4G Telecommunications

Huge data transmission without wires!

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Capstone Team 1

Let’s talk about the same thing

Vocabulary Clearing

- 3G is “3rd Generation” of cell network.
- 4G is “4th Generation” or successor to 3G cell network.

THESE ARE NOT 4G!

- 4G LTE is NOT 4G
- GSM, WiMax, 3G, 3.5G, 3.9G, 3.95G, and Advanced 4G are NOT 4G

A Brief History

2002: Envisioned by International Telecommunication Division (ITD) and US Military

2004: 3G was well-established but Japanese co. DoCoMo began work on LTE

2006: American co. Sprint enters the race for new generation of telecommunications

2007: DoCoMo's first trial of LTE achieved 100 Mbit/s motion and 1 Gbit/s stationary

2009: Swedish co. TeliaSonera deploys to first ever network to be labeled as "4G"

2010: Sprint releases the world's first commercially available 4G cell phone

2023: 4G is still in use today and is expected to remain for rest of the decade at least

Defining 4G as a Standard

- Must be entirely Packet-switching basis
- Interoperable with existing standards
- Must reach speeds of 1 Gbit/s while client is physically stationary
- Must reach speed of 100 Mbit/s while client is physically in high speed motion
- Scalable channel of nominal 5-20 MHz up to 40 MHz
- Frequency bands: 600 MHz, 700 MHz, 1700/2100 MHz, 2300 MHz, and 2500 MHz
- IP Telephony

So, You Wanna Send Data Using 4G?

My Perspective:

1. Turn on my phone and go to messaging app
2. Type “You smell like dog water brother”
3. Hit Send
4. Wait for reply
5. Wait for reply
6. Go to Dairy Queen

My Friend’s Perspective:

1. Phone is off
2. Phone is off
3. Phone receives message
4. Friend turns on phone and sees message
5. Laughs
6. Doesn’t respond

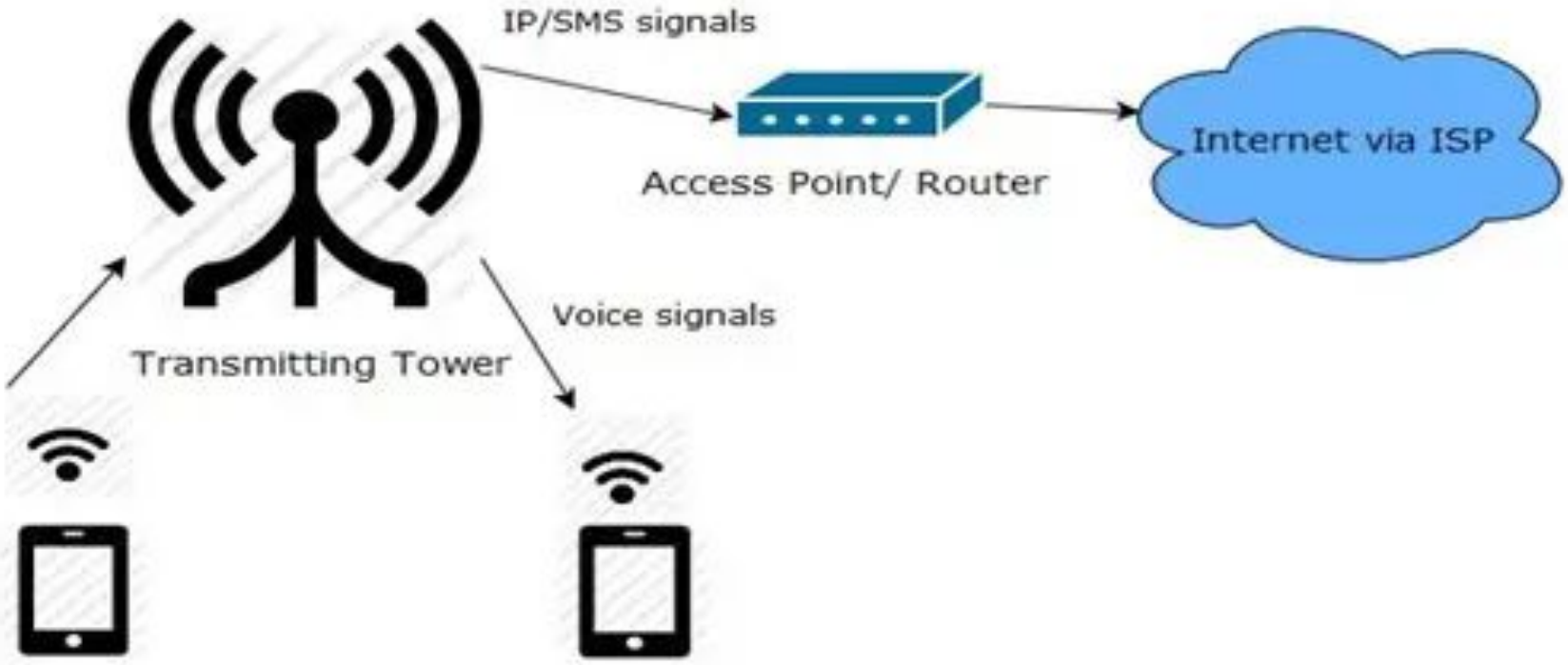
So, You Wanna Send Data Using 4G?

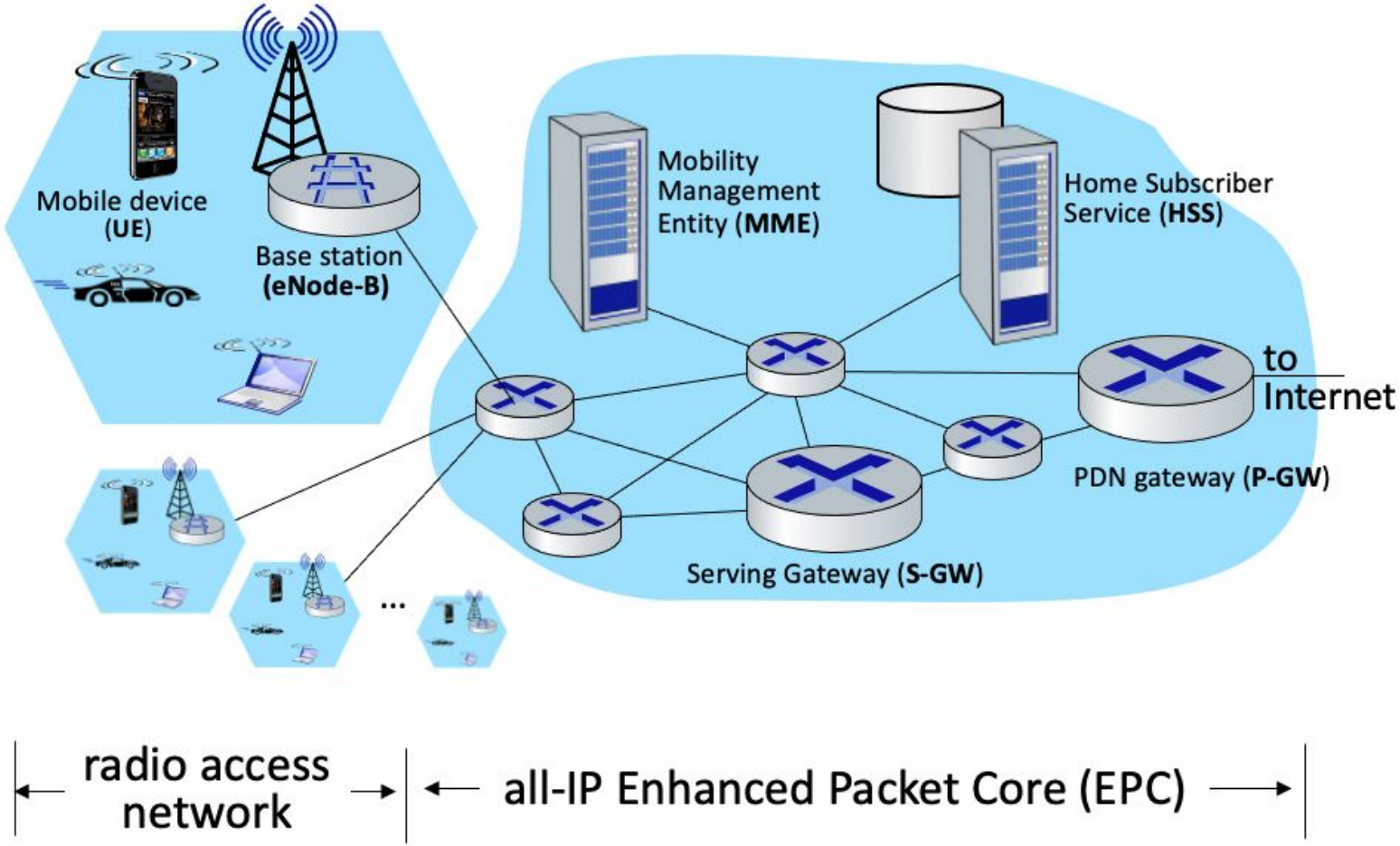
My Phone's Perspective:

1. Power On
2. Format packet data for transmission
3. Read SIM data
4. Send service request to local base station
5. Ack/wait then transmit target SIM/MAC
6. Base station rec then contact Service Gateway
7. Service Gateway shares data with service providers and waits for approval
8. Approved transmission is relayed to PDN Gateway
9. PDN Gateway proceeds node hopping to target
10. Ack/wait for target confirmation
11. Send Ack and path to target back to my phone
12. My phone sends data packet to friends phone
13. Continue until all data is sent
14. Ack/wait then send kill signal
15. Close task and power off

My Friend's Phone's Perspective:

1. Nothing
2. Nothing
3. Nothing
4. Nothing
5. Nothing
6. Nothing
7. Nothing
8. Nothing
9. Nothing
10. Receive incoming data request
11. Receive Ack. Send Ack back
12. Receive packet. Strip packet for actual data
13. Continue receiving and stripping
14. Ack data completed transmission
15. Format data and notify my friend


IP/SMS signals
Internet via ISP
Access Point/ Router
Voice signals
Transmitting Tower


Mobile device
(UE)
Base station
(eNode-B)
Mobility
Management
Entity (MME)
Home Subscriber
Service (HSS)
to
Internet
PDN gateway (P-GW)
Serving Gateway (S-GW)
...
radio access
network
all-IP Enhanced Packet Core (EPC)

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