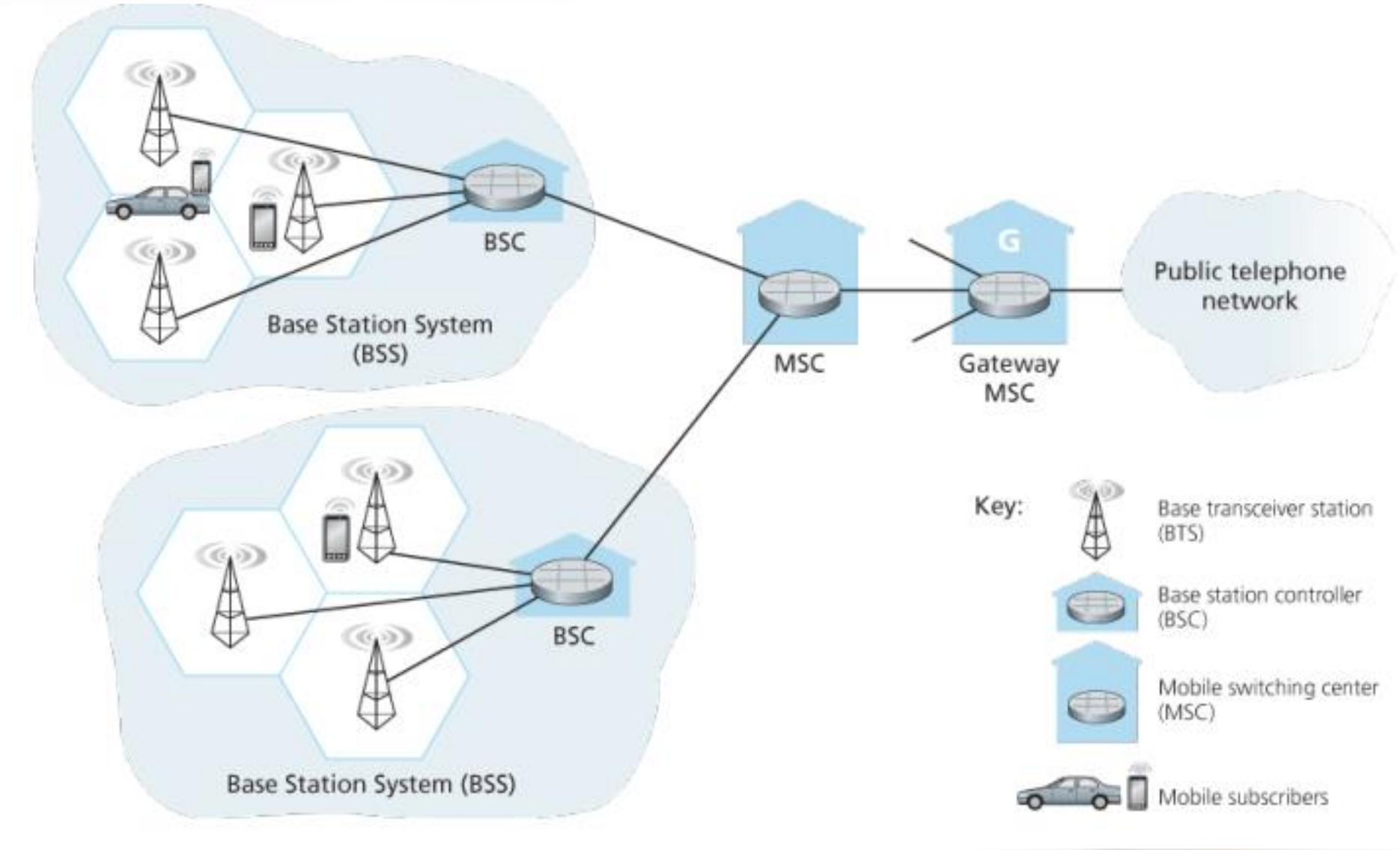
# Cellular Network Architecture, 2G



# Cellular Network Architecture, 2G (Continue…)

**Cellular Networks:**

- "Cellular" means the network is divided into small areas called cells.
- The size of a cell depends on factors like signal strength, obstacles, and antenna height.

**BTS and BSC:**

- Each cell has a BTS, and multiple cells are controlled by a Base Station Controller (BSC).
- Together, BTS and BSC form a GSM Base Station Subsystem (BSS).

# Cellular Network Architecture, 2G (Continue…)

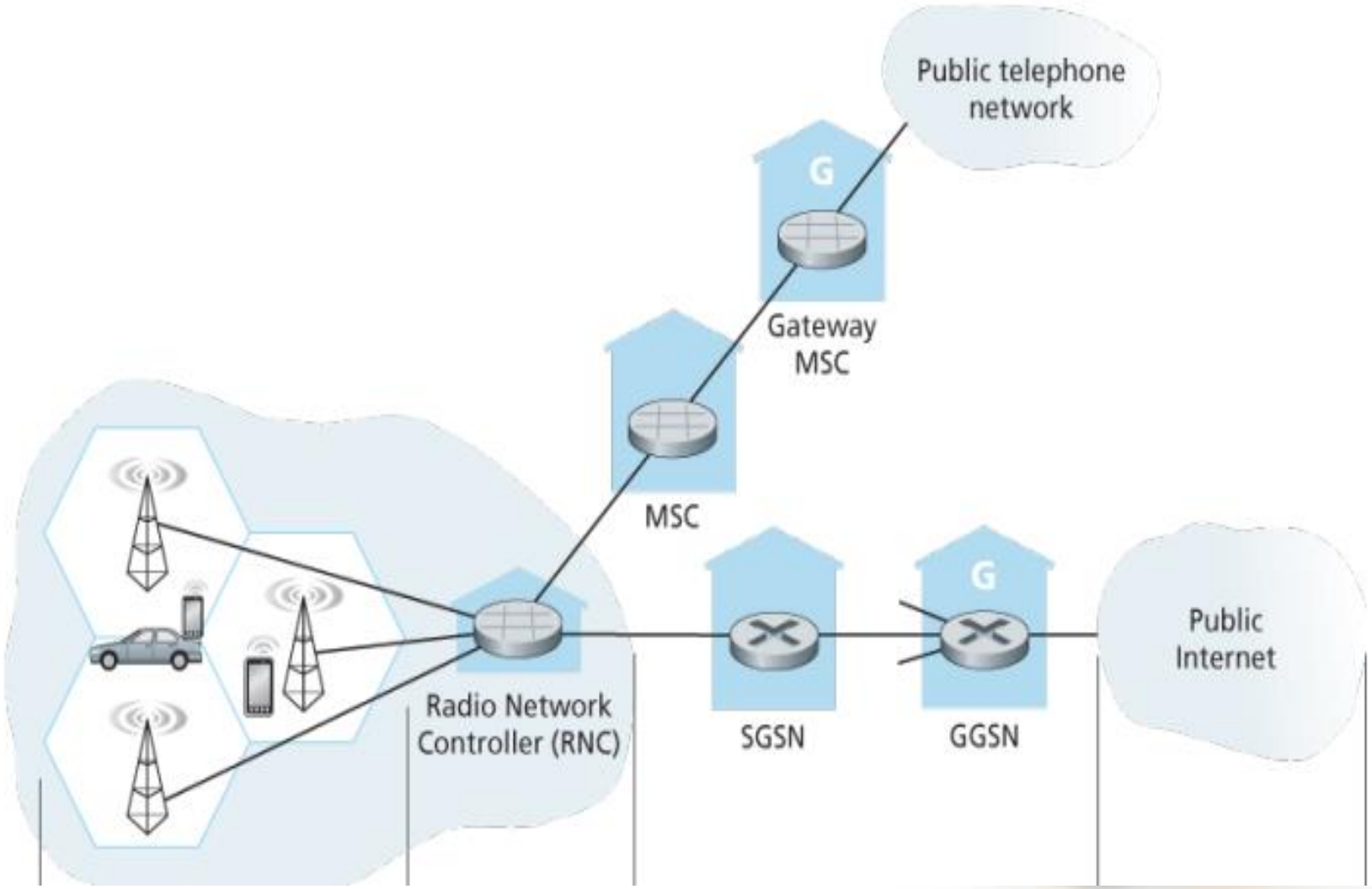
**MSC and Network Structure:**

- Mobile Switching Center (MSC) is crucial for user authorization, and call management
- A single MSC serves multiple BSCs, handling up to 200,000 subscribers.
- Cellular networks have multiple MSCs.

# 3G Cellular Data Networks

- When we use our smartphones outside, we want more than just calls – we want internet services. For this, our phones use different generations of technology to connect to the internet through cellular networks. The standards and technologies are complex, but we're focusing on UMTS as part of the 3GPP, a project that sets the standards for 3G and 4G technologies. The architecture involves different parts working together to make sure we can access the internet on the go.

# 3G Core Network



# 3G Cellular Data Networks (Continue…)

**SGSN and GGSN:**

- Two main types of nodes in the 3G core network, SGSNs and (GGSNs).
- GGSNs act as gateways, connecting multiple SGSNs to the larger internet.
- SGSNs deal with the details within the radio access network, interacting with the voice network and forwarding data between mobile devices.
- GGSNs act as gateways to the internet, connecting the 3G network to the larger online world.

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- **MSC (Mobile Switching Center):**

  It connects and manages calls between mobile phones within its coverage area.

  It handles call setup, routing, and termination.

- **Gateway MSC:**

  It serves as a bridge between mobile networks and the traditional landline telephone system.

# 4G System Architecture: An All-IP Core Network

- 4G is also an all-IP (internet protocol)-based standard for both voice and data, different from 3G, which only uses IP for data, while enabling voice with a circuit-switched network.
- 1000Mbps downstream and 500Mbps upstream

# 4G LTE:

- Two innovations:
- 1. An all IP core network
- 2. Enhanced radio access network

# Network Architecture:

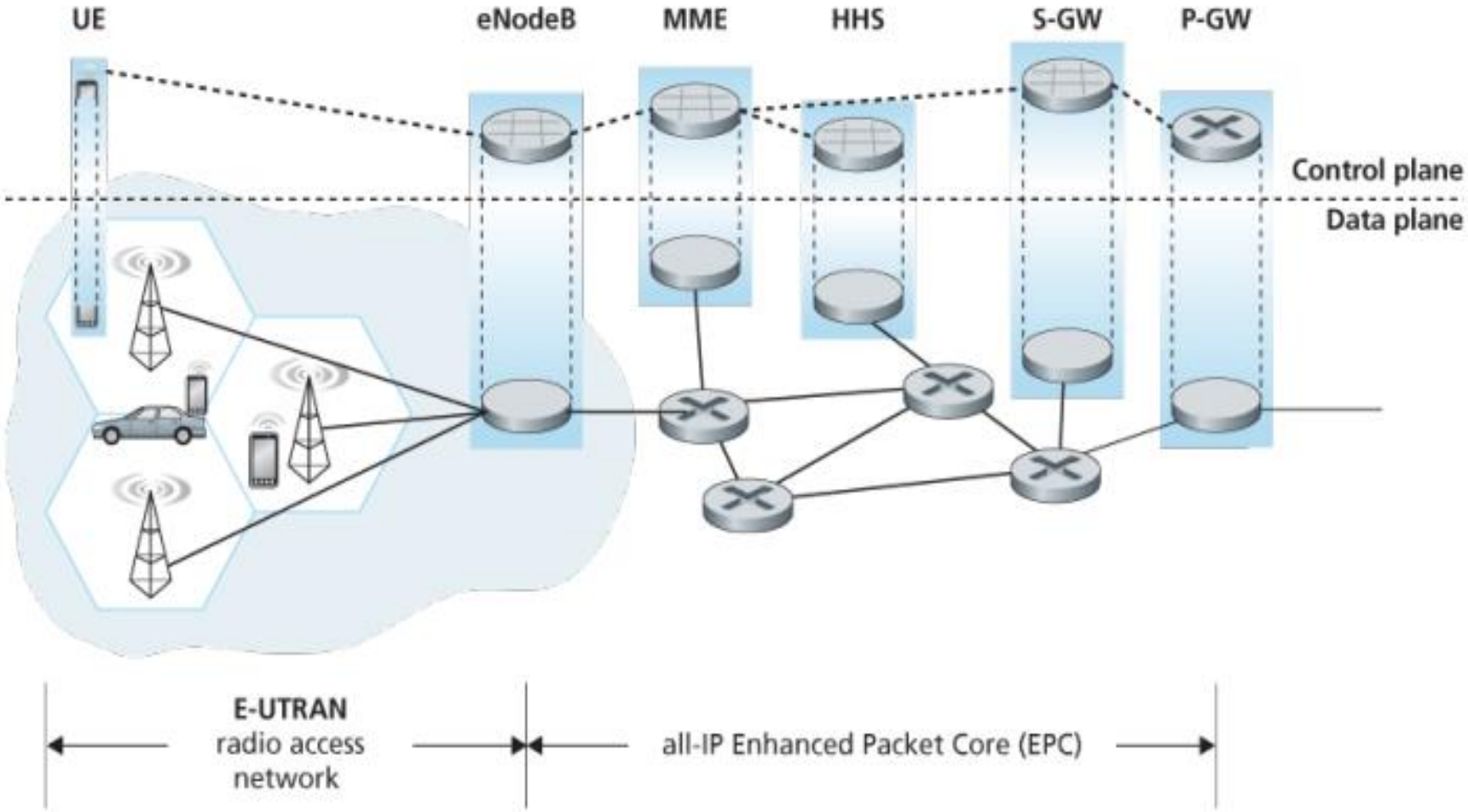



Figure 7.20 4G network architecture

**1. A unified, all-IP network architecture:**

i. allowing for a seamless integration of voice, video, messaging, and other data services over a single, unified infrastructure.

ii. a P-GW serves as a connection point between the edge network and the broader network infrastructure.

**2. Separation between 4 Data Plane and 4G Control Plane**

**i. Data Plane**: Transfers IP-Datagram from UE to

ii. P-GW

**iii. Control Plane:** Involves the coordination of multiple components within the network.

iv. Guarantees QoS.

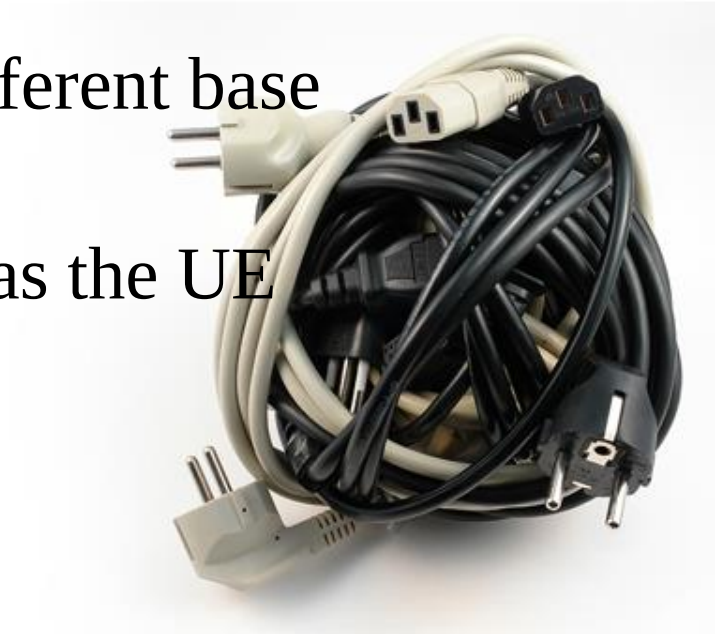
3. **eNodeB (Enhanced NodeB):** The eNodeB's data-plane role involves forwarding datagrams between the UE and the P-GW.

4. **Mobility Management Entity (MME):**

i. tracking a UE location,

ii. handling handovers between different base stations (eNodeBs),

iii. ensuring seamless connectivity as the UE moves within the network.



5. **Home Subscriber Server (HSS):**

i. HSS stores subscriber-related information

ii. During the UE authentication process, the HSS is consulted to verify the credentials of the subscriber and authorize access to the network.

6. **Packet Data Network Gateway (P-GW)**

Connects the 4G network to external packet data networks, allocates IP addresses, routes user data and enforces QoS policies

# LTE (Long-Term Evolution) Radio Access Network (RAN)

- **Role:** Responsible for facilitating wireless communication between User Equipment (UE) and the core network.
- **Components:** The major component is eNodeB.
- **Technique:** Orthogonal Frequency Division MultiPlexing(both time and frequency division)