

Take Control

- ▶ The Importance of Subscriber, Service and Policy Control in Long Term Evolution



THE MOBILE PERSONALIZATION COMPANY

1. The Mobile Broadband Challenge

Mobile data services over 3G networks are proving successful in the market. 3G subscribers account for 350 million of the 3.5 Billion mobile subscribers worldwide, with more than 30 million being added every quarter. Revenues are growing at approximately 40 percent per year, as subscribers enjoy advanced devices and new multimedia applications. As shown in Figure 1, Mobile data traffic is expected to more than double every year between 2008 and 2013¹.

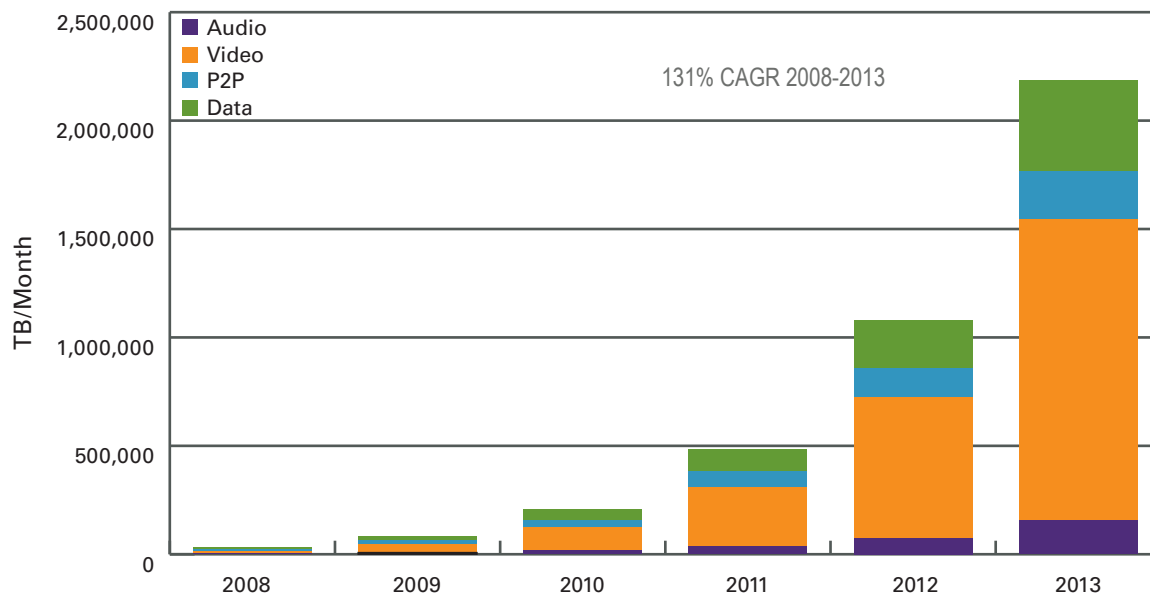


Figure 1: Mobile Data Traffic Growth (Source: Cisco, 2009)

As 3G services grow in popularity, service providers face several challenges. First, unlimited and flat rate plans and competitive pricing pressures are accelerating data usage, putting pressure on business models as revenues fail to keep pace with mobile data traffic growth. To support the continued mass market adoption of mobile data services, prices must continue to decline on a cost-per-bit basis without compromising profitability.

Second, the network is evolving to include not only person-to-person communication, but person-to-machine communication and machine-to-machine communication as more subscribers and devices become connected.

Third, the popularity of application stores and the proliferation of new multimedia applications is changing what subscribers expect from service providers. They want more personalized services, access to a broader range of applications, and more interactive features to engage with their social networks.

Finally, new devices such as smartphones, netbooks, smart meters, healthcare devices, video cameras, and weather monitoring equipment offer improved ways to communicate and connect, access the Internet, interact and collaborate, entertain, stay informed, and mobilize the enterprise.

Mobile service providers are realizing the need to optimize their network and service architectures to continue to grow capacity, lower costs, improve network performance, manage devices, and meet subscriber expectations.

¹ Cisco, 2009.

2. The Long Term Evolution Opportunity

Long Term Evolution (LTE) technology, standardized by the Third Generation Partnership Project (3GPP), is emerging as the next generation wireless technology that will lead the growth of mobile broadband services in the next decade. Its adoption by service providers around the world has the potential to generate economies of scale unprecedented by any previous generation of wireless networking technology as it becomes the universal 4G mobile platform used by both GSM/HSPA and CDMA/EVDO service providers.

LTE is critical to delivering the lower cost per bit, higher bandwidth, and subscriber experience needed to address the challenges of mobile broadband. It has the potential to transform how subscribers and machines use applications and content distributed over mobile and converged networks. The effect will be to increase the value of these networks and create favorable conditions for the continued mass market adoption of mobile broadband services.

LTE offers key benefits that can deliver significant value to service providers, enterprises, and subscribers (see Figure 2). From a service provider perspective, LTE offers:

- ▶ **Higher bandwidth throughput to mobile terminals and lower latencies**, enabling advanced services and applications such as streaming videos. Specifically, LTE delivers peak rates of at least 100 megabits per second and latencies lower than 10 milliseconds;
- ▶ **Lower cost per bit** as a result of greater spectrum efficiency, a simpler architecture, and a global infrastructure, device and application ecosystem;
- ▶ **A service-aware, “flat” mobile IP network infrastructure**, called the Evolved Packet Core (EPC), which allows for better management of network traffic growth, applications, services, and devices, a lower total cost of ownership, easier integration with other networks, and a better subscriber experience; and
- ▶ **New revenue opportunities** that offset declining voice revenues such as compelling applications and devices including person-to-person, person-to-machine and machine-to-machine services.

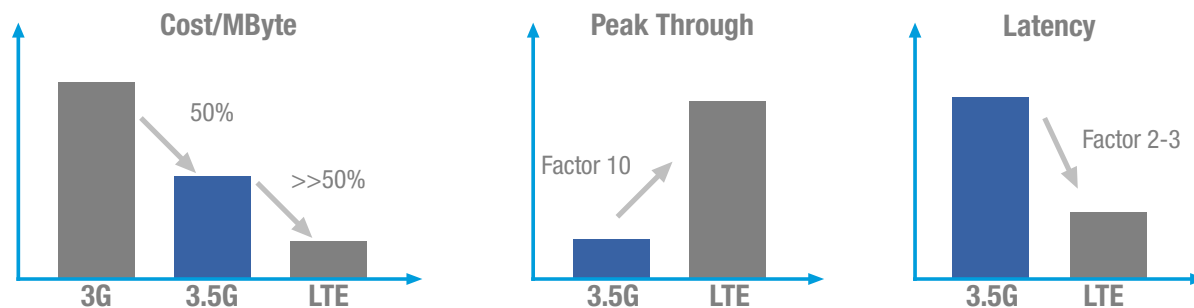


Figure 2: The Promise of LTE

For subscribers and enterprises, LTE promises a whole new level of mobile broadband experience as services become personal, participation becomes more social, behavior becomes more virtual, and usage reaches the mass market. It offers:

- ▶ **Significant speed and performance improvements** for multimedia applications at a lower cost;
- ▶ **Enhanced applications** such as video blogging, interactive TV, advanced gaming, mobile office, and social networking; and
- ▶ **A wider variety of devices** such as smartphones, netbooks, laptops, gaming and video devices as well as machine-to-machine supported applications including healthcare, transportation, and weather devices.

Some examples of LTE experiences for subscribers and enterprises are described in Table 1.

LTE is rapidly moving beyond standards and lab trials and into service provider trials and early implementations. Globally, more than 30 service providers have made the commitment to deploy LTE including Verizon, AT&T, Bell Canada, MetroPCS, and Telus in North America, NTT DoCoMo and KDDI in Japan, Telstra and Optus in Australia, and T-Mobile, Vodafone, Telefonica, TeliaSonera and FT Orange in Europe. Several manufacturers are planning a variety of data devices in support of this timeline.

LTE subscribers are expected to grow from 29.8 million to 340 million between 2012 and 2015, with the majority of this occurring initially in North America and Asia Pacific.² Analysts estimate that by 2015, the number of 4G subscribers will surpass 3G subscribers. This is five years less than it took 2G to surpass analog networks.³ The average bandwidth per subscriber is expected to grow more than ten-fold with LTE over 3G networks.⁴

3. The LTE Evolved Packet Core

To be a significant contributor to end-to-end service creation and enrich the subscriber experience, the LTE network must support an agile, scalable, and open approach. This will depend on:

- ▶ The network's capacity to support peak user data rates, high average data throughputs, and low latency;
- ▶ The ability to leverage existing 3G infrastructure investments with a network migration path to LTE;
- ▶ Ensuring service continuity and parity of existing revenue-critical 3G services, while supporting the rollout of new 4G services;
- ▶ Balancing insatiable demand for mobile data services with time-to-market and LTE rollout plan dependencies on spectrum availability, and a device, services, and applications ecosystem; and
- ▶ Innovative service plans that encourage mass market adoption.

Table 1: The LTE Experience

- ▶ **Imagine traveling to Europe** and you urgently need some documents including video and pictures for a customer presentation. The files exceed 1GB and can be downloaded quickly to your laptop computer with an LTE data card.
- ▶ **Imagine being on vacation and video recording a spectacular festival** with a high definition camera. You load the 500 MB file in less than a minute through your mobile device connected to your camera and share the experience in real time with your Facebook friends.
- ▶ **Imagine transmitting complex weather data and images from a weather monitoring station** to a central computer system for monitoring, analysis, and sending weather alerts.
- ▶ **Imagine accessing a secure electronic health record** including allergies, medical history, recent lab test results, and diagnostic images on your mobile medical device at all times. Your device automatically monitors your health condition and sends regular updates to your doctor's monitoring system.

² Yankee Group, July 2009

³ GSA, 2009

⁴ Informa, 2009

The LTE Evolved Packet Core (EPC) plays an important role in meeting these challenges and is a fundamental shift in mobile networks towards a service-aware, all-IP mobile broadband infrastructure. It has the potential to deliver a higher quality of experience at a lower cost, and improved management of subscribers, applications, devices and mobile data traffic.

The EPC has four main components as shown in Figure 3:

- ▶ The **Mobility Management Entity** (MME) which performs mobility and session management functions. It also manages complex features such as resource allocation and bearer control for multiple nodes and gateways;
- ▶ The **Serving Gateway** which routes data packets through the access network;
- ▶ The **Packet Data Network Gateway** which acts as the on-ramp and off-ramp to the Internet and other IP networks; and
- ▶ The **Home Subscriber Server, Policy Controller and Inter-working Functions** which together form the central control point and include the main repository for subscriber and device information, provide authorization and authentication functions for services, and apply policies to manage network resources, applications, devices, and subscribers.

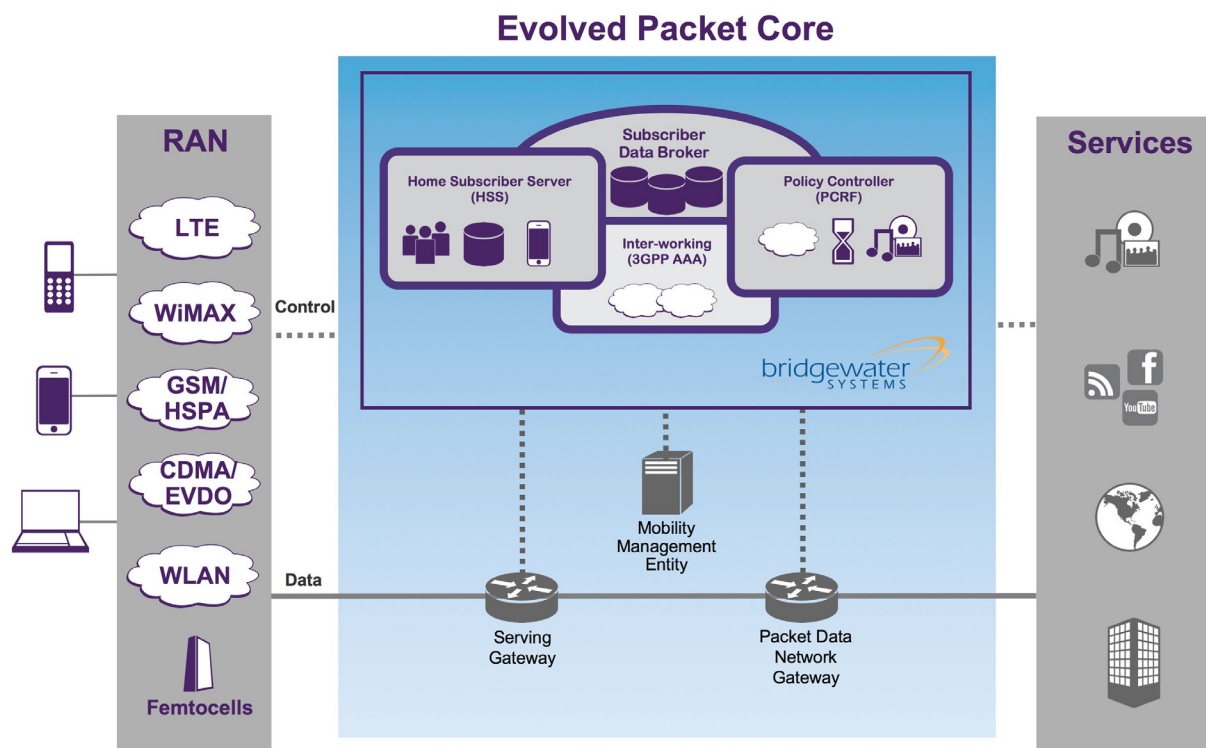


Figure 3: The Evolved Packet Core

4. The Importance of Subscriber, Service and Policy Control in LTE

As the rapid growth in subscribers, devices, and applications generate more mobile data traffic and complexity, service providers are anticipating the need to significantly increase their network capacity to meet this demand. They are investing in LTE radio, transport, and core infrastructure equipment to address the exponential growth in mobile data traffic.

However, bandwidth is a limited resource in much the same way as electricity. In the utility sector, smart meters are being used to manage electricity consumption. Utility service providers are combining smart meters with service plans designed to optimize how electricity is consumed. They are encouraging consumers and businesses to increase usage during off-peak hours with lower rates and decrease usage at peak hours with higher rates.

Mobile service providers will need to adopt a similar approach by supplementing capacity and infrastructure improvements with ‘smart’ subscriber, service, and policy control approaches that manage the flow and demand for data as shown in Figure 4.


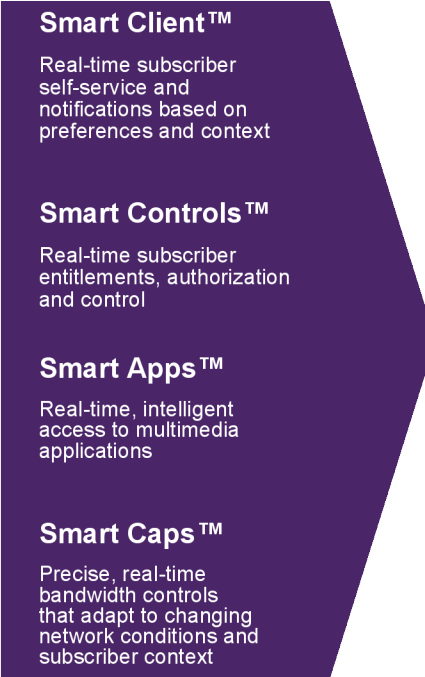



	Static Policy	Dynamic Policy	Adaptive Policy
 <p>Personalized Policy</p>	Online Subscriber Portal Service Information Usage Information	Service and Feature Subscription Time of Day/Day of Week Service Options	 <p>Smart Client™ Real-time subscriber self-service and notifications based on preferences and context</p> <p>Smart Controls™ Real-time subscriber entitlements, authorization and control</p> <p>Smart Apps™ Real-time, intelligent access to multimedia applications</p> <p>Smart Caps™ Precise, real-time bandwidth controls that adapt to changing network conditions and subscriber context</p>
 <p>Subscriber Policy</p>	Subscription Service plan Device type	Subscriber access to: <ul style="list-style-type: none"> • Mobile networks • Applications • Service enablement 	
 <p>Application Policy</p>	Simple applications <ul style="list-style-type: none"> • Messaging • Browsing • Ringtones 	Advanced applications <ul style="list-style-type: none"> • Music • Social Networking • Video 	
 <p>Network Policy</p>	Hard Caps Basic traffic shaping Basic QoS for all applications	Soft Caps Trend-based controls QoS on per application basis	

Figure 4: Bridgewater’s Smart Approach to Subscriber, Service and Policy Control

This smart approach enables service providers to use controls to moderate data traffic and entice subscribers with innovative, personalized services. Examples of such ‘service-shaping’ controls are shown in Table 2 below:

Network Policies	Application and Device Policies	Subscriber Policies
<ul style="list-style-type: none"> ▶ Apply Smart Caps™ which are a more flexible, real-time approach to bandwidth caps that allow service providers to optimize the allocation of available bandwidth across subscribers and ensure fair usage. ▶ Implement tiered services using policy controls such as quality of service and bandwidth tiers to reduce network congestion and personalize services. ▶ Apply service controls to shift data traffic to different access networks such as a WiFi network to optimize network resource usage. 	<ul style="list-style-type: none"> ▶ Design service plans that give bandwidth priority to certain applications over others depending on a subscriber's preferences. ▶ Provide incentives to use applications at certain times of day, days of the week, or in certain locations depending on mobile data traffic patterns. Charge a premium for application usage during peak times in high traffic locations. ▶ Use device policies to direct applications to the most appropriate device. 	<ul style="list-style-type: none"> ▶ Put control directly in the hands of subscribers by allowing them to set their own policies based on personal preferences such as prioritizing applications, and setting bandwidth, cost, or parental control limits and notifications. ▶ Provide special offers that use knowledge of subscribers' real-time usage, location, and behaviors such as a roaming day pass or bandwidth top-up.

Bridgewater Systems has developed best-of-breed subscriber, service, and policy control products for the LTE Evolved Packet Core that are interoperable with LTE equipment from industry leading vendors. Built upon proven products servicing 150 million subscribers, and over 140 service providers globally, Bridgewater's LTE solutions and service migration strategies are optimally designed for the performance and service demands of mobile broadband including:

- ▶ Managing the complexities of billions of mobile data transactions, and millions of subscribers, devices and applications;
- ▶ Enabling personalized services based on a unified view of subscriber preferences, state, and usage behaviors; and
- ▶ Centralizing control across all mobile access technologies including LTE, WiMAX, GSM/HSPA, CDMA/EVDO, WiFi, and Femtocells.

The company's LTE solutions include the Bridgewater® Home Subscriber Server and the Bridgewater® Policy Controller, both anchored by Bridgewater's Subscriber Data Broker™. These products meet the 3GPP release 8 standards and are interoperable with existing 3GPP and non-3GPP networks. Interworking with non-3GPP networks is supported by an Authorization, Authentication, and Accounting module as shown in Figure 3.

The Bridgewater® Home Subscriber Server (HSS) is a master repository that contains subscriber and device profile and state information, and manages subscriber identities, service profiles, authentication, authorization, and quality of service in real time. It federates data from existing Home Location Registers (HLR) as well as other databases to ensure smooth service migration.

The HSS is specifically designed for the challenges of mobile broadband and is more advanced than legacy HLRs which were designed for voice services as shown in Table 3. It has a flexible and distributed

data schema that can be easily extended to model other access networks and data services; it can handle more diverse applications with multiple attributes per subscriber; and is significantly more scalable than a typical HLR. The monolithic and inflexible data structures of the HLR are limiting the ability of service providers to fully capture service revenue opportunities, improve the subscriber experience, and contain costs. For these reasons, repurposing or evolving existing HLRs into an HSS can pose limitations. An alternative approach is to introduce a new HSS and federate data from existing HLRs as required.

Table 3: A Comparison of the Home Location Register and the Bridgewater Home Subscriber Server

Home Location Register	Bridgewater Home Subscriber Server
▶ Built for voice	▶ Built for data
▶ Scalable at higher cost per subscriber	▶ Scalable at lower cost per subscriber
▶ Simple, static subscriber profile	▶ Complex, dynamic subscriber profile
▶ Legacy, monolithic database silos	▶ Flexible, logical, distributed database architecture
▶ Independent management and provisioning	▶ Centralized management and provisioning
▶ Proprietary, custom, limited interfaces	▶ Open, off the shelf, multiple interfaces
▶ Costly data duplication	▶ Inexpensive data federation
▶ Slow service introduction – months	▶ Fast service introduction – days or weeks

Service providers will have 3G and 4G networks co-existing in their mobile networks for many years. An evolution to LTE that includes service migration and inter-working with existing networks is critical. The Inter-working Module (3GPP AAA) performs authentication, authorization, and mobility management to ensure seamless access to applications and services through non-3GPP networks such as EVDO, WiFi, WiMAX, and Femtocells. It also allows service providers to optimize and seamlessly offload mobile data traffic and applications across different networks.

The Policy Controller provides real-time network, application, and subscriber policies that allow service providers to manage mobile data growth and deliver personalized services. It is unique in the industry in leveraging multiple types of policy that work together to deliver a superior mobile experience. Network policies as described in LTE standards are performed by the Policy and Charging Rules Function (PCRF) in the Policy Controller. These policies enable service providers to manage mobile data traffic by applying real-time bandwidth controls that adapt to changing network conditions and subscriber context. The Bridgewater Policy Controller moves beyond LTE standards to support application and device policies that allow service providers to rapidly provision new applications and apply policies to determine what, where, and under which circumstances subscribers or devices can access applications. It also has subscriber policy capabilities that give subscribers direct policy control over their own mobile usage including: tracking real-time data, SMS, and applications usage; setting personalized limits, parental controls, and notifications; and receiving special offers.

The Subscriber Data Broker is an integral part of Bridgewater's LTE control solutions. It brings together rich subscriber data such as location, context, profile, and usage with the sophisticated tools to broker that data to multiple systems and applications to personalize services. This is particularly important in an open LTE ecosystem in which third-party devices and applications are commonplace.

5. Getting Ready for LTE

Many leading global service providers are deploying Bridgewater's subscriber, service and policy control solutions in 3G EVDO and HSPA networks. These future-proof solutions easily evolve to support LTE. By implementing these solutions in 3G networks today, service providers can derive the full benefits of these capabilities and be ready for LTE.

The Bridgewater Service Controller, which performs authorization, authentication and accounting in many 3G and 4G networks, and has advanced subscriber data management capabilities, provides one evolution path to the HSS for LTE subscriber and device management.

Over 65% of service providers polled in a recent Yankee Group survey require policy control currently or within the next 12 months to manage mobile data growth in their 3G networks and are not waiting for LTE (see Figure 5). The Bridgewater Policy Controller can be deployed in existing 3G networks and evolve to LTE when required since it supports both 3GPP Release 7 and Release 8 standards on the same platform.

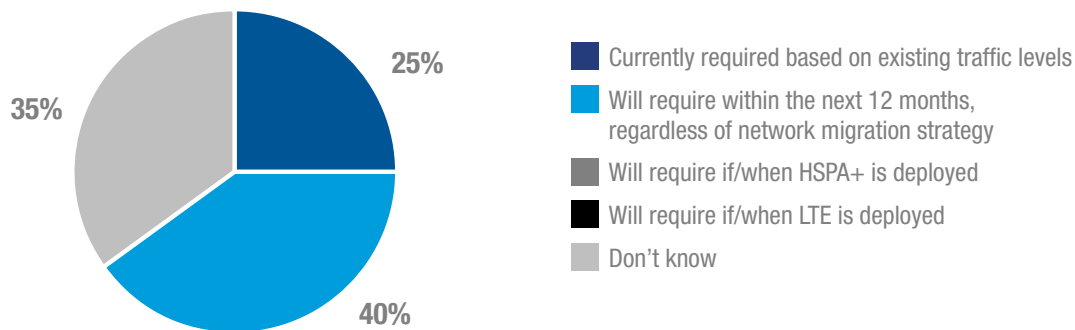


Figure 5: Policy Control Demand not Waiting for 4G (Source: Yankee Group, June 2009)

Service providers can achieve significant benefits by centralizing control across mobile access technologies. Benefits include smoother service migration and better management of mobile data traffic and applications such as the ability to direct traffic and applications to the optimal access network. This can result in significant capital and operating cost savings.

A flexible and modular approach to implementing control solutions is also an important factor in meeting different service provider LTE requirements. Bridgewater's Evolved Packet Core 'control-in-a-box' approach, which integrates subscriber, service, and policy control functions in an integrated system, is ideal for rapid LTE trials and initial deployments. Alternatively, single purpose HSS or Policy Control systems can be introduced as required in LTE implementations. Bridgewater's WideSpan® integrated system is designed for large scale LTE deployments. It integrates all LTE control products in a carrier-class blade server environment and has certified transaction throughput to manage rapid mobile data growth. Service Providers who have deployed the WideSpan system for 3G networks can easily evolve the system to meet 4G requirements.

LTE is well positioned to meet the requirements of next-generation mobile networks as subscribers embrace multimedia services and as machine-to-machine applications are adopted. It represents a significant opportunity for service providers to meet the challenges and opportunities of exponential mobile data growth by complimenting capacity and infrastructure investments with smart subscriber, service, and policy control. This approach enables service providers to control capital costs, manage the flow of data traffic, and create innovative and personalized service offers that entice subscribers and ensure profitability.

Bridgewater Systems, the mobile personalization company, enables service providers to efficiently manage and profit from mobile data services, content and commerce. The company's market leading mobile personalization portfolio provides a real-time, unified view of subscribers including entitlements, devices, networks, billing profiles, preferences and context. Anchored by Bridgewater's Subscriber Data Broker™, the portfolio of carrier-grade and standards-based products includes the Bridgewater® Service Controller (AAA), the Bridgewater® Policy Controller (PCRF) and the Bridgewater® Home Subscriber Server (HSS). More than 120 leading service providers including America Movil, Bell Canada, Clearwire, Cox, Hutchison Telecom, Iusacell, Scartel, SmartTone-Vodafone, Sprint, Tata Teleservices, Tatung, Telmex, Telstra, and Verizon Wireless use Bridgewater's solutions to rapidly deliver innovative mobile services to over 150 million subscribers. For more information, visit us at www.bridgewatersystems.com.

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