University of Science and Technology

Faculty of Computer Science and Information Technology

Computer Science Department

Computer Networking: Lecture (11)

Instructor: Prof. Dr. Noureldien Abdelrahman Date 20/12/2017

An Overview of Cellular Network Architecture

When people talk about cellular technology, they often classify the technology as belonging to one of several "generations." The earliest generations were designed primarily for voice traffic. First generation (1G) systems were analog FDMA systems designed exclusively for voice-only communication. These 1G systems are almost dead now, having been replaced by digital 2G systems.

The original 2G systems were also designed for voice, but later extended (2.5G) to support data (i.e., Internet) as well as voice service. The 3G systems that currently are being deployed also support voice and data, but with an ever increasing emphasis on data capabilities and higher-speed radio access links.

Cellular Network Architecture, 2G

The term *cellular* refers to the fact that the region covered by a cellular network is partitioned **into a number of geographic coverage areas, known as cells**, shown as hexagons on the left side of Figure 6.18.

Each cell contains a **base transceiver station (BTS)** that transmits signals to and receives signals from the mobile stations in its cell. The coverage area of a cell depends on many factors, including the transmitting power of the BTS, the transmitting power of the user devices.

The Global System for Mobile communications (GSM) standard for 2G cellular systems uses combined FDM/TDM (radio) for the air interface. A GSM network's **base station controller (BSC)** will typically service several tens of base transceiver stations.

The role of the BSC is to:

1- Allocate BTS radio channels to mobile subscribers,
2- Perform **paging** (finding the cell in which a mobile user is resident), and
3- Perform handoff of mobile users.

The base station controller and its controlled base transceiver stations collectively constitute a GSM **base station system (BSS)**.

The **mobile switching centre (MSC)** plays the central role in ***user authorization and accounting (e.g., determining whether a mobile device is allowed to connect to the cellular network), call establishment and teardown, and handoff.***

A cellular provider's network will have a number of MSCs, with special MSCs known as gateway MSCs connecting the provider's cellular network to the larger public telephone network.

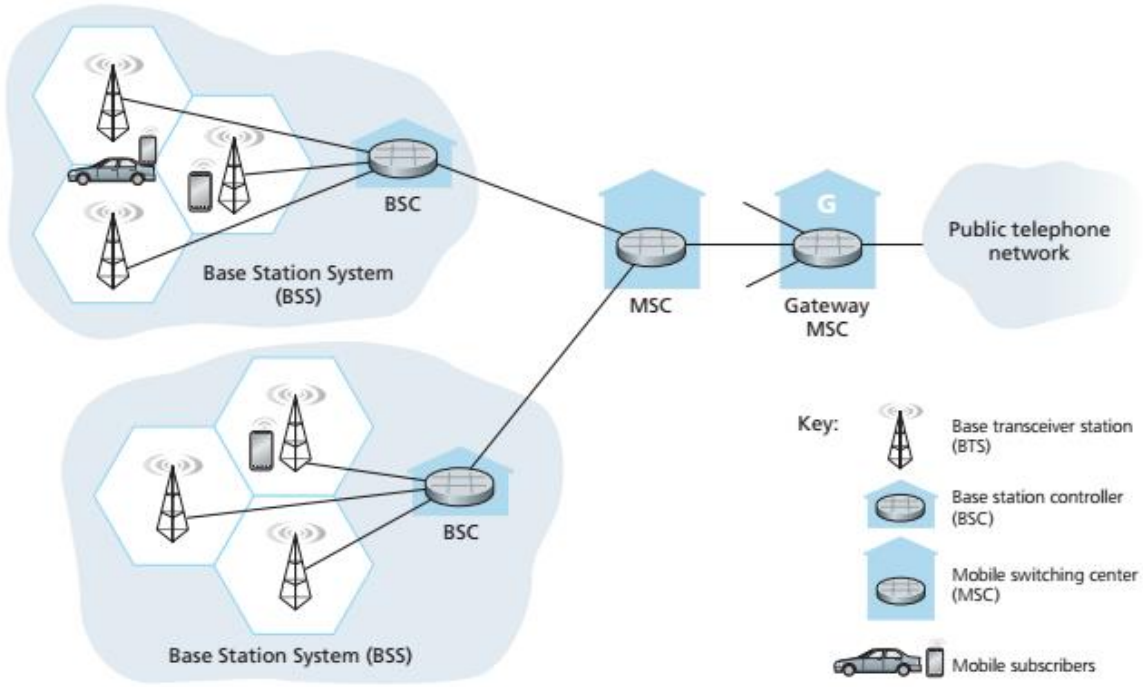

Figure 6.18 ♦ Components of the GSM 2G cellular network architecture

3G Cellular Data Networks

Let's take a top-down look at 3G cellular data network architecture shown in Figure 6.19.

3G Core Network

The 3G core cellular data network connects radio access networks to the public Internet. The core network interoperates with components of the existing cellular voice network (in particular, the MSC) that we previously encountered in Figure 6.18.
Given the considerable amount of existing infrastructure in the existing cellular voice network, the approach taken by the designers of 3G data services is clear:

Leave the existing core GSM cellular voice network untouched, adding additional cellular data functionality in parallel to the existing cellular voice network.

There are two types of nodes in the 3G core network: **Serving GPRS Support Nodes (SGSNs)** and **Gateway GPRS Support Nodes (GGSNs)**. (GPRS stands for Generalized Packet Radio Service).

An SGSN is responsible for delivering datagrams to/from the mobile nodes in the radio access network to which the SGSN is attached.

The SGSN interacts with the cellular voice network's MSC for that area, providing:

- User authorization and handoff,
- Maintaining location (cell) information about active mobile nodes, and
- Performing datagram forwarding between mobile nodes in the radio access network and a GGSN.

The GGSN acts as a gateway, connecting multiple SGSNs into the larger Internet. A GGSN is thus the last piece of 3G infrastructure that a datagram originating at a mobile node encounters before entering the larger Internet.

To the outside world, the GGSN looks like any other gateway router; the mobility of the 3G nodes within the GGSN's network is hidden from the outside world behind the GGSN.

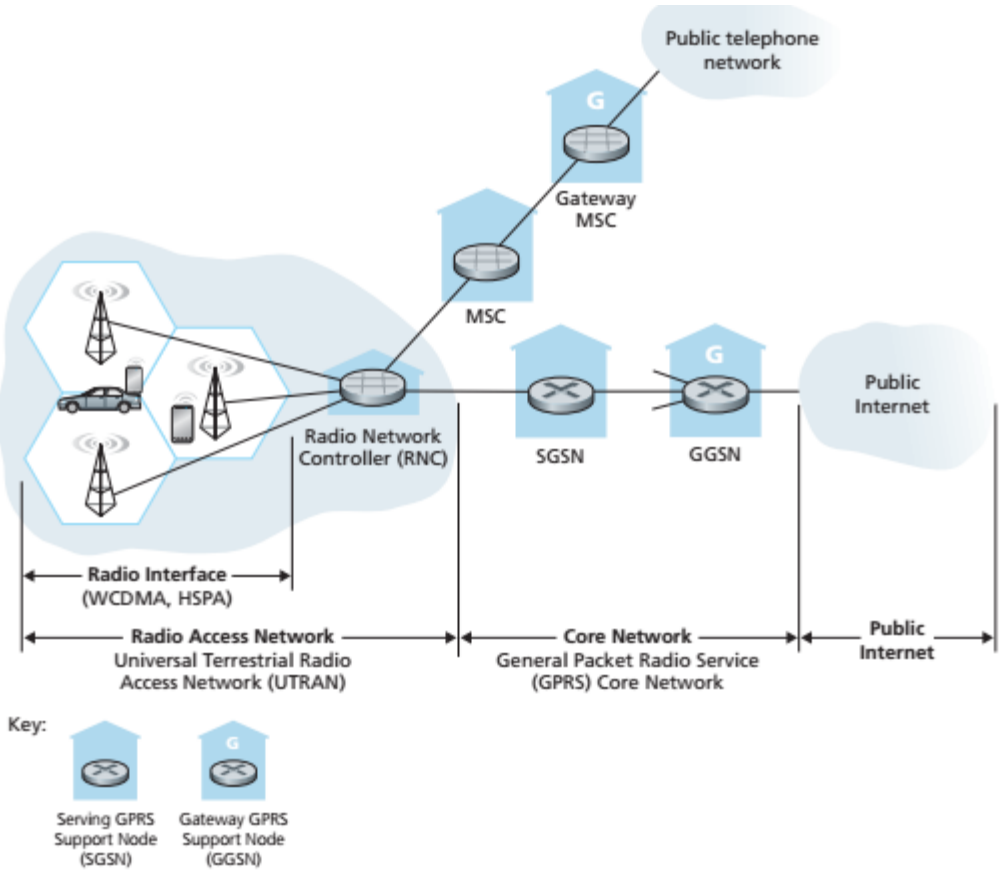

Figure 6.19 ♦ 3G system architecture