Mobile Communications
Chapter 11 : Outlook

The future of mobile and wireless networks
– Is it 4G? All IP? Licensed? Public? Private?

Mobile and wireless services – Always Best Connected

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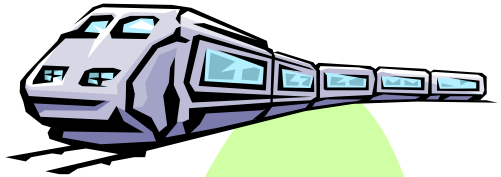
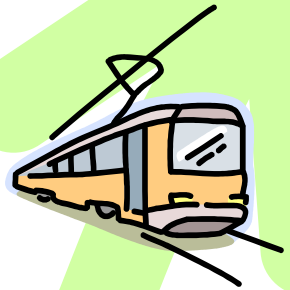
LAN, WLAN
16 Mbit/s

GSM 53 kbit/s
Bluetooth 500 kbit/s

UMTS, GSM
115 kbit/s



LAN
100 Mbit/s,
WLAN
54 Mbit/s



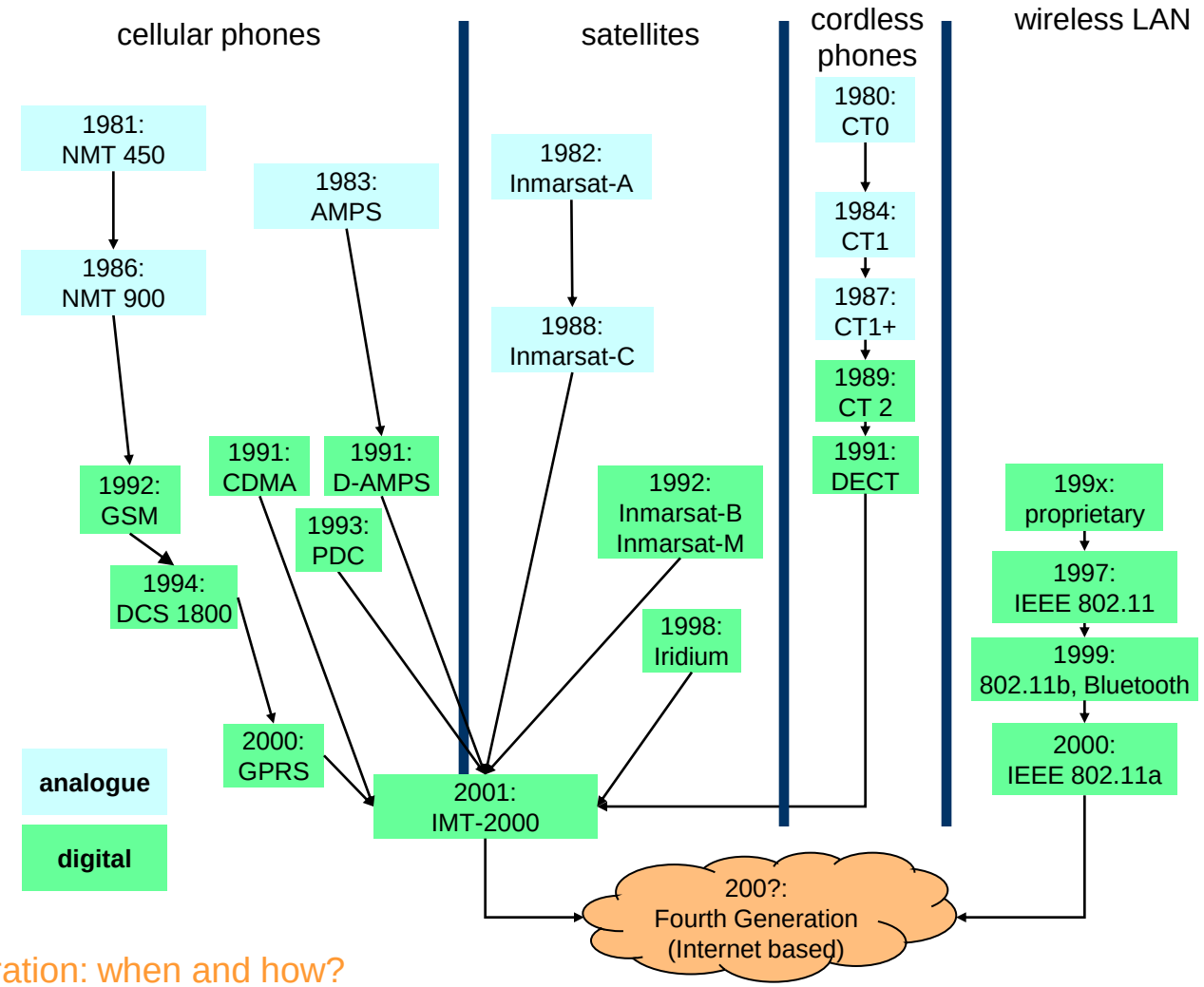
UMTS
2 Mbit/s

GSM/EDGE 384 kbit/s,
WLAN 1 Mbit/s

GSM 115 kbit/s,
WLAN 11 Mbit/s

UMTS, GSM
384 kbit/s

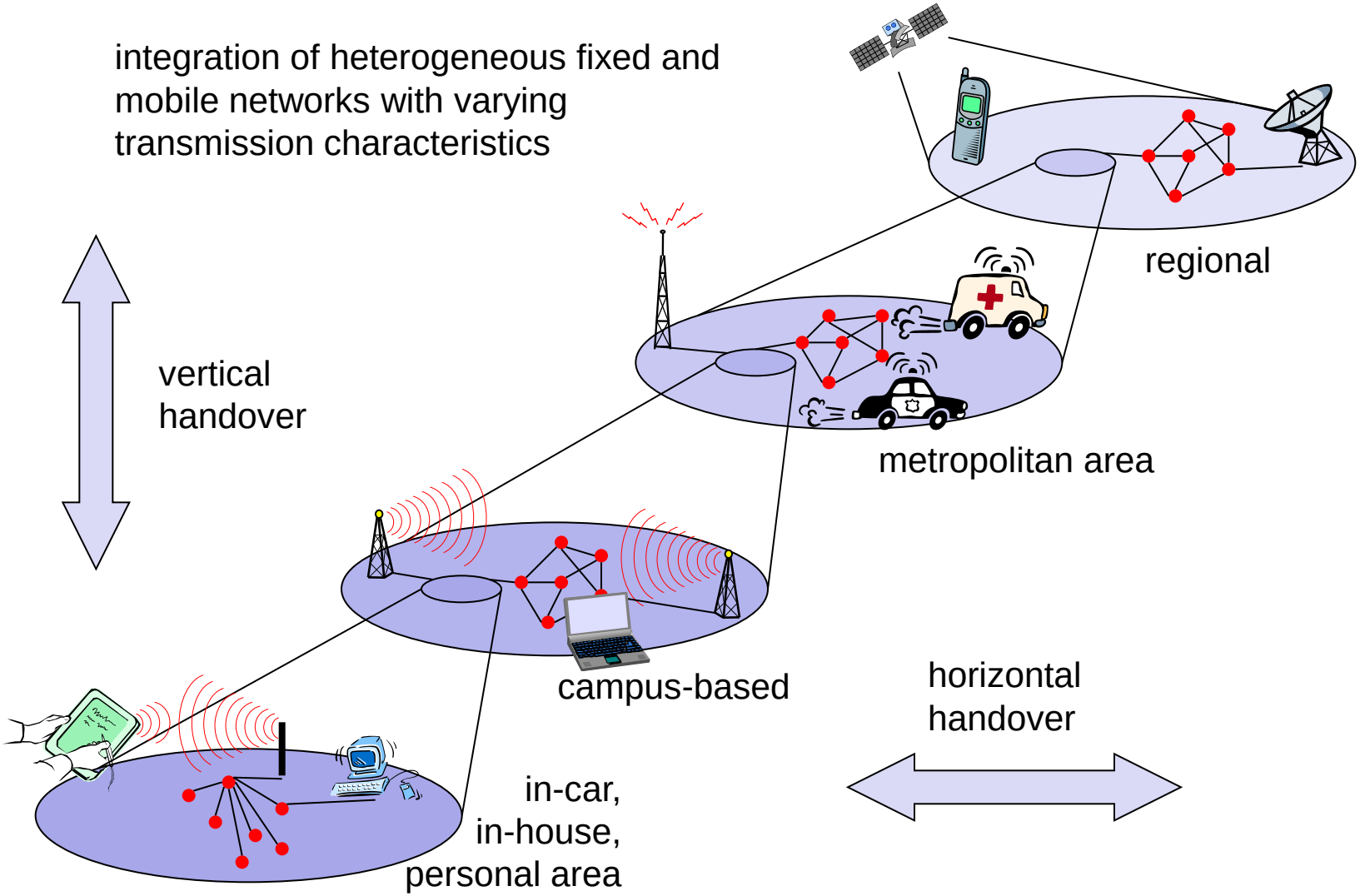
Wireless systems: overview of the development



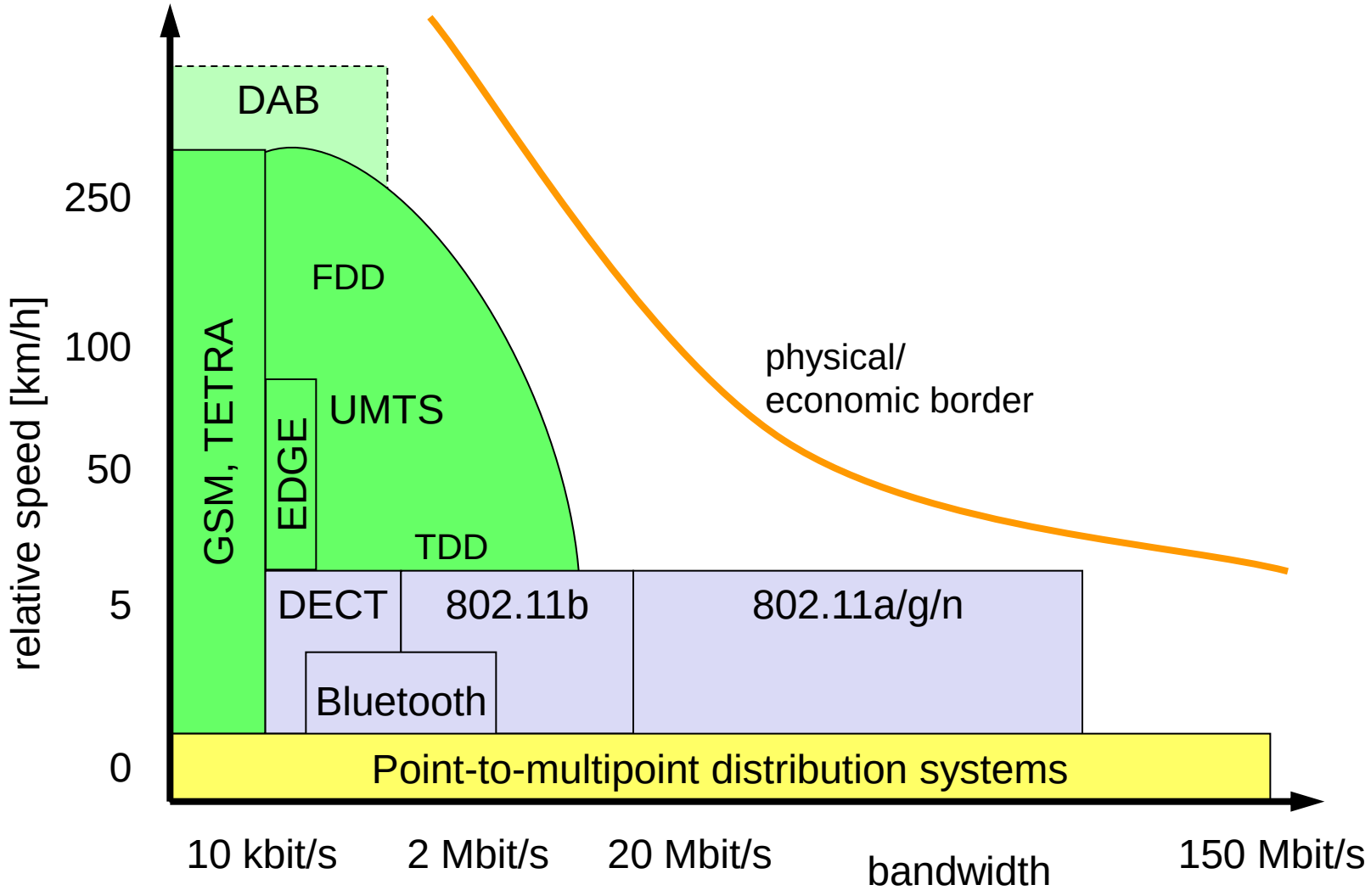
4G – fourth generation: when and how?

Overlay Networks - the global goal

integration of heterogeneous fixed and mobile networks with varying transmission characteristics



Wireless access technologies



Key features of future mobile and wireless networks

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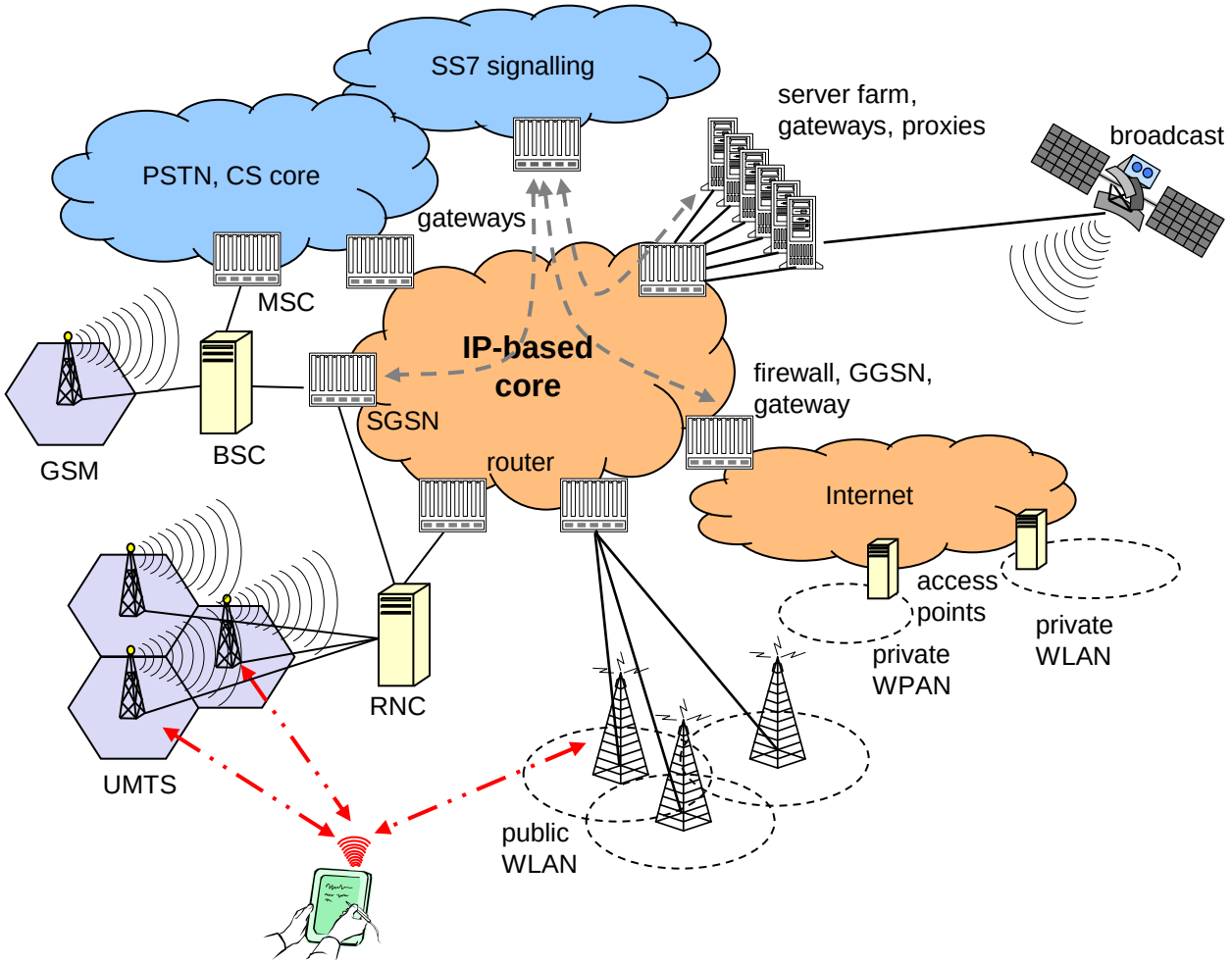
- Improved radio technology and antennas
  - smart antennas, beam forming, multiple-input multiple-output (MIMO)
    - space division multiplex to increase capacity, benefit from multipath
  - software defined radios (SDR)
    - use of different air interfaces, download new modulation/coding/...
    - requires a lot of processing power (UMTS RF 10000 GIPS)
  - dynamic spectrum allocation
    - spectrum on demand results in higher overall capacity
- Core network convergence
  - IP-based, quality of service, mobile IP
- Ad-hoc technologies
  - spontaneous communication, power saving, redundancy
- Simple and open service platform
  - intelligence at the edge, not in the network (as with IN)
  - more service providers, not network operators only

Example IP-based 4G/Next G/... network



Potential problems

- Quality of service
  - Today's Internet is best-effort
  - Integrated services did not work out
  - Differentiated services have to prove scalability and manageability
  - What about the simplicity of the Internet? DoS attacks on QoS?
- Internet protocols are well known…
  - …also to attackers, hackers, intruders
    - security by obscurity does not really work, however, closed systems provide some protection
- Reliability, maintenance
  - Open question if Internet technology is really cheaper as soon as high reliability (99.9999%) is required plus all features are integrated
- Missing charging models
  - Charging by technical parameters (volume, time) is not reasonable
  - Pay-per-application may make much more sense

- **Killer application? There is no single killer application!**
  - Choice of services and (almost) seamless access to networks determine the success