CAMIANT LEADER IN REAL-TIME POLICY CONTROL

Opportunity in the Air:

Congestion Management and the Mobile Broadband Revolution

A Camiant White Paper and Cost Model

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The Opportunity of Mobile Broadband

In wireless broadband, the boom is officially, undeniably, irreversibly "on." Powered by a new breed of handsets including Apple Inc.'s iconic iPhone, today there is an explosion of activities, users, applications and possibilities resounding in a sector that scarcely existed just three years ago.

At airports, in coffee shops, in automobiles and home offices, millions of untethered devices are connected to a growing range of networks that deliver broadband data content and services once confined to the world of fixed-wireline connectivity. Broadband has been liberated convincingly from its wireline leash, and consumers are increasingly free to surf, roam, communicate, watch and play from just about anywhere.

Growth rates of broadband wireless data are astounding. Some recent indicators:

- Industry research firm Analysys Mason projects the number of wireless broadband customers around the world will increase from 70 million in 2008 to 2.1 billion in 2015.
- In the third quarter of 2008, Ericsson reported that data traffic measured in WCDMA networks was four times the volume of voice traffic, up from three times the voice traffic volume just the previous quarter.
- Motorola projects data consumption associated with 3G wireless networks in developed markets will rise at least six-fold in 2009.

The surge in data traffic reflects profound and fast-moving change in the capabilities and possibilities of mobile broadband. Quickly, the medium is moving from a concentration around text-messaging, e-mail and lightweight Web surfing to an embrace of advanced applications like streaming video, games and full-fledged Internet access.

With devices like the iPhone and the Blackberry Storm smartphone featuring improved interfaces, better screens and a wide range of applications, consumer recognition and enthusiasm over the possibilities of mobile broadband will only grow. According to the mobile industry researcher M:Metrics, smartphone users in the U.S. spend an average of four hours and 30 minutes a day browsing the mobile Internet, and counterparts in Britain spend more than two hours a day surfing websites like Facebook and craigslist from mobile devices.

PC connectivity through datacards, USB modems or built-in devices has also found tremendous customer traction. As of Q208, there were 13 million datacards users in the US, up 55% from the year before according to a Nielsen Mobile study. Interestingly, the study also said that 59% of those users are considering dropping their home broadband connection and using the datacard as their exclusive broadband connection. Now, a new breed of lightweight, portable computers outfitted with wireless receivers — so-called netbooks — promises to ignite demand even more sharply. A number of mobile operators, particularly in Europe, offer free or heavily subsidized netbooks as part of contract offers, much in the same way that operators have traditionally subsidized handsets.

Compared with a mobile voice market that is largely flat and in some cases may be experiencing declining revenue per user, the enthusiasm over revenue-enhancing mobile broadband services is welcome news for carriers. For fixed line operators, the business of connecting users to an unfettered Internet has produced extraordinary returns. Today roughly 20% of revenue and more than 30% of operating cash flow generated by the U.S. cable industry comes from provision of high-speed Internet access — a high-demand, high-margin service that has transformed the industry's competitive posture and its economics.

Wireless broadband connectivity has the potential to produce a similar upsurge in revenue and cash flow. But attaining the scale necessary for the medium to flourish will require a fresh look at the way bandwidth is delivered, and the way services are supported.

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Challenges Ahead

A critical challenge facing the mobile communications industry is that neither delivery architectures nor economics have caught up with customers' rising desire for mobile broadband access.

Today, demand for bandwidth is rising at a much faster pace than corresponding revenue. In the same study that found data traffic rising six- to 14-fold in 2009 among 3G networks, Motorola noted that data revenue is expected to grow by only 10 to 30 percent in the same year. As wireless broadband begins to take hold, there is a large and alarming imbalance between data traffic and revenue growth. In order for the economics of an emerging wireless data marketplace to work, revenue and traffic must become better aligned.

Yet today there are few mechanisms in place either in billing practice or in network traffic management approaches that account for the fact that no two mobile broadband users are exactly alike. The young adult who totes an wirelessly connected PC on the train, devouring bandwidth as she peruses the web and watches online video, bears little resemblance from a bandwidth-demand standpoint to the attorney in the next seat who dashes off a series of brief emails on his smartphone during the morning commute. Today's irony is that both are likely to pay the same amount for the same flat-rate mobile broadband service, even though the first user routinely demands far more from the network than the attorney, and may have a much larger impact on network performance. Considering that mobile broadband infrastructure costs an order of magnitude more per bit delivered than fixed broadband networks, mastering this dilemma is even more critical to mobile operators than to their fixed line cousins.

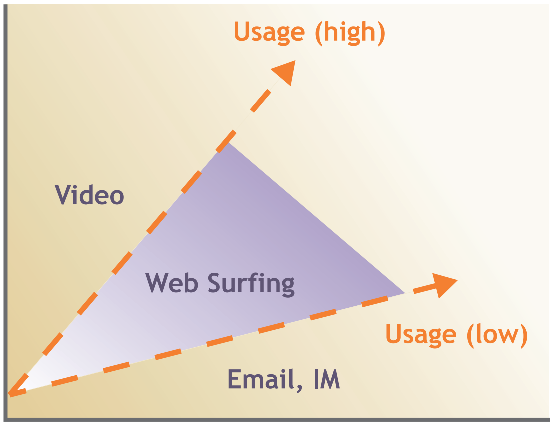

Figure 1. The Variability of Bandwidth Consumption

The network performance issue is critical. As more users spend more time with wireless data applications, exponential increases in data traffic threaten to choke networks to the point where a substantial number of users may encounter poor service experiences.

Thus, wireless carriers that are pursuing the promise of broadband IP services need to fulfill two major obligations:

1) Aligning revenue contributions with traffic consumption patterns.

2) Managing network congestion to enhance customer satisfaction.

To date, carriers have attempted to address these inter-related challenges mainly by applying a tool borrowed from the voice component of their service: a usage cap with overage charges. The idea is simple enough. When customers exceed a certain amount of bandwidth in a particular billing period, they pay more money, often at a much higher rate, for the "extra" bandwidth they consume. For instance, U.K. wireless provider 3 provides a range of contract options from 1GB to 15GB at prices from £10 to £30, with overage charges at £0.10 per MB.

But usage caps are imperfect approaches for controlling bandwidth consumption and for better aligning revenue with usage patterns. They are blunt instruments for a job that requires a more thoughtful and elegant approach.

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Challenges Ahead

For one thing, usage caps provide no guarantee of correcting the very problem that spawned them: network congestion. Congestion within networks, which leads to poor performance, reduced data rates and frustrated customers, often happens well before — and independent of whether — individual user caps are triggered. It's common for networks to become congested, at least within certain cell sites, regardless of whether high-demand users are exceeding their allocated usage caps.

Second, usage caps frequently frustrate or confuse customers because they're based on metrics that are meaningless to customers. A carrier may offer a pricing plan that offers "up to 1 gigabyte" of data for a fixed monthly rate in an attempt to appeal to those with an appetite for on-the-go Internet access and mobile music downloads. But in fact, few users have any idea how much or what type of sessions in the aggregate may constitute 1 GB of data usage, a perception that makes a consumption-based cap difficult for customers to understand and control. In October 2008, the consumer research firm uSwitch found 80% of U.K. broadband customers either wrongly believed they had an unlimited broadband package or didn't know what their limit was.

Another consideration: Applying usage caps penalizes some of the best potential customers for wireless data carriers — those who value mobile data access the most. This same irony has long been evident to fixed-wireline broadband providers, who have occasionally likened the practice of denying bandwidth to their most voracious customers to the idea of a restaurant owner refusing to cater to patrons who are hungriest.

But the most serious flaw of a usage-cap scheme is that it fails to distinguish fundamental differences between the data and voice components of network traffic. On the voice side, when congestion occurs, it generally affects a very small subset of users within a certain cell site, who experience a transient "busy" signal if they happen to attempt a call during a congested moment. Most users, who are not initiating calls at the time, remain happily unaware of the network's temporary problem.

Data traffic is different. When congestion occurs within a cell site, it affects everyone. The Internet seems to bog down. Email messages are slower to render. Downloads take too long. The frustration factor of congestion within the data network is magnified because it is apparent to many more users.

Effectively managing network congestion depends on reducing or controlling these "peak usage" instances in which the network approaches saturation and data packets begin to be delayed or dropped, causing user consternation. By reducing the frequency and duration of peak usage congestion, carriers can deliver a much-improved data experience to all customers. Rather than attempt to regulate network demand through individual-user caps that frustrate customers, carriers should instead concentrate on eliminating or at least reducing these instances of congestion that are noticeable and annoying to multiple users within particular cell sites.

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Solving the problem

Working with some of the largest broadband providers in the wireless and fixed-wireline sector, Camiant has helped to solve these issues by applying intelligent policies and controls to reduce network congestion and assure excellent user experiences across the customer base.

In the wireless world, reducing peak-usage instances requires first identifying the trouble spots where peak usage tends to occur – by day, by time and by cell site. These are the places and moments at which the network is most vulnerable to congestion and its attendant negative effect on customer experience. Once those areas are known, the network's Gateway GPRS Support Node (GGSN) can signal whether any customers who have established a data session happen to be within a trouble spot. The consumption patterns of those who are using the data network within these known congestion points will be monitored. If they happen to exceed a level established in advance by the carrier, the network will take notice and respond in accordance with policies and rules the carrier has established. A user within a trouble spot who exceeds a 25 MB per hour threshold, for example, might trigger the network to respond by modestly reducing data throughput.

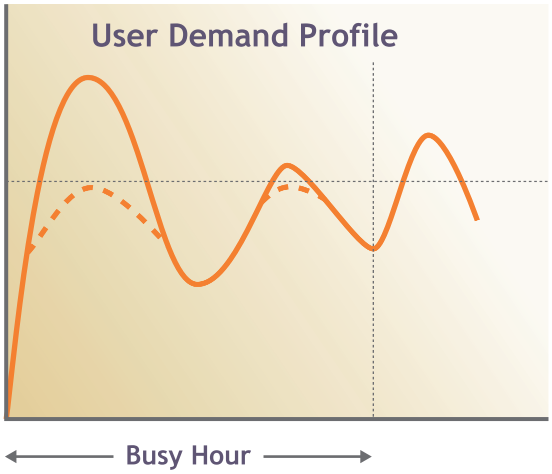

Figure 2. Congestion Management during Busy Hours

Remember that the goal is to avoid congestion that afflicts all users within a certain cell site. Instead of performing poorly for all users, the network instead identifies a small number of high-bandwidth consumers and applies business rules that modestly reduce the network resources available to them. Their experience diminishes only slightly, while – and this is critical – every other trouble spot user who remains within a prescribed consumption range remains unaffected by congestion that otherwise could occur. The widespread dissatisfaction that otherwise tends to occur as cell sites become bogged down with demand has vanished.

It's up to carriers to determine exactly how users may be treated in relation to network resource demand, but there are many models for prioritizing resources based on the needs and the revenue contributions of differing classes of users. For instance, during periods of congestion, it's possible for a carrier to throttle back network bandwidth and resources for users who have agreed to pay less for a non-guaranteed class of service, and to allocate QoS-backed resources to those who have paid more for better-performing classes of service. This variation on the speed-tiering schemes prevalent in the fixed broadband sector can work well to deliver the best possible performance for the largest number of customers – and to help align revenue with demand. Rather than impose the same bandwidth and performance limits at all times – regardless of subscriber, application or network state – a fair approach to congestion management will always endeavor to deliver the best possible experiences based on pre-determined performance designations and user QoS profiles. And in times of congestion, it will reward higher-ARPU users with superior performance they have paid to receive.

Congestion management reflects the reality that network congestion is going to occur as demand and usage of mobile broadband surges. The important principle is to manage congestion so that adequate resources are available to the optimum number or class of customers possible in a particular site. This technique of watching data network trouble spots and applying thoughtful business rules within them mirrors the approach being used by prominent wireline Internet service providers, with excellent results both from customer satisfaction and economic vantage points.

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Economic Impetus

Without a method for managing congestion using policy controls, carriers that hope to match rising demand for data applications have little choice than to play a never-ending game of catch-up by continually adding or fortifying cellular sites and backhaul capacity.

Already, many carriers are concerned about rising capital demands. "We're seeing a large influx of data, and that's creating a lot of problems for the mobile providers that heretofore worried mainly about how to provide a good quality of experience for voice communications," says Jennifer Pigg, a Yankee Group analyst who specializes in mobile communications networks. The economic impact of applying policy controls to manage congestion, versus building more radio sites and adding backhaul links, can be dramatic. In cases Camiant has studied, congestion management approaches have yielded savings of 10 to 25 percent or more from presumed capital budgets.

Recently, Camiant has introduced a network cost-planning tool in association with Omnitele, a Finland-based telecom strategist firm. The model estimates in detail the cost savings of adopting a congestion management approach, versus building out physical facilities to satisfy uncontrolled demand for broadband data applications and services.

Press to get back to navigation!

Impact Comparison Module

	UNCONTROLLED			CONTROLLED			© 2009 Omnitele Ltd	
Network and Subscribers	EoY 1	EoY 2	EoY 3	EoY 1	EoY 2	EoY 3		
Sites	1,000	1,000	1,000	1,000	1,000	1,000		
Total Mobile Broadband Subscribers	153,000	306,000	459,000	153,000	306,000	459,000		
Traffic Monthly	EoY 1	EoY 2	EoY 3	EoY 1	EoY 2	EoY 3	Change(Y3)	Change(Y3) %
Gbyte/month/subs - Handheld Data subscriber	0.02	0.04	0.06	0.02	0.04	0.06	0.00	0%
Gbyte/month/subs - Normal Dongle Subscriber	1.00	1.20	1.50	1.00	1.20	1.50	0.00	0%
Gbyte/month/subs - Heavy Dongle Subscriber	10.00	12.00	15.00	8.88	10.43	12.74	-2.26	-15%
Total Gbyte/month	82,000	200,000	378,000	78,625	190,604	357,649	-20,351	-5%
Traffic in Busy Hour	EoY 1	EoY 2	EoY 3	EoY 1	EoY 2	EoY 3	Change(Y3)	Change(Y3) %
Megabyte/hour/subs - Handheld Data subscriber	0.04	0.08	0.13	0.04	0.08	0.13	0.00	0%
Megabyte/hour/subs - Normal Dongle Subscriber	2.08	2.50	3.13	2.08	2.50	3.13	0.00	0%
Megabyte/hour/subs - Heavy Dongle Subscriber	20.83	25.00	31.25	11.46	11.95	12.41	-18.84	-60%
Total Gbyte per Busy Hour	171	417	788	143	338	618	-170	-22%
Total Traffic Related Cost	EoY 1	EoY 2	EoY 3	EoY 1	EoY 2	EoY 3	Change(Y3)	Change(Y3) %
Cumulative CAPEX (€)	14,078,500	27,569,000	47,392,667	11,763,833	24,025,333	38,539,500	-8,853,167	-19%
Yearly OPEX (€)	2,066,775	3,913,350	6,532,900	1,764,575	3,339,800	5,405,925	-1,126,975	-17%
Total Incremental Cash (CAPEX + OPEX) per year (€)	16,145,275	17,403,850	26,356,567	13,528,408	15,601,300	19,920,092	-6,436,475	-24%
Total Cumulative Cash (CAPEX+OPEX) (€)	16,145,275	33,549,125	59,905,692	13,528,408	29,129,708	49,049,800	-10,855,892	-18%
Total Amortisation+OPEX per year (€)	3,826,588	7,359,475	12,456,983	3,235,054	6,342,967	10,223,363	-2,233,621	-18%
Cost per GB (for weighting average cost per subs)	EoY 1	EoY 2	EoY 3	EoY 1	EoY 2	EoY 3	Change(Y3)	Change(Y3) %
Cost per Gbyte transferred in general hour (€/Gbyte)	*3.89*	*2.94*	*2.38*	*3.47*	*2.67*	*2.17*	*-0.21*	*-9%*
Cost per Gbyte transferred in BH (€/Gbyte)	*61.42*	*46.45*	*37.54*	*62.79*	*49.46*	*41.33*	*3.78*	*10%*
Cost per subscriber (weighted by BH traffic volume)	EoY 1	EoY 2	EoY 3	EoY 1	EoY 2	EoY 3	Change(Y3)	Change(Y3) %
Monthly cost of Handheld Data subscriber (€/subs)	0.08	1.86	2.25	0.08	1.98	2.48	0.23	10%
Monthly cost of Normal Dongle subscriber (€/subs)	3.84	3.48	3.52	3.92	3.71	3.87	0.35	10%
Monthly cost of Heavy Dongle subscriber (€/subs)	**38.38**	**34.84**	**35.20**	**10.79**	**7.79**	**5.96**	**-29.24**	**-83%**
Monthly cost of average subscriber (€/subs)	2.08	2.00	2.26	1.76	1.73	1.86	-0.41	-18%

Click here to change key input parameters!

Key Inputs | Traffic Load Curve | Impact Comparison | Traffic | Scaling | Vendor Prices | QoS_Params | NodeBDIM | Dimensioning Summ | CAPEX_OPEX | NodeB_Units

Figure 3. Camiant and Omnitele Cost Reduction Techno-Economic Model Sample

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Economic Impetus

Omnitele's mobile broadband expertise, developed through numerous network planning, vendor selection and contract negotiation assignments, makes it well positioned for the analysis of infrastructure costs. The techno-economic mobile broadband dimensioning framework developed during these projects has been applied widely for a number of mobile operators in Europe, Middle East and Africa over the last number of years.

The techno-economic mobile broadband cost model predicts the future incremental costs of capacity upgrades triggered by the growing data traffic on the network. It starts by defining relevant market segments and different data packages offered by the carrier, as well as target QoS performance for each service. The average monthly data volume and the share of this data volume falling into the network's busy hours also are specified for each subscriber segment. The next step is to model the spreading of the total traffic across the sites and cells of the network including scaling as appropriate for network busy hours. It is possible to run the dimensioning algorithm on every site and cell of the existing network.

The cell, backhaul and core network level dimensioning algorithms are customized to capture the scaling rules of the specific technologies, vendors and vendor pricing mechanisms of different network layers. The key output of the modeling exercise is estimating the capital and operating expense impact of the increased traffic. The primary output metrics are the total infrastructure capex and opex costs, the average infrastructure cost for each subscriber type, and the cost of transferring a gigabyte of data during the busy hour of the network for each subscriber type.

Working with Camiant, Omnitele created a modified version of the baseline techno-economic model that compares the costs of an uncontrolled network against one that uses a congestion management approach as described here. This model has additional inputs to capture certain busy hour characteristics as well as the nature of the bandwidth controls and which subscribers the controls are applied to. Initial indications from the model show cost reductions, mostly radio access network (RAN) and backhaul related, of between 10 and 25 percent depending on a number of factors. The approach certainly seems to have great promise as a way to maximize overall usage while controlling peak demand in order to constrain network expansion-related costs.

Camiant and Omnitele have made the modeling tool available for viewing by carriers as a way to help estimate the impact of this congestion management approach on planning and budgeting for future data offerings. If you would like to explore the congestion management approach and the techno-economic model, please contact **Randy Fuller**, VP of Business Development at Camiant at **rfuller@camiant.com**.

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A New Way Forward

At Camiant, we believe congestion management is just as critical to the future of mobile broadband as the creative Internet applications that drive consumer usage today. Congestion management represents a behind-the-scenes approach to shaping and influencing the relationship between network demand, the revenue contributions of differing classes of customers, capital expenditure drivers and the overall growth of the mobile broadband sector. Granted, congestion management hardly matches the Blackberry Storm or Apple's iPhone in glamour appeal, but to propel mobile broadband from the niche to the mainstream, it's every bit as important.

Camiant invites and encourages dialogue about broadband and broadband networks worldwide. For an analysis of the economic impact of an intelligent congestion management approach on your mobile broadband network, contact **Randy Fuller**, Camiant's VP of Business Development at **rfuller@camiant.com**.

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