.

To deliver virtualized broadband services with the capability of providing QoS in a cost effective manner, carriers must stretch network intelligence from the Central Office (CO) to the customer premise. A new breed of Intelligent Virtual Broadband Gateways (VBG) are needed to leverage established and emerging traffic management and engineering concepts to enable transport carriers to deliver packet-based, tiered-data services provided by multiple service providers, profitably over a single broadband network. Using standards-based technology, the VBG will create new revenue opportunities and reduce operational costs.

## 2. Sustainability of Broadband Transport Providers

Consider an analogy of package delivery using public roadways: There are numerous service providers, such as UPS and FedEx that provide a service delivering packages using common roadways. Just think what the service would cost if every package delivery provider had to build their own roads. In this example, facilities-based competition is not financially responsible or feasible. Therefore, the package delivery providers compete with one another at the service level rather than at the infrastructure or the facilities level. The roadways model leads to the greatest economic efficiency. The roadways work as they do because all of the costs associated with the infrastructure are apportioned back to the users.

The telephone and cable TV providers have not applied the model set by the public roadways. Under telephone and cable TV model, both the roadways and all of the services actually belong to them. Using the roadways illustration, current models for broadband networks are similar to having UPS hand off the delivery of their packages to FedEx because FedEx not only owns the road, but also, controls the traffic on the roads as well. In addition to FedEx and UPS, there is a great deal of private traffic on roads. Current broadband network models effectively close their facilities to small private users who want simple point to point connections at a reasonable cost because their network architecture does not support this traffic. This example serves to emphasize the

requirement that we find a way to further develop open transport standards at the technological level. Our public road system demonstrates the possibilities.

Open transport innovation must begin at the highest level, with the architecture. This solution avoids engineering bias by stepping all the way back, starting with a blank page and asking how we can support an open transport model by using current technologies and standards. The solution also avoids industry or service bias by focusing on transport only, or simply moving packets without discrimination. The solution is easily scalable, reproducible and network media agnostic. Therefore, not only can new networks be easily built using this model, but current infrastructure can easily be updated regardless of the existing network media.

In April of 2008, Forbes magazine listed “Wired Telecoms” among America’s fastest-dying Industries. AT&T, one of the country’s largest broadband providers, had this to say about wired telecommunications infrastructure: “The existing system remains wedded to a circuit-switched, voice-centric vision for supporting America’s communications needs, and it is spiraling toward collapse in today’s broadband Internet world.” This comment emphasizes the dilemma facing the wired Telco and isolates the source of the sustainability problem.

Put simply, the advent of wireless and packet switching combined with VoIP ended the wired Telco’s monopoly and opened their subscriber base to competition. This means that competition can now be introduced into these markets with virtually no entry costs by another provider because delivering the service no longer requires a separate proprietary network. As we upgrade legacy networks to packet networks, regardless of whether the network began as Telco or Cable, all of these facilities will face the increasing burden of spreading their subscriber base thinner and thinner as they support an increasing number of redundant, overbuilt networks. The Internet introduced the separation of the service from the transport. If transport providers embrace an open network that supports this separation, it will allow for competition for Internet services and a host of other services not even dreamed of. This paradigm shift will help achieve a sustainable business for transport providers.

### 3. Utilization and Optimization of Broadband Networks

In order to optimize the utilization of current and future broadband networks, it is imperative that the industry encourage the following: a) Separation of Broadband infrastructure (transport) from Broadband services, b) Open networks, c) a new demarcation for QoS.

#### 3.1 Separation of Broadband Infrastructure (Transport) from Broadband Services

The idea of separation of the transport infrastructure from broadband services isn’t new to telecom or Cable TV companies that have been in the Internet service business. The introduction of IP networks has allowed for service creation and provisioning that is no longer confined to these companies. VoIP is a classic example of an Internet application which was derived from the separation of transport from services. While the separation of infrastructure from services is not a new idea, the industry has resisted embracing this as a fundamental and necessary change.

The Internet allows any service provider anywhere in the world to offer services to anyone, anywhere who is connected to the Internet. There is no need for the service provider to enter into

any contractual arrangements with the end users' access network operators (Telecom or Cable TV). Service providers can deal directly with end users, bypassing the access network operators.

Under the current Internet model most access network operators are under constant pressure to provide more bandwidth for fewer dollars. While this is great for the consumer and the service providers, it may not be in the best interests of the access network operators. There will always be a need to provide access to the Internet, but the relationship between the access network operators and the consumer/service providers will remain an uneasy one. Were the industry to embrace this model, transport providers could focus on their core competency of network management and provisioning.

### 3.2 Open Networks

Designing a network that is intelligently tuned (optimized) for a particular type of data or service – such as TV or VOIP transactions – inevitably makes that network less open. As software engineers say, “Today’s optimization is tomorrow’s bottleneck.” Thus, the best network is a “dumb” network that does nothing but move bits. Only then is the network truly open to any and all services that want to use it, no matter how innovative or how unexpected. In the best network, the services live at the edges of the network and use the network to transport bits and do not rely on any special characteristics of the network.

The Paradox of the Best Network comes about because as a network gets dumber, connectivity becomes a commodity. Those who own and operate the network will see downward pressure on their current pricing models. The high-value services, the ones that command premium prices, should reside at the edge of the network. Because the best network is simple, it is also operated at a lower cost basis. Lower costs enable reduced prices in a competitive market. This lowers barriers to innovation at the edges of the best network.

### 3.3 Demarking a New Edge for QoS

To ensure that each service receives the appropriate QoS treatment and meets SLA obligations, the VBG (Virtual Broadband Gateway) must manage, monitor and control network traffic at the service level, i.e., provide advanced traffic management and engineering services.

Specifically, the VBG must be able to ensure that QoS objectives are satisfied for new and existing traffic flows and protect against congestion and degradation of network performance. They must monitor and control the latency, jitter, average and peak rate, and loss ratios to ensure that availability and performance is within acceptable or contracted service boundaries, and that premium or priority services are given preferential treatment. To achieve this, the VBG must provide facilities for traffic classification, admission control, traffic shaping, and rate control

## 4. Net Neutrality alongside Additional Networks (Having Your Cake and Eat it Too)

Traditional IP networks operate on a connectionless, best-effort basis, with all packets subject to equal treatment as they are routed individually throughout the network, hop-by-hop, to their ultimate destination. This best-effort model of fairness translates to relative unfairness for traffic that is more sensitive to network impairments and doesn't align well with business plans that call for delivery of a rich portfolio of differentiated services and applications.

Although the internet is an essential part of the broadband infrastructure, it is erroneous to assume that the Internet = Broadband. Future applications which have national importance in such things as: 1) Healthcare, 2) Resource management (Smart Grid), and 3) Public Safety will require the ability to deliver data over converged, IP-based infrastructures via a different breed of access network. These will need to be engineered to deliver carrier-class service but optimized to associate traffic streams with their applications and process each according to its predefined Service Level Agreement (SLA). This new network must provide the same--or better—service quality than existing infrastructures.

The VBG should accommodate existing standards for net neutrality over the public internet and simultaneously classify and groom service flows for parallel networks and appropriately apply traffic engineering services to aggregate and efficiently map data onto the existing network to control behavior, optimize resources and maximize traffic delivery performance.

In heterogeneous public networks, a switching protocol that is independent of the service providers represents the best alternative for enabling the VBG to perform traffic engineering and manage QoS. Since this switching protocol operates independent of the Internet protocols, it becomes protocol-agnostic, and separates forwarding and control functions cleanly from service functions. The network supplies the intelligence required to associate a traffic stream with services and deliver the data according to the specified traffic contract.

This switching protocol gives the VBG the ability to associate and allocate any type of traffic with a particular service class. Each service class represents an aggregation of traffic that will be treated in the same manner as it traverses the network. These service classes are mapped to service policies that have been engineered to support specific SLAs (e.g., guaranteed bandwidth and low latency).

#### 4.1 Managing at the Service Level

By using VBGs to extend the switching protocol to the customer premises, transport carriers can apply virtual switching to the local loop and enable a connectionless IP infrastructure to support connection-oriented services. By classifying, mapping and aggregating ingress traffic into service and/or application level virtual connections, providers can manage at the service level.

By supporting both a physical and logical distribution of network intelligence, the VBG will create access networks that are feature-location agnostic. This virtualization of the access network enables carriers to deliver extremely scalable, efficient and secure private voice and data networks and transparently drive voice and unified communication features directly to the customer's doorstep. These VBGs reduce the complexity and operational costs associated with operating multiple networks for each service and provide a single network infrastructure that creates opportunities for many other services.

#### 4.2 Telephone and Cable TV Company's Dilemma

The telephone and cable TV companies are impaled on the horns of this dilemma. Historically, their high-margin services have been built into the middle of their network, which has been optimized for a single application – voice and broadcast video. Their businesses are based on these special-

purpose networks. They know that implementing the new commodity network threatens the very basis of their businesses.

## 5. Security Enhancements

Separating services from transport will create new cooperative relationships in which transport companies will become “service enablers” for service providers, providing QoS necessary for a trusted environment delivering security, privacy and reliability.

Security is a primary consideration in any public switched network. The transport company must be able to ensure that different service providers on a common infrastructure cannot affect each other, and that denial-of-service (DoS) attacks or other malicious actions cannot interfere with SLA compliance.

In addition, these transport companies will offer network security as a value-added service, protecting service providers from security attacks. Most security attacks originate from within the service provider's network-not from outside. By separating service from transport as suggested in this document, these companies can provide protection from attacks such as ARP spoofing, Dynamic Host Control Protocol (DHCP) attacks, Denial of Service (DoS) attacks, and other internally based threats.

Although Ethernet brings tremendous flexibility to the service portfolio, these transport company must consider the security that is inherent in their offering. Traditional point-to-point WAN or connection-oriented connections are easier to secure than multipoint-to-multipoint networks based on switched Ethernet technologies. Publicly available hacker software can enable users to exploit standard Ethernet switch mechanisms without any expert knowledge, so the transport company must choose a solution that includes support for many robust security features and separation of protocol and address space.

## Conclusion

The real test of the Broadband deployment is connected to the quality and number of services that are offered over a converged network in a sustainable and secure manner.

The proposed transformation will allow the transport provider to profitably shift from basic switching to managing the network as an intelligent information utility - automating and simplifying service delivery software and enhancing the infrastructure to bring the service provider closer to the customer.

Customers are becoming more aware of their networking needs and how to get them at the most cost-effective levels. They want on-demand services and self provisioning - and they want it all now.

Innovation in the underlying transport layer will make for more cost effective and faster transport of raw information - but the value will still remain in the differentiating and optimizing services offered and bringing the benefits of faster and more innovative service delivery to the end-user.