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Sonus Special Edition

Voice over LTE

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Learn to:

- Discover VoLTE and its importance
- Understand how VoLTE works in mobile networks
- Maximize the value of VoLTE in enterprises
- Understand the role of SBCs and DSCs in VoLTE networks

Pat Hurley

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Introduction

Voice over LTE (VoLTE) is the next big transformation for mobile operators. VoLTE is essentially Voice over Internet Protocol (VoIP) for mobile networks. Just as wireline carriers have been abandoning traditional circuit-switched voice for VoIP over the past decade, now mobile carriers are looking to do the same.

As these companies complete their transitions from 3G mobile services to Long Term Evolution (LTE) 4G, they've reached an inflection point because unlike all previous mobile network standards, LTE is entirely packet based, even for voice. (In previous networks, the voice component of mobile services was circuit-switched.) In order to get to the end state of "all 4G everywhere," carriers need to move away from traditional circuit-switched voice services and transition those services to the packet network.

Because VoLTE is a completely different way of providing voice (and related services such as text messaging [SMS] and videoconferencing) over the mobile network, many new features and functionalities will be involved in building out this future mobile operator network.

About This Book

Voice over LTE For Dummies, Sonus Special Edition, is here to help you understand what VoLTE is all about, what it takes to deploy it, and the benefits you gain when you make your move to VoLTE. This book isn't written to give you a deep technical understanding or tips for developing VoLTE applications — trust me, there's plenty of source code and technical documentation online for your reading pleasure. Instead, this book is designed for nontechnical folks — marketers, sales professionals, finance wizards, service providers, and mid- to large-sized enterprises — who want to better understand VoLTE and how it can help your business.

Icons Used in This Book

This book calls out important bits of information with icons on the left margins of the page.

Tips alert you to actionable information that can save you time, headaches, and money.

Pay attention to the Remember icons that point out crucial parts of the text to lock away in your memory because you may need to know it again in the future.

Warnings are where we look out for you. A warning indicates an area where you need to pay attention to avoid certain pitfalls.

Technical Stuff is data that you don't *need* to know, but you may want to learn. When you see this icon, you'll know that background information is coming that may help you understand the topic better, but you can safely gloss over it without missing the entire point.

Chapter 1

Getting Acquainted with Voice over LTE

In This Chapter

- Defining VoLTE
- Understanding why VoLTE exists
- Discovering the importance of VoLTE
- Introducing the elements that make up VoLTE

If you work in the mobile industry or even if you've purchased a new smartphone in the last year or just watched the endless parade of TV commercials from mobile operators and device manufacturers, you've heard of Long Term Evolution (LTE), the latest and greatest 4G standard for mobile networks.

Mobile operators are rapidly deploying LTE to provide high-speed data services for customers, offering mobile customers (armed with shiny new smartphones, tablets, and other mobile devices) access to a nearly limitless array of mobile data applications and services.

However, mobile operators are faced with the non-trivial matter of how to deal with voice in the eventual (and inevitable) transition of the entire mobile network to packet based LTE. The crux of this matter is that LTE is an all-packet, Internet Protocol (IP)-based mobile network standard, and mobile voice services have, to this point, been primarily *circuit-switched* (like traditional phone calls prior the advent of Voice over IP [VoIP] systems).

In this chapter, I discuss the advent of *Voice over LTE* (VoLTE) — a packet-based, IP-based solution that will complete the transition of mobile services and the networks they run on to a completely IP future.

Just What is VoLTE, Anyway?

VoLTE is pretty simple, at least at a high level: VoLTE moves the voice portion of mobile services onto the packetized network where revenue generating advanced IP services such as instant messaging (IM), web browsing and applications reside. This is an evolution that has, to a large degree, already happened in other parts of the telecommunications service network. For example, many corporate and enterprise voice networks have moved to VoIP-based Unified Communications (UC) services, as have many consumer "landline" phone services.

VoLTE uses the IP network to both control and carry voice calls end-to-end as IP packets. Essentially, with VoLTE, voice becomes just another "app" utilizing the mobile data connection between a phone (or other LTE mobile device) and the mobile operator's network.

This approach is a really big change from previous generations of mobile networks (like 3G), where the data and voice elements were logically and physically separate. In fact, with some mobile networks, the user could either make a (circuit-switched) voice call *or* use a data service or application, but not both at the same time.

A good example for better understanding the introduction of VoLTE is considering how residential phone and broadband networks evolved. A few years ago, a household used traditional plain old telephone service (POTS) for their voice calls and something like a Digital Subscriber Line (DSL) for Internet access. Today, many homes have high-speed fiber and cable modem broadband services that support VoIP carried over this broadband connection.

Understanding the Motivation behind VoLTE

The motivation behind the development of VoLTE is mobile operators' desire to transition to an all IP network. In addition to being IP-centric, VoLTE provides the added benefits of improved spectral efficiency and the ability to offer richer, more advanced voice services. The early days of mobile

networks focused almost exclusively on carrying voice calls. Data services have now reached a tipping point. According to GSMA — an association representing mobile operators' interests worldwide — mobile operator data revenues will overtake voice revenues globally by 2018. The mobile data explosion is driven by a surge in demand for connected devices and machine-to-machine (M2M) communications.

What are the motivations?

- Reduction in operating expense (OpEx) by managing a single network, not multiple (circuit switched and packet-based)
- Deliver innovative, revenue generating advanced IP services
- Better compete with Over the Top (OTT) services or engage in revenue sharing opportunities

You can see this tipping point reflected in the latest mobile operator offers. Some family plans are built around packet-based services, with small per-phone fees for unlimited voice and texting. Packetized services are where the money is for mobile operators.

Even though packet-based services are the new revenue king, voice services are still an essential (and eternal) part of the mobile services offering. Mobile operators still make a lot of money on voice, and they have no desire to surrender those revenues to OTT services such as Skype or FaceTime. The question that remains is this: What's the best way to deliver voice over a data-centric, IP-based packet network? The answer is VoLTE — VoLTE migrates voice to an all-IP, all-packet network and lets mobile operators focus on building the best combination of packet-based networks and advanced IP services, such as video calling, collaboration, and instant messaging.

Grasping the Importance of VoLTE

Mobile operators have been delivering voice services for many years, and they're very good at it (if you still deal with dropped calls or distortion, you're in the minority these

days). So why would they want to get rid of this perfectly good 3G, circuit-switched voice network and move on to something new, like VoLTE?

Both 3G voice and VoLTE are very efficient and cost-effective technologies for delivering voice services to mobile customers. In fact, you won't see much of a difference in the cost of building/operating the network.

So what's the big deal about VoLTE? Mobile operators want to make the switch for many reasons:

- **Consolidating multiple networks into a single network:** This point is the biggest driver for VoLTE. The cost savings associated with operating and managing fewer networks is too significant to dismiss. As VoLTE eventually becomes widespread, mobile operators can move to a packet-centric, all-LTE network, rather than simultaneously supporting voice (circuit-switched) and data (packet LTE) networks. The result is a greatly simplified and better-optimized network for revenue generating services.
- **Supporting concurrent voice and data:** Today's Code Division Multiple Access (CDMA)-based mobile networks (used by major mobile operators) don't support simultaneous voice and data usage. Moving to data service-based VoLTE removes this restriction, letting users surf the web or utilize data apps while talking.
- **Competing based on Quality of Experience (QoE):** VoLTE helps mobile operators compete on more than just service price by offering users a better voice experience compared to the alternatives, such as other mobile operators or cheap OTT services like Skype. These benefits include
    - **Guaranteed Quality of Service (QoS):** While OTT services get "best effort" service quality — and may be affected negatively when the network is congested — VoLTE mobile operators can prioritize and ensure better service for a user's voice traffic.
    - **Support for higher quality voice:** VoLTE easily supports high-definition (HD) voice, higher bandwidth, and higher-quality voice *codecs* (encode/decode algorithms), which provide higher fidelity voice communications.

  - **Reduced latency:** A mobile operator can provide a lower latency (lag time) "connection" for VoLTE calls, avoiding delays in conversational flow.
  - **Faster connections times:** VoLTE can connect calls quicker, reducing the time required to complete a call.

- **Improving spectral efficiency:** VoLTE increases the number of simultaneous calls per MHz of wireless spectrum. This is a critical factor for mobile operators who face spectrum shortages as network utilization grows — they can increase capacity without growing the network itself.
- **Delivering advanced IP services:** Just as UC has enabled enterprises to create rich layers of integrated services, such as voice conferencing, videoconferencing, instant messaging, photo sharing, and more, so too will VoLTE. VoLTE allows mobile operators to deliver new revenue generating services so subscribers can communicate with more than just voice. Instead, they can leverage VoLTE to add presence, messaging, photos, and video to voice communications.
- **Giving data-only mobile operators the opportunity to offer voice:** Traditionally, mobile operators focused on voice-first and then added data services, but some mobile operators have pursued data-only wireless networks. VoLTE allows them to easily layer voice services without needing to develop a circuit-switched voice infrastructure.
- **Getting the benefit of spectrum refarming:** Refarming isn't only a great term but also a very real benefit of VoLTE. As mobile operators complete their transition to network-wide VoLTE, they can "turn off" legacy networks and reuse that spectrum to increase their LTE (and VoLTE) capacity. Given the many billions of dollars that mobile operators have spent in spectrum auctions and spectrum-driven acquisitions, this is a certifiable big deal.

The bottom line is this: Voice revenue is a declining share of the overall picture for mobile operators. VoLTE lets mobile operators focus on what's most important — data — and support the voice services that they must offer without carrying a separate network infrastructure to do so. At the same time, VoLTE allows these mobile operators to compete on a

cost basis with the OTT services running across their data networks, while also offering innovative "rich voice" services.

Looking at the Elements that Make Up VoLTE

While LTE networks are growing fast, they aren't everywhere yet. Some interim steps exist that enable mobile operators to support LTE data with legacy circuit-switched voice. These steps in the evolution to VoLTE include the following:

- **Circuit-Switched Fall Back (CSFB):** Uses a traditional circuit-switched 2G or 3G network (like GSM or CDMA) for voice calls (or SMS texts), then reconnects the device to the LTE network when the call is complete. CSFB essentially ignores VoLTE and uses legacy networks for voice.
- **Single Radio Voice Call Continuity (SRVCC):** Enables a device to use a single radio while switching from VoLTE to circuit-switched calls when required, including on the fly when coverage requires it to happen.

An overview of what's required to support VoLTE in a mobile operator network is listed here:

- An IP Multimedia Subsystem (IMS) infrastructure in the network core to support VoLTE
- VoLTE support in client devices (phones and other end devices)
- Support (in devices and the network) for the voice codecs used by VoLTE
- Support for inter-network connectivity (roaming)
- A Session Border Controller (SBC), discussed in detail in Chapter 3
- A Diameter Signaling Controller (DSC), discussed more in Chapter 4

Chapter 2

Understanding How VoLTE Works

In This Chapter

- Looking at the comparisons in VoLTE and legacy mobile voice
- Getting a grip on VoLTE requirements
- Understanding the services enabled by VoLTE
- Securing a VoLTE network
- Making VoLTE work with 3G

The folks who are primarily responsible for turning Voice over LTE (VoLTE) from a technology into a service that customers (enterprise or consumer) can buy and use daily are the mobile network operators. These mobile operators have already spent a *ton* of money (to channel Carl Sagan: billions and billions of dollars) upgrading their (not so old!) 3G networks to support LTE data services, and now they're starting down the path of moving away from traditional circuit-switched voice services and toward packet-based VoLTE.

If you read Chapter 1 before coming here, you already dug into the basics of VoLTE. In this chapter, you gain more insight into what VoLTE means for mobile service providers, including discussions of key issues related to VoLTE, services enabled by it, and how mobile operators will secure it and make it interoperate with their existing 3G networks.

Comparing VoLTE to Legacy Mobile Voice Services

It's a fair statement to say that mobile operators are expecting to "evolve" their networks and services toward VoLTE. It's also fair to say that VoLTE is revolutionary in terms of how mobile operators will deliver voice and related real-time communications services to subscribers. In fact, the migration to VoLTE will be as evolutionary as the transition from analog mobile networks to digital 2G networks in the 1990s.

One of the defining features about VoLTE that makes it so revolutionary is how mobile calls are handled by the network. Every other mobile voice standard, from the first mobile phone until now, has leveraged general phone circuit switching concepts that date back to the beginning of the telecom industry. VoLTE, however, is essentially Voice over Internet Protocol (VoIP) for mobile operators. It migrates calls away from the legacy circuit-switched infrastructure and onto the IP packet-based communications infrastructures, where calls can be managed as an advanced IP application.

Other mobile VoIP solutions are already well-established in the mobile world from Over the Top (OTT) service providers, such as Skype or Microsoft Lync. The difference with VoLTE is that it's explicitly offered by the mobile operator, with all of the attendant Quality of Service (QoS) expectations.

Understanding Specific VoLTE Requirements

Because VoLTE isn't part of the long-standing continuum of circuit-switched voice, the legacy infrastructure of mobile circuit-switched voice isn't equipped to handle VoLTE. The switches, media gateways, and protocols (like Signaling System 7 [SS7], the legacy call signaling protocol for circuit-switched voice, and short messaging service [SMS] services, which are text messages) simply don't apply. Instead, VoLTE

has been designed around the IP Multimedia Subsystem (IMS) architecture designed for delivering multimedia services over an IP network.

IMS brings a number of Internet-centric protocols into the telecom world and provides a framework for delivering advanced services by using IP with levels of quality and performance similar to legacy telecom services.

Detailed discussions of all elements of IMS are far beyond the scope of this book (and would take far more pages than available all by itself). With that said, it's important to discuss the IMS-based VoLTE high-level requirements:

- For the subscriber, VoLTE must provide *at least* all the communications services of legacy 2G/3G services, with *at least* the same level of quality assurance for things such as call completion rates, voice or video quality, and reliability.
- For the mobile operator, VoLTE needs to be inexpensive enough to deploy, reliable enough to replace well-established 3G networks, and capable of providing revenue generating, high-quality experience services to end-users.

Key network protocols that support VoLTE are

- **Session Initiation Protocol (SIP):** A signaling protocol that provides the underpinnings for establishing, carrying out, and ending multimedia sessions (or calls)

  In the VoIP and VoLTE world, a session is roughly equivalent to a call in the circuit-switched world.
- **Diameter:** A protocol to handle Authentication, Authorization, and Accounting (AAA) for sessions

  Where SIP deals with the establishment and control of the calls themselves, Diameter deals with the backend systems that identify users, authorize their access to the network, and account for that access for billing and other purposes. I focus on SIP and the Session Border Controllers (SBC) that manage SIP sessions in Chapter 3. In Chapter 4, I take a closer look at Diameter Signaling Controllers (DSC) that manage Diameter signaling.

Figure 2-1 places SIP and Diameter side by side with legacy circuit-switched voice enabling technologies, so you can get a better idea of what does what.

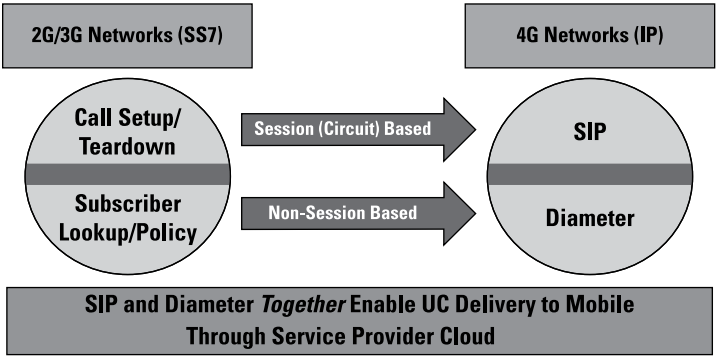

Figure 2-1: SIP and Diameter's roles in VoLTE compared to circuit-switched mobile voice.

For a deep dive technical look at VoLTE requirements and standards, you can check out the GSMA VoLTE Service Description and Implementation Guide at `www.gsma.com/network2020/volte/implementation-guide`. ***Warning:*** It's not a light read.

Looking at the Services Enabled by VoLTE

In its simplest form, VoLTE is required to support the same real-time services supported by legacy 2G/3G networks. Specifically, that means voice calls and SMS. These services are, by default, pretty much identical to their legacy counterparts. The biggest difference is that the voice codec used in VoLTE is improved compared to legacy mobile voice, and is often the Adaptive Multi-Rate (AMR)-wideband high-definition (HD) voice codec.

VoLTE isn't limited to just voice and SMS/MMS. It can also support a range of supplemental services — just as landline VoIP systems feature more than just simple phone calls. These additional services include the following:

- Videoconferencing
- Data sharing (files and photos)
- Multiparty audio conferencing
- Instant messaging (IM)
- Presence (metadata about people that indicates if they're available for communications)

This list looks a lot like Unified Communications (UC) systems deployed in many enterprise networks.

Tuning into VoLTE Security

Because VoLTE is vastly different than existing circuit-switched mobile voice systems, it has its own unique requirements to ensure the security of the network (and the privacy of subscribers' media as it traverses that network).

As an IP-based network — particularly as an IP-based network that extends IP connectivity all the way out to the cell towers in the mobile operator's network — LTE (in general) and VoLTE (specifically) require a conscientious approach to security from the mobile operator.

Securing the VoLTE network involves a number of steps:

1. **User authentication**

   The user must be positively identified as an authorized user of the network.

2. **Policy enforcement**

   The user's access to the network (in other words, what services she can utilize and *how* those services can be utilized), once authorized and granted, must comply with the policies of the network and the specific subscriber services authorized for her.

User authentication and policy enforcement protects the mobile operator against service theft and fraud and protects both the operator and users against spoofing (where people deliberately modify or disguise their identity on the network), while ensuring that legitimate users are able to access the services that they pay for. This is known as *session admissions control.*

3. **Encryption**

   Both the signals and the media payloads related to the subscriber's calls should be encrypted by a strong protocol such as IP Security (IPsec). IPsec is a commonly used encryption protocol designed to ensure that malicious parties can't read the signals or media payloads in the unlikely event that they're able to intercept the call data.

4. **Topology hiding**

   Hiding the topology (or architecture) of the network makes it difficult, if not impossible, for unauthorized people to gain access to parts of the network.

5. **Denial of Service (DoS) protection**

   DoS and Distributed Denial of Service (DDoS) attacks occur when a malicious actor floods a server or router with requests in an attempt to overload its processors and crash it. The network must be able to identify these attacks and continue connecting legitimate users even when they occur.

6. **Protection from registration storms**

   During a DoS attack, or even after an unplanned event such as a major power outage, the network may be overloaded by a *registration storm* — when huge numbers of devices try to establish their connection all at once. The network must be prepared to determine which registrations are valid and which aren't and scale to rapidly allow paying customers to connect.

The SBC and DSC platforms are designed to help provide these essential security elements in a VoLTE deployment or to coordinate and control communications with any additional security devices that help provide these elements. Check out Chapters 3 and 4 for more information on the SBC and DSC platforms.

Interacting with Existing 3G Networks

While there is relatively little VoLTE deployed today, there's a lot (a whole lot!) of deployed legacy devices and infrastructure. A day may come when legacy 3G circuit-switched voice networks are turned off, but that day is a long way away. (For comparison purposes, think about how long after the advent of 2G digital mobile services that the old analog mobile networks continued running.) With that in mind, users of VoLTE may find themselves on VoLTE networks part of the time, but other times, when they're in a rural area or roaming on a different network, they'll be in an area where all voice services are carried by circuit-switched 3G networks.

Until VoLTE is truly everywhere, voice in a mixed 3G/LTE network environment can be handled in three ways:

- **Circuit-Switched Fall Back (CSFB):** For most people with LTE phones today, CSFB is the default. In this scenario, LTE is used solely for data services and any voice calls "fall back" to 3G. Essentially, the radio in your device disconnects from the LTE network and then connects to the 3G network for the duration of the call.

  This approach adds some delay in the connection time for calls, as the phone's disconnection from LTE and reconnection to the 3G adds a non-trivial amount of the time to the overall connection process.

- **Simultaneous voice and LTE:** This approach maintains a connection to both the 3G and LTE networks at all times by using the 3G connection when required (or all the time if the phone isn't configured for VoLTE) for voice calls.

  This approach tends to use more battery power because two radios are active at all times within the phone.

- **Single Radio Voice Call Continuity (SRVCC):** This approach, based on advances in mobile chips, allows a single radio in the phone to move seamlessly from VoLTE to circuit-switched voice, even during the middle of a call. A lot of magic happens in the network — essentially when the LTE network figures out that a user is about to lose VoLTE coverage, a process begins within the network to "cue up" a 3G call and automatically transfer the user to that call without noticeable interruption.

Chapter 3

Looking at the Benefits of VoLTE

In This Chapter

- Matching VoLTE up with the enterprise customer
- Making the business case for VoLTE

In this chapter, you discover the topic of Voice over LTE (VoLTE) and the enterprise and how this new technology can fit into enterprise Unified Communications (UC) systems for videoconferencing, call centers, and as a mechanism for providing presence and messaging services. You find out why VoLTE makes good business sense for all parties involved — the mobile operators who offer VoLTE to their subscribers, the enterprises who integrate it with their UC platforms, and even third-party vendors who may use VoLTE as a platform for delivering their services.

VoLTE in Enterprise Unified Communications

As mobile operators progress on their evolutionary path toward VoLTE, enterprises will find opportunities to integrate VoLTE mobile services with their existing UC platforms. This integration makes rather obvious business sense — workers of all kinds increasingly rely on mobile devices even when

they are within the office — but it also makes a lot of technical sense. That's because both UC and VoLTE are essentially Voice over IP (VoIP) services with many things in common:

- Technological underpinnings, such as protocols
- Supported services, such as presence and media sharing
- Equipment requirements, such as the Session Border Controller (SBC) discussed in Chapter 4

UC is a suite of integrated voice, video, data, and text communication — both real-time (like a call being delivered person-to-person) and non-real-time (like text messages being sent back and forth between two people over a period of time). These communications between people occur in an enterprise and can be delivered over an Internet network through the following:

- **Voice:** Calls, conference calls, voice mails, and so on
- **Video:** Videoconferences, on-demand video learning, and so on
- **Data:** Text messaging, email, document sharing, and so on

The *unified* part of UC refers to the fact that the server and software architecture take all the previously disparate communications and put them under the purview of a centralized control system. Traditionally, enterprises "rolled their own" UC systems, owning and managing the platforms (such as SBCs and application servers). They relied on telephone companies (broadband or mobile) simply for network access. More recently, enterprises are increasingly investigating (and implementing) outsourced UC services.

VoLTE can fit into either one of these scenarios because it shares so many underlying technical attributes with UC and because it's offered by the same mobile operators that enterprises are already dealing with.

UC enterprise services enabled by VoLTE include the following:

- **VoLTE video conferencing services:** VoLTE inherently supports video calling (including audio bridges as part of a video conference) even high-definition (HD) video codecs. A VoLTE video conferencing service could be integrated with a standards-based service already installed within an enterprise, or the mobile operator could host the entire service in the Cloud and provide both the access and the management of the service for the enterprise.
- **VoLTE presence and messaging services:** Simple messaging services such as IM are handy but unsophisticated. VoLTE, especially when combined with supplemental services such as those offered by Rich Communication Services (RCS), can bring a new level of sophistication to messaging with the addition of presence data. (For more information on RCS, see the nearby sidebar "VoLTE and RCS — two sides of the same coin?") Presence provides contextual information about individuals — such as if they're already on the phone, if their calendars are blocked off, or if they've indicated that they can't take calls at the moment — and uses that data to deliver messages in the most appropriate way at the most appropriate time. This is a far cry from your "Do Not Disturb" message in your favorite IM client.

Along with IP voice and messaging, mobile operators can layer any number of value-added features, from video conferencing and other collaboration services to presence and universal voicemail boxes, on top of VoLTE. VoLTE allows enterprises to easily integrate their corporate communications networks with their mobile phones.

Dual-persona services powered by VoLTE will prove particularly popular and allow workers to host both work and personal identities — and two separate phone numbers — on the same device.

VoLTE and RCS — two sides of the same coin?

When you examine advanced IP services that are beyond voice and text services — services such as richer multimedia, file/media sharing, and presence — proposed as part of VoLTE service provider offerings, you'll find that they bear a striking resemblance to RCS, an industry effort started back in 2007.

RCS, which was originally known as rich communication suite, is a multi-vendor, multi-mobile operator effort to develop a suite of enhanced communications services for mobile devices particularly around the concept of beefed-up IM services. RCS incorporates features such as

- Enhanced phonebook
- Enhanced call
- Enhanced messaging

In each of these cases, the enhancements provide presence information and multimedia capabilities (like content sharing and file transfer). The idea is to bring some of the features available in Over the Top (OTT) messaging apps like WhatsApp or Skype, into the mobile phone's primary calling/messaging applications right out of the box, and to make these features interoperable across different phones and on different mobile operators.

RCS and VoLTE are both based on IP Multimedia Subsystem (IMS) and use a lot of the same technical underpinnings. Because of this, it is relatively easy for a mobile operator deploying VoLTE to additionally support RCS and to integrate these two services to provide more functionality to users. For example, a mobile operator can combine VoLTE and RCS services as a hosted UC offering for its enterprise customer.

By the way, you may see a mobile operator marketing RCS services under a different name: the GSMA, a group of mobile operators and equipment vendors who support the GSM mobile standard, has chosen to market RCS to the public under the brand name *joyn.*

Understanding the VoLTE Business Case

Like any new service, VoLTE must make business sense. In order to succeed, it must provide some tangible economic benefits to both those who provide it and to those who use it.

Sometimes a business case is based on savings — perhaps a company saved 25 percent on delivery costs over the course of a year by buying hybrid delivery vehicles. Other times there's a hard revenue increase that can't be missed (like before the iPad, no one ever had a tablet computer and now tens of millions of people have given Apple a huge revenue stream by snapping them up like crazy).

Most often, there's a mixture of the two as well as some slightly soft benefits that may not translate as easily into numbers but have a positive impact on a business. For example, perhaps an investment didn't produce tangible cost savings or revenue growth on its own, but it did stop a customer loss problem. You can, at least eventually, try to put a number to that, but you can even more easily — at a glance — understand what the benefit was.

For VoLTE, all three of these scenarios can be achieved. While it may not save as much money as that fleet of hybrids, or bring as much new revenue (at least in the near term) as the launch of the iPad did, there are some real, tangible business case justifications for VoLTE — benefits for enterprise customers, service providers, and potentially for third-party applications.

For the enterprise

For the enterprise, the real business benefit of VoLTE is the ability to get out of the business of owning and operating UC networks and let real subject matter experts (mobile operators or third-party hosted services) do what they do best, while the enterprise focuses on its own core competencies. VoLTE makes it easier for enterprises to migrate to hosted UC services and to get out of the business of running their own networks.

Regardless of whether the enterprise moves quickly to hosted UC or simply integrates VoLTE with their existing UC services, VoLTE brings some advantages to mobile operators:

- **Improved productivity through mobility:** VoLTE hastens the move of UC from dedicated desktop devices or PCs and onto mobile devices. Employees can increase productivity by working wherever and whenever they want (office, road, or home).

- **Reduced expenses with Bring Your Own Device (BYOD):** Just as many enterprises want to get out of the business of owning their own UC networks, many also want to get out of the business of buying, maintaining, and distributing mobile devices to their employees. BYOD puts more of the burden on the employee but at the same time gives the employee far more choice about what device to use when. The combination of ever-present smartphones and other LTE-enabled devices such as tablets and PCs makes it easy for VoLTE services to be delivered to whatever device works best for an employee at any given moment.
- **Increased application performance:** One general benefit of LTE itself (not just of VoLTE) is that it is fast. In fact, LTE can often meet or even exceed traditional wireline broadband speeds — especially for those in the small office/home office (SOHO) environment who rely on cable modems or Digital Subscriber Line (DSL). Enterprise VoLTE services can leverage that increased speed and provide data and communications to employees faster and with richer presentation environments.
- **Emergent applications:** The mobile industry really, at this point in time, is just scratching the surface of what LTE and VoLTE — combined with the smartphone app environment and innovative third-party developers — can really bring to the enterprise. For every app or service available today, dozens more may profoundly change and improve enterprise productivity.

Benefitting service providers

Service providers face significant expenses and "time-to-market" issues to implement VoLTE, but almost all the major operators are *at least* working on it. There *is* an acceptance of the inevitable with regards to the transition to all-IP networks and to VoLTE. Now that LTE for advanced IP-based services is widely deployed, it seems that VoLTE is the next obvious evolutionary step.

To understand why VoLTE will happen sooner rather than later, take a look at some advantages that VoLTE brings to the mobile operators:

- **Increased spectral utilization:** Most mobile operators are crunched for *spectrum* (the allocated radio frequencies used to transmit and receive data and calls). Customer growth continues and customers are doing more via the mobile network than they did the year before. VoLTE allows more simultaneous calls per given unit of spectrum (or per cell tower, to simplify things). That means that mobile operators can worry less about running out of spectrum or at least place their worries at the feet of other data services and breathe a little bit more easily as they save some spectrum that would've otherwise gone to voice calls.
- **Improved customer Quality of Experience (QoE):** This one may seem a bit intangible, but it's very real. As mobile operators reach relative parity in price and services offered, the quality of the experience — the experience customers have using their mobile devices — becomes a big differentiator and plays a huge role in reducing churn. If there's one thing mobile operators hate, it is churn. The acquisition costs of bringing a new subscriber online puts a big dent in the initial profitability of that customer when compared to a subscriber already on the network.
- **Increased revenue for supplemental services:** Because VoLTE can support additional enterprise services (such as UC services) as well as consumer services, mobile operators can look to increase their top line with new service offerings. Because of the increased customer experience that VoLTE offers (guaranteed bandwidth and latency to offer to the end-user), VoLTE gives mobile operators a chance to take on OTT operators who are currently using their infrastructure without providing any marginal revenue.
- **Capital/operating expense savings:** This will happen in the long run, but in the short term, several expenses are related to rolling out VoLTE. There's equipment to buy and engineering, testing, and operationalization to take care of. But in the longer run, after VoLTE is everywhere, that is, there are plenty of cost savings on the horizon:
    - Mobile operators won't need to maintain separate voice and data infrastructures.

- The network itself will become flatter and simpler, with essentially every service "riding" on the LTE data connection.
- When legacy networks can eventually be turned off completely, the mobile operator can refarm that spectrum and those towers to further build out the LTE network.

Affecting third-party hosted services

Third-party hosted service providers could be app developers who create UC applications for enterprises, or they could be OTT service providers (such as Skype) who ride on the existing broadband/mobile infrastructure but aren't technically a part of the mobile operator marketplace.

In the short term, because mobile operators are just coming to grips with the implications and business models for providing VoLTE and supplemental VoLTE services, there isn't a large ecosystem for third-party VoLTE application providers. In fact, elements of risk may exist for them as mobile operators encroach on their turf with the customer experience benefits that they gain from being part of the Quality of Service (QoS)-guaranteed VoLTE service. Some app developers may, however, find opportunities to develop elements of mobile operator-hosted/managed services or applications for enterprise UC services that are enhanced by VoLTE.

In the future, if network neutrality regulations allow it (or the third-party providers can pay mobile operators for access to VoLTE networks on an equal footing with that operator's own services), these providers may find that they've gained an ability to offer enhanced, QoS-assured services instead of just "best efforts" experiences they offer today. Revenue-sharing business models between mobile operators and OTT service providers would be a big deal indeed.

Chapter 4

Defining the Role of the SBC in VoLTE

In This Chapter

- Leveraging the SBC in VoLTE
- Using the SBC to enable services
- Playing well with existing voice services with an SBC

The Session Border Controller (SBC) is an essential element for Voice over Internet Protocol (VoIP) and Unified Communications (UC) networks. The SBC has a number of key functions:

- Securing the borders of the network (between an enterprise and a service provider or between service providers)
- Facilitating the routing of both control and media signals
- Enabling service creation and fulfillment

In other words, the SBC is a pretty big deal in the VoIP world, so it shouldn't surprise you to learn that one of the most important roles for the SBC is within Voice over LTE (VoLTE) networks. Like legacy VoIP networks, VoLTE is an all-IP, all-packet network service so it has many of the same requirements. In the VoLTE world, the SBC controls borders of the network, plays a role in service creation, and helps enable existing voice services. Some key roles fulfilled by the SBC include the following:

- Maintaining security for the network and the traffic flowing across it

- Providing interoperability by seamlessly translating between different protocols and codecs
- Allowing interoperability between different versions of Session Initiation Protocol (SIP), ensuring seamless support of calls between networks constructed by different vendors
- Acting as the voice network traffic cop, controlling the flow of SIP sessions (calls, messages, video, and so on) in and out of the network

In this chapter, you discover how the SBC helps maintain security within a VoLTE network, enables service creation, and assists in the crucial role of providing continuous service for customers moving between VoLTE and legacy 3G networks.

Patrolling the Borders

One of the most important roles performed by an SBC is security. Just the name alone implies a lot about what the SBC does: controls the traffic that flows between network borders — both the border between the mobile device and the mobile operator's network and between the mobile operator's network and other networks (for example, the mobile operator hosting the other party in a call's phone).

The main security and control functions of an SBC in a VoLTE network include the following:

- **Denial of Service (DoS) protection:** DoS attacks (and their cousins, Distributed Denial of Service, or DDoS) occur when malicious parties send vast amounts of unauthorized and fake resource requests to a network, overwhelming its ability to pick out and complete legitimate connections. SBCs can filter out this traffic and keep the VoLTE network up and running.
- **Admission control:** Related to the DoS protection in the preceding bullet, an important function of an SBC is identifying and allowing legitimate traffic to connect into a network. The SBC is essentially a gatekeeper at the border of a network, allowing traffic to enter and then routing it correctly within the network.

- **Topology hiding:** An SBC can keep the exact virtual location (IP address and internal routing information) of a network hidden from the outside world while still providing incoming connections for the ability to reach intended end-users. By hiding this internal network topology, the SBC decreases the network's vulnerability to intrusion and attack.
- **Signaling and media encryption:** The SBC provides an ability to encapsulate media and signaling traffic within encrypted tunnels. This encryption greatly reduces the likelihood of traffic interception or tampering.

Enabling New Services

The SBC enables new services within a VoLTE environment. Specifically, the SBC supports both the creation of new services and the enforcement of the policies for services. Additionally, the SBC supports the deployment and operationalization of new services by enabling the creation and provisioning of those services, as described in the following list.

- **Service creation:** Many SBC solutions include service creation and development platforms that provide an underlying environment for rapid creation of new apps and services. These platforms provide an abstraction layer above the "telecom" complexities so developers can quickly write new apps and services without extensive insider knowledge.
- **Policy enforcement:** The SBC can access and enforce policies. These policies can govern a user's (or group of users') access to network resources and applications. The user of policies help ensure that users who are authorized access to a particular service element get that access, while those who aren't don't. This process safeguards network resources and makes it easier to add additional service elements to users as required.
- **Quality of Service (QoS) assurance:** A major — I would argue *essential* — goal of a VoLTE-based service is to provide the same level of call quality, reliability, and responsiveness (such as time required to complete a call) as a traditional circuit-switched mobile call. Users may accept lower QoS from an Over the Top (OTT) free

service like Skype, but they expect a new service from their mobile operator to be as good or *better than* legacy services — often with stringent service level agreements (SLA) governing this performance. The SBC plays key roles by performing the following functions:

- **IPv4-IPv6 interworking:** The SBC provides a mechanism for packets to easily transfer between IPv4 and IPv6 networks, ensuring that SLAs are met.
- **Network Address Translation (NAT)/firewall traversal:** The SBC allows VoLTE packets to seamlessly, and without delay, cross through NAT and firewall systems so calls can be completed without interruption.
- **Policy enforcement (again):** The role of the SBC as an enforcement mechanism for policies helps ensure that subscribers (end-users) get the services they expect (and have paid for).

- **Support for high-definition (HD) codecs:** An important business driver for VoLTE is the service's ability to deliver a higher quality experience for subscribers than they would receive with "best effort" or OTT services. The reason for this is because HD codecs are supported for voice and video calls. Essentially, HD codecs improve the subjective quality of calls and video sessions, making the "can you hear me now" of traditional mobile telephony a thing of the past. The SBC supports the media routing of these codecs and also supports transcoding or *transrating* (converting between different codecs and bit rates when endpoints have differing speeds).
- **Routing:** Another Quality of Experience (QoE) factor supported by the SBC is the SBC's ability to efficiently — and at great scale — deal with the routing of both the signaling and media packets in a VoLTE call. This signaling and media routing is an essential feature in any SBC, and the ability of an SBC to do this routing efficiently and quickly provides a better call experience for the end-user.

Connecting with Existing Voice Services

A simple fact of VoLTE is that very few VoLTE calls will occur between two VoLTE-enabled mobile devices. Instead, most VoLTE calls originate from or terminate on other voice networks, such as conventional circuit-switched mobile networks, corporate VoIP-based UC networks, via Web Real-Time Communications (WebRTC)-enabled Internet client devices or even on an analog Plain Old Telephone Service (POTS). ***Note:*** Situations will occur in the near- to mid-term where a VoLTE-enabled device finds itself roaming on a part of the network where LTE isn't yet supported.

Both of these scenarios point to a strong need for devices to help VoLTE to "play nicely" with existing voice services. Luckily, this is a job that the SBC was designed for — one that it performs today for enterprises and service providers using an SBC to control and enhance their existing packet-based voice systems.

A number of SBC functions serve to enhance this existing voice service compatibility specifically, including the following:

- **Single Radio Voice Call Continuity (SRVCC) support:** SRVCC is a mechanism designed to support the evolution to universal VoLTE. In SRVCC, the handset uses a single radio to communicate with both LTE and circuit-switched 2G/3G towers (using separate radios increases power consumption and decreases handset battery life). The SBC can perform this function within a mobile network and rapidly and seamlessly switch calls between LTE and 2G/3G networks on the fly, mid-call (hence the use of the term *continuity* in the name SRVCC).

The functionality performed by the SBC to facilitate SRVCC is known as Access Transfer Control Functionality (ATCF). ATCF uses the IP Multimedia Subsystem (IMS) network to control the call and to rapidly switch a call from VoLTE to the circuit-switched network when required. Essentially the IMS network (and the SBC acting as ATCF) tracks the call as it's in progress; if a VoLTE service interruption is detected, the ATCF instantly (in less

than 300 milliseconds) contacts the circuit-switched elements of the network (the 2G or 3G network), connects the ongoing call to that network, and continues to control the call for its duration.

- **Interoperability between SIP variants (normalization):** As a VoLTE call moves between the mobile network and other networks (such as another mobile operator's network or onto an enterprise VoIP network), there are often small differences and inconsistencies between the way SIP (discussed in Chapter 1) is implemented in these different networks. The SBC "smooths over" these differences by finding common ground (called *normalizing*) between the different variants of SIP so the call can be completed and work as designed.
- **Transcoding:** Sometimes the endpoints on a call support different codecs. For example, a VoLTE handset may be using Adaptive Multi-Rate (AMR)-wideband (HD voice codec), but the UC client on the other end of the call may not. The SBC handles the media transcoding on the fly to ensure that both ends of the call receive the call media data by using a codec that they can handle.

Similarly, the SBC may transrate (change the bit rate) the call if required. For example, if one end of a call is on a network with limited access bandwidth, the SBC can reduce the bit rate of the call to accommodate.

- **Support for WebRTC services:** WebRTC is an IP packet-based communications (video, voice, data, and so on) method that lets users utilize a web browser as their client instead of using a dedicated phone or other communications device. Enterprises (or service providers) are increasingly developing WebRTC applications as inexpensive and easy to deploy additions to their UC systems. The SBC can bridge between a WebRTC deployment and the IMS network that supports VoLTE.
- **Lawful Intercept (LI):** Unlike most OTT communications solutions, VoLTE must abide by many of the same regulatory constraints as traditional mobile voice. One of these constraints is the requirement to support lawful intercept. Because VoLTE communications don't rely on "circuits" like existing mobile communications, the SBC provides this intercept when required.

Chapter 5

Understanding the Role of Diameter Signaling Controllers in VoLTE

In This Chapter

- Understanding Diameter
- Using Diameter to control roaming to other VoLTE networks
- Roaming to non-VoLTE networks with the help of Diameter
- Controlling signaling traffic with Diameter

For Voice over LTE (VoLTE) deployments (and LTE in general), service providers rely on a protocol called *Diameter* for Authentication, Authorization, and Accounting (AAA), and use a Diameter Signaling Controller (DSC) to manage their AAA needs.

AAA is commonly pronounced *Triple A* and does a few things:

- It identifies who a user is (that's the Authentication part).
- It determines what services and network resources the user can access. This is the Authorization element of AAA.
- The AAA system keeps track of what the user then actually does — be it for billing purposes or just to monitor usage and allow auditing of the network. This is the Accounting element.

In this chapter, I talk about what Diameter is and how it fits into the various facets of a VoLTE deployment.

There is a small degree of Authentication and Accounting within the Session Border Controller (SBC) with regards to policy management, but the major lifting of these tasks happens within the DSC. Either way, the SBC and the DSC work together closely and in harmony to enable VoLTE, with the DSC focusing on those elements that are *not* session-based.

Learning about Diameter

Diameter performs an irreplaceable role in a VoLTE network because it's the language (or protocol) used by IP resources in the LTE core network to exchange information that's essential to managing and monetizing mobile data services (including VoLTE). In this section, you find out more about Diameter and the device that supports it in a VoLTE network, the DSC.

Explaining the Diameter protocol

Diameter isn't the name of a piece of equipment or a system of some sort; instead, it's a protocol that's implemented to enable AAA in a network. The name itself is based on the protocol that Diameter is replacing in telecommunications networks, and that's Remote Access Dial-In User Services (RADIUS). You may recall that in geometry a radius is half the diameter; Diameter is similarly a bigger (better and more modern) protocol than RADIUS when it comes to AAA.

Diameter is a flexible AAA protocol, with an underlying Diameter Base Protocol and usage-specific Diameter applications built on top to provide more specific functionality (like supporting LTE networks).

Mobile operators today are deeply involved in the process of building and operating 4G LTE networks to meet the exponential demand caused by smartphones, tablets, and other subscriber devices — each of which supports an ever-growing number of always-on applications. The build-out of networks to support user demand requires a similarly exponential growth in infrastructure devices. This includes policy servers, gateways, SBCs, and billing systems. Each of these infrastructure devices is interconnected, and Diameter allows them to communicate and exchange information. The amount of Diameter signals crossing the network increases as the number of 4G

subscribers increases (and as the number of applications used by each grows as well). In other words, there is an ever-increasing amount of Diameter signaling transiting across the mobile operator's network.

The Diameter signaling between and among these devices is absolutely critical to the ability of a mobile operator to support and charge for the services it offers. Even services that aren't specifically being charged for by usage require Diameter signaling to operate correctly. Therefore, the ability to scale the signaling network to deal with added complexity and the large volume of signaling messages is critical to keeping the network running.

Diameter provides much of the same functionality for IP Multimedia Subsystem (IMS) networks (like LTE and VoLTE services) that Signaling System 7 (SS7) provided for legacy telco networks. SS7 has a number of components or subsets of the protocol; two of the most important are ISDN User Part (ISUP) and Transaction Capabilities Application Part (TCAP). ISUP sets up calls, but TCAP determines if those calls are allowed or finds where the subscriber is currently roaming. Today, SIP has taken over the role of ISUP, and Diameter has largely taken over the role of TCAP.

Meeting the DSC

If Diameter is a protocol (and it is!), then a service provider or enterprise needs something more concrete to deploy Diameter in their network. That's the job of the Diameter Signaling Controller (DSC).

The DSC essentially does the same job for Diameter that the SBC does for Session Initiation Protocol (SIP): The DSC is a specialized (but flexible) network appliance designed to handle large volumes of Diameter signals without introducing any delays or congestion in the network or to users, while simultaneously providing network security. A key function of the DSC is to simplify operations by providing a central point to monitor and control the network.

The DSC works hand-in-hand with the SBC. As a user's device requests SIP connections via the SBC, the DSC is working in the background to authenticate that the user is who she says

she is, then determines which services she can access, authorizes that access and, finally, accounts for the usage of those services for billing, audit or network accounting.

The DSC is designed to

- Handle mobile Diameter signaling in real-time
- Improve the routing of Diameter signals
- Provide encryption, topology hiding, and Denial of Service (DoS) protection
- Protect the network against overloads
- Provide normalization and interoperability between disparate Diameter systems

In some vendors' systems, the DSC and the SBC can be integrated into a single device — or even virtualized onto servers — to decrease the complexity of the network and the number of devices required to support that network.

Working in tandem with SIP

The SBC handles the signals and media responsible for the routing of the actual session (call, video chat, and so on), while the DSC provides the AAA behind those calls. In other words, while the SBC is working to establish (set up) and end (tear down) SIP sessions for subscribers, the DSC is working on those same subscribers' accounts to authenticate that they belong on the network, to determine which services they can access and then to account for the usage for billing and other purposes.

Roaming to Other VoLTE Networks

One of the most important functions of the DSC is to provide AAA for roaming mobile users. In the continental United States, users of the big mobile operators don't frequently find themselves roaming onto other networks — particularly not onto other LTE networks — but in other parts of the world roaming is still a frequent occurrence. In order to support roaming

between different service provider networks with VoLTE, the DSC provides a function known as *Diameter Edge Agent* (DEA). The Diameter Edge Agent functionality is designed to allow users to roam between VoLTE networks just as they have roamed between 2G/3G mobile systems in the past.

Specifically the DEA does the following:

- Acts as a single point of contact between different service providers' networks for roaming purposes
- Routes Diameter signals efficiently between networks for AAA purposes
- Provides topology hiding so that "foreign" parties can access the network without discovering its secrets
- Screens Diameter traffic to protect the operator's network

Roaming to Other Legacy Networks

Sometimes a VoLTE user won't be in range of an LTE network providing VoLTE services. This is a simple fact of life that continues until the transition to VoLTE becomes complete at some point in the future. This "roaming" between VoLTE and legacy networks could occur within a single service provider's network (where the provider hasn't yet deployed LTE towers and radios) or between the network of a user's provider and one of its roaming partners that hasn't yet deployed LTE.

The DSC has an important role to play here. Legacy mobile networks don't use Diameter like IMS networks do. Instead, they use a system called SS7.

The DSC can include a functionality known as *SS7 Interworking Function,* which is the interworking (or seamless translation) between Diameter and the legacy SS7 system. Specifically, Interworking Function allows for protocol translation between Diameter in IMS networks and the Mobile Access Part (MAP) of SS7 in legacy networks. This interworking can occur either within a provider's network as it begins the deployment of VoLTE in some, but not all, areas or between the user's service provider and one of its non-VoLTE roaming partners.

Controlling Signaling Traffic

Another important function of the DSC deals with the general AAA functionality required when a subscriber is within the VoLTE network and trying to make or receive calls.

Two key functions in the VoLTE are controlled by the DSC in this environment. These functions are:

- **Diameter Routing Agent (DRA):** This function routes signals to the Policy and Charging Rules Function (PCRF), which is the software function tasked with providing real-time, on-demand policy rules in the VoLTE network. The DRA forwards signals to the user's appropriate PCRF, which in turn accesses subscriber databases and returns the appropriate policy rules for that subscriber, as well as records usage for billing and other purposes.

  

  Some DRAs can route signals to multiple PCRFs in larger or distributed networks.

- **Subscription locator function:** In some VoLTE deployments, network size (either based on the distribution of the network or the number of subscribers) will dictate that multiple Diameter servers be deployed within the network. The subscriber locator function, performed by the DSC, is used to find the server appropriate to each individual end-user and route messages and signals regarding that user's activity to the appropriate server.

Chapter 6

Ten Reasons to Choose Sonus for VoLTE

In This Chapter

- Leveraging Sonus' VoIP expertise
- Supporting advanced media types
- Maintaining Quality of Service
- Playing well with other vendors

Voice over LTE (VoLTE) is poised to grow, and experts and analysts have noted that VoLTE deployments began in earnest in early 2014 and are expected to grow for the next few years. This observation is obvious when you consider how quickly mobile operators and handset manufacturers have adopted Long-Term Evolution (LTE) and just how much sense it makes to transition the voice part of the network into the packet world with the rest of the IP services offered by mobile operators.

In this chapter, I offer 10 (actually 12) reasons to choose Sonus VoLTE solutions (that is, Sonus Session Border Controllers [SBCs], Diameter Signaling Controllers [DSCs], and the Sonus Policy Server) for your network.

VoIP Experience

If you're considering solutions for what is — for all intents and purposes — VoIP, choose a vendor with a lot of VoIP experience. Sonus has considerable VoIP experience. Sonus SBCs and other equipment have been deployed in large, production VoIP networks for over a decade.

Carrier Grade

Sonus SBCs and DSCs are built carrier-grade from the ground up. They're already supporting carrier deployments and large enterprise deployments that equal the traffic of many smaller mobile operators. The SBC and DSC are designed to grow and scale as your network does. They deliver the carrier-class hardware and software performance and reliability demanded by the largest and most aggressive 4G/LTE mobile operators.

Interworking with 3G

A VoLTE solution must be able to interoperate seamlessly with existing mobile voice networks for the foreseeable future. 4G networks will coexist with 3G for quite some time, and users of 4G devices will find themselves outside of 4G coverage areas at least some of the time.

The Sonus DSC with its Signaling System 7 (SS7) Interworking Function is designed to support both 3G and LTE in a single, mobile operator-grade platform.

Advanced Routing and Screening

Sonus DSC supports advanced routing and screening for Diameter traffic and scales to support the kinds of deployments the larger mobile operators are working on today. Additionally, the Sonus DSC solution supports virtualization, meaning the DSC functionality has been virtualized to be deployed on servers. This allows support of independent instances to control Diameter signals for interconnection with IP eXchanges (IPX) and peering for inter-mobile operator exchange of IP traffic.

Scaling with the Software-Based SBC

Sonus developed the industry's first software-based SBC architected to deliver unlimited scalability with the same advanced features and functionality of hardware on a virtualized platform. Sonus' SBC SWe addresses mobile service providers' requirements for Network Functions Virtualization- (NFV) and Software Defined Networking- (SDN) enabled SBC technology. This is a good fit for a mobile operator beginning the transition to VoLTE because this SBC uses commodity hardware and is entirely software-based. Adding capacity (or upgrading functionalities) requires a simple software download and install. The Sonus SBC SWe works with the leading industry virtualization platforms.

NFV moves functionality from purpose-built hardware platforms onto industry-standard servers, switches, and storage devices. The virtualization allows the platforms to be geographically dispersed or even Cloud-based without affecting functionality.

NFV is an especially intriguing solution for a mobile operator that's taking a phased approach to its VoLTE transition. An NFV-based build-as-required approach can reduce the initial costs of such a transition by avoiding overbuilding, while at the same time allowing for rapid expansion of capacity when needed.

Using a Common Code Base

In some instances a custom hardware-based product is the best choice, while in others a virtualized approach is better — even within the same network, a mobile operator may wish to deploy both hardware and virtualized products. Sonus supports the same code base for both its NFV and server-based products, allowing customers to mix-and-match products without having to support two separate and disparate code bases. This simplifies deployment, operation, and maintenance which significantly reduces OpEx and is something not offered by another vendor.

Supporting Advanced Media Types

Different types of voice, video conferencing, screen sharing, data conferencing, photo sharing, text, presence and more can be part of a VoLTE "call." That's a lot of codecs to handle! The SBC solution supporting a VoLTE deployment needs to be able to deal with all these media types. The alternative is to limit customer choice and make the customer experience weaker.

Sonus' SBC has a broad set of multimedia support capabilities, so your customers can communicate how they want, when they want.

Assuring QoS

The SBC plays a vital role in assuring Quality of Service (QoS) with its support of *transcoding*. Essentially the SBC polls both ends of the call, determines which codecs are supported, and — if necessary — do an on-the-fly translation of media from one codec to another.

With Sonus' transcoding support, both ends of the call can communicate with each other, using their preferred native codecs, with no interruption in their ability to place the call and enjoy a high QoS during the call. So a call from a VoLTE phone can communicate with a VoIP device in a business or landline phone in someone's home, no matter which codecs each supports.

Playing Well with Other Vendors

Two primary protocols that support VoLTE are SIP and Diameter. These are standards-based protocols, which, in theory, means that any systems utilizing them should be interoperable with each one another. That's the theory, at least. As is often the case, when theory meets reality there can be a few hiccups. That's because different vendors often have slight variations in how they implement and use these

protocols. The variations may not be significant, but they can cause issues when traffic is moving between different network segments serviced by different vendors.

Sonus SBCs and DSCs are designed specifically to provide a wide degree of SIP and Diameter normalization, which makes customers happy.

Exhibiting Discretion

Customer experience is an increasingly important factor in acquiring and (more importantly) retaining customers. Today's mobile services marketplace is highly competitive, especially because there's broad feature compatibility and parity among the competitors. An important part of differentiating the customer's experience is a seamless and responsive VoLTE environment — one where calls go through with little delay and the media is presented in high fidelity, with little lag or latency.

Sonus SBC technology development takes a unique approach by developing and treating the hardware processors required for SBC tasks as part of a discrete three-dimensional model. In other words, instead of using general purpose processors to do most functions, Sonus SBCs are architected with a combination of processors for three different functional areas:

- **General computing** for policy management and call control
- **Network processing** for networking such as the interworking among different SIP protocols and routing packets
- **Media processing** for transcoding and transrating

With this approach, a Sonus SBC can be easily custom configured with more processing power for the tasks that are particularly computational intensive. This can be done without requiring upgrades for the functions for which you already have more than sufficient processing overhead. So you can save money and still improve the customer experience.

Dealing with the Broadest Profile

One size doesn't fit it all — in life and in 4G VoLTE networks. This is particularly true as mobile operators start with relatively small deployments of VoLTE and then expand their networks as more subscribers purchase VoLTE-capable devices (and as the 4G network expands to support them).

Sonus has a broad portfolio of SBCs for the VoLTE market, affording customers flexibility in deployment. A mobile operator can start as large or small as needed and easily grow or reconfigure the network as required. Sonus has a solution for networks of all sizes.

Making Diameter Comprehensive

DSCs keep VoLTE networks running and let mobile operators effectively deliver and charge for services. Sonus offers a comprehensive portfolio of Diameter Signaling Controller products for the VoLTE market. Sonus DSCs support VoLTE to 3G roaming, interworking between VoLTE and 3G (supporting call continuity), and Diameter routing.

Enrich your business and personal communications with VoLTE

Move beyond legacy phone systems to the latest 4G LTE. In this book, you see how Voice over LTE (VoLTE) is revolutionizing telecommunications in the consumer and enterprise markets. Discover what makes up VoLTE, the business case for VoLTE, and the role of the Session Border Controller (SBC) and Diameter Signaling Controller (DSC) in a VoLTE network.

- ***Understand what VoLTE is all about — grasp the importance to mobile operators and enterprises***
- ***Look at the business benefits of VoLTE — generate revenues and save money***
- ***Discover what elements make up VoLTE — find out the products required***
- ***See the role of the SBC in VoLTE — provide security and enable new VoLTE services***
- ***Learn how the DSC fits in VoLTE — support roaming and control signaling in VoLTE***

Open the book and find:

- **What VoLTE is all about**
- **The business benefits of VoLTE**
- **The communication services enabled by VoLTE**
- **The roles of SBCs and DSCs in VoLTE**

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