

Goggin (2006):

1G technology / limitations:

- Low functionality
- Large size
- Low quality of handsets
- Capabilities of communication networks (voice communication over circuits)

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	Technology	Commercial release	applications	Data transmission type / speed
1G	NTTTC (NTT Public Corp.) NMT450 (Nordic Mobile Telephone System) AMPS (Advanced Mobile Phone System) TACS (Total Access Communication System)	1979 (Japan) 1981 (Scandinavia) 1983 (USA) 1985 (UK/Ireland)	voice	(analog)
2G	1	2	3	4
2.5G	5	6	7	8
3G	9	10	11	12

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Goggin (2006):

1982: GSM started being developed in Europe.

1G vs. 2G

Range of reception from base station
50-70km vs. 30km.

Digital works better in crowded places, but signal may end abruptly

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Farley (2005):

2G technology:

- Sound from a cell phone receiver was digital coded, compressed and transmitted via radio waves, then received and decoded
- Sharing of network more efficiently managed
- More secure and more difficult to be intercepted

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Goggin (2006):

2G/GSM Applications:

- address book
- SIM card
- Clock
- Alarm function
- Calendar
- Calculator
- Games
- Tacking calls
- SMS***

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Farley (2005):

Success of 2G mobile phones in Europe
Delay in the US

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Farley (2005) / Goggin (2006):

1990s: first tests for 3G (UMTS) in Europe

Goals:

- Support universal roaming
- Offer broadband multimedia services with up to 2Mbps throughput

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Goggin (2006):

The development of 3G mobiles

3G characteristics:

- Transmit audio, still and moving pictures
- Large data streams / access to Internet
- Location services

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Goggin (2006):

The development of 3G mobiles

BUT...

"3G was not so much a paradigm shift away from the two previous major cellular systems (1G and 2G)." (p. 189)

- Essentially an extension of 2G

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Goggin (2006):

The development of 3G mobiles

Initial failure of 3G:

- High prices in auctioning the 3G spectrum and advertising transferred to services and consumers.
- Not many good services (top-down – Wilson)

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Javaid et. al. (2008)

What is 4G?

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Javaid et. al. (2008)

1. Linear 4G vision (extension of 3G services)

- Ultra high speed broadband wireless network (100 Mbp/s to 1Gbp/s)
- Coverage extension
- Power and spectral efficiency
- Increased capacity and reliability
- Japan / China / South Korea

Javaid et. al. (2008)

2. Concurrent 4G vision (services)

- A) Terminal heterogeneity
- B) Network heterogeneity (not limited to cellular systems)
- C) **Personal** ubiquitous environment (PUE)
- D) Based on cooperation / peer-to-peer interaction

A) Terminal heterogeneity

"The 4G landscape will not just be about defining higher data rates or newer air interfaces, but rather will be shaped by the increasing integration and interconnection of heterogeneous systems, with different devices processing information for a variety of purposes, a mix of infrastructures supporting transmission and a multitude of applications working in parallel making the most efficient use of spectrum." (p. 32)

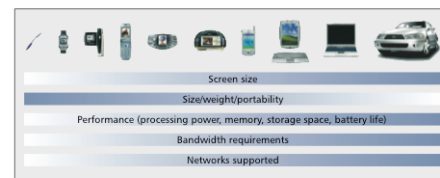


Figure 3. Heterogeneous terminals.

B) Network heterogeneity

"4G is not the name of a single technology, rather it is a cooperative platform, where a large range of heterogeneous wireless networks and services coexist" (p. 32).

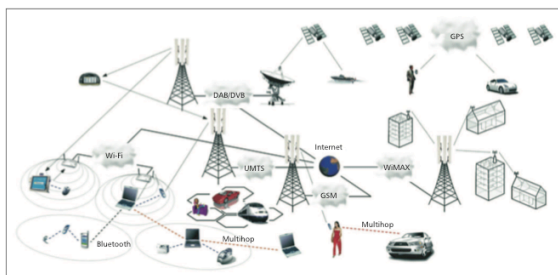


Figure 4. Heterogeneous networks.

C) Personal ubiquitous environment (PUE)

4G Services (p. 31)

- a) Intelligent transport systems (ITS) networks
- b) Cooperative community networks
- c) Personal (group centric)

C) Personal ubiquitous environment (PUE)

4G Services (p. 31)

- a) [Intelligent transport systems \(ITS\) networks](#)
- b) Cooperative community network (WiFi, WiMax, etc.)
 - a) Community-based IPTV
 - b) Cooperative web-radio
 - c) Mobile ad-hoc services ([wireless sensor networks](#))
- c) Personal (group centric)
 - a) [Ubiquitous and collaborative healthcare monitoring](#)

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D) Based on cooperation / peer-to-peer interaction

3 perspectives on cooperation (p. 139)

- Devices need to cooperate with each other (user-centric)
- Devices should cooperate with user's environment (user-centric)
- Users should cooperate with each other (group-centric)

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Q: Why would people want to collaborate?

Q: Why does the user want to extend his PUE in order to accommodate other users?

Rheingold...

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Javaid et. al. (2008)

"4G will be a convergence platform extended to all the network layers. Hence, the user will be connected almost anywhere thanks to widespread coverage due to the exploitation of the various networks available".

Real technical step-up of 4G:
= integration of heterogeneous systems

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