



Wireless WAN Technologies

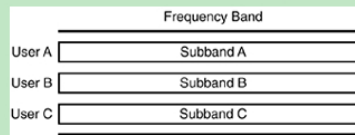
Wireless WANs make use of technologies that focus on modulation of voice and data. As discussed in Chapter 2, "Wireless System Architecture: How Wireless Works," modulation converts digital signals that represent information inside a computer into either RF or light signals. Wireless WANs exclusively use RF signals designed to accommodate many users. Each user has a dedicated channel, and this is different from wireless LANs, where all users share one channel. This significantly reduces interference between wireless WAN user devices and base stations.

Take a closer look at the different modulation techniques.

Frequency Division Multiple Access

Frequency division multiple access (FDMA) divides a wide-frequency band into smaller subbands, where each user transmits voice and data over their assigned subband. All users transmit their signals simultaneously. Figure 7-9 illustrates this concept. Traditional 1G cellular systems use FDMA for sending data.

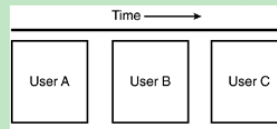
Figure 7-9. FDMA Allows Simultaneous Transmissions Because Users Do Not Operate in the Same Part of the Frequency Spectrum



Time Division Multiple Access

As shown in Figure 7-10, time division multiple access (TDMA) keeps users separate by allowing only one user to transmit at any give time. Each user has an assigned time slot for transmission. Some of the older telecommunications operators utilize TDMA to offer voice and data connections over wireless WANs. For example, T1 circuits make use of TDMA for combining separate user connections over the same circuit.

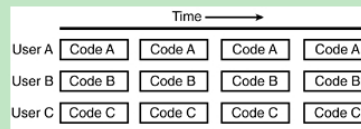
Figure 7-10. TDMA Makes Users Transmit Only During Their Assigned Time Slot



Code Division Multiple Access

Similar to FDMA, code division multiple access (CDMA) allows simultaneous transmissions. (See Figure 7-11.) The difference, however, is that CDMA users can occupy the entire frequency band at the same time. The users do not experience any interference, because each user modulates her signals using a different code. An advantage of CDMA is that user devices can connect to multiple base stations because of separate codes. This increases performance and reliability. Cellular systems predominately make use of CDMA wireless networks.

Figure 7-11. CDMA Assigns a Code to Each User, Which Makes It Possible for Users to Transmit Simultaneously Without Interference



Spatial Division Multiple Access (SDMA)

SDMA accommodates multiple users by focusing a beam for each user. This is common in satellite systems. Some SDMA systems are adaptive, where the radio beams follow movement of the user. Other systems require the user device to re-associate with the next beam as users move.

note



Some wireless WAN devices, such as mobile phones, have multiple modes or bands and support more than one technology. For example, a single mobile phone can support both TDMA and CDMA. The phone automatically switches from one technology to the other depending on which network is available.



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










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-  [Introduction](#)
-  [Chapter 1. The Wireless World: An Introduction to Concepts](#)
-  [Chapter 2. Wireless System Architecture: How Wireless Works](#)
-  [Chapter 3. Radio Frequency and Light Signal Fundamentals: The Invisible Medium](#)
-  [Chapter 4. Wireless PANs: Networks for Small Places](#)
-  [Chapter 5. Wireless LANs: Networks for Buildings and Campuses](#)
-  [Chapter 6. Wireless MANs: Networks for Connecting Buildings and Remote Areas](#)
-  [Chapter 7. Wireless WANs: Networks for Worldwide Connections](#)
 -  [Wireless WAN Components](#)
 -  [Wireless WAN Systems](#)
 -  [Wireless WAN Technologies](#)
 -  [Chapter Summary](#)
 -  [Chapter Review Questions](#)
-  [Chapter 8. Wireless Network Security: Protecting Information Resources](#)
-  [Appendix A. Answers to Chapter Review Questions](#)
-  [Glossary](#)

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