

## WHITE PAPER

---

# Mobile Networks at the Tipping Point: The Data Explosion and Next Generation Network Challenge

Sponsored by: Juniper Networks

---

Godfrey Chua  
February 2010

## IN THIS WHITE PAPER

For several years now exploding data traffic has defined the mobile industry. Mobile network operators (MNOs), though quick to recognize and acknowledge this trend, have however been slow to respond to it. The economic reality is that voice continues to dominate and data, in aggregate, remains relatively small. With data not yet at a critical mass, the process of network and business transformation could be prolonged.

The scenario has fundamentally changed in the past 12 months. Today, **the mobile network finds itself at a critical tipping point**. The iPhone pioneer, AT&T, has for example seen data traffic rise nearly 5,000% over the last 12 quarters. The rapid expansion in mobile broadband service and the rise of iconic smartphone and connected devices (i.e. the Kindle, Nook and just released Apple iPad) have combined to create an unprecedented level of pressure on the MNO. This pressure is multi-faceted, spanning infrastructure and business model issues. On the infrastructure side, network congestion and poor quality of service is resulting from the explosion in data traffic. This can hinder subscriber growth and raise the risk of increased churn rates. Equally and if not more important is the pressure data traffic growth is creating on the traditional MNO business model. The rise in Internet access of applications and services is expanding at an unprecedented rate. This risk of disintermediation – of becoming that ever so highly feared "dumb pipe" – is at a level never before seen in the industry. It is in part represented by the fact that while data revenues are growing, the rate of expansion is nowhere near that of traffic growth. The non-linear relationship between revenue and traffic growth represents the fundamental cost related challenge MNOs face. It also represents the risk of disintermediation, which is the primary challenge to the MNO business model. Developments such as the proliferation of handset ecosystems (i.e. iPhone App Store, Android, etc.) are changing the traditional dynamic and balance of power between the handset supplier and MNO – and thus the respective revenues they are able to derive from the mobile customer base.

In facing these challenges, it will be important that MNOs make the right technology choices and choose strategic partners that enhance their business models. Technology that is future proof, best in class, and provides an immediate impact on network costs will ensure investment protection and deliver the most competitive network possible. An open ecosystem that enables strategic partnerships with key technology and development organizations will foster innovation and creativity that in turn will help MNOs initiate new business models and revenue streams. These elements are essential to the future competitive toolkit for MNOs across the globe.

This white paper examines the challenges facing MNOs as they confront the issue of exploding data traffic in their networks and as they migrate from 3G to 4G. It looks at the transformational challenges they face and the role technology plays in the process. In this context, the paper also discusses Juniper Networks Project Falcon initiative and its underlying philosophies. The Traffic Direct and Media Flow solutions, among the first to arise out of Project Falcon, is specifically studied. A total cost of ownership (TCO) model for the solution, as provided by Juniper, is also evaluated.

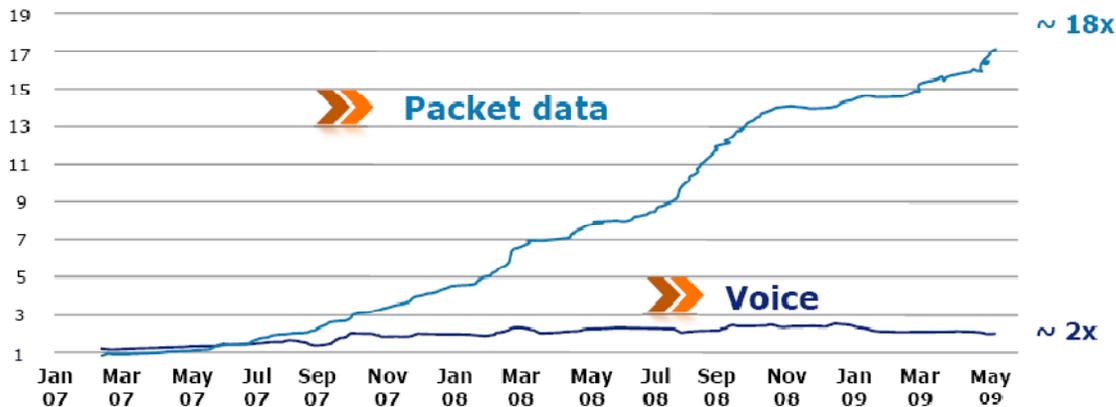
## SITUATION OVERVIEW

### Mobile Broadband: Fundamentally Transforming the Mobile Experience

The mobile network is the most important communications medium today. With well over 4 billion subscriptions and networks in every corner of the globe, the mobile network is the most ubiquitous means by which human beings communicate with one another. Amidst this unprecedented scale, a fundamental shift is taking place that promises to further amplify the role and utility of the mobile network. This shift is represented in the long standing notion of exploding data traffic over the mobile network (see **Figure 1**).

**FIGURE 1**

Mobile Data Traffic Explodes



Source: 3G Americas

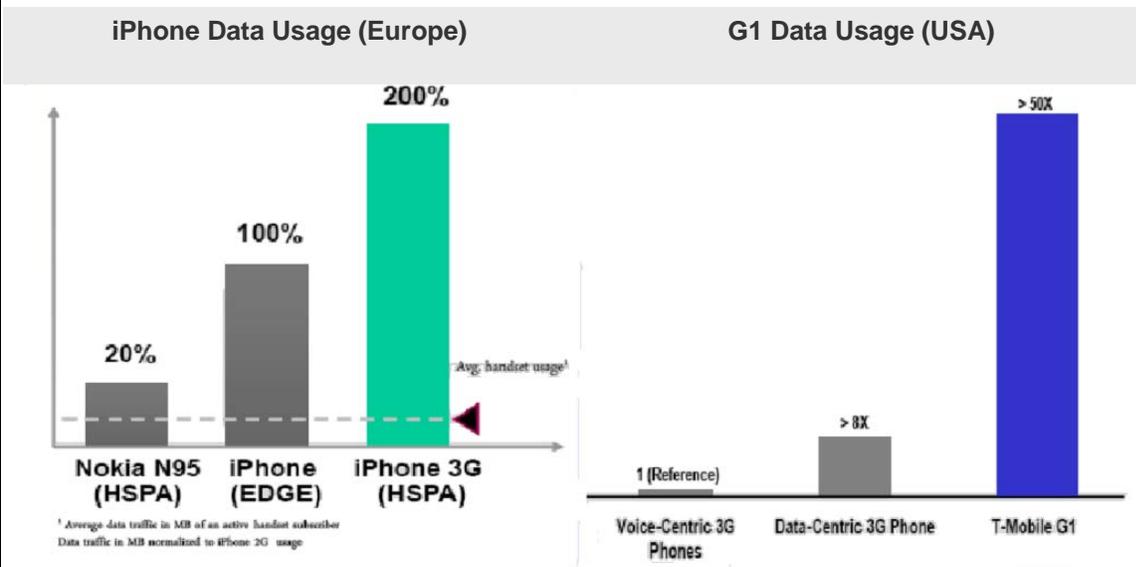
The rise in mobile data traffic has been fueled by a number of factors. The most influential of these has been the rise in mobile broadband services leveraging increasingly available 3G networks. Nearly 280 operators have deployed WCDMA networks (in 121 countries) and over 290 have implemented CDMA2000 systems (in 105 countries). This economies of scale has brought about declining device and service costs, key ingredients that have led to an accelerated pace of service uptake – especially in the last 12 to 18 months. As the base of laptops connected to the Internet via mobile broadband networks rise, the pressure these bandwidth hungry users apply to the mobile network has expanded exponentially. While the average 2G or 2.5G handheld user will consume tens of megabytes per month, the typical laptop user will consume between two to three gigabytes. With the prospect of more robust

and higher bandwidth 4G technologies such as LTE emerging, the potential for even greater levels of data consumption is a given.

Further contributing to the expansion of mobile data traffic is the rise of capable and iconic smartphones. These devices are already consuming as much as 300 megabytes of data per month. And the number is growing. Apple iPhone users, for example, are generating traffic at least two times greater than other smartphone users (see **Figure 2**). MNOs also report that as more applications are launched, that further leverage the connectivity of these devices to the mobile network, usage is expected to rise even further. While smartphones do not consume as much data as laptops, the pressure they create is the result of their sheer volume in the network. As of the latest IDC analysis, sales of smartphones (converged mobile devices) in the last quarter of 2009 grew 39% year over year and expanded 15% for the full year. In contrast, the overall device market grew only 11% in the fourth quarter and for the full year actually declined by 5%. Clearly, the general trend is towards data intensive smartphones such as the iPhone, the Blackberry suite of products and new offerings like Motorola's Droid.

**FIGURE 2**

The Rise of Capable and Iconic Smartphones



Source: T-Mobile

Another factor contributing to data growth is the rising complexity of the applications themselves. Consumption of rich media and video is increasing substantially. Rich media and video require significantly more bandwidth and consume greater capacity than traditional email or text-based messaging services. IDC conversations with MNOs reveal that video now accounts for as much as half to two-thirds of the overall data traffic. As usage continues to rise, demand for even higher levels of bandwidth and network capacity will arise. Expanded efforts to deliver personalized and customized services will add another layer of complexity and pressure on the network. Targeted advertising and services, for example, require real-time analysis of a customer's preferences, location and activity. Delivering this will demand not only

additional bandwidth and capacity, but also a significant level of network intelligence and IP competency.

**Mobile Network Operator: Two Fundamental Challenges**

The MNO therefore faces two fundamental challenges from the rise in mobile data traffic. First is containing costs in an environment of escalating usage. The non-linear relationship between data traffic and revenue growth means that the current status quo, in terms of technology, infrastructure and business models, can no longer be sustained. Second is the risk of disintermediation posed by the rapidly escalating use of "off-deck" applications and services – essentially, as MNO walled gardens inevitably begin to collapse, customers are en mass moving towards consumption of applications and services wherein the MNO has little to no revenue generating opportunity (see **Figure 3**).

**FIGURE 3**

Mobile Data Traffic Explosion and the Challenge to MNOs



Source: IDC, 2010

**Mobile Network Operators: Tools for Success**

The tools required for success therefore must naturally speak to the challenges described in **Figure 3**. MNOs must effectively decouple costs from bandwidth. To do so they must transform the network through technologies that substantially lower their "cost per bit." One conventional solution to expanding network capacity is by adding software and hardware elements to the service complex. Since this ala carte approach scales poorly, it does not address the non-linear relationship between data traffic and revenues. MNOs require a solution that provides an immediate reduction in TCO and simplification of the overall network, as both complexity and cost related stresses exist today. Solutions must also bridge the requirements of existing network technology with the next generation. This is critical given that nearly all MNOs are on a migration path or are planning a migration strategy from existing 3G technologies (whether in the CDMA or WCDMA roadmap) towards LTE.

To reduce the risk of disintermediation, it is important that MNOs embrace the realities of a collapsing walled garden and deploy a technology platform that encourages and enables an ecosystem of strategic partners that can deliver innovative applications and services – from which the MNO can then build new revenue streams. Essentially, the MNO must create an application blending environment where they are at the center of the value chain. Innovation must occur at

a rapid pace and enable multi-partner entitlement models that cater to new revenue concepts – such as those promised by ad-sponsored, fee or subscription based services. The environment must be an open and inherently secure user-driven platform that benefits from the creativity of a development community at large, a platform that leverages the advantages and business models from the Internet and Web 2.0 community into the telecommunications world.

## **JUNIPER'S OPEN AND SECURE EVOLVED PACKET CORE**

At the heart of Juniper's effort to address the MNO market is an internal initiative called Project Falcon. Project Falcon aims to develop products and solutions for the mobile packet core. It also encompasses subscriber management for 4G networks and seeks to facilitate "universal edge" applications that effectively combine wireless and wireline networks. The intelligent convergence of wireline and wireless will enable least cost bit routing, critical for cost structure and capital investment management, as well as the creation of media-rich applications suitable for consumer (i.e. multimedia entertainment) and enterprise (i.e. collaboration tools) consumption.

Underlying the Project Falcon program is the goal of delivering an *open and secure evolved packet core* for next generation mobile networks. Open speaks to a platform available for third party development of quality applications and services by firms that are fully vetted by Juniper. It also includes the creation of an ecosystem of strategic technology partners that further enhance the technology value proposition and address key MNO pain points. Secure speaks to the notion that, as the mobile network becomes more dominated by data based applications and services, its vulnerability to malicious activities, such as the propagation of viruses and malware, will be amplified and therefore must be guarded against.

Ultimately, Project Falcon aims to aid in the transformation of the mobile packet core along sensibilities that are defined by a future MNO network that is data-driven, demands tremendous and unprecedented scale, and sees a strategic emphasis on monetization based activities. Given the practicalities of the capacity and cost-based stresses facing MNOs today, their need for new revenue generation ideas, and the investment protection they require in light of the huge capital requirements for network transformation, Project Falcon seeks to answer these concerns through solutions that:

- ☒ **Immediately address 3G traffic overload challenges and reduce the total cost of ownership (TCO).** Rising costs as a result of exploding data traffic are threatening the traditional MNO business model. There is urgent need to create innovative solutions that provide an immediate reduction in the cost of delivering broadband service to customers and improve user experience. To this end, Juniper has introduced a new solution, Traffic Direct, to offload mobile data traffic directly to the Internet. Juniper's MX 3D platform provides an important foundation as it delivers best in class cost to performance ratios in key areas such as bandwidth and service scalability.
- ☒ **Enable new services and revenue models.** To encourage innovation, both in terms of applications delivered over the network, as well as technologies that solve capacity and performance related issues, a platform to enable participation from a broad set of developers and technology companies is required. For

Juniper, this means leveraging its standardized and open Junos software and partner development platform (Junos SDK and Junos Space). Juniper has partnered, for example, with Ankeena Networks to develop Juniper Media Flow, a rich content and video caching solution which enables a smooth viewing experience for mobile and fixed end users to lower the cost of content delivery and ensure quality of service. Given that video is the principle cause of network congestion – the Ankeena partnership addresses one of the most acute pain points. Another partnership of note is with Feeva Technology, a specialist in addressable digital advertising solutions. MNOs are, for example, already experimenting with the combination of location based services and digital advertising solutions to deliver highly relevant, customized, real-time services and special offers to customers.

☒ **Ensure investment protection via a seamless migration from 3G to LTE.**

The roadmap towards a high bandwidth IP based next generation wireless network has been confirmed by the more than 100 operator commitments to LTE. The investments being made into the mobile network today are enormous and it is imperative that, while investments address key pain points today, they must also be future proof and provide a seamless transition to next generation technologies such as LTE. This challenge is heightened by the inherent discontinuity between the legacy network, which is voice and TDM based (slow and expensive to expand), and the next generation which sees a clear emphasis on data applications, is based on IP architecture, and requires the ability to scale rapidly in multiple dimensions. To deliver on this IP architecture, Juniper is leveraging the MX 3D platform to add 3G and 4G gateway capabilities to its Mobile Core Evolution solution – thus paving a path that allows MNOs to capitalize upon LTE functionality over time.

**The Traffic Direct and Media Flow Solution**

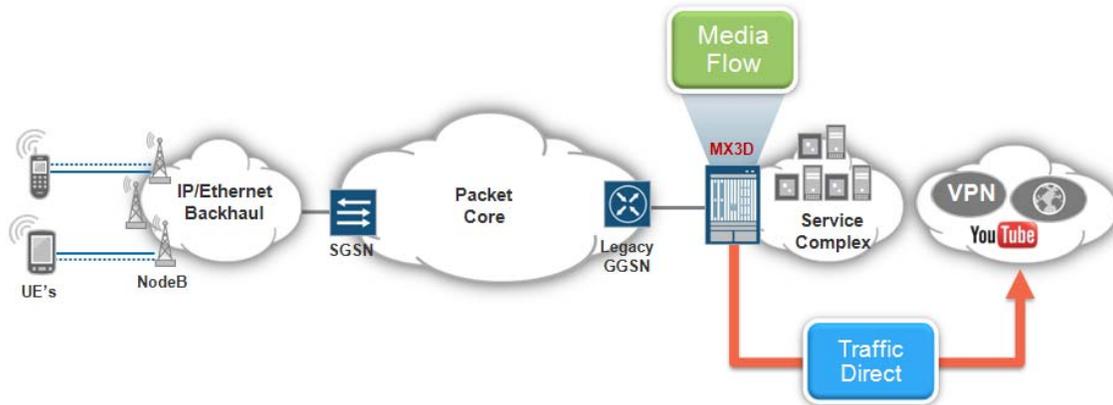
An early Project Falcon effort is Juniper's Traffic Direct and Media Flow solution. The solution offers a cost based value proposition that addresses the challenge of exploding data traffic in the mobile network. The concept is straightforward. As data traffic expands, one of the greatest challenges an MNO faces is how to effectively scale the service complex (comprised of hardware and software elements such as WAP gateways, content filters, firewalls, etc.). Expanding the service complex is a capex and opex intensive exercise. Adding to the challenge is the fact that many components are not inherently designed for the kind of volume and bandwidth required by 4G or for that matter a 3G network. As more elements are introduced into the service complex, it builds latency into the network which risks degrading the quality of experience. Juniper's solution proposes to offload the subscriber data traffic that does not have to go through the service complex. Juniper Media Flow, on the other hand, is a content caching solution that complements Traffic Direct by speeding the delivery of services to the customer. It also has the effect of reducing the transit costs an MNO has to contend with.

As IDC conversations with MNOs have confirmed, the majority of content responsible for the explosion in data traffic is web based and therefore does not actually require transit through the service complex. Offloading this traffic would substantially decrease the amount of capex and opex as much of the expansion would be obviated. Offloading also means that the data traffic would not be subjected to the

latency that is introduced in the service complex. Thus, it also creates the added benefit of an improved quality of experience.

**FIGURE 4**

Juniper Traffic Direct and Media Flow Solution



Source: Juniper

To review the Traffic Direct and Media Flow solution Juniper provided IDC with its full TCO model for the products. The following are IDC's observations after careful evaluation and manipulation of the model:

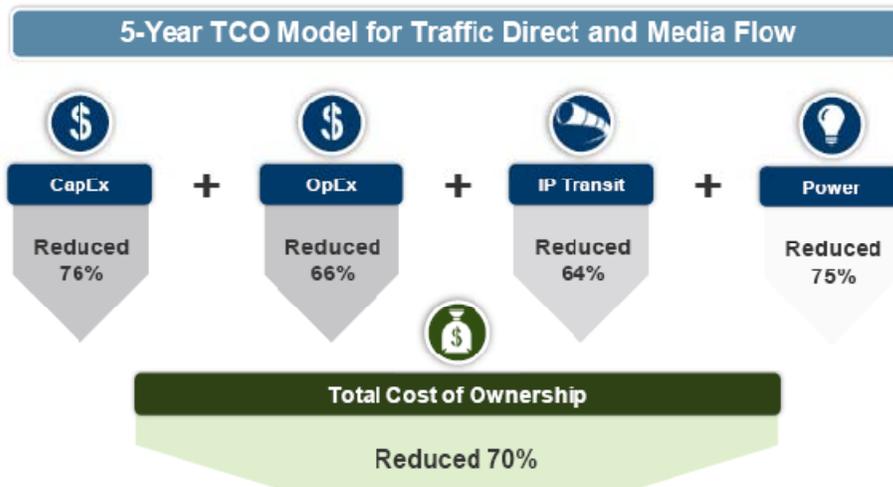
- ☒ Base level assumptions for mobile data, bandwidth and device growth built into the model are consistent with generally accepted trends in the industry. They do reflect the feedback IDC has obtained from a variety of MNOs across the globe. If anything, some of the assumptions may be conservative (i.e. average monthly data consumption levels). Usage patterns are continuing to evolve and a number of 4G networks have been reporting impressive data consumption levels as of late. Overall, the assumptions utilized by Juniper are particularly applicable to a developed market MNO scenario.
- ☒ Transit pricing and other operational costs items (i.e. power consumption, leasing, etc.) are also acceptable. To be sure, significant differences in variables such as transport, real estate and power costs exist from one market to another. The benchmarks utilized by the Juniper model fall within the range that can be found across a variety of markets across the globe.
- ☒ Hardware costs as represented in the Juniper TCO model are based upon generally accepted "list prices." While IDC believes these assumptions are directionally and proportionally consistent with market realities, it is important to recognize that in the fast evolving network infrastructure business significant pricing differentials are emerging as a result of professional service and support integration into more and more deals. Essentially, where margins can be sacrificed in one aspect of a deal, it can be made up for in another. Hardware costs can therefore see significant inconsistencies. Having said that, capex is but

one component of TCO and even with a comfortable margin of error factored in, the results remain directionally true.

With these observations in mind, Juniper's Traffic Direct and Media Flow solution delivers a TCO benefit of as much as 70% over a five year modeled scenario. Benefits are derived via the improved performance – lower net hardware and power consumption costs as delivered by the best in class Juniper MX960 router (used for the modeling exercise). The traffic offloading feature reduces requirements on the service complex, saving the MNO a significant amount of the capex and opex that would have been associated with scaling it further. Content caching features from Media Flow, on the other hand, substantially lower the transit costs an MNO has to pay for (see **Figure 5**).

**FIGURE 5**

Five Year TCO for Juniper Traffic Direct and Media Flow Solution



Source: Juniper

This result translates directly into the metric that matters most to MNOs – that of the production "cost per bit." Working with Juniper, the TCO model result was also translated into a scaled metric that allows for more generalized comparisons. The result of this exercise is seen below in **Figure 6**.

**FIGURE 6**

Juniper Traffic Direct and Media Flow Solution TCO



Source: Juniper

Another key attribute is the seamless migration from 3G to 4G that is afforded by the solution. It is an intermediary network device that has been scaled and purpose built for 4G networks (with inherent 3G capabilities). That it is placed into a 3G network means that it will be able to handle the transition to LTE. Since 100 plus operators have committed to move towards LTE over the next five years, this is critical and speaks to the addressable market Juniper is targeting. The 3G to 4G transition capability stems from the utilization of the next generation MX 3D series router platform. The platform delivers exceptional performance via its "3D scaling" capability. Traditionally, mobile networks only had to scale along the singular axis of subscriber capacity. Three-dimensionality adds the critical layers of bandwidth and services. Service was in the past essentially comprised of voice. The transforming MNO, on the other hand, sees service encompass a plethora of data based applications where the potential number is limitless. Going forward, multi-dimensional platform scalability will be an essential attribute of a successful MNO's network.

#### **Mobile Core Evolution and Unified Services Delivery**

Project Falcon efforts further emphasize the evolution of the packet core into a *fully monetized and cost-controlled converged network*. Juniper anticipates release of packet gateway functions combined with Junos Space and Junos SDK to deliver applications with capabilities such as those for the Serving Gateway (S-GW), Packet Data Network Gateway (PDN-GW) and Gateway GPRS Supporting Node (GGSN). The company stresses the investment protection provided by MX 3D scale and open APIs which provide immediate TCO reduction with Traffic Direct and migration to 3G and 4G service. Leveraging the MX 3D products, Juniper can also offer to distribute

mobile edge capabilities throughout the network and therefore increase the packet core scale. Such an effort would potentially allow the MNO to extend benefits of the Traffic Direct solution into other parts of the network and thereby further increase the savings potential as it enables the MNO to route appropriate traffic into the least cost options available at these network layers. Most recently for example, Juniper completed interoperability testing of DragonWave's ethernet microwave solution (the Horizon Compact product line) with its BX Multi-Access Gateway. Through this the two companies will have a collaborative go to market solution that addresses a key MNO pain point – mobile backhaul. All the systems will be built upon standardized Junos software and new service creation will be enabled via the Junos SDK. The Junos SDK will thus serve as the foundation for packet core monetization programs going forward.

Another key facet of Project Falcon is delivering on the vision of convergence. The MX 3D platform offers the capability to simultaneously support services across the wireline (business and residential services) and wireless access networks. Unifying the edge has the clear benefit of reducing the different elements and operating systems in the network, thereby simplifying inventory, operations and reducing capital requirements. More important is the unification of the service experience across the different access mediums. As more MNOs integrate with fixed line operations, inherent in their value proposition will be an integrated service delivery mechanism that ensures universal availability of business and consumer applications – regardless of access technology. To be sure, the MX 3D platform's scale and capacity are key features enabling this convergence at the edge.

## **AN OPERATOR VIEW: A EUROPEAN EXAMPLE**

In developing the viewpoints for this paper, IDC relied upon ongoing conversations with MNOs as well as specific interviews with operators independent of and as recommended by Juniper. One case particularly worth noting is that of a European operator providing an expanding set of wholesale services to MNOs. The operator provides support for some 40 million 3G subscribers, thus representing a significant scale of operations. Extensive adoption and use of video related content and services in its market has resulted in significant stresses to itself and the MNOs it is supporting. Recent traffic load analysis had pointed to video comprising as much as two-thirds of the total data traffic in the network. While the average smartphone user sees as much as 300 megabytes of use per month, this operator actually saw significantly greater usage due to the tremendous popularity of video in its market. With a multi-billion dollar infrastructure investment program in place, it was critical that it carefully evaluate the solutions available for scaling and lowering the cost of data and, in particular, video service delivery. To be sure, the operator is a firm believer in a variety of traffic offload techniques that lower their overall "cost per bit" to deliver service. From its evaluation efforts emerged the identification of a solution provided by Juniper and one of its key ecosystem partners. While the operator would not provide specifics of the potential TCO savings it anticipated for its own network, it did provide feedback on the model it used. Based on a network model with about half the size of the 3G subscriber base it was supporting on its actual network, the operator anticipated that the Juniper and partner solution could yield over a \$100 million in savings over a five year period. In contrast, another solution, outside of the status

quo, would yield only about a \$50 million saving. It attributed these results to the architecture offered by Juniper and its partner, as well as the strong performance of the Juniper MX 3D platform it tested. The operator noted that, in aggregate, this could reflect as much as a 6% to 8% savings in the total overall opex budget. It also mentioned that it is important to recognize that the benefits of the Juniper and partner solution are best realized when examined in the context of other network transformation initiatives (a holistic network transformation approach), rather than on its own.

## CHALLENGES

Juniper's solution offers MNOs an elegant means by which to change the economics of delivering data to customers today. At the same time, it ensures a seamless migration to next generation technologies such as LTE. Equally important is the open platform that allows for and enables the development of a robust technology and applications development ecosystem. However, infrastructure technology and a development platform is only the starting point and numerous other factors are critical to the successful transformation of an MNO. Thus, MNOs examining the Juniper value proposition, as well as those from other technology vendors, are advised to carefully consider the following:

- ☒ **An ecosystem is only as good as its participants:** No matter how conceptually open and enabling a technology platform for an ecosystem may be, its value is only as good as the sum of its participants. Application developers and technology companies will naturally gravitate towards environments that are supportive of their efforts and are best in class. However, the factor that ultimately determines participation is the potential economic reward. Choosing an open and effective platform and ecosystem is one thing. Equally important is choosing a platform and ecosystem that has the critical mass of developer and technology company support, participation, and buy in.
- ☒ **The mobile network has many moving parts:** The mobile core is undoubtedly a critical part of the network. Tremendous scale, flexibility and intelligence are now required for it. However, it is not the only part that matters. LTE base stations, for example, will substantially lower the cost of delivering service as a result of their flat, distributed architecture (i.e. removes the requirement for costly radio network controllers) and the implementation of self organizing network (SON) technology (i.e. lowers the cost of base station systems integration and maintenance). Network transformation and the technologies that enable it must be seen from a holistic, rather than compartmentalized, view.
- ☒ **The technical capabilities of the MNO still matter:** As much as MNOs are increasingly relying upon vendor provided professional services – and while vendor capabilities in this area are also expanding – the complementary technical and network execution capabilities of the MNO itself will continue to matter immensely. Time has consistently proven that these competencies provide a unique competitive advantage for a MNO. A MNO's ability to deliver a high quality network to their customers, via market leading technology and network execution competencies, has played a critical role in the rise of the leading MNOs around the world. MNOs with an inferior mobile network have, more often than not, been quickly relegated to the second tier.

## **CONCLUSION**

The mobile network is now at a key tipping point. Driven by powerful smartphones and compelling applications, mobile data traffic has sky-rocketed. This has created increasingly tense stress factors throughout the MNO's network and business model. MNOs can no longer prolong the process of transformation. The next decade will be defined by accelerating data traffic and transformation of the mobile business case towards the models and challenges of the Internet and Web 2.0. It is imperative that MNOs choose the right, future proof technologies to deliver immediate TCO reduction and best in class performance. They must also choose solutions that provide a platform that truly embraces and enables the notion of an open ecosystem of strategic technology and application partners. Juniper, through its Project Falcon initiative, is developing solutions with this underlying philosophy in mind. Products such as the Traffic Direct and Media Flow solutions, among the first to emerge from Project Falcon, offer a compelling value proposition and provide MNOs with an important piece to the puzzle that answers the question of "how can they remain competitive" in the decade ahead.

---

### **Copyright Notice**

External Publication of IDC Information and Data — Any IDC information that is to be used in advertising, press releases, or promotional materials requires prior written approval from the appropriate IDC Vice President or Country Manager. A draft of the proposed document should accompany any such request. IDC reserves the right to deny approval of external usage for any reason.

Copyright 2010 IDC. Reproduction without written permission is completely forbidden.