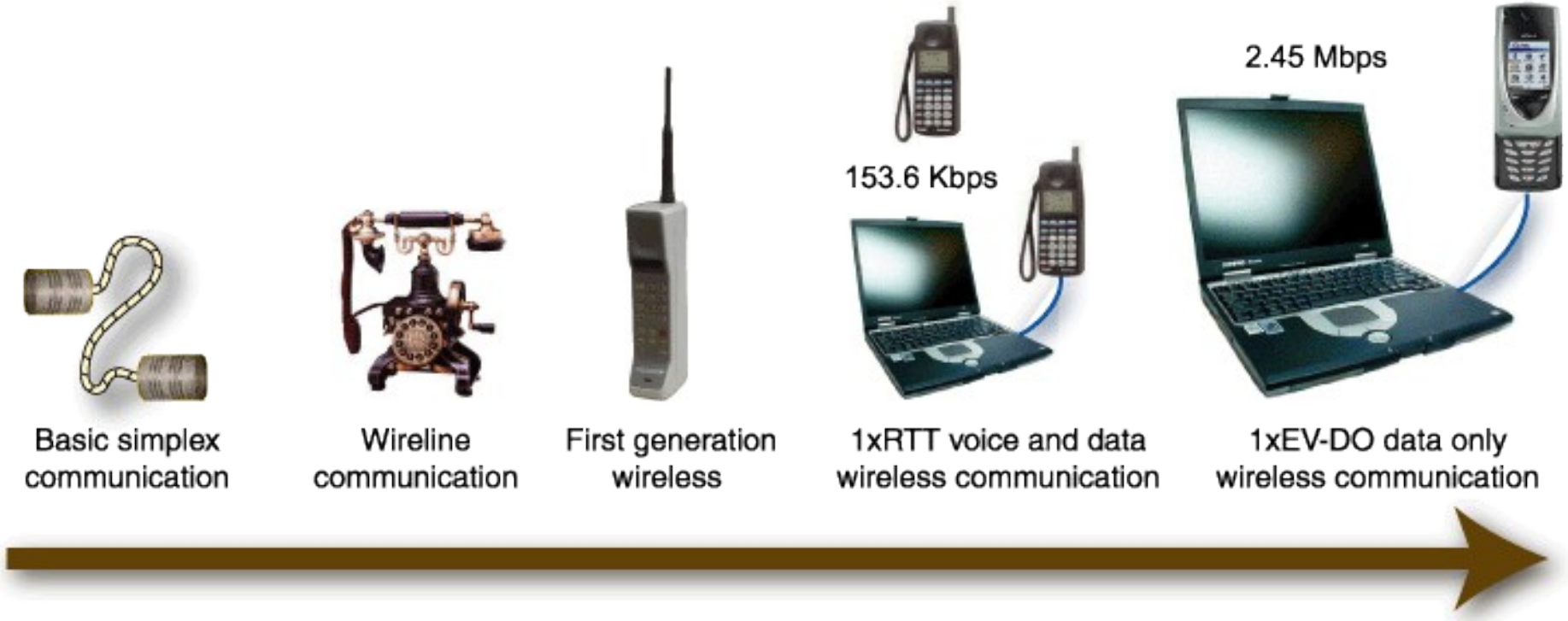
Fundamentals of Wireless Communications

Unit 9: CDMA 2000–1xEV-DO

The evolution to CDMA2000 1xEV-DO





Review - Multiple Access Techniques

FDMA **(example: AMPS)**

Frequency Division Multiple Access

each user has a private frequency

TDMA **(examples: IS-54/136, GSM)**

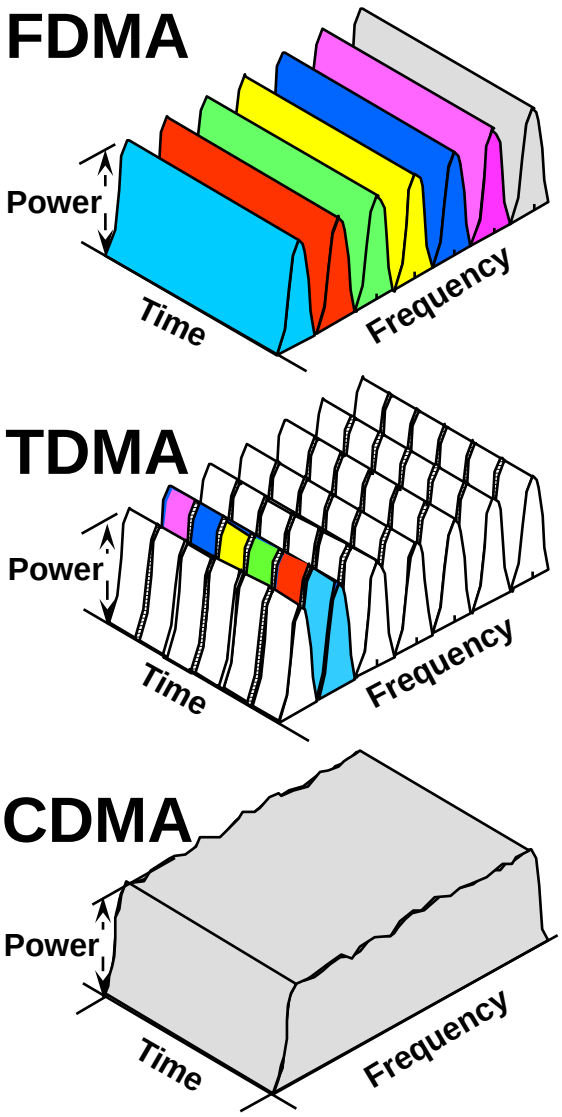
Time Division Multiple Access

each user has a private time on a private frequency

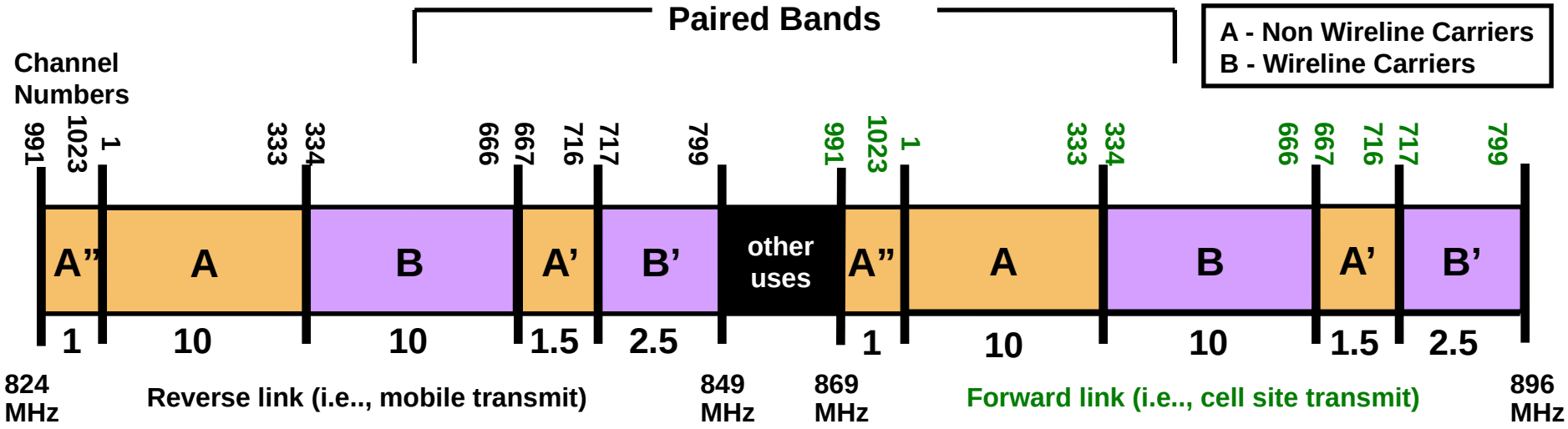
CDMA **(IS-95, J-Std. 008)**

Code Division Multiple Access

users co-mingle in time and frequency but each user has a private code



The CDMA Cellular Spectrum



- 25 MHz of spectrum is licensed to each of these operators
  - 12.5 MHz is used for the reverse link and 12.5 MHz for the forward link
- The expanded spectrum allocation is depicted as A’, A” and B’
- The reverse and forward links for one RF channel are separated by 45 MHz

Wireless Evolution

		CDMAone		CDMA2000/IS-2000	
Generation	**1G**	**2G**	**2G**	**2.5G**	**3G**
Technology	**AMPS**	**IS-95/J-Std008**	**IS-95B**	**IS-2000: 1xRTT**	**IS-2000: 3xRTT**
Signal Bandwidth, #Users	30 kHz. 1	1250 kHz. 20-35	1250 kHz. 25-40	1250 kHz. 50-80 voice and data	F: 3x 1250k R: 3687k 120-210 per 3 carriers
Data Capabilities	None, 2.4K by modem	14.4K	64K	153K 307K 230K	2.4 Mb/s
Features: Incremental Progress	First System, Capacity & Handoffs	First CDMA, Capacity, Quality	• Improved Access • Smarter Handoffs	• Enhanced Access • Channel Structure	Faster data rates on shared 3-carrier bundle

Spreading Rates and Radio Configurations

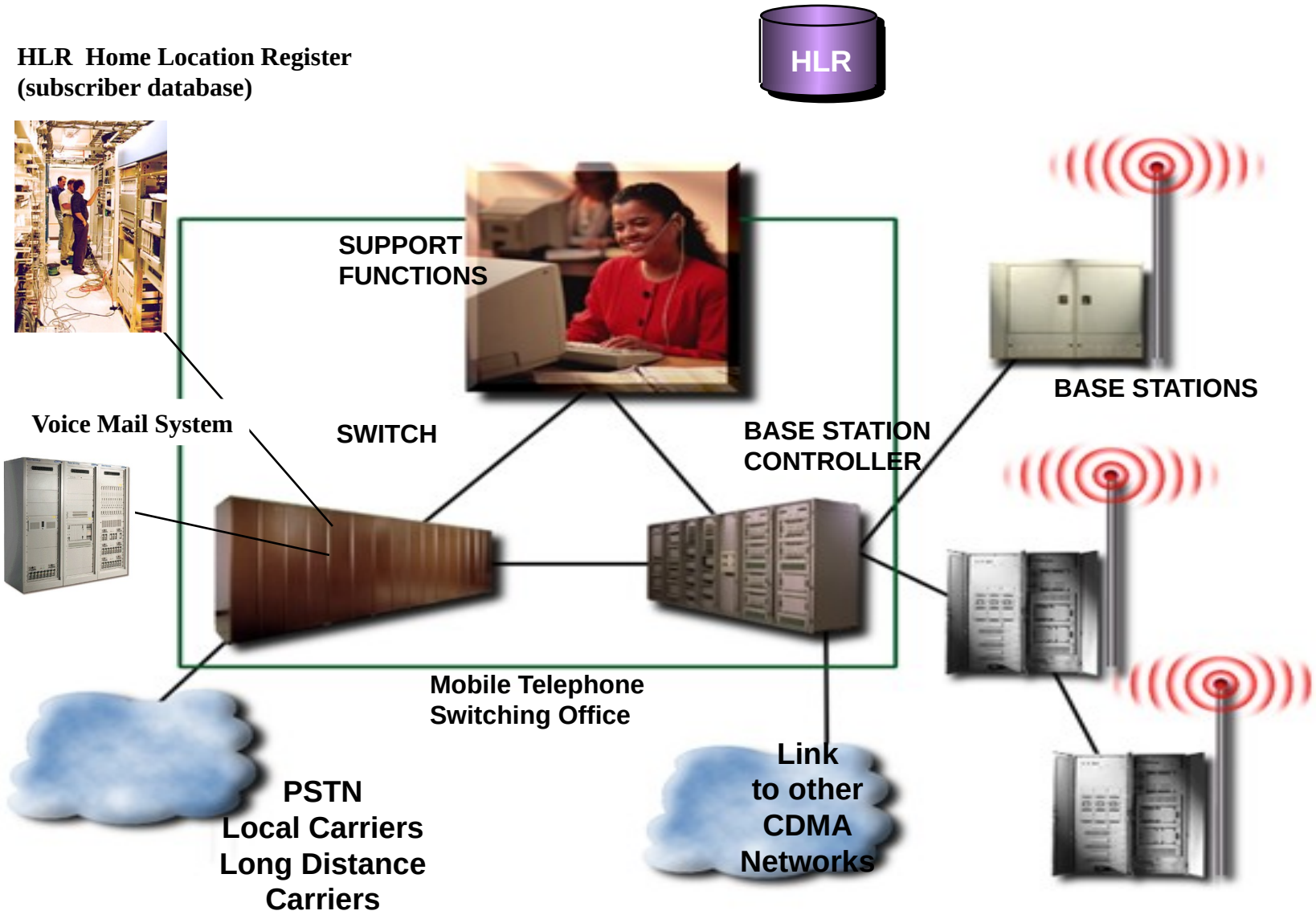
- Spreading Rate refers to the speed of the waveform which spreads the CDMA signal, determining its spectral width and its processing gain
  - Spreading Rate 1 is 1,228,800 chips per second, identical to current IS-95 operation. It makes signals about 1.25 MHz. wide, and can carry certain amounts of data per sector
    - This is called 1xRTT, 1x Radio Transmission Technology
  - Spreading Rate 3 is 3 times Spreading Rate 1, or 3,686,400 chips per second. It makes signals about 3.75 MHz. wide and can carry larger amounts of data per sector
    - This is called 3xRTT, 3x Radio Transmission Technology
- Radio Configuration refers to the coding arrangements and channel definitions used

The path to CDMA2000 1xEV-DO

CDMA2000 1X in the beginning:

- CDMA2000 1xEV-DO is a data only evolution from conventional IS-2000 (CDMA2000 1X) networks. Offers high speed packet data rates of up to 2.45 Mbps
- CDMA2000 1X offers both voice and data capabilities compared to conventional CDMA (IS-95) networks (voice only)
- CDMA2000 1X high speed packet data
  - Rates of up to 153.6 Kbps (144 Kbps user)

Structure of a Typical Wireless System



What is CDMA2000 1xEV-DO?

- CDMA2000 1xEV-DO (1xRTT evolution–data only) is a wireless packet data-only technology
  - Used for customer data applications where voice communication is not required
- high-speed packet data support of variable rates up to 2.45 Mbps on the forward link and up to 153.6 kbps on the reverse (upload) link
- CDMA2000 1xEV-DO uses time-division multiplexing (TDM) in the forward direction, meaning there are no soft handoffs in the forward direction and only one terminal receives data from each sector at a given time

What is CDMA2000 1xEV-DO?

- CDMA2000 1xEV-DO stands for 1xRTT Evolution – Data Only
  - What this means is that it is an evolution from CDMA2000 1X (IS-2000/CDMA2000) networks
  - Where CDMA2000 1X has both data and voice capabilities, CDMA2000 1xEV-DO is data only (without the voice component)
- CDMA2000 1xEV-DO offers high-speed packet data rates up to 2.45 Mbps where CDMA2000 1X has a maximum data rate of 153.6 Kbps

What is CDMA2000 1xEV-DO? (continued)

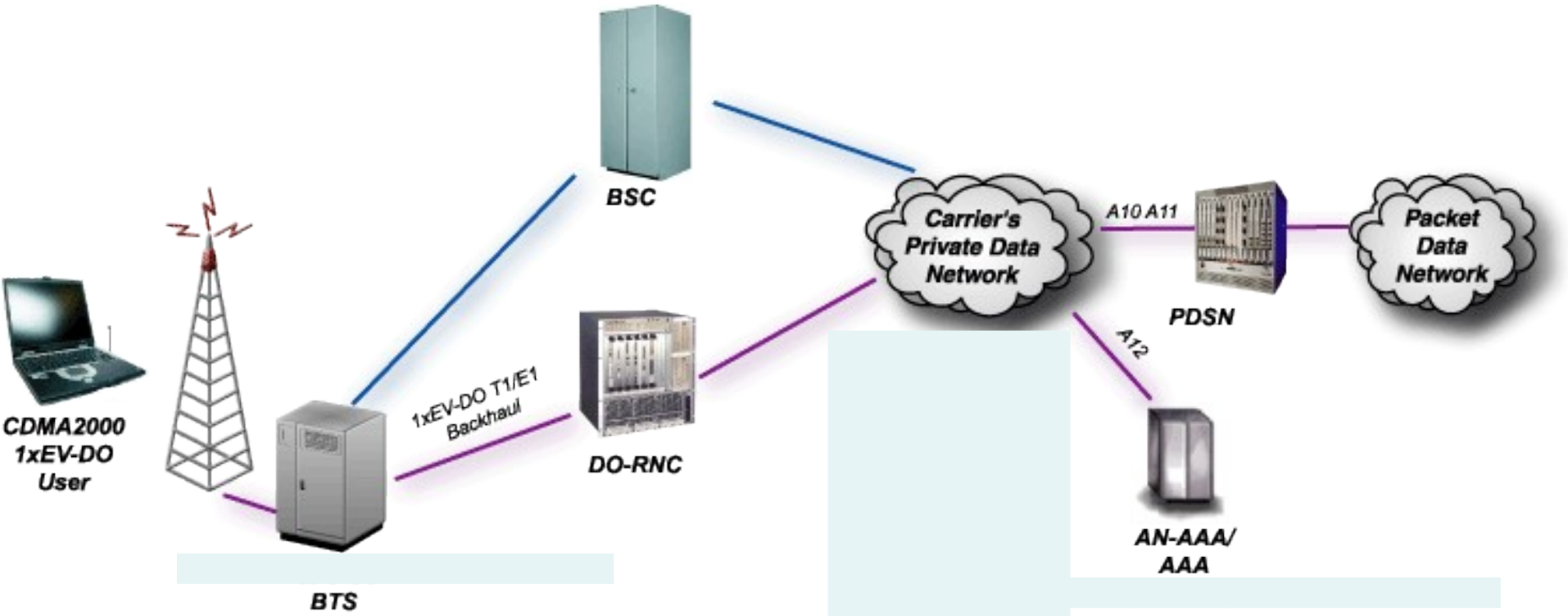
- CDMA2000 1xEV-DO is overlaid on an existing CDMA2000 1X network but requires a separate 1.25 MHz carrier and a dedicated T1/E1 backhaul from the Base Station to the data only radio nodecontroller (Radio Node Controller, RNC)
- Shares the packet-data network with CDMA2000 1X
- CDMA2000 1xEV-DO is based on IS-856 / CDMA2000 1X is based on IS-2000

CDMA2000 1xEV-DO components (continued)

Network upgrades from CDMA2000 1X

- Dedicated T1/E1 backhaul from the Base Station to the RNC
- Additional 1.25 MHz carrier for data only traffic

EV-DO Key Components



AAA servers in CDMA data networks are entities that provide Internet Protocol (IP) functionality to support the functions of authentication, authorization and accounting.
The AAA server in the CDMA wireless data network architecture is similar to the HLR in the CDMA wireless voice network architecture.

One type of common AAA servers is
Access Network AAA (AN-AAA) – Communicates with the RNC in the Access Network (AN) to enable authentication and authorization functions to be performed at the AN.
The interface between AN and AN-AAA is known as the A12 interface.