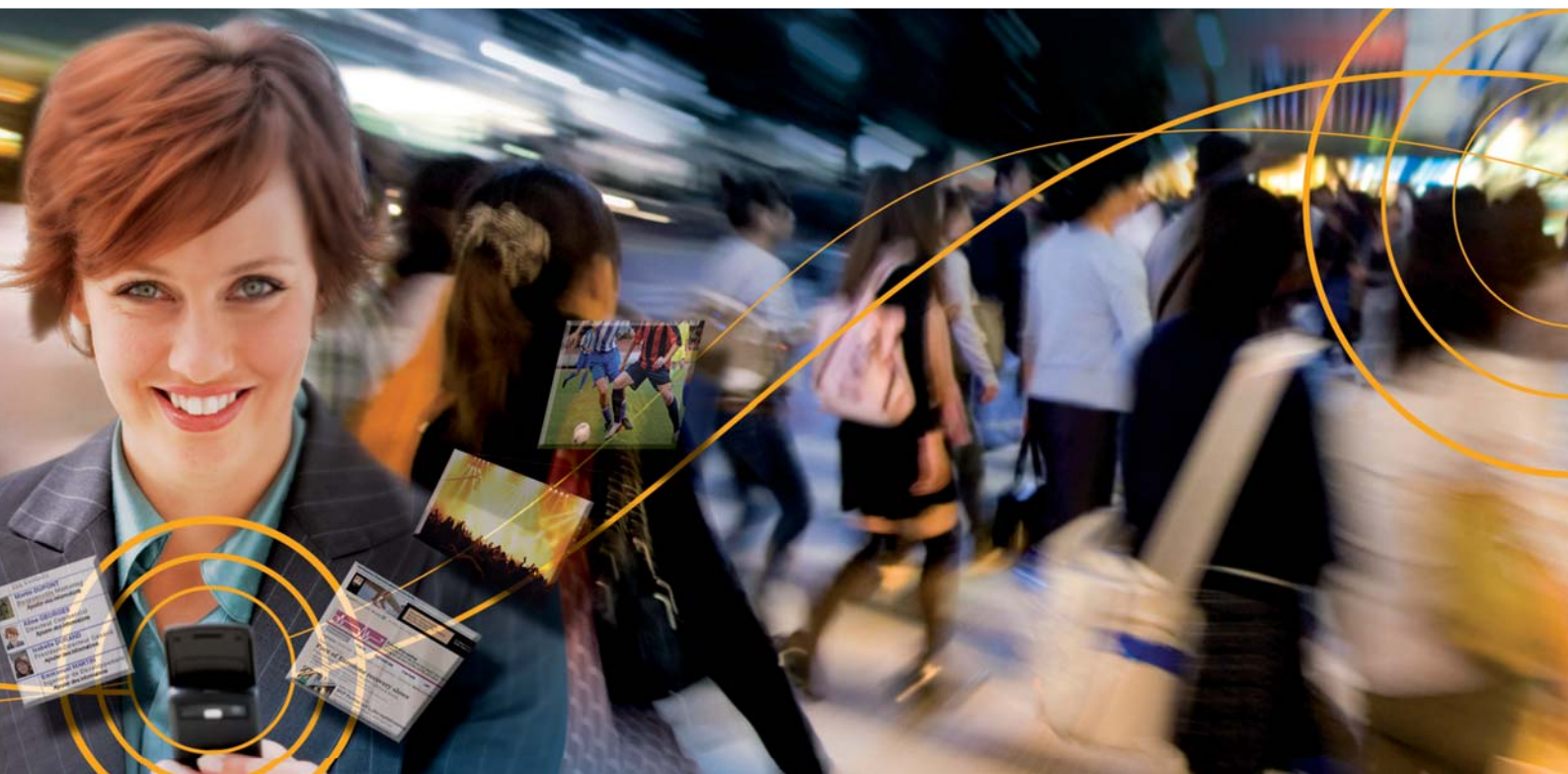


# Make **the most** of your **network**



## White Paper

How can Network Monitoring help to maintain  
top quality services for Mobile Broadband  
at a reasonable cost?





## How can Network Monitoring help to maintain top quality services for Mobile Broadband at a reasonable cost?

### Context

There isn't a telecom summit or a webinar today that doesn't start with this slide (Figure 1) showing the data traffic sky-rocketing, decoupled from the slight increase in both ARPU and Voice traffic. That said, the problem now lies in understanding how to play this new game we have entered. To summarize, operators basically have the triple challenge of:

- providing satisfaction to all those data greedy subscribers (particularly the high revenue generating ones),
- finding an intelligent way to value their networks as service providers instead of just being bit-pipe providers.
- All this with constant attention given to aligning their Capex and Opex spending with revenues.

A large set of solutions is being proposed to address these concerns. Besides the necessary increase of network capacity, solutions exist on the market to optimize the resources such as QoS differentiation, traffic shaping, network offloading or even data compression. Regardless of the chosen technique, network monitoring solutions, like those proposed by Astellia, enable operators to have a clear picture from the network side, services side, or even up to the end user. Complete monitoring solutions for mobile broadband such as Astellia's can cover a great variety of needs. From technical reporting or troubleshooting information for investigation, optimization or capacity planning, to higher level requirements such as network wide reporting or usage analysis usually used by management or marketing staff.

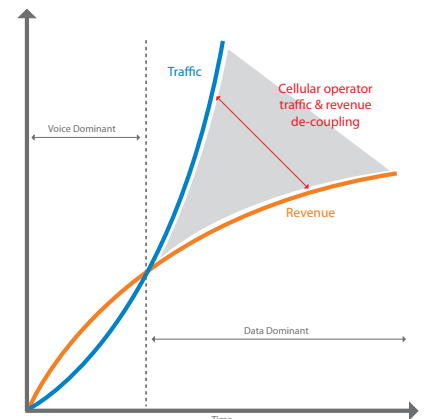


Figure 1: Well known traffic explosion phenomenon (source: Heavy Reading)

### Optimization is about getting more value with lower spending

The first thing that comes to mind to ensure the highest level of service to each subscriber considering this traffic explosion is: "let's add capacity". Aside from the significant impact on costs, increasing the capacity of an entire network is not such an easy task. First, a network is a complex thing with multiple interactions between the nodes. An unplanned upgrade would lead to the creation of more problems than what it is supposed to solve. Particularly on the access side, adding capacity on the RAN implies considerations on the backhaul and frequency planning which is linked with spectrums allocated by regulator and cell planning. More capacity requires smaller cells, which implies acquisition of more sites. Moreover, data traffic acts like gas; the more capacity we add, the more traffic will increase.

Prior to adding more resources, it is vital to ensure the network is properly used. This is about optimization. Sometimes, increasing the capacity of a network simply relies on properly setting parameters such as timers, message repetition rules or even configuration. One of the crucial points is having a clear understanding of where the bottle necks are in order to be able to take the right decisions. Astellia's multi-interface Monitoring Solution plays a key role in this process. Operators can now benefit from having a comprehensive view of the network behavior, from Core to Access, as well as from Network Equipment to the User. End-to-End monitoring solutions enable operators to visualise each leg of a network and pinpoint where the QoS is deteriorating, understand why, and take corrective actions before subscribers feel the quality decreasing and decide to churn to competition. It is clear that that preventive QoS management is way more cost effective than recovering from quality degradation, not to mention the impact on customer satisfaction.



## Why such a focus on packet and user plane?

Because mobiles are today being used for data applications but also because data traffic is more complex than voice.

Back in the circuit based world, applications were limited to voice and SMS. If circuit mode brings the issue of wasting some resources (once the circuit is opened it is pre-empted no matter the level of usage), it has the advantage of guarantying a level of QoS. In the circuit switched world, congestion can be seen as a binary mode, when the traffic load increases less calls will be accepted by the network but ongoing calls are not affected. Therefore focusing on signaling analysis to understand the overall health of the network, assess the Quality of Service (QoS) and troubleshoot is a sufficient approach.

Packet-based traffic however is less determinist. Since resources are shared between users it is essential to have a global view of the traffic - including the user plane - to understand for each session the level of quality provided to the end-user. It is only by having this complete view that we can assess the contribution of a given session to the overall picture. Root causes of Packet Services inefficiencies are multiple. It comes from Mobiles (configuration, or performances), Radio coverage, network dimensioning, server or application inefficiencies, or even network equipment behavior.

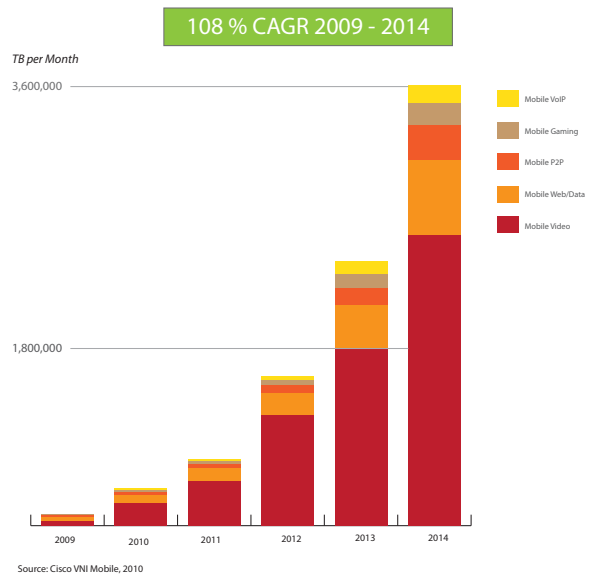


Figure 2: Data Mobile Forecasts show that Video will have major contribution in traffic explosion

## Packet services versatility

Yet, there is another reason to focus on packet services: the phenomenal multiplication of services and applications, each having its own set of requirements to function correctly. While voice and video are very demanding in real time constraints, mail will require large overall throughputs and online gaming requires very good performances in terms of jitter and round trip delay, on top of comfortable throughputs. To add to all of this there is a new constraint, the introduction time for new terminals or applications has significantly reduced; testing is being compressed; sometimes pushing the final testing phase directly to the field (particularly true for web applications). Operators then need to be very reactive to quickly adapt their network performances to each application, even more when they achieve massive success.

## Quality of Experience: what is this?

This sounds like a “buzz word”, but it reveals an important concept. As stated earlier, in the old days of circuit-switched-voice-only networks, as long as the circuit is open, and radio conditions are ok, subscribers are practically guaranteed to have decent voice services. With packet services, traps in the quality originate from many directions in the network. From congestion squeezing the bandwidth, to hiccups at any part of the packet network introducing delay, abnormal jitter or even packet loss. Measuring this information across the network gives an indication of the Quality of Service (QoS) of the network or Quality of Experience (QoE) when it deals with criteria directly linked to the way the end user experiences the service (indicators like overall throughputs or time to connect to the network). While these measurements are very important to get a good overall picture, Astellia is pushing the understanding of subscribers’ experience one step further with Perceived QoE. We have carried out extensive research and worked along side with many operators to understand what the key elements are to measure subscribers’ feelings across a wide set of valued applications. Astellia’s Packet Service Monitoring is now able to provide highly elaborated indicators which emulate subscribers’ perception. With indicators such as the time to access and download a web page (from PDP activation to the very last icon) or MMS average throughputs depending on the size of the file, operators can get direct access to what subscribers’ feeling can be while they enjoy Mobile Broadband. With such visibility, it is much easier to optimize a network from the Radio Access up to the Applications and Services platforms. All this with a single objective: increasing overall quality to the end users and anticipating problems before they hit the field. In the Mobile broadband world, customer satisfaction is directly linked to their spending. If the quality is not there, subscribers don’t use broadband services or simply go to the competition.



## Managing the traffic surge

So, the level of traffic has become enormous and will continue to grow as the terminal offer keeps on getting richer (Figure 3). Consequently, the quantity of information to be analyzed is also growing. Following the same path as network equipment, the capacity of monitoring systems had to evolve. Using state-of-the-art high capacity technologies along with innovative improvement in algorithms, Astellia's monitoring solutions have expanded their capacity in order to cope with this massive traffic increase.

If frequently used QoE indicators (such as usage statistics, throughputs, delays, ...) can be measured in real time, complex indicators measuring true Perceived QoE, require in-depth analysis with correlation of multiple information sent across the network during one or even several sessions. It therefore cannot be processed on the fly. On the other hand, Astellia believes that costs need to be adequately distributed between network equipment and monitoring systems. To allow operators to control monitoring costs, Astellia has developed the technology of multi-criteria targeted analysis(\*\*). Powered with highly efficient DPI technology, it allows operators that don't want to massively invest in large storage systems to narrow the deep dive analysis to selected traffic, while maintaining real time QoS and QoE statistics on the entire traffic. Using very innovative screening methods Astellia's system allows operators to select any portion of the traffic with acumen to run in-depth perceived QoE (\*) analysis. Selection can be done using a combination of criteria such as the type of traffic, application, network element, geographical zone, individual, group of users or even the type of terminal. Sampling is also made available for a statistical approach.

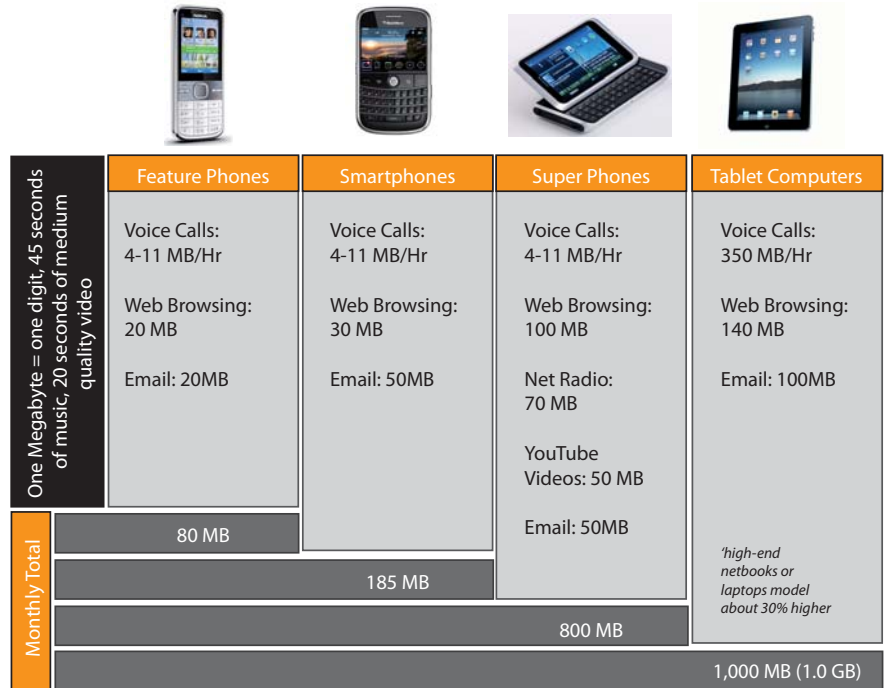


Figure 3: The expansion of devices and screen size increases the demand for higher bandwidth (source: GSA)

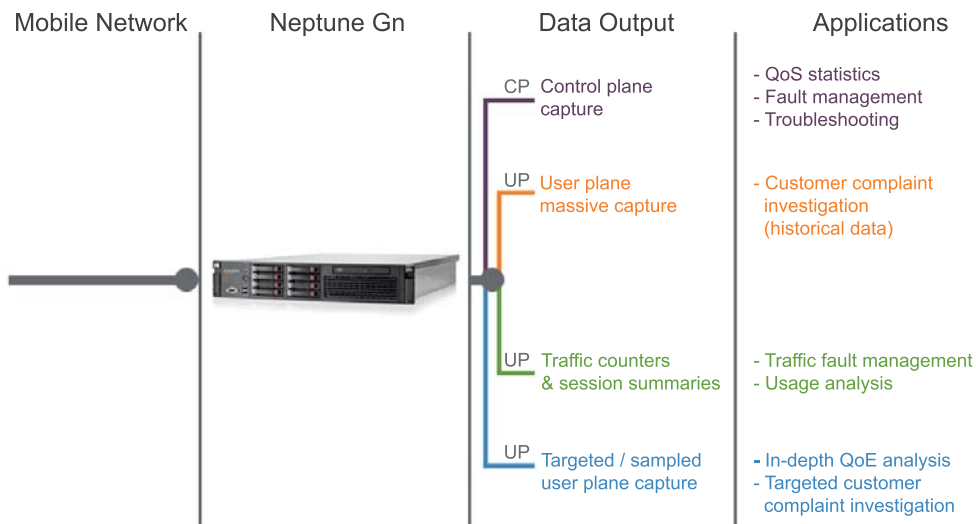


Figure 4: Accurate Monitoring requires traffic measurements as well as in depth analysis based on traffic or subscriber characteristics (source: Astellia)



### Some Examples of Traffic distribution

Traffic	Throughputs	Total Size
Mobile Voice Call	6 kbps - 12 kbps	0,5 MB - 1 MB
Land Voice (VoIP)	50 kbps - 100 kbps	4 MB - 8 MB
Music Stream	50 kbps - 300 kbps	4 MB - 25 MB
Mobile Video	150 kbps - 1Mbps	11 MB - 75 MB

Figure 5: Highlight of bandwidth requirements depending on type of usage (source: Astellia)

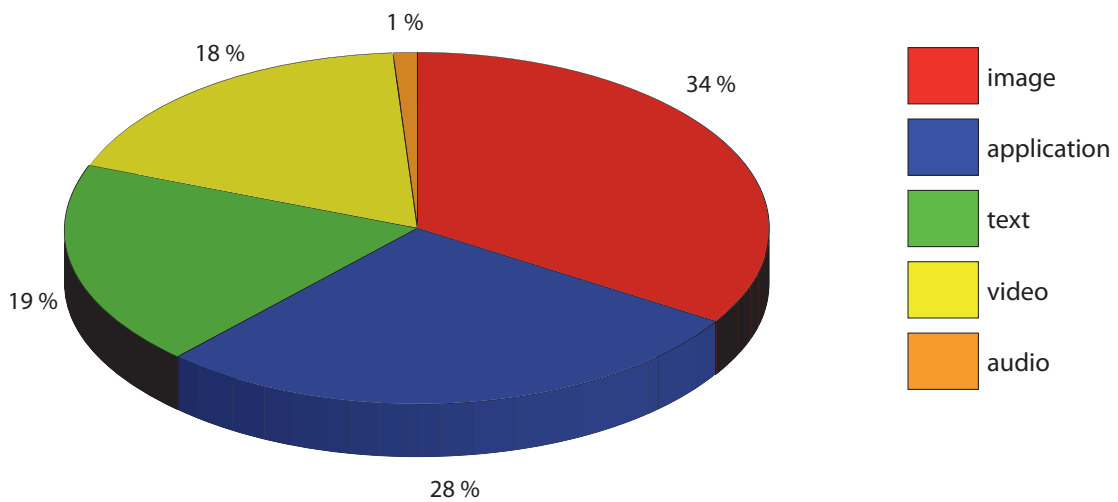


Figure 6: The importance of Multimedia in Mobile Broadband traffic; In this example, it represents more than 50% of the traffic (source: Astellia)



## Importance of correlating user plane with RAN information: End-to-End view

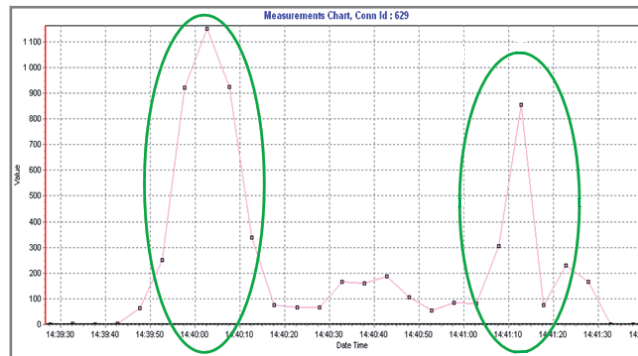
So radio technology has something to do with this matter! It is important to remember that the radio constraints faced in 2G have not disappeared and are even playing a more important role in Wireless Broadband.

Analyzing the user plane will give a very good picture of health of the network. When the time comes to investigate the causes of the degradation, it is important to have the full end-to-end visibility from the core to the access. For this reason, Astellia's solution increases operations teams' efficiency by providing rich information. With advanced correlation and enrichment mechanisms, Astellia's End-to-End monitoring solution can link information captured on the user plane of the Gn interface with information coming from the RAN, giving important information on radio conditions during a given session.

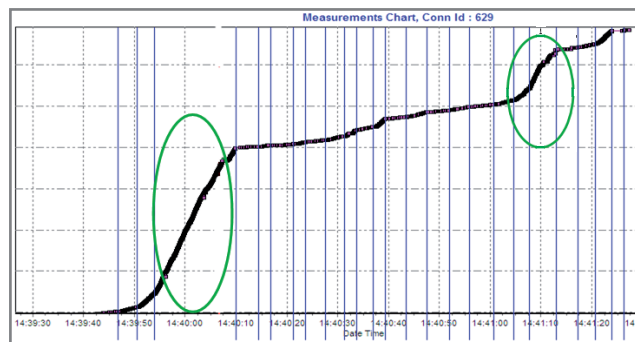
Let's take the example of a subscriber having trouble accessing his favourite video-on-demand program. Looking at the Gn shows weak throughputs. End-to-End visibility enables analysis of radio conditions, determining whether radio conditions deteriorate during the session (as shown in the highlighted example).

### Importance of End-to-End Visibility

This example started with throughput abnormally low observed on the Gn interface. The display of the throughput over time on PS interfaces shows the classical or well known "camel waves" effect. The throughputs increases then drops.



In such a case a correlated UTRAN investigation is the only way to find the root cause of the problem. For this example, the display of the evolution of the TCP sequence number over time shows a lot of reconfigurations of the radio bearer. Those events (highlighted with blue lines by Astellia's investigation tool) are triggered by the NodeB, thus interrupting the transmission of packets.



This example typically shows how critical it is to correlate PS investigation with RAN information. This real case – caused by the incorrect parameter setting of the RNC - would have taken days or weeks of investigation without End-To-End capabilities.

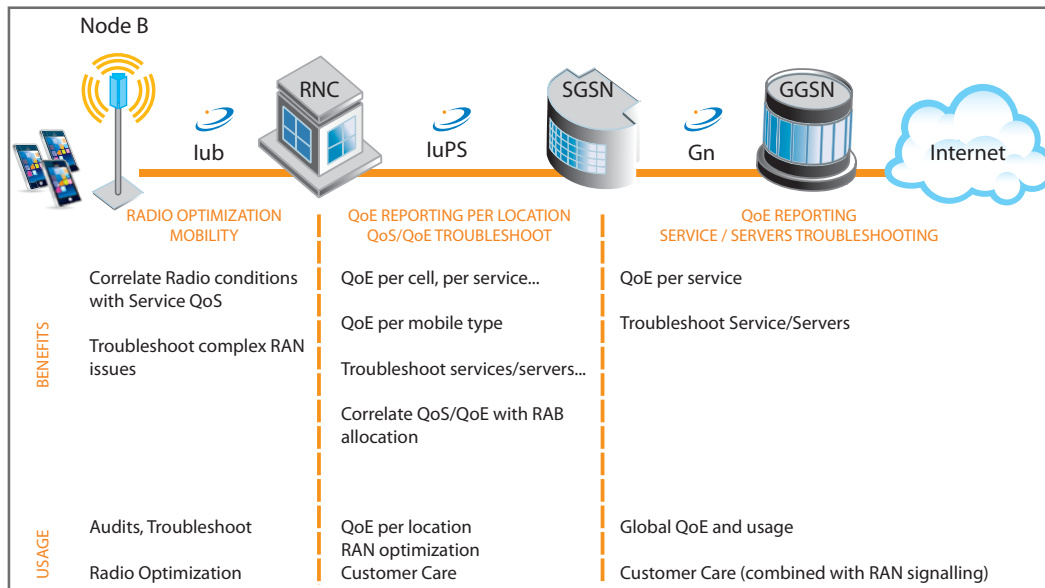


Figure 7: Different possible capture points (source: Astellia)

## Conclusion

When dealing with mobile broadband it is crucial to have a clear overall picture of what is happening on the network. Firstly, because data technologies don't eliminate radio issues - broadband wireless is still based on radio networks - but also because flat IP architecture is non hierarchical. Each traffic flow has an impact on its neighbour. Therefore, having a complete end-to-end view is necessary when it comes to pinpointing potential bottle necks or sources of problems.

Astellia's complete monitoring solution comprises all the necessary pieces and rules to complete the puzzle. From radio access to core packet data, from signaling analysis to application layer on the user plane, all these elements need to be brought together to understand the entire network behavior.





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