



# LTE AND OFFLINE CHARGING

DRIVING THE NEED FOR A LOWER  
TOTAL COST OF MEDIATION

**A WHITE PAPER**



## INTRODUCTION

The increasing customer demand for mobile data services is widely publicized in both the general media and telecoms press. Cisco forecasts global mobile traffic will increase sevenfold between 2016 and 2021<sup>1</sup>. Current growth is driven by the popularity of new devices, like smartphones and tablets, and the rising use of data consuming mobile applications from a variety of App Stores (like Apple and Google). Future growth is expected to be driven by mobile video services, and Cisco estimates that 75 percent of mobile data traffic will be video by 2021.

To address these incredible growth projections, operators are investing in network evolutions to support this capacity. Today, HSPA (High Speed Packet Access) is the leading mobile broadband technology globally and 3G/HSPA networks cover more than 80 percent of the world's population<sup>2,3</sup>. However, many mobile operators around the world are looking beyond today's technologies to invest in Long Term Evolution (LTE). LTE offers faster data speeds and the ability to squeeze more bits of data into the

same amount of spectrum than existing networks, resulting in increased capacity and faster upload/download speeds.

## LTE IS BECOMING THE TECHNOLOGY OF CHOICE FOR MEETING TOMORROW'S DEMAND

LTE has broad commitment from both service providers and network equipment providers around the world. As of August 2016, 521 operators had launched LTE networks<sup>4</sup>. And it is expected that LTE continues to gain traction for three reasons: firstly, because both GSM and CDMA operators can migrate to LTE it is expected to become the single standard for mobile networks; secondly, LTE can be deployed at lower cost than 3G because it more easily allows network sharing and uses a simplified IP architecture; and lastly LTE can be deployed using a small amount of spectrum, or alongside existing networks.

<sup>1</sup>Cisco, "Global Mobile Data Traffic Forecast Update, 2016-2021", March 2017

<sup>2</sup>Global mobile Suppliers Association, "HSPA Operator Commitments", 24 January 2011

<sup>3</sup>Global mobile Suppliers Association, "GSA GSA confirms 521 LTE networks launched, LTE-Advanced now mainstream," August 2016

<sup>4</sup>Global Mobile Suppliers Association, "Global mobile trends," October 2016



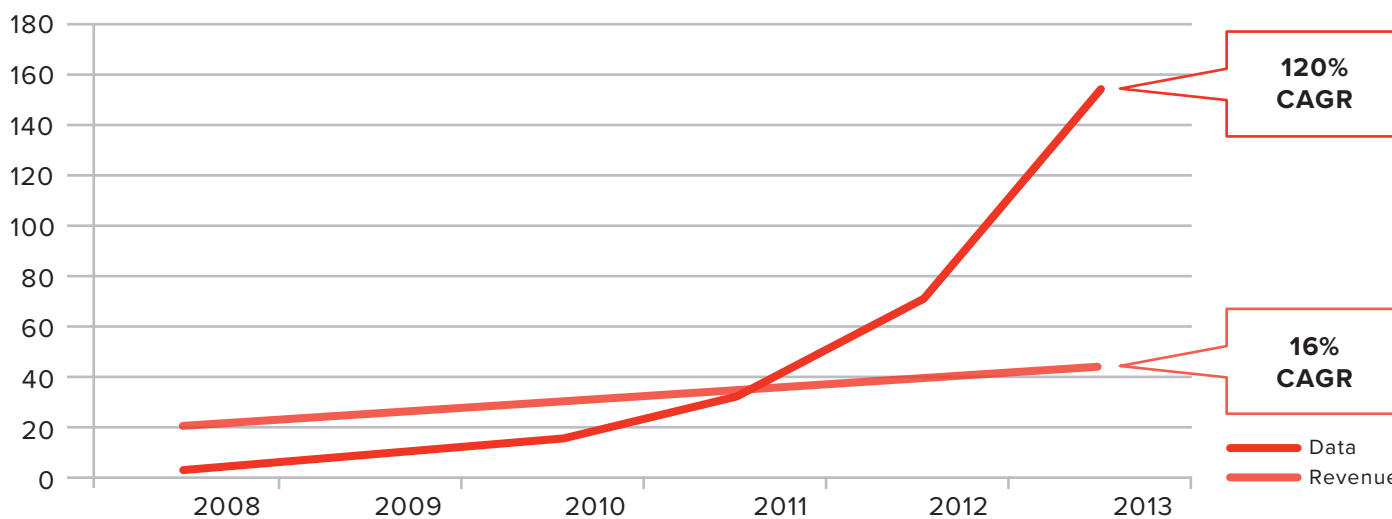
Regulators around the world are allocating spectrum for LTE, particularly in the spectrum freed up from switching off analogue TV (800MHz). More auctions and awards of spectrum suitable for LTE are expected in the coming months.

Mobile broadband is the first service being supported for most LTE deployments, with data cards and USB devices compatible being available first. It is expected they will be followed by mobile phones and a wider range of services, including voice over LTE, in the near future.

### LTE AND MOBILE DATA GROWTH ARE DRIVING THE NEED FOR A LOWER TOTAL COST OF MEDIATION

Whilst LTE provides a solution to capacity challenges, operators face a significant business problem, because revenues for mobile data services are not expected to grow as quickly as customer demand, as illustrated by analysts Analysys Mason in the chart below<sup>5</sup>.

Furthermore, it is widely recognized that the cost of building and operating networks is rising, whilst revenues are falling. In fact, a study by Tellabs predicted that network costs would surpass revenues, and that if operators maintained their current operating model they could have seen an end of profit within a four-year window<sup>6</sup>.



Source: Analysys Mason 2010

Figure 1: Demand for mobile broadband is expected to grow faster than revenues

<sup>5</sup>OSS Observer, part of Analysys Mason, CEO Digest, January 2010

<sup>6</sup>Tellabs, "End of Profit study, Executive Summary", February 2011



As a result service provider executives responsible for Business Support Systems (BSS) are being tasked with delivering innovations to improve revenues, whilst also lowering costs. To maximize revenue opportunities BSS managers are deploying real time charging and policy management solutions, like the CSG Charging and Policy solution. Whilst on the cost side of the equation they are trying to minimize the Total Cost of Ownership (TCO) of currently installed systems. This places particular emphasis on controlling the costs to run and operate mediation systems and Offline Charging for IP services.

### **LTE AND OFFLINE CHARGING CREATE NEW CHALLENGES FOR MEDIATION**

At the same time as reducing mediation costs, BSS managers need to upgrade existing mediation systems to support Offline Charging for LTE services.

To support the LTE radio infrastructure, a new core network must be deployed. The Evolved Packet Core (EPC) is simplified for data and, unlike 2G/3G, uses IP from end-to-end. Operators can use the EPC to manage not just LTE network access, but also 2G, 3G and WiFi, and as a result some operators are deploying the EPC before LTE spectrum allocation.

Consequently, the EPC creates a new touch point for BSS into the network, and the services delivered over LTE networks create a number of specific challenges for mediation. Mediation must evolve to support the Offline Charging requirements for next generation charging as specified by the Third Generation Partnership Project (3GPP) standards body.<sup>7</sup>

This paper explores the new demands on mediation to support the growing demand for data services and presents factors to consider when lowering the total cost of mediation ownership. It outlines what LTE means for mediation and describes the unique challenges of Offline Charging. Finally the paper describes the approach many operators are taking to support high growth data mediation and puts forward what service provider executives are taking into consideration when selecting a next generation mediation supplier for Offline Charging.

### **INCUMBENT MEDIATION SYSTEMS CANNOT COPE WITH NEW DEMANDS**

Many incumbent mediation systems cannot scale to meet the volume growth anticipated for future LTE services, or indeed the current demand for IP services delivered by 3G/HSPA. In particular, for offline mediation, the processing of data records is taking too long. For one operator in Western Europe each day's post event mediation processing was taking until 3 a.m. to complete. This was slowing the time to billing and creating revenue assurance risks as fraud systems were not seeing processed charging records on time.

Many operators anticipate that the current mediation systems will reach capacity limits in less than a year. Some even calculate that incumbent systems can only support demand for the next few months, without intervention.

<sup>7</sup>3GPP, "TS 23.203 Policy and charging control architecture"



### FAST GROWING VOLUMES IMPACT MEDIATION COSTS

In the short term, operators are being forced to do three things to cope with enormous volume growth:

Firstly, BSS managers are having to allocate more systems administration effort to ensure charging data is reliably processed. This diverts the time of skilled resources from contributing to strategic value-building programs to working on repetitive tactical tasks that are error prone. Ultimately supporting such administrative activities increases the burden of mediation on OPEX.

Secondly, managers are resorting to upgrades of the hardware that incumbent mediation systems are running on. Typically this involves adding extra system

resources (processors, memory) to legacy server platforms. This can be expensive when hardware is reaching de-support dates or the end of its useful lifespan, as the costs of upgrades and extensions to support contracts can be disproportionately high. Also if existing mediation applications do not scale linearly even more hardware is needed to meet the performance requirements.

Thirdly, managers are also forced to upgrade third party product licences in line with hardware upgrades. This is particularly significant for mediation applications that require the use of a database like Oracle. Extending Oracle licences and support can cost as a much as \$680,000 when upgrading a small five year old server cluster from eight to sixteen processor cores<sup>8</sup>:

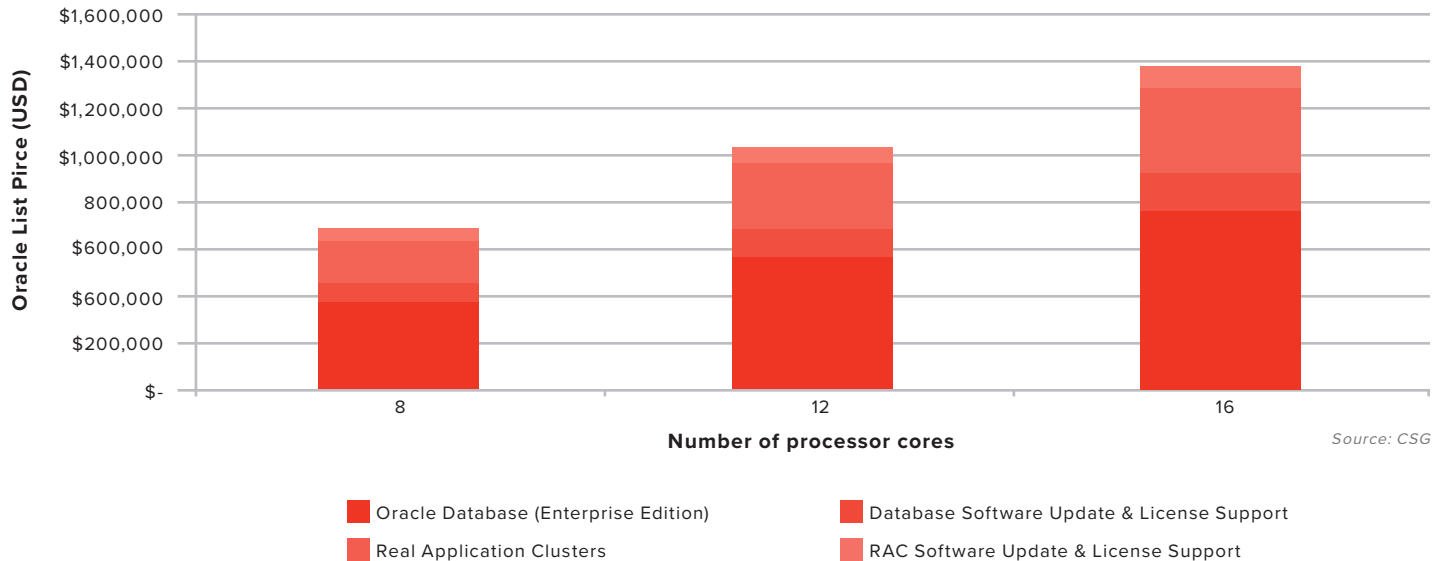


Figure 2: Oracle costs to scale some mediation platforms can be very high

<sup>8</sup>Price for upgrading two HP Integrity rx7620 servers from four to eight Itanium 2 processors (single core 1.5 GHz with 6 MB cache), with Oracle Enterprise Edition and Real Application Clusters, according to Oracle Technology Global Price List, 20 January 2011.



Further, because incumbent systems are running out of capacity so fast, many operators are having to allocate CAPEX budget to mediation in an unplanned manner. This has deeper implications because obtaining emergency funding distracts BSS managers from long term strategic programs.

## LOWERING THE TOTAL COST OF OWNERSHIP FOR MEDIATION

There are three fundamental components of TCO for mediation systems: application software and support; platform expenditures; and staffing costs. Each cost component is affected by different aspects of each mediation solution.

Firstly, software and support costs are determined by mediation vendor pricing policies, for example, selecting a provider that does not charge additional licenses for new network interfaces can lower the total cost of mediation.

Next, platform costs are predominantly based on the cost of servers, storage, database licenses, power (including UPS), air conditioning and rack space. The biggest factor affecting these costs and the overall TCO of mediation is application performance. Mediation applications should minimize the hardware system resources needed to process forecast event volume throughputs and latency to lower platform costs. Mediation software that requires fewer servers, with fewer processors and less memory lowers the mediation TCO. Higher performance applications also reduce the data center costs as less rack space is needed and less power consumption is required for operations. This also reduces the heat dissipation and so lowers the costs of server room cooling. All

these factors lower energy consumption, which helps operators to reduce carbon emissions, an important objective for overall corporate responsibility.

Finally, staffing costs are affected by how easy the mediation application is to use, and also by the system architecture. Mediation software should be designed to optimize the efficiency of mediation operations and should have tools to enable the fast implementation of new services. Integrated Development Environments (IDEs) tailored for configuring and testing mediation business logic are a prerequisite of a modern mediation application.

Lastly, some mediation applications require a database and need expensive database administrators (DBAs) to maintain and tune the system to support the continuously available configurations needed for next generation IP services. Whereas other applications have fewer platform dependencies and can be deployed on commodity hardware, which reduces the burden on hardware specialists and administrators.

## LTE CREATES NEW CHALLENGES FOR MEDIATION

In addition to reducing mediation costs, BSS managers must support new networks. Operators that choose to implement the 3GPP standards for LTE charging are typically using the 3GPP Release 8 standards, which describe the data charging aspects of LTE<sup>9,10</sup>. In this architecture, the Evolved Packet Core (EPC) is the touch point for BSS into the network and charging is carried out by the Offline Charging System (OFCS) and Online Charging System (OCS), highlighted in the diagram on the following page.

<sup>9</sup>3GPP, "TR 32.820 Evolved Packet Core: Charging aspects"

<sup>10</sup>3GPP, "TS 23.203 Policy and charging control architecture"

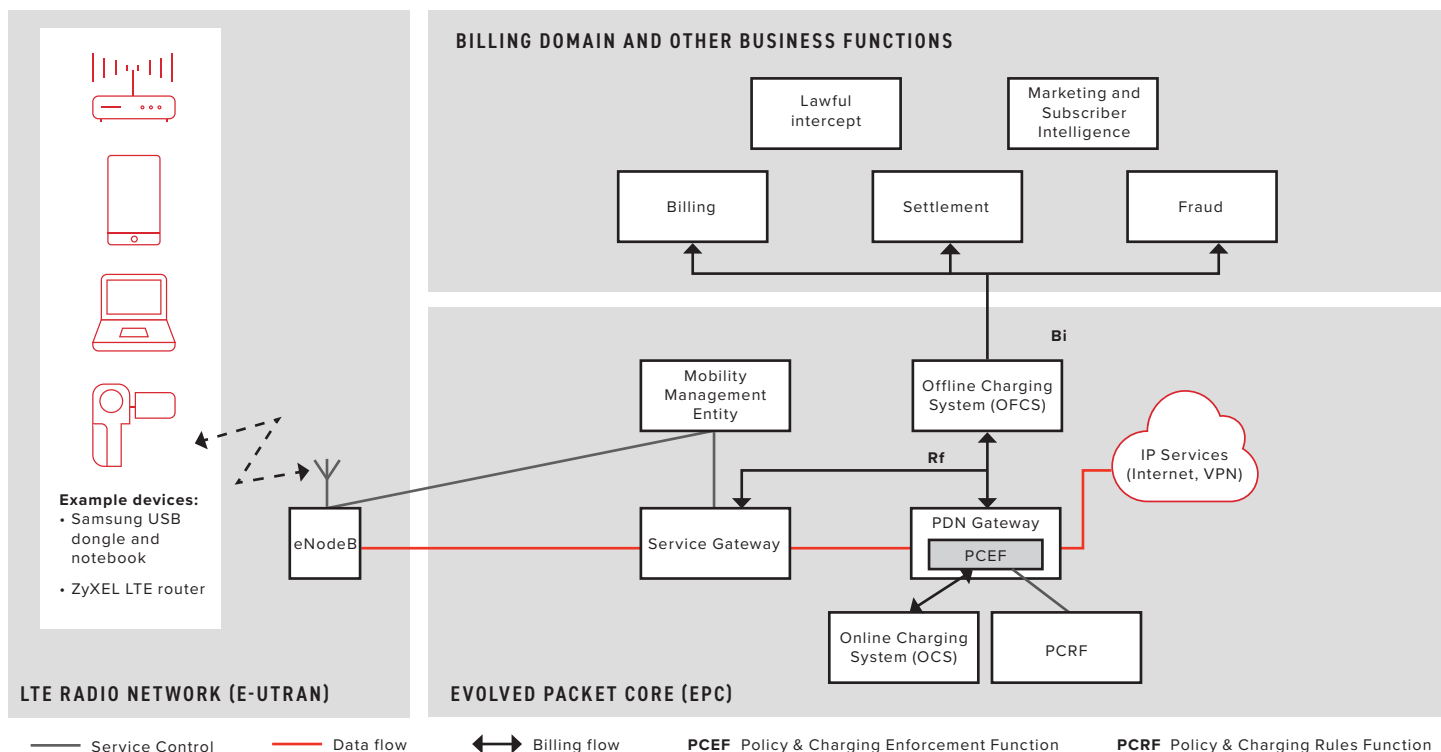


Figure 3: Offline Charging is the master system of record to many business functions for LTE usage data

The OFCS supports billing mechanisms where the charging information does not affect, in real-time, the service rendered. Offline Charging must support functionality such as: collecting event and session based charging data, in real-time as network resources are used; constructing charging data records, using DIAMETER start and stop events, and enriching records to formatting them in the Charging Data Record format specified the 3GPP<sup>11</sup>; and lastly, support an enterprise mediation role, being the master system of record for business functions in addition to retail billing which require LTE usage data, such as wholesale/settlement functions, fraud management and marketing for subscriber intelligence. The role of Offline Charging is similar to post-event mediation in 2G/3G networks, but again with some important differences. Unlike

current mediation systems, Offline Charging must be able to collect usage data from network elements in real-time as “volatile” event messages and uses these to construct meaningful charging information, whereas 2G/3G network elements generate CDRs in files and write them safely to local disk before mediation collects them. Because of this volatility Offline Charging must be always available, whereas current mediation systems can have bottlenecks when deployed in highly available configurations, particularly for real-time correlation. Lastly Offline Charging must support processing very large volumes of data efficiently as LTE has the potential to produce many billions of events per day. One mobile operator working with CSG estimated that event volumes would double between 2010 and 2014, due to the commercial launch of LTE.

<sup>11</sup>3GPP, “TS 32.299 Telecommunication management; Charging management; Diameter charging application”



The OCS is an application that integrates with network devices and application servers in a communication service provider's environment to provide real-time functions to support charging subscriber usage activity for all services. Online Charging includes functionality to manage complex interactions between any network source and the rating and balance management functions throughout the life of a subscriber's session; to support complex event rating, both individually and within the broader context of other historical events; and to maintain the current balance of the subscriber's accounts and manage the balance as a result of subscriber activity. The role of Online Charging is similar to the prepaid IN platform in 2G/3G networks, but with some important differences. Unlike most IN platforms, Online Charging must support both prepaid and postpaid accounts, managing the balances of prepaid account as well as enforcing postpaid credit limits in real-time. It should also support greater personalization, integrating seamlessly with policy management (PCRF) to enable management of personalized usage policies as well as offering targeted service bundles that appeal to the needs of key market segments.

Lastly it must integrate seamlessly with existing billing systems for them to perform invoicing and revenue recognition for postpaid accounts.

## OFFLINE CHARGING PLACES UNIQUE DEMANDS ON MEDIATION

### COST EFFECTIVE SCALABILITY

Unlike circuit switched networks which typically generate a single charging record per event or session, packet switched networks typically generate

at least twice as much data. When delivering an IP-based service, such as a VOIP call or broadband data session, packet network devices typically generate a separate start event and stop event. They commonly generate mid-session events as well. Not only must mediation systems have a scalable architecture to support this volume step change, but they must also efficiently correlate the event records together and manage real time reference data to produce meaningful charging information. As a result, it is critical to Offline Charging for mediation applications to cost effectively to support very large processing volumes.

### ROBUST SUPPORT FOR REAL-TIME

Depending on the packet network equipment deployed, Offline Charging requires mediation to support real-time charging protocols, such as DIAMETER, on the 3GPP Rf interface. To support existing 3G/HSPA architectures mediation may also need to support other real-time protocols, such as RADIUS accounting requests, SNMP, Cisco NetFlow or GTP'. Unlike circuit switched network elements that conveniently store charging data as CDR files in local directories, such protocols push charging records out as real-time events or data packets. If mediation or Offline Charging does not reliably capture these events they are not stored, so the data is lost.

Lastly, to enable legacy charging and billing systems to integrate in real-time with new network equipment online or active mediation may also be required.





### FAST INTEGRATION OF NEW DEVICES

Mediation must support fast integration with next generation network equipment to enable operators to quickly monetize and optimize newly launched LTE services. However mediation must not only be quickly integrated into next generation 3GPP architectures for Offline Charging of LTE, but to minimize the Total Cost of Mediation, they should also support existing 3G network devices. The diagram below illustrates a convergent Offline Charging architecture, supporting both 3G/HSPA and LTE data services.

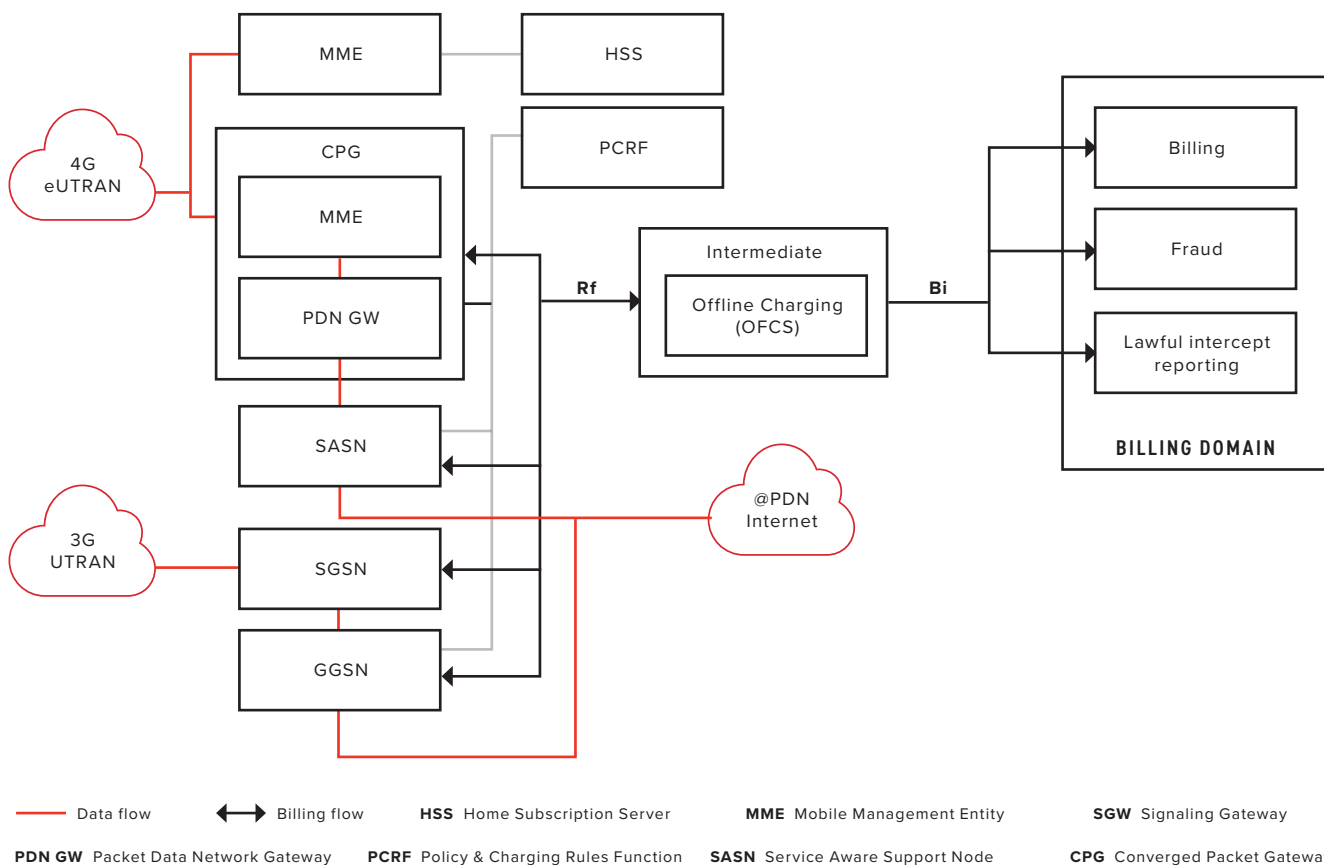


Figure 4: A convergent Offline Charging architecture lowers the total cost of mediation for both LTE and 3G/HSPA



## ALWAYS-ON AVAILABILITY

Massive volumes of volatile charging data means Offline Charging must always be available to reliably produce charging data for packet networks. To reliably support revenue assurance mediation must have proven capabilities for continuous service availability and redundancy, to ensure that any hardware component failure does not impact the Offline Charging function.

## SUPPORT FOR IMS AND VOLTE

How operators deploying LTE choose to implement voice and SMS services is of great importance to BSS managers, as it will have implications for how these services are charged. Unlike existing voice and SMS services in 2G and 3G networks, which are delivered over circuit switched networks via MSCs and SMSCs, and use SS7 for call control and set up, LTE services are set up and delivered using Internet Protocol (IP) connections. The 3GPP advocate using the IP Multimedia Subsystem (IMS) standards for delivering packet voice and SMS over LTE, and it is backed by the GSMA Voice over LTE (VoLTE) initiative, to develop a standard way of delivering voice and messaging services.

These service evolutions will create additional demands on Offline Charging beyond integrating with the new equipment for data services. Mediation will need to support the Offline Charging requirements for IMS, and in particular interface with new IMS platforms for voice and other services, such as the Call Session Control Function (CSCF), Border Gateway Control Function (BGCF), Media Gateway Control Function (MGCF) and other Application Servers.

## SERVICE PROVIDERS ARE TAKING A LOW RISK, PHASED APPROACH TO OFFLINE CHARGING

BSS managers are commonly finding that incumbent mediation systems were not designed to support the unique challenges of Offline Charging. As a result many operators are replacing legacy mediation systems. They are typically taking a phased approach to replacement projects, by initially deploying next generation mediation for high growth data streams alongside existing systems. Typically the project to integrate LTE network equipment is used as the driver for the business case to re-evaluate current mediation systems. Other operators wish to deploy Offline Charging for 3G/HSPA first to cope with the rising data volumes and reduce risk before integrating new LTE infrastructure.

A phased approach has a four of advantages:

1. It reduces the load on existing mediation systems, and so avoids costly upgrades (legacy mediation software, hardware and third party products)
2. It lowers the revenue assurance risk for non-data services, like voice and SMS, as the legacy mediation systems are given “breathing room” to support projected growth volumes reliably
3. It allows operators to maximize the value obtained from existing mediation investments, or “sweat” these assets
4. The reduced scope limits the deployment interfaces, and so minimizes the project duration and project implementation risks

After the successful deployment of next generation mediation for the “offload” of high volume IP services, many operators go on to fully replace or consolidate legacy mediation systems to the new platform in order to gain further cost savings.



## STRATEGIC SUPPLIER REQUIREMENTS FOR OFFLINE CHARGING

So what should service provider executives take into consideration when selecting a next generation mediation supplier for Offline Charging?

Because mediation is critical to enterprise revenue assurance, operators are looking for long term strategic partners that can help them overcome the challenges of IP services today and in the future. The following lists some typical questions operators are asking of Offline Charging providers today:

- What is the processing volume of the supplier's ten largest mediation implementations for IP services?
- What are the estimated platform costs for these deployments (hardware, third party products, energy)?
- What are the daily correlation volumes for these deployments (events per day)?
- How many mediation implementations are processing over 1 billion events per day?
- What experience does the supplier have supporting LTE in a production environment?
- How long was the provider's fastest LTE implementation?
- How many implementations are supporting high volumes with a distributed architecture for horizontal scalability?
- What experience does the supplier have taking advantage of commodity hardware?
- Does the provider's mediation application require third-party products, like Oracle Enterprise Edition or Real Application Clusters?
- How many off-the-shelf integrations with network elements does the supplier have available?
- What experience does the provider have with next generation network equipment for wireless (PDN GWs, SGWs, xGSNs, PDSNs, MRFs, CSCFs, SIP GWs), data/broadband (AAA servers, BRAS, routers, switches) and application servers (VOIP GWs, Video GWs, content servers, web servers)?
- What auditing capabilities does the supplier have to ensure packet network revenue is protected?
- How many professional services staff does the provider have?



## SUMMARY

In response to fast growing customer demand for data services, operators are deploying evolutions of IP networks, like LTE. However, the demand and costs for these new services is widely anticipated to outstrip the revenues. Consequently service provider executives responsible for BSS are identifying ways to reduce the total cost of mediation ownership, whilst at the same time as supporting the new requirements for Offline Charging and IP networks.

The tremendous volume growth means that many legacy mediation systems cannot cost effectively scale and are reaching capacity limits. This combined with the challenges of Offline Charging means that many BSS managers are replacing legacy mediation systems. To reduce risk many operators are opting for a phased implementation of next generation mediation for high growth data services, before the full consolidation of legacy platforms to a new lower cost base.

To address the growing costs of mediation, the three most critical considerations for service provider executives are:

1. To minimize the total cost of mediation ownership today;
2. To ensure cost effective support for considerable future volume growth tomorrow;
3. To select a long term partner that has customer references with massive volumes and next generation IP networks.

Following these best practices service provider executives can meet the challenges of supporting huge volume growth and new IP services, whilst at the same time lowering the Total Cost of Ownership for mediation.

## CSG TOTAL SERVICE MEDIATION HAS PROVEN TO REDUCE MEDIATION COSTS FOR HIGH VOLUME DATA SERVICES AND LTE

For operators with mediation systems that are reaching capacity because of data growth, or that need upgrading to cope with new packet networks, CSG Total Service Mediation is proven to support Offline Charging for LTE and has an exceptionally low Total Cost of Ownership. In some deployments CSG customers have lowered total mediation costs by a factor of ten. One operator partnering with CSG found that implementing new blade server architectures reduced the anticipated costs of upgrading legacy hardware by more than 65 percent. With the CSG Charging & Policy solution for Online Charging and policy, CSG has a complete solution for mobile charging and LTE.

## ABOUT CSG

CSG simplifies the complexity of business transformation in the digital age for the most respected communications, media and entertainment service providers worldwide. With over 35 years of experience, CSG delivers revenue management, customer experience and digital monetization solutions for every stage of the customer lifecycle. The company is the trusted partner driving digital transformation for leading global brands, including Arrow, AT&T, Bharti Airtel, Charter Communications, Comcast, DISH, Eastlink, iFlix, MTN, TalkTalk, Telefonica, Telstra and Verizon.

At CSG, we have one vision: flexible, seamless, limitless communications, information and content services for everyone. For more information, visit our website at [csgi.com](http://csgi.com) and follow us on [LinkedIn](#), [Twitter](#) and [Facebook](#).