

# Billing in a 3G Environment

## Definition

Billing in a 3G environment refers to the capacity of a wireless communications service provider to capture, rate, and bill next-generation mobile communications events. These events include voice, data, and electronic content such as mobile Web browsing and e-mail, mobile commerce activities, and streaming video.

## Overview

The migration from second generation (2G) to third generation (3G) wireless communications systems represents a landmark shift in the development of the mobile communications industry—and the communications and information industries in general.

This tutorial explores the evolution of the wireless market from 2G through interim 2.5G to advanced 3G networks. Its central focus is an examination of the challenges that service providers face in deploying billing systems that are capable of meeting existing requirements and flexible enough to support the gradual adoption of 2.5G and 3G next-generation services by consumers.

The tutorial also reviews the enabling technologies and standards that define each generation of communications services. To satisfy the unique billing requirements of carriers that deploy advanced network services, billing systems must support the standards described in the following sections.

## Topics

1. 2G Billing Challenges
2. Transitioning from 2G to 2.5G Network Services
3. The Emergence of 2.5G Services and Resulting Billing Challenges
4. Next-Generation 3G Services: Bringing Challenge and Opportunity
5. New Business Models for Billing 3G Services
6. Conclusion

Self-Test

Correct Answers

## 1. 2G Billing Challenges

The introduction of 2G cellular radio in the 1990s led to a genuine and significant change in human behavior. Technically, it provided the basis for the transition of voice technology from an analog, wired environment to a digital, wireless environment. Psychologically and socially, the advent of 2G transformed telecommunications from a communications tool to an agent of social change that improved people's professional and personal lives by enabling unprecedented communications flexibility.

Deploying a billing system for wireless services has never been simple. However, in the early days of 2G, billing was based on voice minutes. As a result, many wireless carriers, familiar with traditional voice telephony, implemented wireless billing systems using previous models that billed for voice minutes using call detail records (CDR).

## 2. Transitioning from 2G to 2.5G Network Services

By the late 1990s, wireless subscribers' voracious appetites for value-added services such as two-way messaging, unified communications, electronic voice-mail and e-mail, and personal number services drove an evolution toward more sophisticated 2.5G network services.

The rate of acceptance of 2.5G services varied around the world. The growth of value-added services in the United States was outpaced by widespread acceptance in Europe and Asia. One major reason for this was a lack of integration among various network technologies such as code division multiple access (CDMA), time division multiple access (TDMA), and the Global System for Mobile Communications (GSM). Billing systems could not support the disparate standards required for different network types.

In Europe and Asia, however, the adoption of a single standard, GSM, facilitated rapid acceptance and implementation of value-added 2.5G services.

As a result of the lack of uniformity in standards, wireless carriers focused on two leading criteria in the selection of wireless billing systems:

- Speed to market
- The ability to interface with other systems

These market conditions also gave rise to a new market driver that would confer an important strategic edge—convergence—the ability to offer and bill for multiple services, such as long distance, Web browsing, and voice on a single bill. Convergence prompted wireless carriers to plan the rollout of enhanced services and products that would extend wireless capabilities well beyond voice.

By 1998, wireless messaging had gained a foothold in Asia. Mixed mobile and fixed services, as well as value-added services, enjoyed growing popularity in Latin America. Meanwhile, in more mature markets such as the United Kingdom, the United States, and parts of Europe, increasing numbers of carriers began upgrading their billing systems to support the growing market for wireless data offerings.

The rollout of these services presented a critical challenge. To offer wireless data services, carriers needed a billing system that could accommodate the new services—particularly if charges were to be calculated based on the quantity of data transferred rather than the duration of time on-line.

As a result, convergent services strained legacy billing systems that were designed to measure and rate usage-sensitive wireless voice. With the emergence of 2.5G, existing billing systems simply were not equipped to rate wireless data, which typically was charged based on a flat rate.

### 3. The Emergence of 2.5G Services and Resulting Billing Challenges

Mobile data technologies such as short message service (SMS), wireless application protocol (WAP), and general packet-switched radio service (GPRS) have facilitated the move into the 2.5G world of content, with applications such as mobile e-mail and access to other Web-based services via mobile handsets.

SMS originated as a platform for e-mail and value-added services such as news, weather, and stock reports. WAP, which allows Internet content to be retrieved via mobile phones or other wireless devices, became available to the mass market in 2000.

Concurrent with the introduction of WAP, GPRS facilitates GSM-based wireless broadband access to the Internet via a personal computer (PC). GPRS also enhances WAP service levels. GPRS enables mobile service providers to offer complex services that are transferred as packet-switched, non-voice, value-added services. This is in contrast to traditional circuit-switched services that are available across mobile networks.

GPRS adds value because it enables instant wireless connections ("always on" service), which in turn allow information to be sent or received immediately as

the need arises, subject to radio coverage. No dial-up modem connection is necessary.

Despite the accelerated pace of development in wireless technology and the digital data world, business drivers have focused on acquiring customers and increasing revenue to the exclusion of developing and implementing adequate billing and business solutions. Consequently, many entrants into the 2.5G marketplace had to rely on less-than-adequate billing solutions, using shortcuts to accommodate the drivers. Two of the most common shortcuts include the following:

- Bundling data charges into access charges
- Adding "all-you-can-eat" service for a flat rate

In assessing the complexity of billing for wireless data, the first challenge has been event collection and mediation. Carriers needed to deploy Internet protocol (IP) billing models capable of capturing information from multiple servers, routers, gateways, and content providers.

Suddenly, as service providers watched their margins disappear, flat-rate billing began to lose its appeal. The new catch phrase used to describe more recent usage-sensitive billing is *billing for content*. This new billing model is currently being addressed by billing standards organizations such as the Global Billing Association (GBA) to represent industry interests.

The objective of billing for content is two-fold—to help all service providers, and mobile service providers in particular, to determine the following:

- The type of data being transmitted over their networks
- How to capture revenue from the data being transmitted

As the rollout of more sophisticated and complex 3G services becomes a reality, these questions present an even greater challenge.

## 4. Next-Generation 3G Services: Bringing Challenge and Opportunity

In the future, as 3G services are adopted, GPRS will provide a massive boost to mobile data usage and usefulness. The promise of next-generation technology is likely to be realized because of its flexible feature set, and inherent latency, efficiency, and speed.

In Europe, next-generation or 3G cellular mobile radio is known as Universal Mobile Telecommunications System (UMTS). UMTS is expected to offer broadband multimedia services in addition to basic services such as voice.

Both GPRS and UMTS will support many new types of services. These include the following:

- Streaming video services
- Videoconferencing
- Interactive on-line shopping
- Location-sensitive directories
- On-line banking, stock trading, and sports reporting

It is unlikely that these services initially will justify the significant capital investment required to fund the network development that enables them. Instead, industrial and commercial applications will most likely lead the way as major consumers of pure bandwidth.

The types of commercial applications being proposed include expanded versions of existing sales and service applications—extending on-line computer facilities to staff in the field and using mobile security applications to monitor buildings and moving vehicles.

If the mobile Internet is to succeed and enjoy widespread acceptance, service providers must offer a variety of services. However, service providers alone cannot supply all of the services that consumers will require. In fact, growth would be severely hampered if service offerings were limited to only those that service providers can develop and offer. As a result, in addition to their own, service providers will have to offer services supplied by outside sources.

## Service-Provider Challenges

While the possibilities that result from the launch of next-generation services and content-based services are exciting, they present service providers with numerous challenges, such as the following:

- Where to assess the value of the content moving across networks
- How to deliver content developed and provided by third parties
- How to capture revenue generated by content provided by outside sources

## Service-Provider Advantages

As service providers scramble to establish effective models for billing for these new services, several factors work in their favor:

- Service providers already interface with subscribers on a monthly basis in the form of invoices
- Service providers can bill content providers, uniquely positioning them as aggregators of content

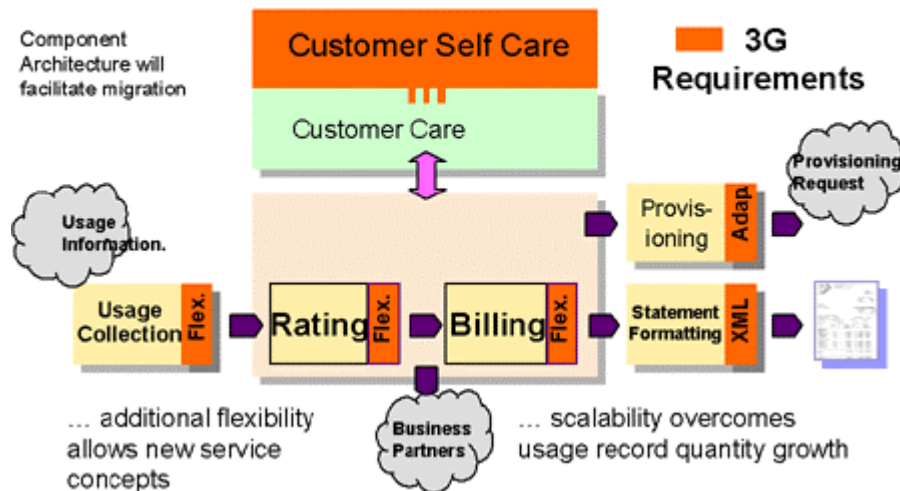
## Redefining Billing Requirements to Keep Pace With Change

As described previously, GPRS and UMTS are packet-switched networks that will change the elements of billing for a number of reasons:

- Users will be able to access content via a visual subscriber interface—as opposed to voice, mobile subscribers will be able to send and receive text, pictures, and video.
- New users will always be on-line. The concept of "making a call" will disappear.
- Networks will be able to locate users within a few miles or meters. This capability yields new forms of advertising and sponsored services, which means that third parties may be prepared to pay operators for access to their subscribers.
- To support GPRS and UMTS services, a new generation of mobile "phone" is being developed. The lines between traditional phones and laptops will blur as technologies converge. Different types of consumers will use different types of devices, depending on whether they want games, music, video, or voice.
- New partnership opportunities will abound as communications service providers partner with outside sources to produce the content that they cannot produce in-house. As a result, the volume of settlement activities required to manage the exchange of content between networks is expected to grow. Depending on the length of the value-chain, the speed with which the settlements are made will become critical.
- New, next-generation networks will generate different forms of data using different types of records in larger quantities. Forecasts range

from twice as much data to 50 or even 100 times as much. Scalability in a billing system will be imperative.

Diagram of 3G Billing System  
**Customer Care and Billing Platforms**



## 5. New Business Models for Billing 3G Services

In view of the new services and resulting billing challenges, the overriding question is how should these new services be billed? Data and content-based services enabled by high-bandwidth packet networks will require new business models. Consequently, service providers will have to modify or replace existing, voice-centric billing infrastructures with new systems.

### Devising a Framework for Next-Generation Billing Systems

To be viable, next-generation billing systems must be capable of pricing data and content events in addition to voice calls. They will have to be highly flexible, event-based, and truly convergent. In developing a billing solution equal to the task, a number of new parameters for calculating charges can be used:

- Number of packets
- Uploading or downloading of data
- Quality of service (QoS)

- Location
- Content

Communication service providers will certainly seek to bill subscribers directly for some services. However, they may also consider any of the following scenarios:

- **Billing third parties for access to subscribers:** Banks, travel agents, stock-brokers and similar entities could be billed for secure access to mobile subscribers.
- **Billing subscribers directly for everything, including content:** This scenario would generate a convergent bill that resembles a credit card statement, giving the service provider complete control of the relationship and maximizing the value of the customer relationship. This model would require a complex system to track the delivery of goods, ensure the QoS across the various forms of content that they deliver, and settle payments with suppliers.
- **Billing content providers for access:** Subscribers might pay content providers directly and service providers might receive a commission. This type of approach would simplify logistics for the operator, but also would burden the subscriber with multiple bills.

## Keys Issues in Selecting a 3G Billing System

When it comes to selecting a billing system, a number of key issues must be considered. The right billing system must do the following:

- Be real-time. To perform balance management and authorization for 3G services, the billing system must return a price for an ordered good or service in a sub-second time frame.
- Be based on open industry standards to allow for interoperability with other OSS solutions
- Be modular to minimize total cost of ownership (TCO) for the communications service providers
- Accommodate all current and future types of services (including voice, data, and content)
- Support bundling of these services into cross-product packages to meet the needs of individual market segments



- Provide a "customer-centric view" of the account versus a "service-centric view." This means that the customer-service representative (CSR) has a 360-degree view of the customer with all his or her services in order to give targeted and relevant service.
- Minimize time to market for new products and services. State-of-the-art billing systems are not an obstacle anymore when it comes to launching new products—they are essential tools.
- Enable the customer to perform his or her own customer care via the Web or any other device (WAP phone, handheld, etc.)

## 6. Conclusion

Criteria like these are important factors to consider when evaluating and making decisions about potential billing solutions in the 3G environment. In the best of all worlds, an ideal solution will address all of these requirements. However, as the nature of services is redefined, certain compromises will be necessary. For example, the sheer complexity of service offerings will make fully itemized bills impractical. At the same time, self-care will enable users to examine their bills in the detail of their choice. In all cases, the bill must be clear and easy to decipher.

In weighing the pros and cons of the respective billing approaches, one fact is clear. The common denominator is the need for a technically practical way to bill for services—one that makes sense to the subscriber.

Service providers must approach GPRS and UMTS services in a consistent and straightforward manner and should bill subscribers in the same ways that they would be billed for the traditional version of the service.

As the GPRS and UMTS communications "revolution" unfolds, promising extraordinary changes in the ways in which we communicate, exchange information, and make purchases, no one knows exactly what the future will bring.

What we do know is that the future will not be exactly what we expect it to be. And we know that it is reasonable to expect that the business models that will succeed are those that can evolve over time.

In conclusion, billing systems must be as flexible as possible. And because service providers cannot be tied down to particular ways of doing business, they will have to forge alliances with business partners that are just as flexible and adaptable.

Compared to the considerable capital investment that service providers are making in GPRS and UMTS services, the customer care and billing investment is

a relatively small one. It is, however, a central and vital concern in a marketplace where differentiation is the key to success.

A leading determinant in market differentiation will be the customer-care and billing system—and in some cases, it may be the pivotal investment that will mean the difference between success and failure.

## Self-Test

1. In the early days of 2G, wireless billing was based on voice minutes using call detail records (CDR).
  - a. true
  - b. false
2. Which of the examples below is considered a 2.5G value-added service made available to wireless subscribers in the late 1990s?
  - a. 2-way messaging
  - b. e-mail
  - c. electronic voice-mail
  - d. none of the above
  - e. all of the above
3. Convergence is the ability to offer and bill for multiple services such as voice, long distance, and e-mail?
  - a. true
  - b. false
4. Wireless carriers' incumbent legacy billing systems could easily support the new 2.5G data-centric services.
  - a. true
  - b. false
5. The term flat-rate billing refers to the shortcut of bundling all voice and data services onto a single bill.

- a. true
  - b. false
6. Which of the services below is NOT considered a next-generation, or 3G, service?
- a. streaming video
  - b. wireless voice
  - c. interactive shopping
  - d. on-line banking, stock trading, and sports reporting
7. In Europe, next-generation or 3G cellular mobile radio is known as general packet-switched radio service (GPRS)?
- a. true
  - b. false
8. Service providers alone cannot supply all of the services that consumers will require, prompting the need for service providers to offer, not only their own services, but those offered by outside sources.
- a. true
  - b. false
9. Next-generation billing systems must have the ability to price data and content events in addition to voice calls.
- a. true
  - b. false
10. Which of the parameters listed below will need to be incorporated into next-generation billing solutions to calculate new 3G charges?
- a. number of packets
  - b. location

- c. quality of service (QoS)
- d. none of the above
- e. all of the above

## Correct Answers

1. In the early days of 2G, wireless billing was based on voice minutes using call detail records (CDR).

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b. false

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## Glossary

### **Bill Cycle**

The period for which a consumer receives an invoice; can also denote when a cycle begins or ends

### **Call Detail Record (CDR)**

A billing-system feature that tracks details about calls, such as type, time, duration, originator, and destination. CDRs can be used for network monitoring, accounting, and billing purposes.

### **Carrier**

(1) A telecommunication company that offers its services to the public; typically, a carrier files tariffs that are equally applied to all consumers; (2) a continuously varying electromagnetic signal that carries analog signals such as frequency modulation (FM), amplitude modulation (AM), or digital signals. (AKA: service provider, operator)

### **Cellular Telecommunications Industry Association (CTIA)**

A trade organization that represents the cellular/PCS wireless industry and is involved with regulatory and public affairs issues in the mobile wireless phone industry

### **Code Division Multiple Access (CDMA)**

CDMA is a generic term that describes a wireless air interface based on code division multiple access technology.

cdmaOne™ is a brand name, trademarked and reserved for the exclusive use of CDG member companies, that describes a complete wireless system that incorporates the interim standard (IS)–95 CDMA air interface, the American National Standards Institute (ANSI)–41 network standard for switch interconnection, and many other standards that make up a complete wireless system. CDMA2000 is a name identifying the 3G technology that is an evolutionary outgrowth of cdmaOne offering operators that have deployed a 2G cdmaOne system—a seamless migration path that economically supports an upgrade to 3G features and services within existing spectrum allocations for both cellular and personal communications system (PCS) operators. CDMA2000 supports the 2G network aspect of all existing operators regardless of technology (cdmaOne, IS–136 TDMA, or GSM). This standard is also known by its

International Telecommunication Union (ITU) name International Mobile Telecommunications (IMT)–CDMA Multi-Carrier (1X/3X).

### **Convergence**

The ability to offer and bill for multiple services

### **Customer-Service Representative (CSR)**

A carrier representative who deals with the consumer for ordering services and handling troubles or discrepancies in billing records

### **Event Processing**

The process of gathering events in a network for the purposes of billing and/or network monitoring. Most often associated with capturing the details of 2.5 and 3G services such as short message service, mobile Web browsing, mobile e-mail, and multimedia.

### **General Packet Radio Service (GPRS)**

A GSM data transmission technique that does not set up a continuous channel from a portable terminal for the transmission and reception of data, but transmits and receives data in packets. It makes very efficient use of available radio spectrum, and users pay only for the volume of data sent and received.

### **Global Positioning System (GPS)**

A series of 24 geosynchronous satellites that continuously transmit their position. Used in personal tracking, navigation, and automatic vehicle-location technologies.

### **Global System for Mobile Communications (GSM)**

A digital cellular or PCS network used throughout the world

### **Internet Protocol Detail Record (IPDR)**

IPDR.org is an open consortium of leading companies working together to bring this vision to reality. Collaborating service providers, equipment vendors, system integrators, and billing and mediation vendors facilitate the exchange of usage and control data between network and hosting elements and operations and business support systems by the deployment of IPDR standards.

### **Mediation Device**

A device that can interface with complex multivendor switches and billing systems to gather the required information for provisioning; also can refer to the software used by carriers to interconnect operations support systems (OSS).

### **Personal Communications Service (PCS)**

A two-way, 1900 MHz digital voice, messaging, and data service designed as the second generation of cellular.

### **Personal Digital Assistant (PDA)**

A portable computing device capable of transmitting data. These devices make possible services such as paging, data messaging, electronic mail, computing, facsimile, date books, and other information-handling capabilities.

**Provisioning**

The process by which a requested service is designed, implemented, and tracked for a particular customer.

**Quality of Service (QoS)**

A measure of a carrier's service to a consumer

**Rate Plan**

The plan to which a consumer agrees upon requesting service

**Time Division Multiple Access (TDMA)**

A method of digital wireless communications transmission allowing a large number of users to access (in sequence) a single radio frequency channel without interference by allocating unique time slots to each user within each channel

**Universal Mobile Telecommunications System (UMTS)**

Europe's approach to standardization for 3G cellular systems