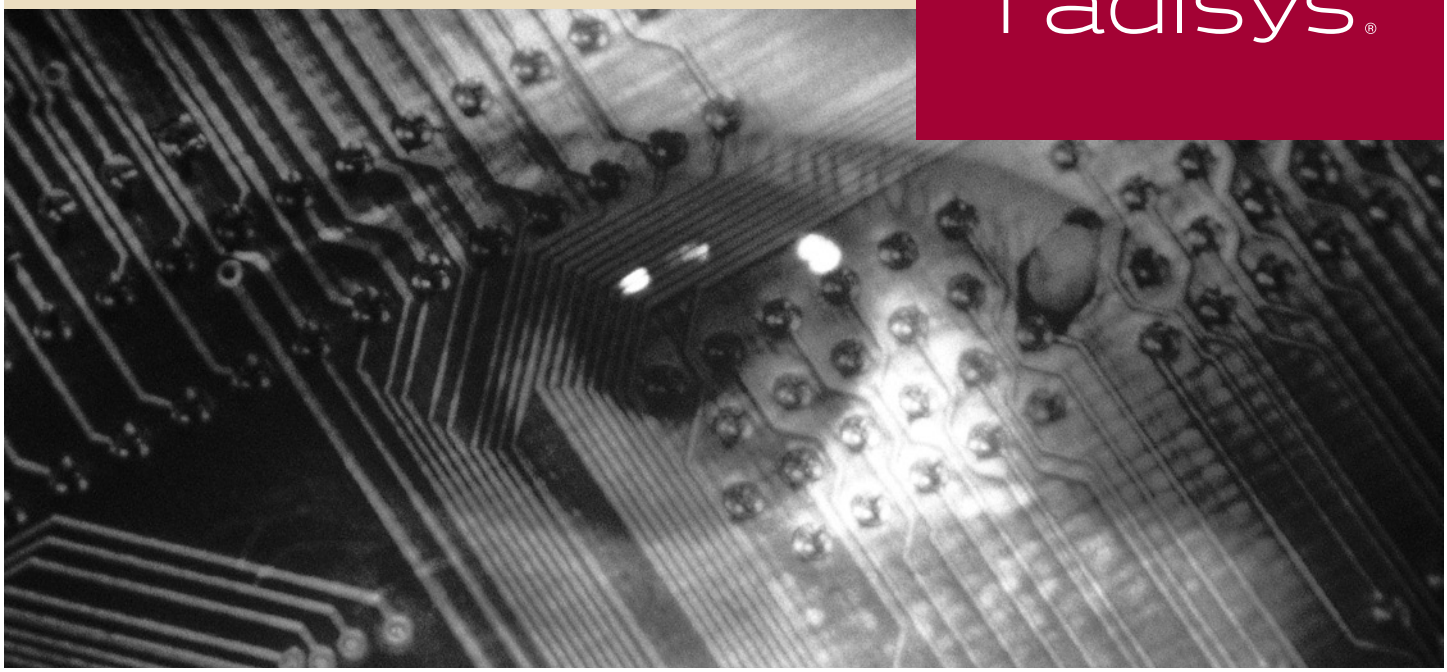
Technology Article

radisys®



Bringing Deep Packet Inspection (DPI) into Wireless Networks

By Mike Coward, VP of Strategy & Innovation

In wireless as in wireline networks, there is never enough bandwidth. The introduction of smart phones like the iPhone, as well as mobile data cards, has created significant congestion on 3G networks with users complaining of slow downloads and dropped calls. The next generation of mobile networks, sometimes called 4G but more properly termed 3G LTE (Long Term Evolution), promises to offer dramatic increases in bandwidth for the subscriber — up to 200 Mb/s downlink. With this much bandwidth, it is tempting to think of LTE as representing the silver bullet for bandwidth concerns, but a closer look at traffic patterns suggests otherwise. Deep Packet Inspection, commonly known as DPI, has received a bad name due to several early implementations, but the latest generation of DPI products promises to allow service providers to operate their networks more efficiently while facilitating new revenue streams. The following is a primer.

3G/LTE Capabilities

3G and LTE networks are built around a shared data channel for all mobile devices in a cell. As shown in Figure 1, all of the devices feed data through a single data channel. This architecture was selected when it was presumed that the main use of mobile data would be Web surfing and email. These applications are inherently bursty, and having a data channel shared between many users means that any given user gets high bandwidth when downloading a web page, but isn't wasting the channel when idle.

The problem, however, is that a shared data channel performs very poorly when one or more subscribers try to use the network for large sustained transfers. Such downloads soak up large amounts of the shared channel bandwidth and can lead to congestion for every other user in the cell. Two kinds of transfers in particular fit this profile of high bandwidth sustained downloads: video and peer-to-peer (P2P). As shown in Figure 2, video and P2P already account for 60% of data traffic and are forecasted to grow to 74% by 2013.

Although video traffic is hard on the network because of the high sustained transfer rate, P2P traffic is even worse. Most P2P programs run in the background and will run 24 hours a day, and are specifically designed to consume as much bandwidth as possible. They sense available bandwidth and adjust their demands up or down to completely fill the data pipe. In the context of a shared data channel between multiple subscribers, this is the worst possible behavior because a single subscriber can keep the data channel congested 24 hours per day. So, when Subscriber B attempts to send a packet during Subscriber A's P2P session, the packet may be delayed or dropped even if Subscriber B is attempting a low bandwidth transaction like Web surfing or email. Thus, P2P traffic yields poor network performance for every subscriber in the cell, including, ironically, the subscriber running the P2P program.

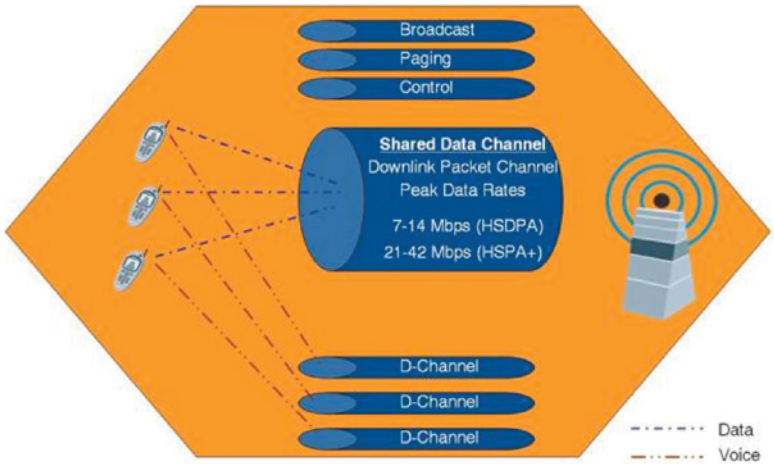


Figure 1. *3G Network Channel Structure: Shared Data Channel*

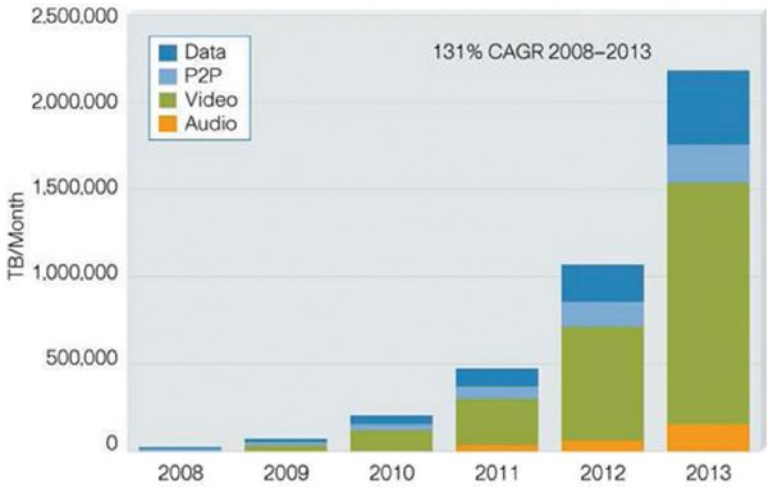


Figure 2. *Data Forecast shows application usage and growth, 2008-2013. Source: Cisco*

Because the P2P program consumes any available bandwidth, the subscriber will find that his/her own interactive web and email traffic is also sluggish.

Wireless Data Cards & USB Dongles: The Real Threat

Although many users assume that smart phones such as the iPhone are responsible for congestion on the 3G network, much of the data growth actually comes from laptop users with data cards or USB dongles, or netbooks with built-in cellular modems. On average, a single laptop generates as much traffic as 15 smart phones — as much traffic as 450 regular phones (Source: Informa). With large screens, laptops can play back mobile video at higher resolutions, therefore driving much higher data rates.

Similarly, although many users consume most of their data at home or at the office, the convenience and flat rate pricing of 3G connections leads many subscribers to use their 3G connection even in situations where WiFi or wired connections are available. Currently, laptop subscribers account for more than half of mobile data usage (Source: Informa).

Figure 3. *80 Gb/s DPI Platform*

DPI Capabilities

DPI offers the ability for an operator to inspect each packet, classify it as part of a flow, and then inspect the flow to determine application, subscriber and content provider. Once this is done, the operator can apply different policies to the flow based on subscriber profile, application, time of day, or cell site loading. Such policies can include prioritizing one traffic flow over other flows, dropping a flow, or routing a flow directly to the Internet and not through the operator's core infrastructure.

Previous systems had been limited in the data rates that could be inspected, but modern DPI platforms can perform detailed application classification at line rates. Figure 3 shows an example of the Radisys ATCA DPI Platform capable of inspecting, classifying, shaping, and modifying traffic at 80 Gb/s per shelf.

New Revenue Models: Tiered Service Plans and Content Revenue Sharing

DPI provides new avenues to monetize mobile broadband and can lead to new revenue streams, both from subscribers and from content publishers.

In particular, DPI enables an operator to offer subscribers tiered data service plans which can be segmented based on a range of criteria. Today, most mobile operators offer a single data plan and simply cap data usage at approximately 5 GB per month despite the fact that most users don't understand how much traffic a gigabyte represents. The simplistic approach is to offer data plans with different size caps: 5 GB/month, 10 GB/month, 25 GB/month, and 100 GB/month — or offer plans that cap the mobile broadband speed at different levels like 128 Kb/s, 256 Kb/s, or 1 Mb/s.

Utilizing DPI, however, operators can use "application awareness" to offer attractive plans built around understanding how consumers actually use their service. Some sample plans would be:

- A service plan optimized for web and email, but with a very tight bandwidth cap on any P2P traffic (e.g., 64 Kb/s).
- A service that allows YouTube-style video streaming <250 Kb/s, but limits high definition video streaming (e.g., 4 Mb/s or higher).
- A service optimized for gamers which offers low latency for gaming packets.
- A premium service for corporations which offers traffic priority in any cell site for email, CRM and other corporate applications.
- A service designed to appeal to P2P users (instead of fighting them) which offers unlimited bandwidth during off-peak hours, but tightly caps the P2P bandwidth during busy times.

In addition to new revenue streams from the subscriber, DPI also enables new revenue streams from content providers like YouTube, Yahoo, or Facebook.

Mobile data caps tend to discourage subscribers from using their broadband connection for video clips or content-rich sites like Facebook, but because these sites are advertiser-funded, content providers are incentivized to find a way to eliminate the data caps as a barrier to usage. One solution is for content providers to share advertising revenue with mobile operators in exchange for not counting their data traffic against the cap.

Conclusion

Mobile broadband provides revenue growth opportunity for mobile operators, but adoption is likely to stall unless operators can ensure that users experience solid performance with their connections. The traffic dynamics of the two largest forms of mobile data traffic, video and P2P, conspire against the shared data channel architecture of 3G and LTE thereby necessitating new solutions to classify, manage and monetize the mobile data.

In addition to simply controlling traffic, operators are always seeking new revenue streams, especially in today's economic climate which has accelerated an already competitive market. DPI offers the potential to create exciting new service plans built around the many ways that subscribers use their services rather than technical limitations, and also enables new revenue streams from content providers.

radisys®

Corporate Headquarters
5435 NE Dawson Creek Drive
Hillsboro, OR 97124 USA
503-615-1100 | Fax 503-615-1121
Toll-Free 800-950-0044
www.radisys.com | info@radisys.com

February 2010