White Paper

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Using DPI to Increase ARPU Despite Flat-Rate Plans

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Overview

It is undeniable that the primary source of revenue growth for mobile operators in today's mobile wireless market is data services. 3G has finally arrived and is the fastest- growing provider of broadband data services of all time. This growth is being driven by a combination of elements.

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First, new devices are greatly enriching the mobile data experience. Devices such as Apple's iPhone, RIM's family of BlackBerries, and the ultra-mobile netbooks with embedded 3G access cards make the mobile Internet easy to use. They also provide platforms for applications that leverage HSPA connectivity and data speeds as well as a rich media environment.

Second, a new generation of subscribers is hitting the market, as the coveted 18-to-24 demographic is the "always on, always connected" generation. Finally, we live in the era of the "all-you-can-eat" flat-rate data plan, which is unquestionably facilitating unfettered utilization. How many automatic e-mail downloads a day does your smart phone make? Would you let this happen if you paid per byte?

While driving greater adoption and utilization, flat-rate plans have effectively capped the opportunity to increase average revenue per user (ARPU) via data services that is, unless operators find a way to do something different. Next-generation networks provide the basis for driving down the cost-per-bit while delivering vastly increased data rates. Specifically, Long-Term Evolution (LTE) is receiving broad commitment from the global operator community, though its cost to deploy is pushing timelines years out. Operators need solutions for existing 3G infrastructure that allow them to increase ARPU today.

DPI Facilitates New Services

Today's solutions need to leverage deep packet inspection (DPI) to provide new services to the consumer. DPI offers the ability to examine the contents of a packet all the way up to Layer 7 in the OSI model and to subsequently take action on those packets. DPI is valuable for security and traffic management,[1, 2] which are necessary for fixed-line and mobile networks alike. But the real hidden value lies in the new services that DPI can be leveraged to provide.

The first service opportunity is the tiered-Service Level Agreement (SLA). Sometimes called the "bronze, silver, and gold plans" approach, the tiered-SLA enables the operator to deliver a guaranteed premium quality-of-service (QoS) to a user who demands and is willing to pay for it. Not all data users are alike, yet mobile networks currently treat us all the same.

Top-tier SLA plans may be bundled with top-tier devices such as the iPhone. For example, the iPhone data plan may be slightly more expensive per month, and the iPhone may be slightly cheaper for those who elect this plan. But the subscriber receives a much better QoS than the casual e-mail browser.

The second service opportunity is further optimization of the general tiered-SLA, providing service packages based on either a specific application-type (i.e., gaming, mobile TV), time of day (i.e., priority during daytime), location (i.e., priority in travel locations like airports, train stations, etc.), or any combination of the above.

Additionally, the operator has the opportunity to deliver priority service to the content providers themselves. Recent deals struck between mobile search providers (Yahoo,[3] Google, and MSN) and operators for priority status represent a new paradigm so operators can increase revenue from data services by exploiting DPI technology.

Mobile DPI: A Different Animal

Where there is operator opportunity, equipment vendors subsequently stand to benefit. Yet doing so requires a combined strong understanding of mobile networks as well as DPI technology. Unfortunately, very few organizations have expertise in both. One cannot simply toss the fixed-line DPI approach at the mobile network and expect to meet this need optimally. The mobile network has a few distinct differences from fixed-line networks, providing both the opportunity for differentiation as well as a challenge to leverage DPI technology.

The first of these challenges to mobile operators is mobility itself. This is a fairly obvious but critical aspect to delivering ARPU-increasing services. Location-based QoS requires a real-time and specific understanding of which cell-sector a user is being serviced by as well as the loading at that specific cell-sector. (Figure 1). Obtaining this level of specificity requires pulling information from the radio access network (RAN), including signaling information, to have a consistently accurate depiction of user and cell-site combinations.

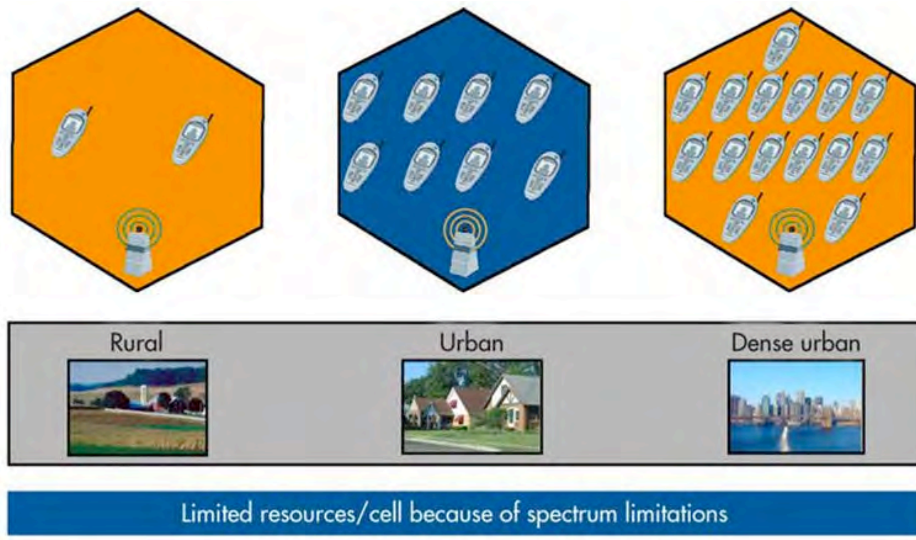

Figure 1.

The second challenge is the type of "pipe" provided. In fixed-line DSL networks, for example, users are provided with their own dedicated pipe from the home or enterprise to the first aggregation point in the network. The aggregate data speed that each fixed-line broadband user realizes is most influenced by the overall traffic traversing the operator's edge and core networks. Conversely, the mobile "last-mile" is the air interface, which is shared access.

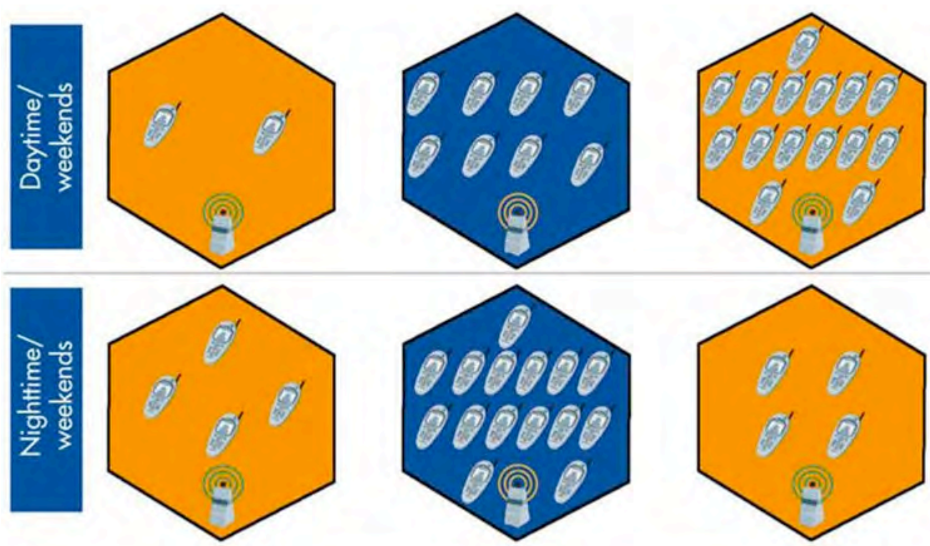

Figure 2.

In other words, each cell site represents one fat pipe that all active local users are sharing. Therefore, simply impacting traffic rates in the core of the mobile network using a fixed-line DPI approach leaves out the key aspect of cell-site loading. For instance, if there's a cell site that currently isn't very loaded, but the DPI system is unaware of it, it may impact a lower-level-SLA user's traffic unnecessarily.

Conversely, in high-load conditions, a RAN-unaware DPI system could rate-limit the traffic destined to a different cell site altogether and not take adequate action at the appropriate cell site, leaving higher-SLA users without the guaranteed QoS for which they are paying. (Figure 2).

The final important difference is security. The security methodology in existing mobile networks is very different than that used by fixed-line broadband service providers. In the context of mobile DPI, existing security methods present a challenge in extracting the appropriate information to provide enhanced services without creating vulnerability.

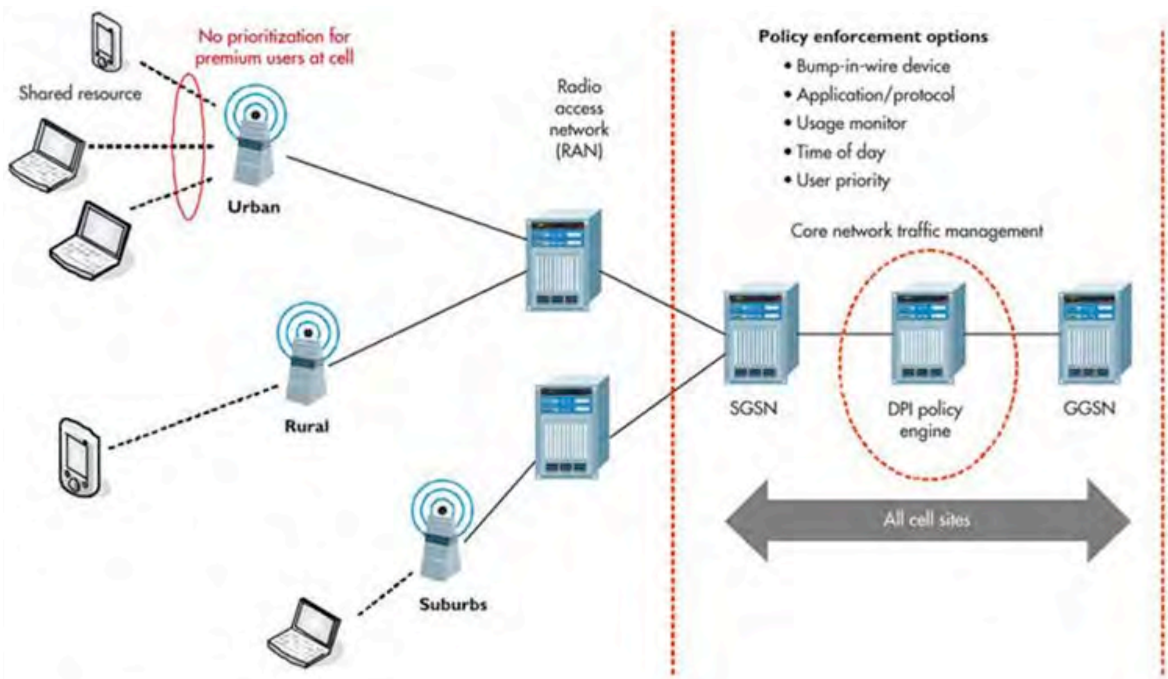

Figure 3.

All traffic from the mobile user to the edge of the core network (i.e., the radio network controller or RNC in WCDMA) is encrypted including the data and signaling information. This encryption is provided to protect the privacy of the individual user as well as to protect the network itself from attacks.

However, key information is embedded in the encrypted signaling traffic in the RAN that is critical to delivering the general and specific SLA services identified in this article. Innovative solutions are necessary to truly provide enhanced services without requiring substantial changes in existing mobile infrastructure.

Architecting Mobile DPI Solutions

How can network equipment providers (NEPs) take advantage of the emerging revenue opportunities presented by mobile DPI applications? A couple of key architectural aspects must be taken into account when putting together a solution that targets DPI in mobile networks to specifically solve these challenges.

Currently, mobile operators are deploying solutions that mirror fixed-line DPI systems in their networks to tackle the challenges of security and traffic management. This solution is sub-optimal as it does not tackle or take advantage of the unique aspects of the mobile network; namely mobility, shared pipe delivery, and security.

The first enhancement requires gathering information specifically about the RAN for use by the DPI system. Information needs to be extracted from the signaling messages within the RAN in real time and presented in an aggregated fashion so the DPI system can combine the mobile-unique aspects with the data already extracted from the packets themselves (e.g., application type). The information added by the RAN includes cell-site, user-ID, and location updates that are critical to delivering tiered-SLA services. (Figure 3).

The next critical decision is whether to build a standalone DPI solution or to integrate the DPI solution into existing wireless infrastructure. Both approaches are being applied today, including enhanced gateway GPRS support nodes (GGSNs) that include DPI-enabled traffic management and security enforcement capabilities, in addition to the deployment of specialized DPI equipment from pure-play DPI solution providers.

Standalone DPI systems are mostly “bump-in-the-wire,” whereby a DPI appliance is put inline in the data traffic path and the box inspects traffic and thus enables traffic management and security applications. While effective, the “bump-in-the-wire” deployment scenario requires additional boxes that inherently increase complexity and associated operational and capital expenditures.

Wireless network operators that have already deployed 3G HSPA networks have no choice but to adopt the “bump-in-the-wire” deployment schemes. However, “Greenfield” HSPA deployments can have DPI capabilities embedded inside wireless gateways, like SGSN, GGSN, and femtocells. DPI-enabled gateways allow network operators to reduce their network complexity while achieving the desired functionality.

Each approach has both positive and negative aspects. Integrating the DPI capabilities with a wireless network node simplifies the gathering and integration of critical RAN information. In some cases it also allows for the extraction of RAN information following decryption but prior to translation into less-specific parameters. As the signaling data traverses the network, it becomes less and less granular since each network element only gets the data required to support its functionality.

The integrated device presents challenges, though. The first is deployment strategy for the DPI capability. As referenced above, getting the integrated solution into an existing HSPA network would require investment not only in DPI applications, but new core network equipment too. Second, DPI systems aren’t just about affecting traffic. They also deliver rich reporting and analytical capabilities that are often better hosted on systems that aren’t mission critical.

The standalone DPI device benefits from being easier to deploy in existing networks as well as having established reporting and analysis functionality. These devices are also designed to sit in the network without impacting network service in case of a failure. The standalone DPI device does, however, make the extraction of critical RAN information more challenging. It also necessitates the addition of another device into the network, increasing both capital and operational expenditures.

Conclusion

The application of DPI for providing tiered-SLA type services in today’s mobile networks represents a near-term opportunity for wireless operators to generate increased ARPU in the face of current flat-rate data plans. The challenges and opportunities for combining DPI applications with mobile networks are clear. Successful targeting of this market requires organizations to have existing core competency in either DPI or wireless or to partner with companies that already have the distinct competencies they may be lacking in-house.

The good news is that the opportunity does not stop with current 3G networks, but instead amplifies as operators plan their LTE rollouts. Establishing the tiered-SLA paradigm today is critical to delivering similar services integrated into LTE tomorrow. Rather than coming in after subscribers are conditioned for “all-you-can-eat plans,” LTE services can be delivered immediately on a tiered-SLA basis. And last but not least, DPI technology is absolutely required as operators move to an all-IP core network if one assumes that building out the LTE network with these capabilities from the beginning will be critical to successful deployments.

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