SOLUTION BRIEF

Reducing Wireless Network CAPEX Through Streamlined Planning

Network intelligence closes the network planning and optimization loop

The Mobile Network evolution challenge

Almost half the population of the Earth now uses mobile communications, according to the GSMA report, "The Mobile Economy 2013." It is now a well-known fact that all mobile operators must deal with the explosion in mobile data demand. Today, it appears that demand is accelerating: Ericsson forecasts[1] a 10-fold increase in the world's mobile data traffic between 2013 and 2019. This rise in data is primarily driven by subscribers' use of data-hungry mobile devices. According to Cisco's latest Visual Networking Index[2], smart mobile devices generated 29 times more traffic than non-smart mobile devices in 2013.

Filling the demand for mobile data

It is obvious to mobile operators that the 3G technology and optimization of their current mobile networks will not be enough to fill the demand for mobile data. Mobile operators are, therefore, forced to deploy new technologies, frequency bands and small cells that more efficiently utilize available frequency spectrum. This trend has driven global interest in LTE technology, small cells and heterogeneous networks (HetNets).

While the dominating trend is the tremendous growth in mobile data, interestingly, Informa Telecoms & Media reports[3] that mobile data traffic growth slowed substantially in mature LTE markets between August 2012 and April 2013, and that some countries are even showing a slight decline in Android smartphone users' average monthly cellular data use. This is probably due to a combination of factors such as more Wi-Fi off-loading and the introduction of new data plans that limit subscribers' monthly data usage.

Many markets are also becoming gradually more saturated, with reported "mobile penetration rates" well over 100 percent. This means that the number of active SIM cards exceeds the population in many regions, likely because so many people use several mobile subscriptions (e.g. different smart phones for work and personal, connected tablets, etc.).

Especially in saturated markets, customer retention is a key issue, as the cost to acquire new customers is much higher than the cost to retain existing customers. An Ericsson ConsumerLab report[4] found that network performance is the main driver of loyalty among mobile subscribers (measured by relative impact on net promoter score). Network performance was found to be twice as important as price (20 percent, as compared to 10 percent). In a survey[5] conducted by Mobile Europe, 86 percent of respondents agreed that network performance is the single most important customer experience metric.

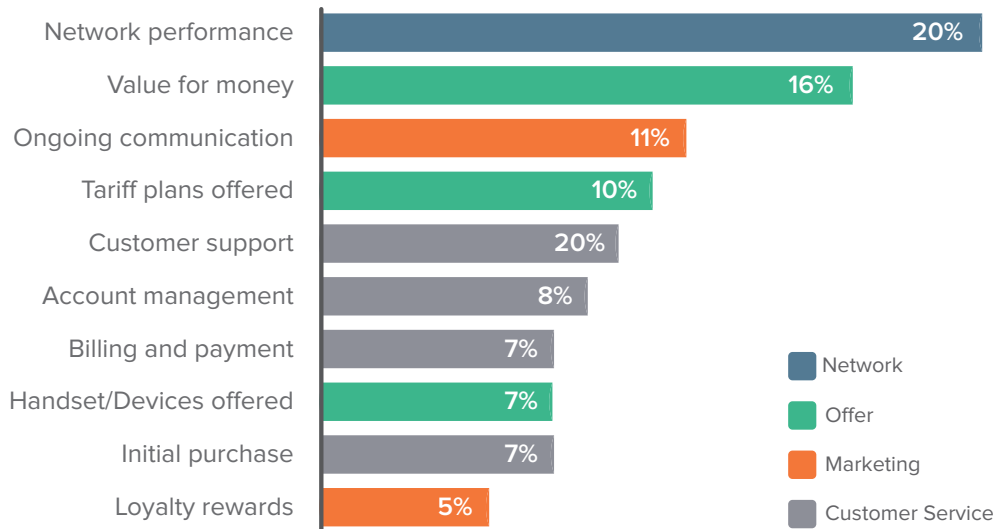## THE CHALLENGES FACED BY MOBILE NETWORK OPERATORS

Figure 1. Regression analysis showing the relative impact of each driver on Net Promoter Score
Source: Ericsson ConsumerLab, Global Network Performance Study, 2013

MOBILE NETWORK COMPLEXITY

Regardless of mobile operators' strategic path to meet subscribers' mobile data demand, one thing is clear: the complexity of mobile networks will grow as more technologies, equipment vendors, frequency bands and cells must be handled. With a small cell deployment strategy, three to four small cells per macro cell can be expected, according to Analysys Mason[6]. At the same time, mobile operators are under financial pressure to lower their operational costs per delivered payload ($/bit), and they will therefore need to seek out more efficient and streamlined workflows to handle the network complexity.
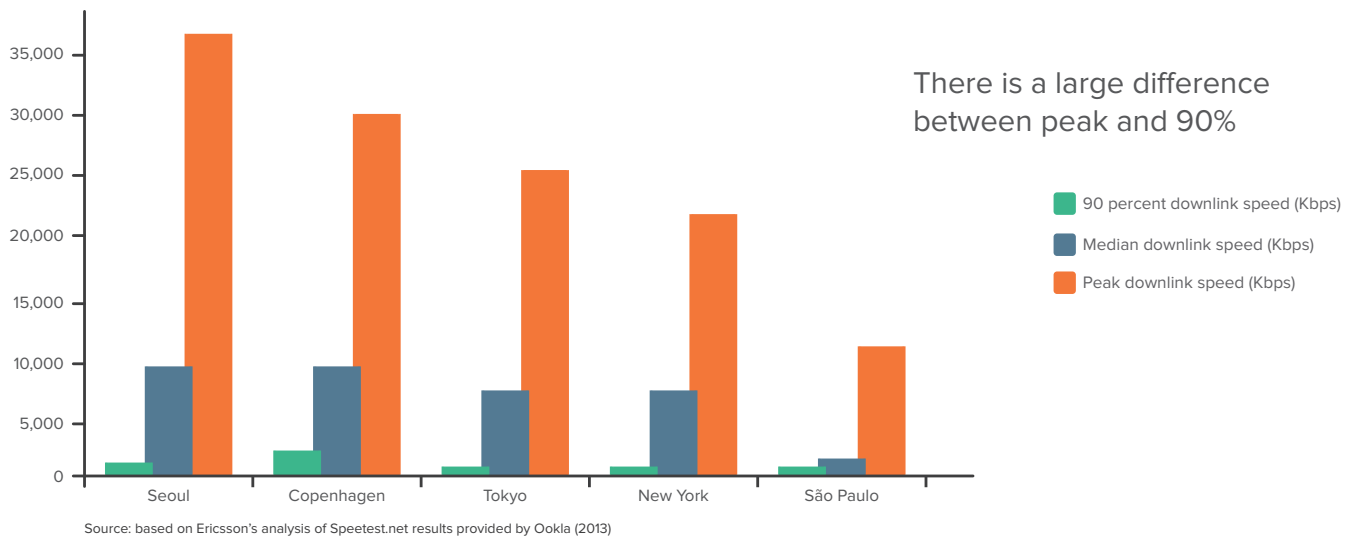
REACTIVE NETWORK PLANNING AND OPTIMIZATION

Fulfilling customers' expected quality of experience (QoE) is becoming increasingly important for mobile operators to avoid churn. With rapid changes in customers' demand for mobile data, there is a risk of being overrun with troubleshooting and reactive performance management, thus reducing mobile operators' focus on making larger, strategic decisions. The focus ought to be on proactive network planning that is based on long-term strategic goals, rather than on solving individual customer-reported issues as they happen.

OUTDATED TRAFFIC DATA

The challenging task of planning, building and operating mobile networks is often divided between many departments and teams within a mobile operator: teams that conduct cellular network planning, design, site acquisition, roll-out, drive testing, optimization, operations, etc. These teams are equipped with different sets of tools, have different ways of working and maintain different focus points. One very obvious issue with this structure is that network data cannot easily be shared amongst teams as it often requires manual and time-consuming steps, especially in today's multi-vendor networks with many different data sources. As a result, the network planning teams too often use outdated network traffic data – perhaps even several months old – that does not encompass the latest network traffic developments, such as new hotspots, which can evolve very quickly with the establishment of new, popular sites like stores, cafés and restaurants.

There is a large difference between peak and 90%

- ■ 90 percent downlink speed (Kbps)
- ■ Median downlink speed (Kbps)
- ■ Peak downlink speed (Kbps)

Source: based on Ericsson's analysis of Speetest.net results provided by Ookla (2013)

Figure 2. Comparison of peak, median and 90 percent probability downlink speeds
Source: Ericsson Mobility Report, November 2013

VARIABLE TRAFFIC PATTERNS

Because it is cumbersome to collect mobile traffic data, RF engineers often only use "busy hour traffic" as the basis for network planning and optimization. The busy hour traffic varies quite a lot across different locations and time of day, as well as between weekdays, weekends, holidays and event days. By only looking at the peak hour traffic, other traffic patterns are ignored – even if this is how customers will experience the mobile network most of the time. Network traffic data is often also seen as a single snapshot and is not used systematically to identify network traffic trends that eventually will impact subscribers' QoE.

TRADITIONAL WORKFLOWS IN SILOS

Another consequence of mobile operator teams using different data sets and tools is that new, more agile network planning and optimization strategies are hard to introduce if they are not supported by the engineering software. As a result, existing workflows are preserved, even if they aren't necessarily the most effective. The teams also have different views of the mobile network as it is hard to combine information across domains (e.g. combining

predicted network coverage with network performance management data). Traditional, siloed workflows make it hard to execute well-informed and timely decisions regarding network investments and network optimization, which affects both OPEX and CAPEX.

LACK OF FEEDBACK

Traditional workflows for network planning, roll-out, optimization and operation often result in a waterfall approach in that the network planning engineers will not automatically receive feedback on their network design. Did planned updates and new site and technology roll-outs improve the network as planned? Without direct feedback, the network planning team may repeat unnecessary mistakes and continue to create sub-optimal network roll-out plans. This is especially critical during the roll-out of a new technology, such as LTE. A complete performance management solution including LTE might not be in place until big parts of the network are already deployed. The whole organization will thus be forced to rely on costly drive tests during the LTE roll-out process, and will lack detailed knowledge about the traffic uptake in the network.

NETWORK OPTIMIZATION AND PLANNIGN EMPOWERED BY PERFORMANCE MANAGEMENT

MAKE THE RIGHT DECISION AT THE RIGHT TIME

Network planning and optimization teams can be more efficient with integrated access to network performance data, also known as key performance indicators (KPIs), via their engineering software. With embedded access to multi-vendor KPIs, mobile operators' workflows will become more streamlined.

Plus, by leveraging rich performance data collected from the network, RF engineers can truly understand the dynamics of an evolving mobile network. This insight enables mobile operators to stay ahead of the competitive curve by being more proactive about mobile network deployments, and making the right decisions at the right time.

Further, they can focus on providing network capacity where it is most needed and ensuring the QoE that customers expect, rather than using up valuable resources to reactively solve reported quality issues.
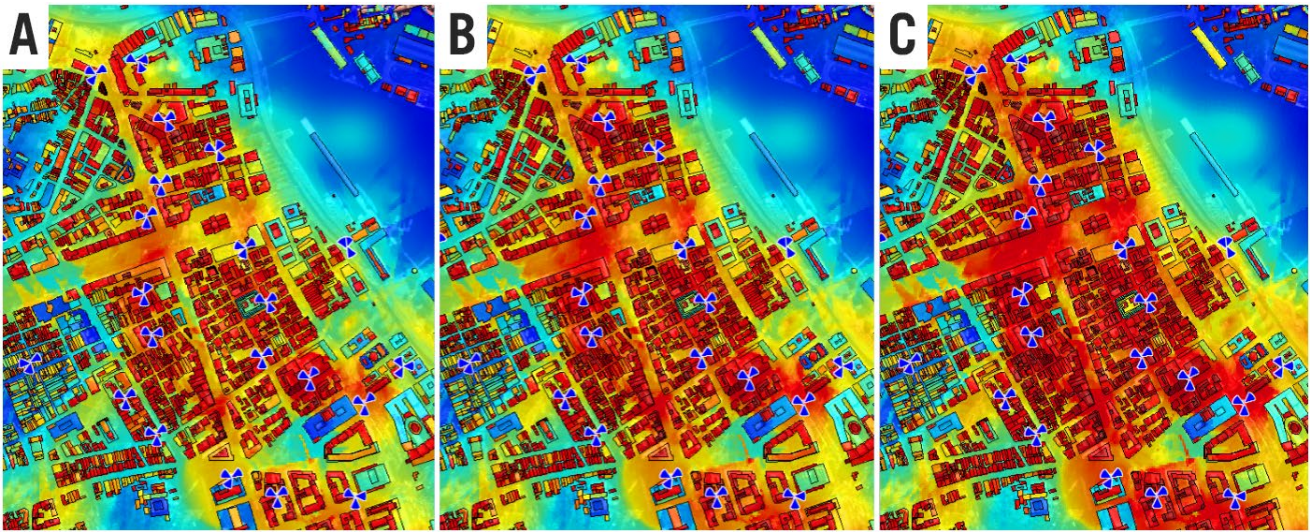
ACCURATE TRAFFIC MAPS AS INPUTS

The accuracy of mobile network planning is highly dependent on accurate inputs. Traffic maps, i.e. the geographic distributions of mobile data demand, are essential inputs to the mobile network analyses when determining where and when network investments are required. By using several sources of information, such as live traffic data and traffic forecasts from performance management systems, geographic distribution of social media usage patterns and geo-localized call traces from the network, the traffic maps' accuracy can be increased. Combined with high resolution geodata and scaling based on market trends and market strategies, even more accurate geographic views of the traffic demand can be created. These traffic maps, together with accurate network modelling and network analyses, are the foundation for creation of accurate coverage, capacity and quality maps. That accuracy can then be translated into CAPEX when network investments decisions are made.

Figure 3. The goal is high utilization of network and equipment while maintaining quality of service. Accurate traffic maps are required.

NETWORK INVESTMENTS WHERE AND WHEN REQUIRED

ACCURATE COVERAGE, CAPACITY AND QUALITY MAPS

NETWORK MODELLING AND ANALYSES	ACCURATE TRAFFIC MAPS				
	Geo-localized call traces	Live traffic data	Traffic forecasts	Social media usage data	High res Geodata

Figure 4. The ability to predict the traffic development in the mobile network based on the actual traffic trends in the network enabling more agile network planning and optimization. Here is a map of the evolving traffic demand in a city area. Today's traffic (A), in 3 months (B) and in 6 months (C). High traffic demand is shown in red color, medium traffic demand in yellow and low traffic demand in blue.

STRATEGIC NETWORK PLANNING

High data growth and mobile network complexity make strategic network planning more important than ever.

Mobile operators need to make well-informed, long-term decisions, and then align future decisions to their chosen paths.

Each mobile operator has their own constraints to consider when they evaluate different network options for the future.

This requires a network planning solution that pairs strong scenario-based planning support with a good understanding of traffic development in the network.

Several concurrent scenarios should be manageable and offer strong capabilities to evaluate RAN performance versus cost, and thus select the best scenario. Accurate traffic loads and traffic forecasting are also key inputs to strategic planning, and can be achieved by integrated access to multi-vendor traffic KPIs in a network planning solution.
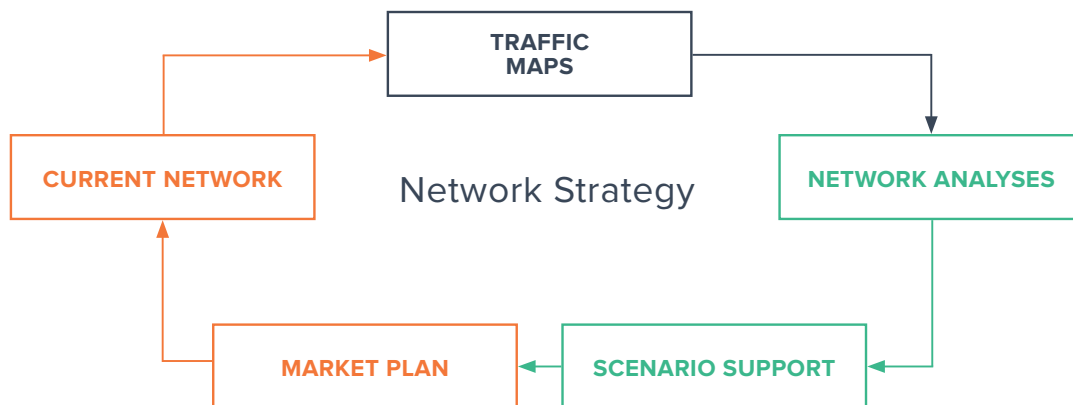
Figure 5. Mobile operators need to evaluate many different network scenarios to form a solid network strategy, e.g. the value of new frequency bands, gains by new technologies and deployment pace for small cells. Each mobile operator must consider their specific constraints in different scenarios to optimize their ROI.

NETWORK PLANNING AND DESIGN

During the network planning and design phase, network investments are detailed based on strategic planning as well as further input regarding the network quality and traffic development. Tying measured mobile network behavior with simulations of the future state of the network makes it possible for mobile operators to pre-empt performance issues rather than simply react to performance degradation. Current network traffic and forecasts for future traffic are both critical inputs to ensure that mobile capacity is added where it will matter the most. At the same time, denser networks mean added interference and conducting precise network planning is thus required to avoid interference and achieve an optimal utilization of the network investment.

The automated retrieval of up-to-date traffic loads and cell loads from the mobile network are necessary to ensure that the most accurate information is used, not only for the busy hour, but also for weekdays, specific times of day and during special event days, as traffic patterns can vary a lot. This process also requires a network planning solution with accurate network modelling and advanced analysis in 3D to address the actual locations of mobile devices (e.g. on different floors of a building).

Automatic cell planning functionality (ACP) can be very effective to optimize network configurations; when teamed with strong scenario support, it is easy to find the most cost-efficient solution to roll out.

NETWORK ROLL-OUT AND OPTIMIZATION

When a new mobile technology such as LTE is rolled out and traffic starts to come onto the network, mobile operators can begin to monitor network performance, even if it is initially based on only drive testing and friendly users. Performance management KPIs can help identify network configuration errors early so they can be corrected, optimize the network configuration, and monitor performance quality and traffic development – all very important tasks for mastering a new network layer.

When performance management is an integrated part of the network planning and optimization process, mobile operators can gain access to critical performance management (PM) and traffic KPIs from the early stages of the roll-out at a reasonable cost.

This data allows mobile operators to better understand the behavior of new technology and its traffic uptake. For instance, do customers adapt the new technology at the expected pace? Also, is it off-loading traffic from other network layers as expected? What is the geographic distribution of the traffic? With this very relevant input, mobile operators can adjust their network roll-outs based on actual customer behavior and network performance, and avoid disappointing early adopters with a low QoE.

Access to live network intelligence from within a network planning solution provides unique feedback to the network planning team. With this data, they can answer the question: does the network work as planned? And, if it does not, why? This information helps RF engineers master the deployment of a new technology faster. Plus, potentially costly mistakes can be rectified at an early stage. Once network traffic increases, advanced traffic forecasting based on live traffic development can be used to identify developing hotspots and other areas with potential future capacity issues.

The use of mobile services varies a lot between different days of the week and different times of the day. Events with large crowds, such as sporting events and music festivals, can cause extremely high traffic loads during just a few hours or days, in limited areas. Busy hour traffic measurements do not capture these variations and their consequences on subscribers' experience. Advanced selections of traffic data are therefore important to plan for different traffic situations.

Figure 6. Direct access to network performance data enables proactive planning and optimization. Here is an example of a city area where the users in the white areas suffer from to low data rates (below 6 mpbs) today. In 6 months' time, also red areas will have data rates below 6 mbps – the degradation is due to increasing mobile traffic in the network. Areas in blue will in 6 months' time still have acceptable data rates, i.e. above 6 mbps.

Figure 7. Number of dropped calls is one example of Performance Management Data that can be accessed from within Planet. Here the number of dropped calls for two cells during a day compared to the average number of dropped calls for the selected cells.

NEW FEATURES AND SERVICE INTRODUCTIONS

The technology evolution drives new releases and new network features, providing the opportunity to build more spectral efficient networks at a lower cost. New service options are also made available to mobile operators with each new release.
Voice-over-LTE (VoLTE) is an example of a new service introduction. The effect of these new features and services on the network must, of course, first be evaluated in the planning phase, and again in the deployment phase.

To have access to the main KPIs from within the network planning solution are highly useful when comparing the expected outcome with reality. Mobile operators need to ensure the quality of experience of both the newly introduced service and of the existing services in the mobile network in order to safeguard customers' expected quality of experience.

Infovista offers advanced software solutions that help mobile operators cost-effectively deliver the network capacity and QoE that customers expect, and thus help mobile operators reduce churn. These integrated systems harvest useful information and make it easily available, empowering mobile operators to make the right decisions at the right times. As network complexity increases, mobile operators need unified network planning and optimization systems rather than individual tools for specific tasks. Infovista's unified network planning and optimization solution provides properly synchronized network plans and network data for multiple technologies, offering instant and accurate views of network coverage, capacity, quality of service (QoS) and performance throughout the network lifecycle.

PLANET

Planet® is an innovative network planning, design and optimization platform with industry-leading support for new technologies. Planet uniquely provides mobile operators with:

- **Full 3D-planning capabilities:** Support for 3D traffic map generation based on unique Planet 3D fingerprinting technology.

- **Visualization** of outdoor and indoor coverage and capacity in 3D.

- **Multi-technology ACP** with unique spectral efficiency improvement goals.

- **Network traffic forecasting** based on network traffic development, enabling engineers to identify evolving hotspots and most relevant small cells placement.

- **Scenario management** and what-if analysis.

- **Native integration with VistaNEO** mobile network experience optimization solution to leverage its rich call trace data for live network analysis capabilities.

- **Layer generation from call trace data**: network analysis, interference matrices and highly accurate traffic maps based on call trace data inherited from VistaNEO.

- **Advanced traffic maps** based on a combination of network traffic forecasts, geo-localized call traces, social media usage data and high-resolution geodata.

- **Direct access to real-time network performance data** through VistaInsight for Planet. Graphical and statistical visualizations of KPIs to troubleshoot problems and optimize the mobile network

VISTAINSIGHT FOR PLANET

Enables mobile operators to easily leverage the most critical network performance management data in Infovista's Planet® and Vista360®. With VistaInsight® for Planet, mobile operators have access to:

- Live and historical network intelligence data from within Planet that can be applied to network analysis or troubleshooting.

- Pre-defined, multi-vendor, up-to-date KPIs, including cell throughputs (uplink and downlink), dropped call rates, the number of active users, handover success rates, etc.

- Advanced and temporal rich traffic KPIs for minimum, average, maximum, 95th percentile and daily maximum for any selected time period, such as a specific day of the week, weekdays, weekends or event days.

- Forecasts for network traffic loads and LTE cell loads based on actual traffic development.

- A web client option, Vista360, with access to all performance management data in VistaInsight for Planet.

- A performance management solution tailored for cost-efficient network planning and optimization, as well as network roll- outs of new technology. This solution can also be upgraded to end-to-end network performance management.

VISTA360

Vista360® is a powerful Web 2.0 application that provides a flexible, easy-to-use, self-service network performance dashboard and enables users to access the performance management data in VistaInsight for Planet.

XEUS

Xeus® is a powerful desktop analytics software solution that provides subscriber-aware mobile network optimization based on call traces and other sources. In Planet, call traces are geo-localized by an advanced RF fingerprinting algorithm and used to refine traffic maps by accounting for actual subscriber locations.

GEODATA

Geodata is a set of telecom-grade digital mapping data products designed specifically to work with network planning and optimization software. Geodata and CityScape HD provide mobile operators with substantial benefits, including improved propagation modeling accuracy, increased model reusability and robustness, and reduced reliance on propagation model calibration

SUMMARY

There once was a good reason for the distinction between network planning and network optimization, as workflows were based on different sets of engineering software that often required a long series of manual steps. The focus was mainly on delivering network coverage to high-paying customers and on reactive issue resolution.

Today, due to increasing network complexity, mobile operators need unified network planning and optimization systems rather than individual tools for specific tasks so they can best manage network investments and the evolution to large, multi-technology networks while also controlling OPEX.

The main goal for network planning and optimization efforts is to cost-effectively match rapidly-changing customer demands with adequate capacity and to deliver the QoE that customers expect in order to reduce churn. Infovista is passionate about equipping mobile operators with the solutions they require to efficiently manage the performance of the mobile network throughout its entire lifecycle.

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About Infovista

Infovista, the leader in modern network performance, provides complete visibility and unprecedented control to deliver brilliant experiences and maximum value with your network and applications. At the core of our approach are data and analytics, to give you real-time insights and make critical business decisions. Infovista offers a comprehensive line of solutions from radio network to enterprise to device throughout the lifecycle of your network. No other provider has this completeness of vision. Network operators worldwide depend on Infovista to deliver on the potential of their networks and applications to exceed user expectations every day. Know your network with Infovista.