Learning Track 2: Cellular System Generations

Cellular Generations

Wireless phone systems throughout the world are gradually moving toward much higher speeds and capacities. This transition involves over $150 billion in worldwide investment by 2016 in what are called **4G networks** (fourth-generation cellular networks).

The first generation (1G) of cellular networks originating in the early 1980s were analog based. They supported voice communication and could only be used for data transfer with a proper modem. Second-generation (2G) cellular networks appeared about 10 years later using digital networks. 2G systems provide better voice quality and global roaming capabilities and can support simple data services such as SMS. Although 2G systems are used primarily for voice, they can support data transmission at rates ranging from 9.6 to 14.4 kilobits per second (Kbps). This transmission speed is still too slow for comfortable Internet access.

Third-generation (3G) cellular networks are based on packet-switched technology that achieves greater efficiencies and higher transmission speeds. 3G networks have speeds ranging from 144 Kbps for mobile users in, say, a car, to over 2 Mbps for stationary users. This is sufficient transmission capacity for video, graphics, and other rich media, in addition to voice, making 3G networks suitable for wireless broadband Internet access and always-on data transmission. If 3G networks are able to handle e-mail, instant messaging, and Web browsing as effortlessly as current wired technologies, but they are not fast enough to handle video, especially high definition video.

Fourth generation (4G) cellular networks use a variety of multiplexing technologies to share network resources among many users. 4G networks are also referred to as 4G-LTE for Long Term Evolution. In the U.S., all 4G networks use this variant of 4G.   Commercially available 4G-LTE networks can achieve speeds of 100 Mbps download, and 50 Mbps upload, which is faster than typical home cable speeds.

Although wireless carriers have invested in 3G technology, it is still not in wide use. In the meantime, those interested in high-speed Internet access and data transmission are turning to an interim solution called **2.5G networks.** These networks are packet-switched, use many existing infrastructure elements, and have data transmission rates ranging from 50 to 144 Kbps. A 2.5G service called

General Packet Radio Service (GPRS) transports data over GSM wireless networks and improves wireless Internet access. 2.5G also improves data transmission rates for CDMA. Table 7-2 summarizes these cellular generations.

TABLE 7-2   Wireless Cellular Generations

Generation	Capacity	Description
1G	Low	Analog cellular networks for voice communication
2G	10–14 Kbps	Digital wireless networks, primarily for voice communication; limited data transmission capability
2.5G	50–144 Kbps	Interim step toward 3G in the United States
3G	144 Kbps—2+ Mbps fixed	High-speed, mobile, supports video and other rich media, always-on for e-mail, Web browsing, instant messaging
4G-LTE	50–100 Mbps	Very high speed cellular service that can support high definition video, teleconferencing, along with phone and data services .