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UNIK4700

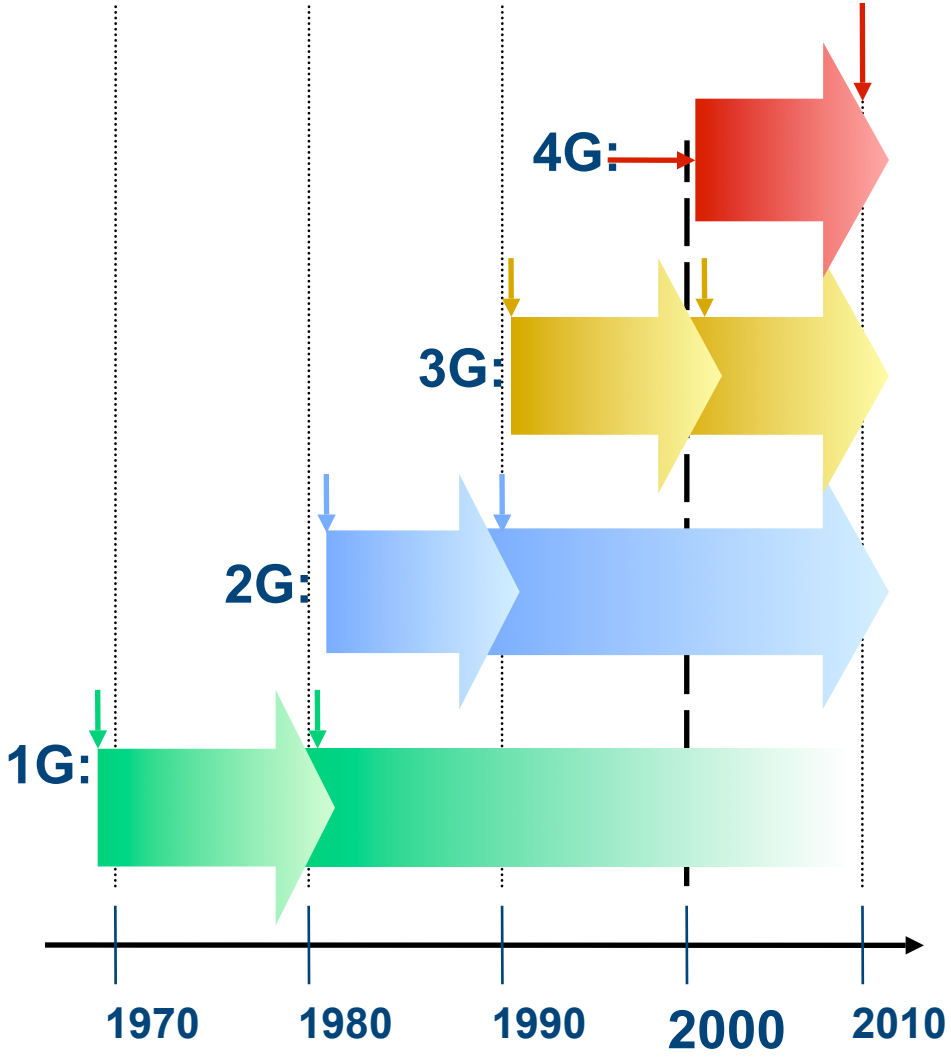
Wireless Mobility – Trends and Challenges

Josef Noll

University of Oslo/University Graduate Center

josef.noll@unik.no

Service development



source: J. Noll, Telenor R&D, 2002

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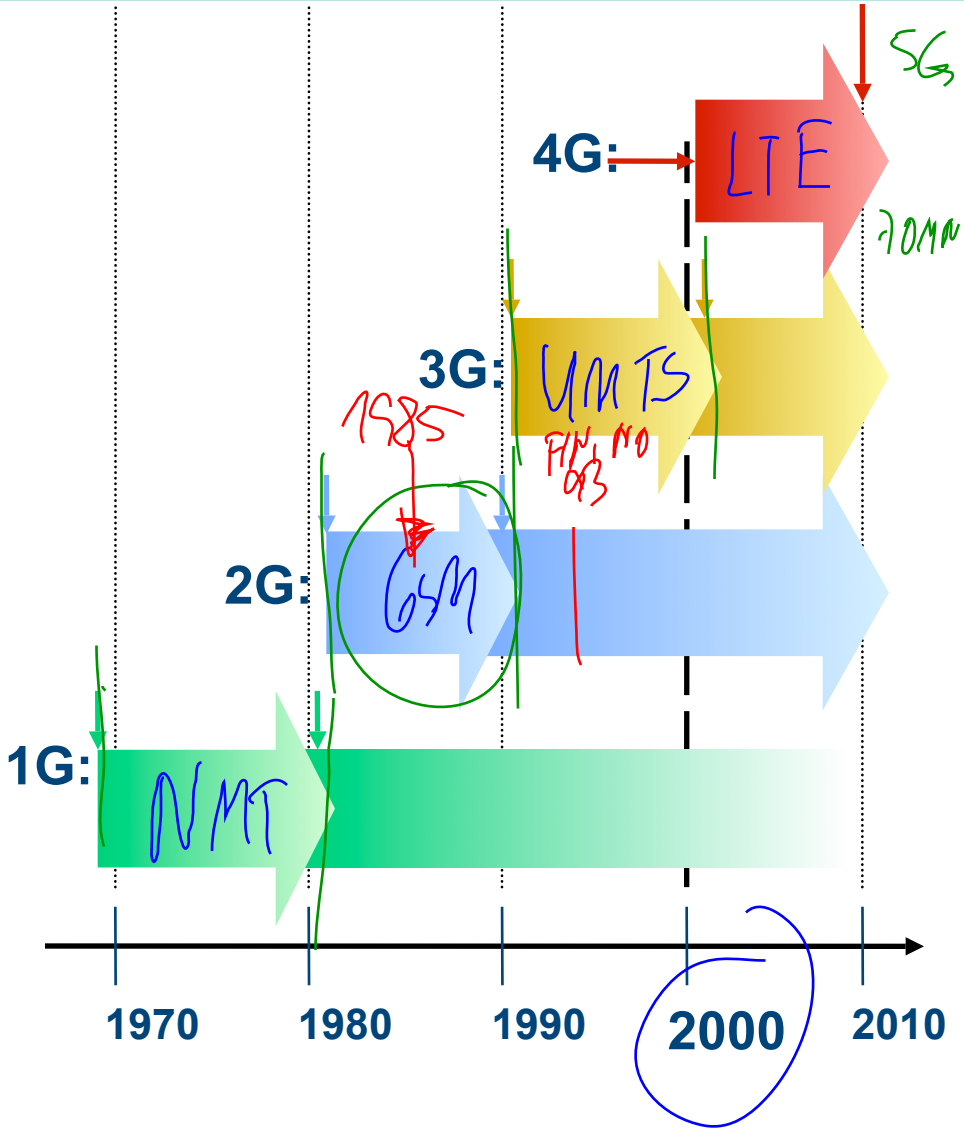


Personalised Broadband wireless services

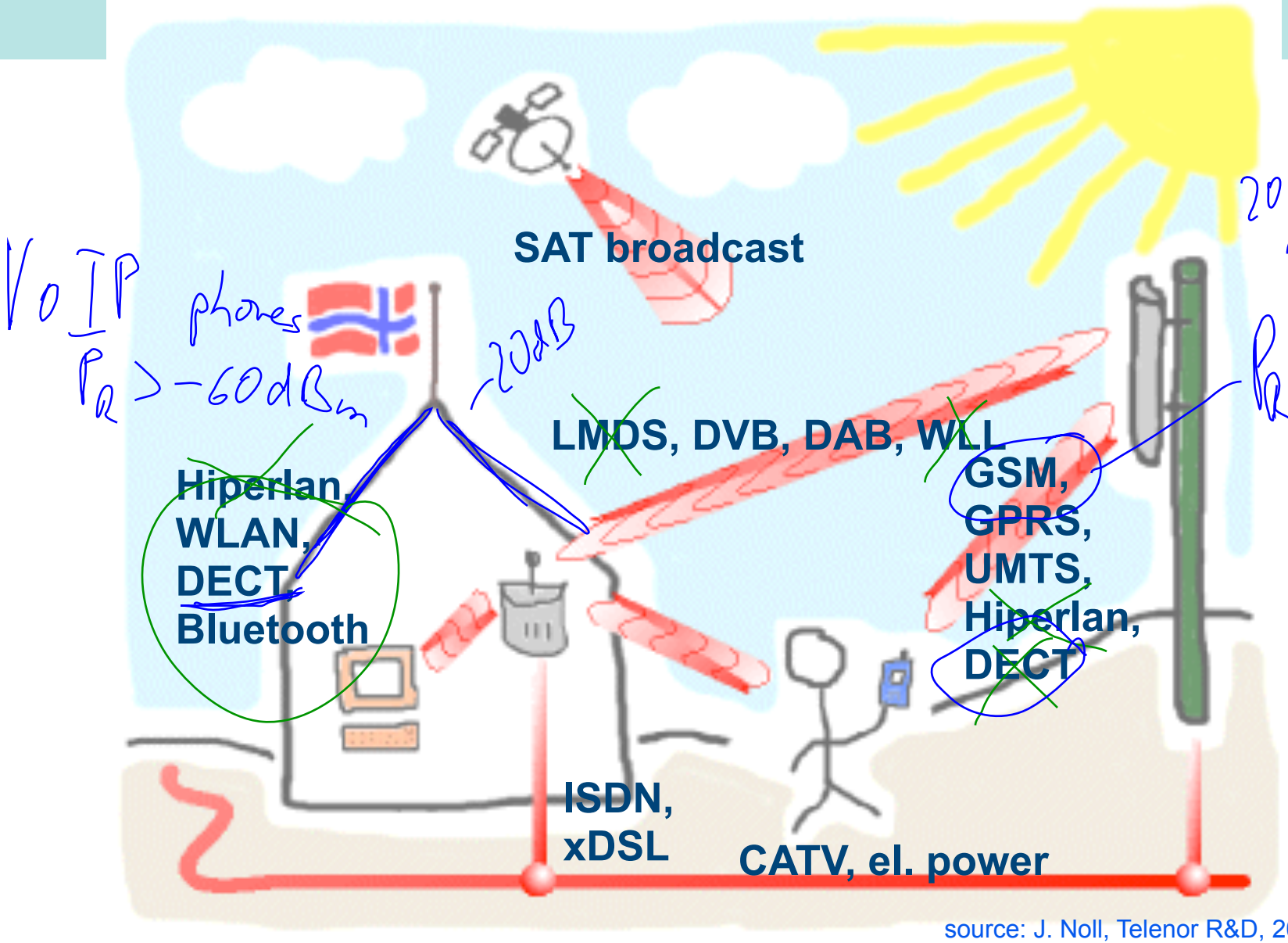
Multimedia communication

Mobile telephony, SMS, FAX, Data

Mobile telephony

source: J. Noll, Telenor R&D, 2002

The wireless access



source: J. Noll, Telenor R&D, 2002

Conclusion for network development

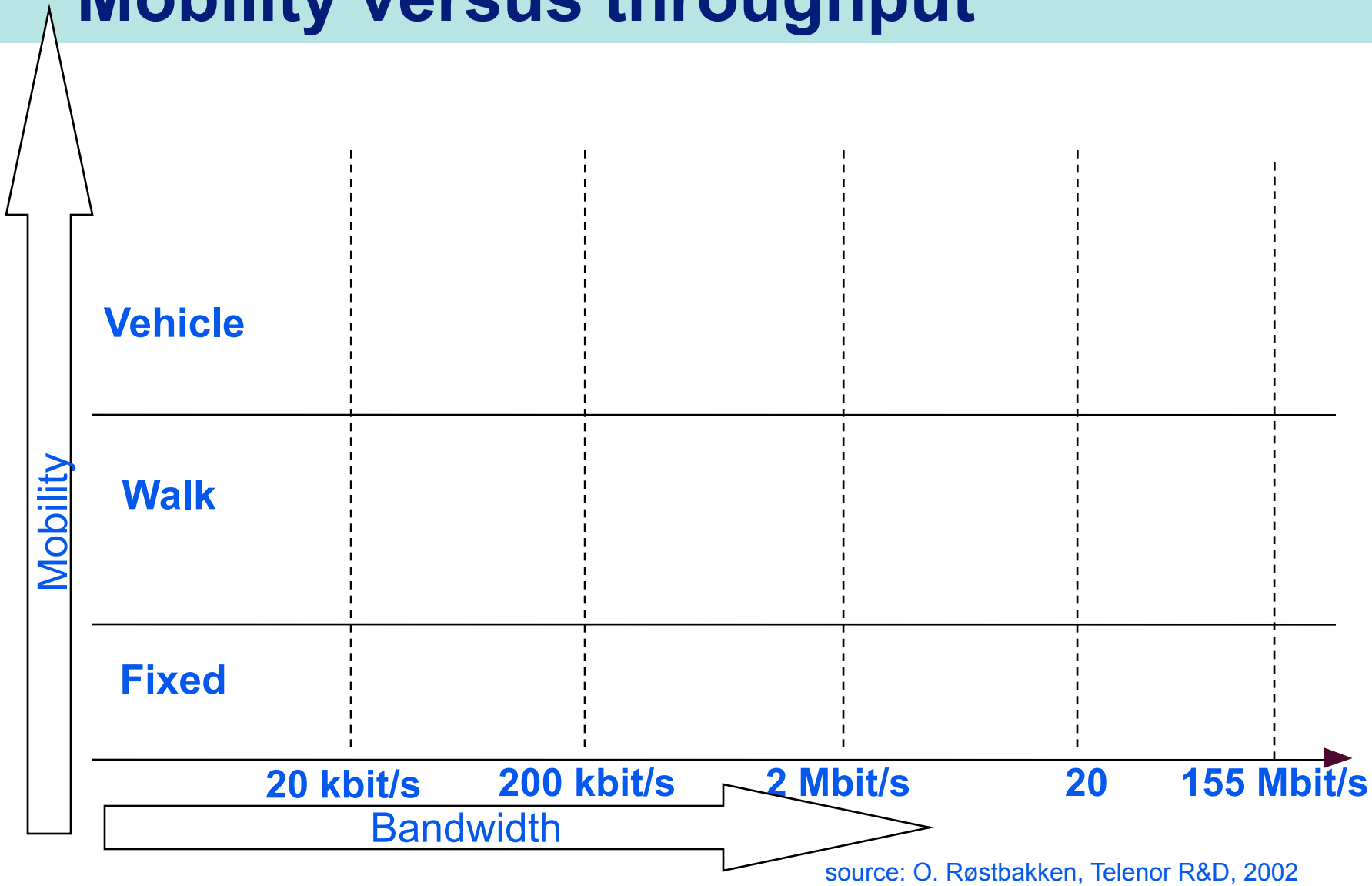
LTE > 20 Mbit/s ?

- Applications and hardware requirements grow faster than modem capabilities
- UMTS is developed for ”mobility” (v <= 250 km/h), thus sub-optimal for high-bandwidth applications
- Limitations: max network capacity 1 Mbit/s in an UMTS network
- Trends visible today: Data access (HSCD) mainly from fixed positions (limited/no mobility)

➔ **Optimum access mode required for each user scenario**

source: J. Noll, Telenor R&D, 2002

Convergence: Mobility versus throughput



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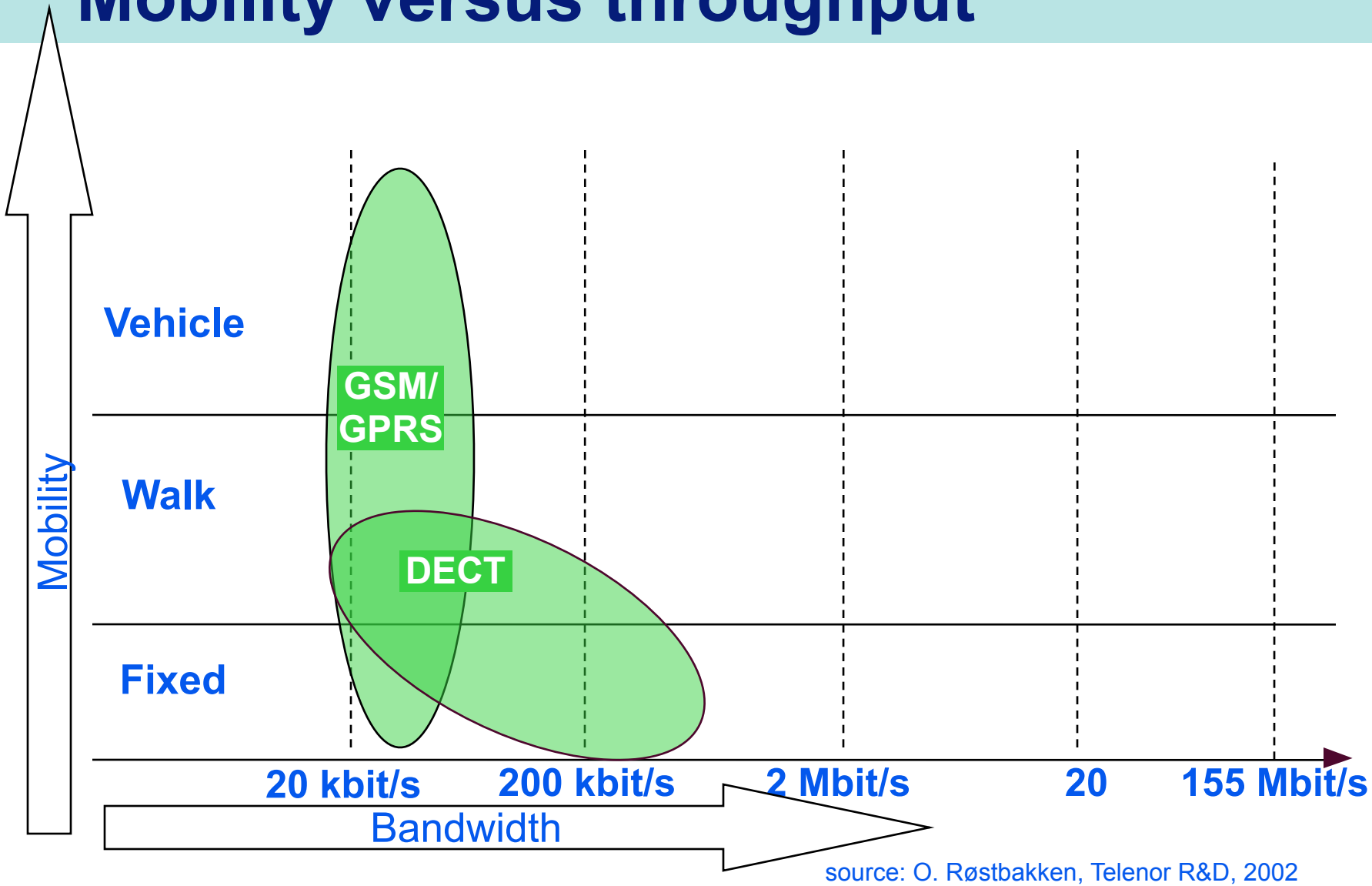

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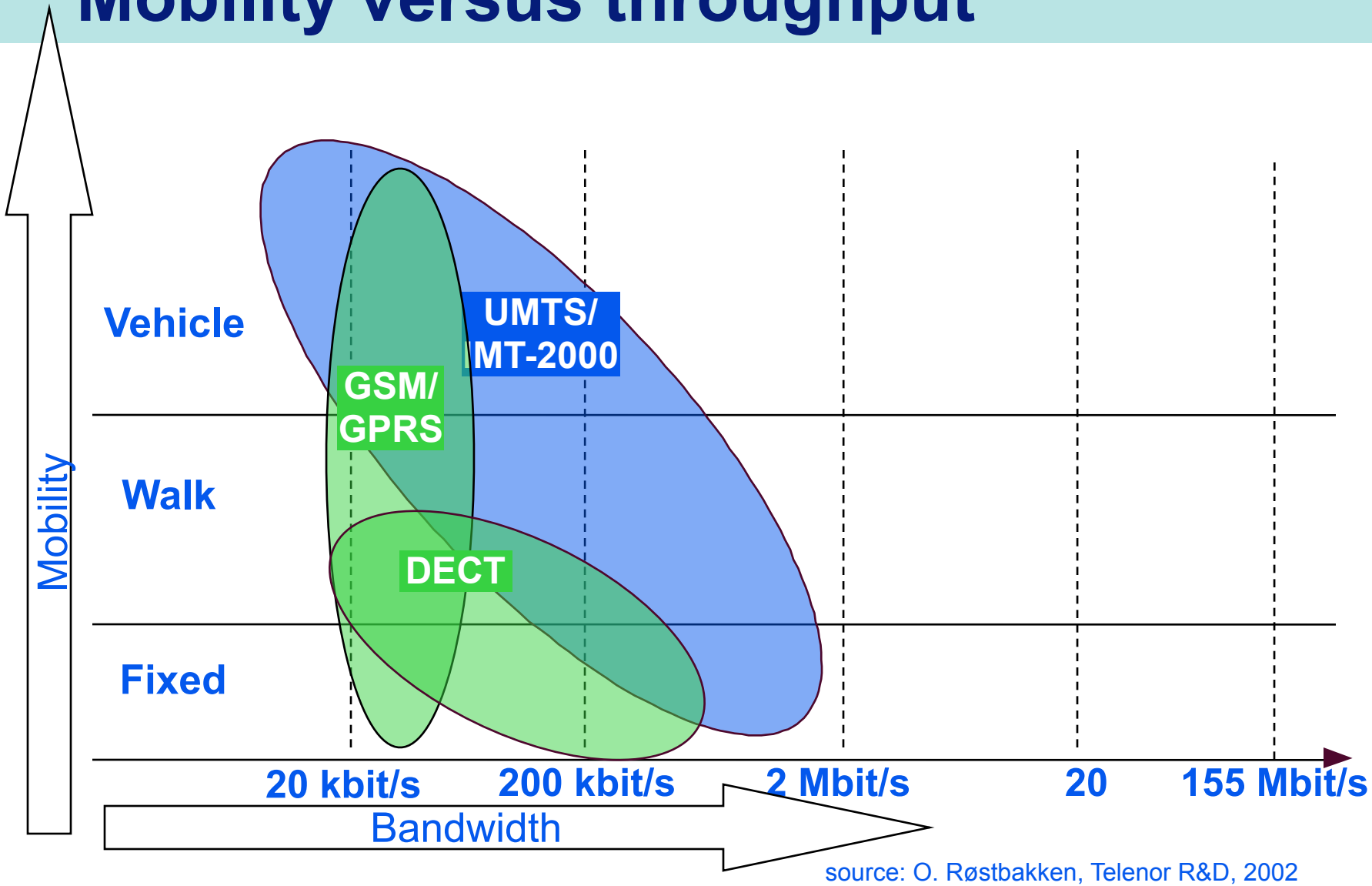

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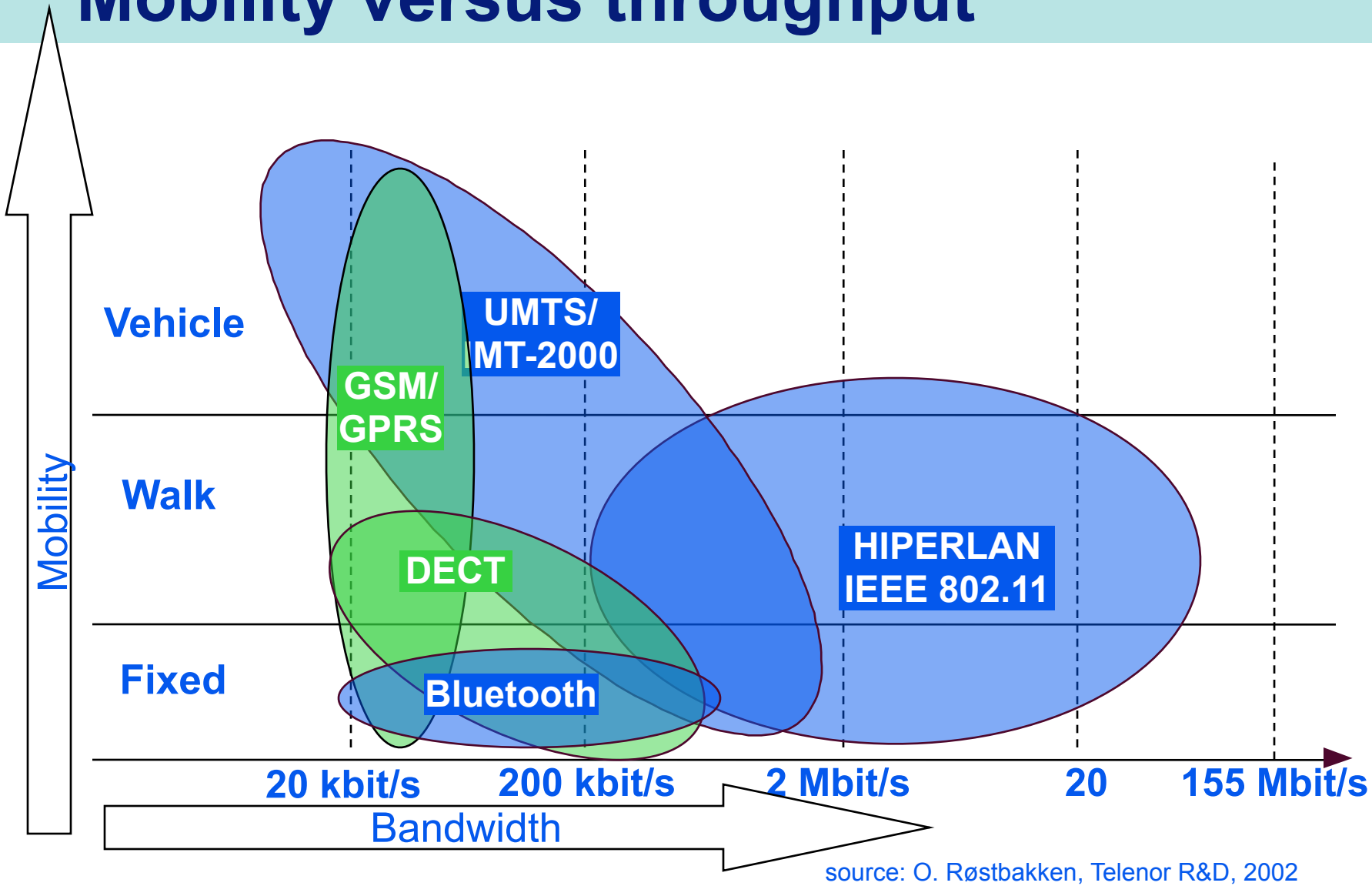

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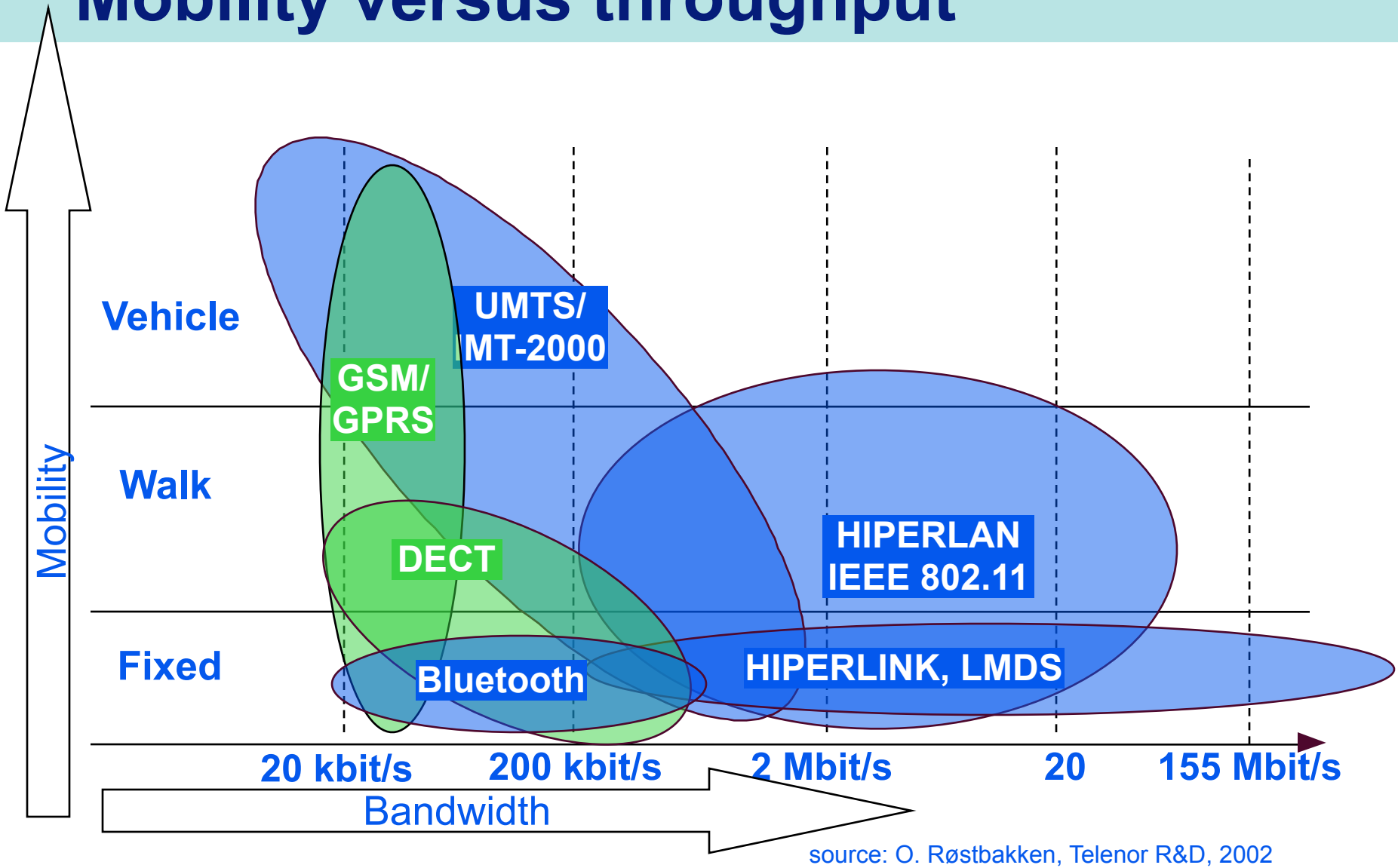

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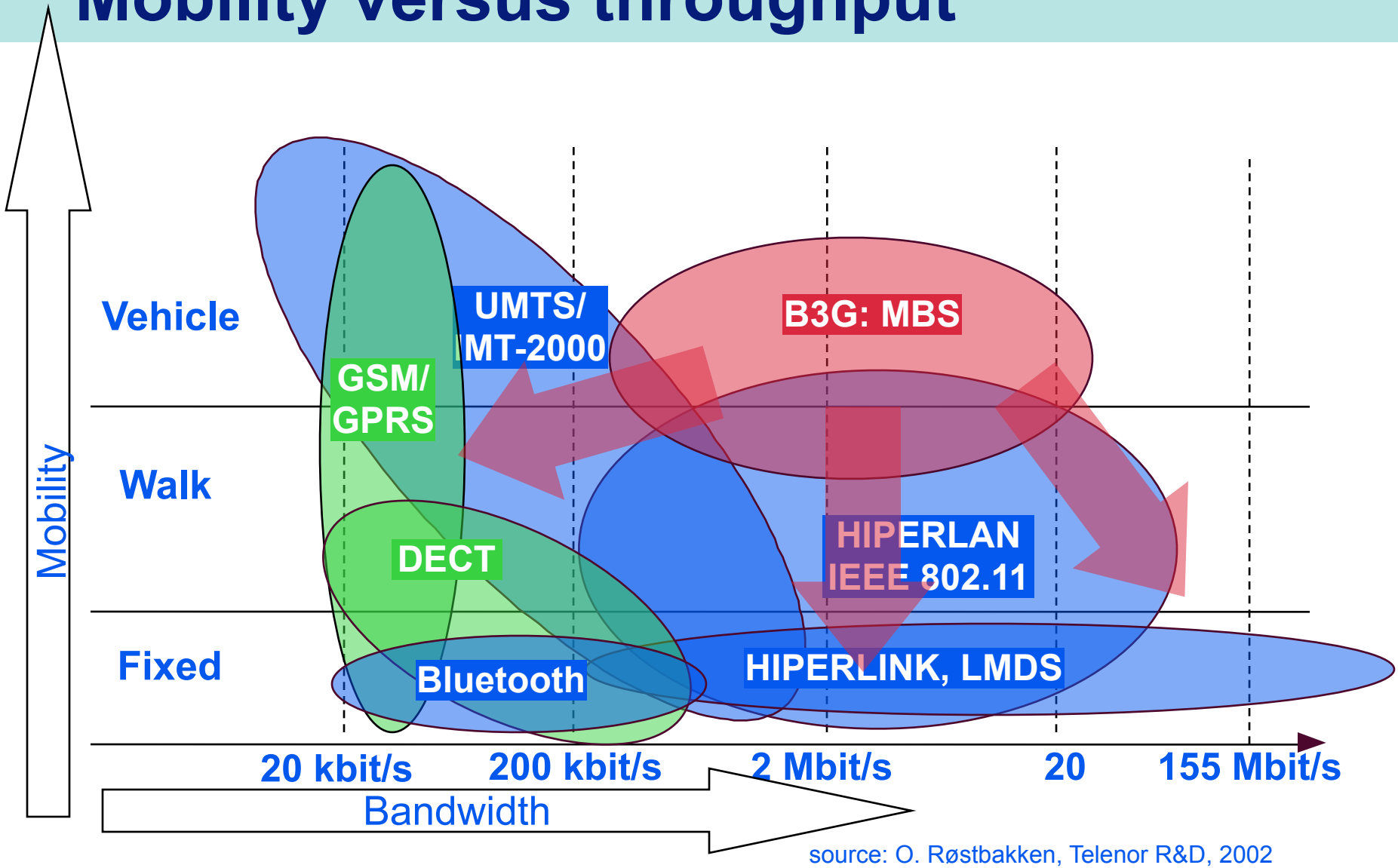

source: O. Røstbakken, Telenor R&D, 2002

System comparison - radio

System	freq. [GHz]	typical range [m]	user capacity [Mbit/s]	Comment
GSM/GPRS	0.9/1.8	900	0.032	GSM1800, urban
UMTS	2.1	650	0.4	urban ~> HSPA
MBS	40	300	32	Line-of-sight
DECT	2	300	0.5	
Bluetooth	2	10	0.5	
WLAN	2.4	50	5	
Hiperlan/2	5.1	25	25	

all values estimated based on rule-of-thumb!

source: J. Noll, Telenor R&D, Jan 2001

System comparison

GSM / GPRS
+ ”complete” coverage
+ guaranteed security
- limited capacity
- No ’private network’

UMTS
+ City coverage
+ Guaranteed security
- Capacity for mobile applications

DECT / HomeRF
+ Established system
- DECT data too late (?)
- No interworking

Bluetooth
+ Local connectivity
+ Unlicensed operation
- ISM band

WLAN (802.11)
+ Hot spot serving
+ Unlicensed operation
- No radio resource management
- No QoS mechanisms

Hiperlan/2
+ High data rates
+ Interworking with UMTS (?)
- Too late (?)
- 5.1 GHz frequency requires multiple RF front-ends

source: J. Noll, Telenor R&D, Jan 2001

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Outline

Global and Seamless Mobility
Mobility handling: Mobile IP, GSM/UMTS
Seamless Mobility: Personalised access

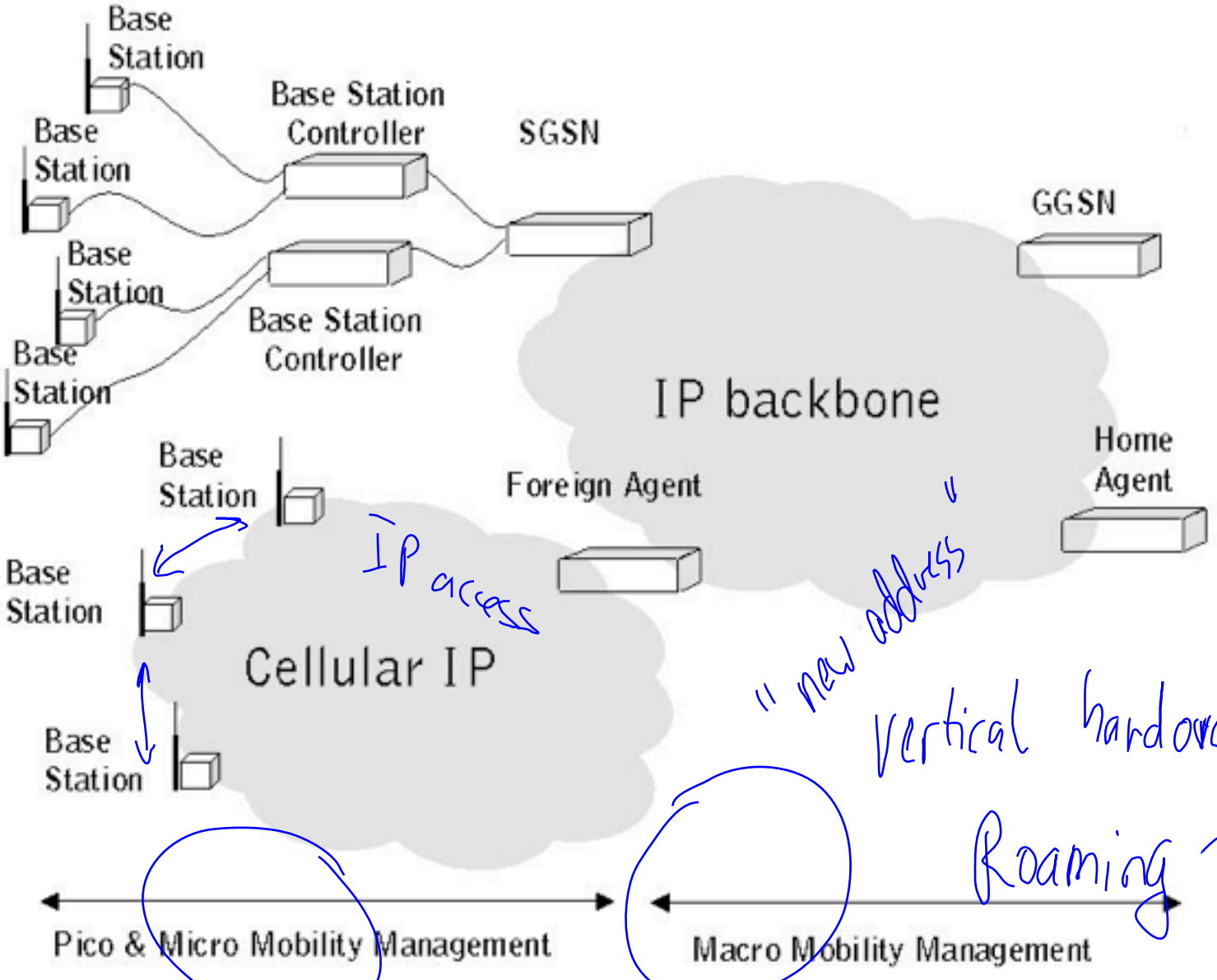
The Nomadic User ….

From mobile Personality
to personal Mobility

Mobility: Classification according to the availability

- Continuous mobility enables continuous availability of services while the user moves.
- Discrete mobility enables the availability of services within certain areas and for certain access points, e.g home and office, but not while moving from one area to another.
- Portability is an example of discrete terminal mobility, where it is only allowed to move a terminal from one plug to another.

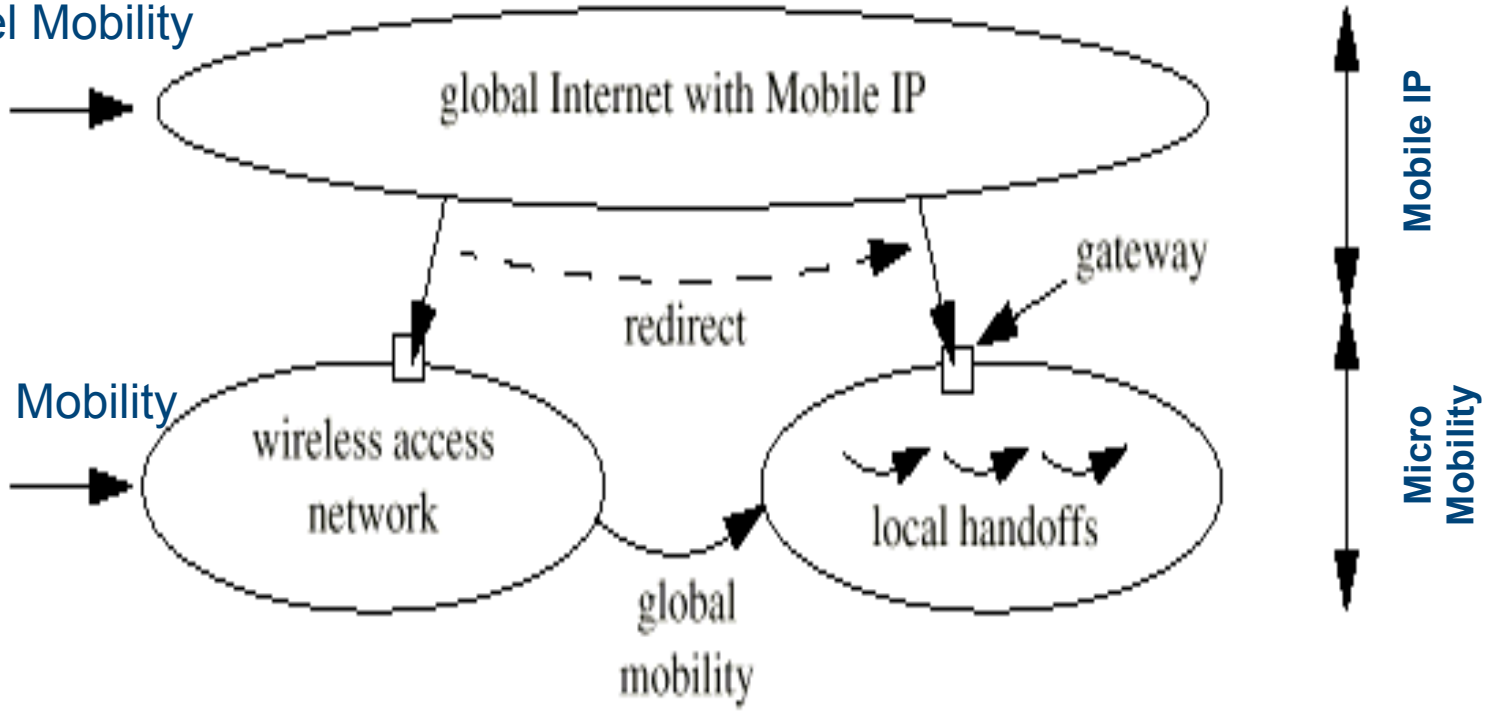
Mobility schemes [Ala2000]



Mobility Management – Micro Mobility and Mobile IP

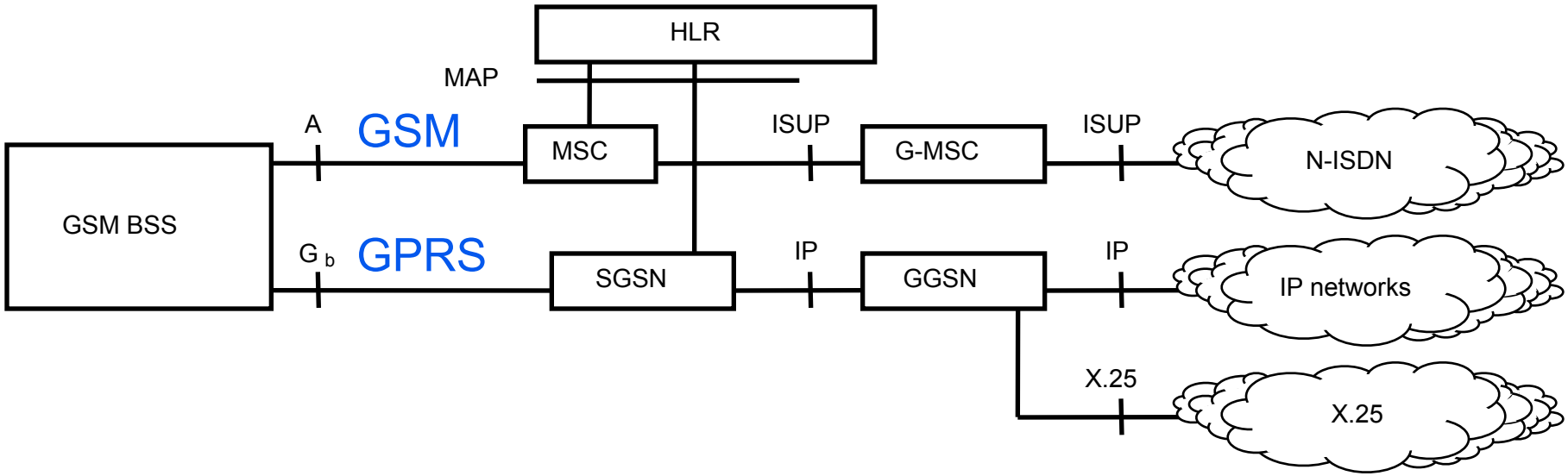
Macro Level Mobility

Micro Level Mobility



GSM evolution

- Today: GSM (9.6 kbit/s)
- Q3.99: HSCSD (14.4-64 kbit/s)
- Q1.2001: GPRS (24 - 115 kbit/s)
- Q4.2001: EDGE (115 - 384 kbit/s)
- Q4.2001/Q1.2002: UMTS (< 2 Mbit/s)



GSM/GPRS/UMTS Mobility (1)

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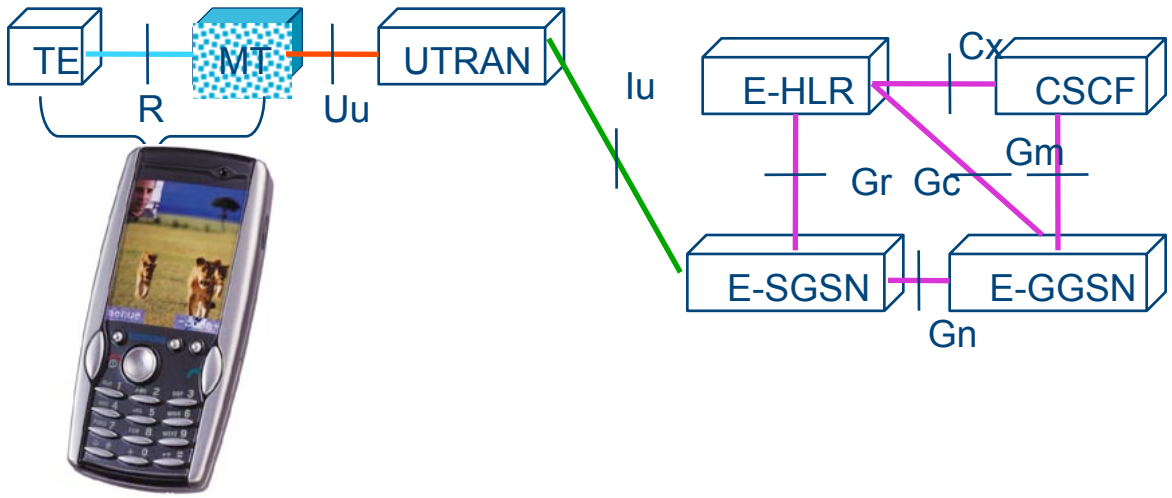
- GSM/GPRS/UMTS core network (here rel. 5)
  - MSC, HLR
  - Extend by ”home” cells



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- Mobility enabled through
  - Radio sub-system (radio network controller RNC in UMTS and base station controller BSC in GSM)
  - RNC or BSC > 100 base stations

GSM handover mechanisms

- mechanisms for requesting hand-over
  - power lever in handset is too low
  - signal/noise ratio is too low
  - bit-error-rate is too high
  - ....
- procedure
  - handset requires hand-over
  - base-station decides
- alternatives
  - hand-over to neighbour cell
  - hand-over to different RNC/BSC
  - first registration (roaming)

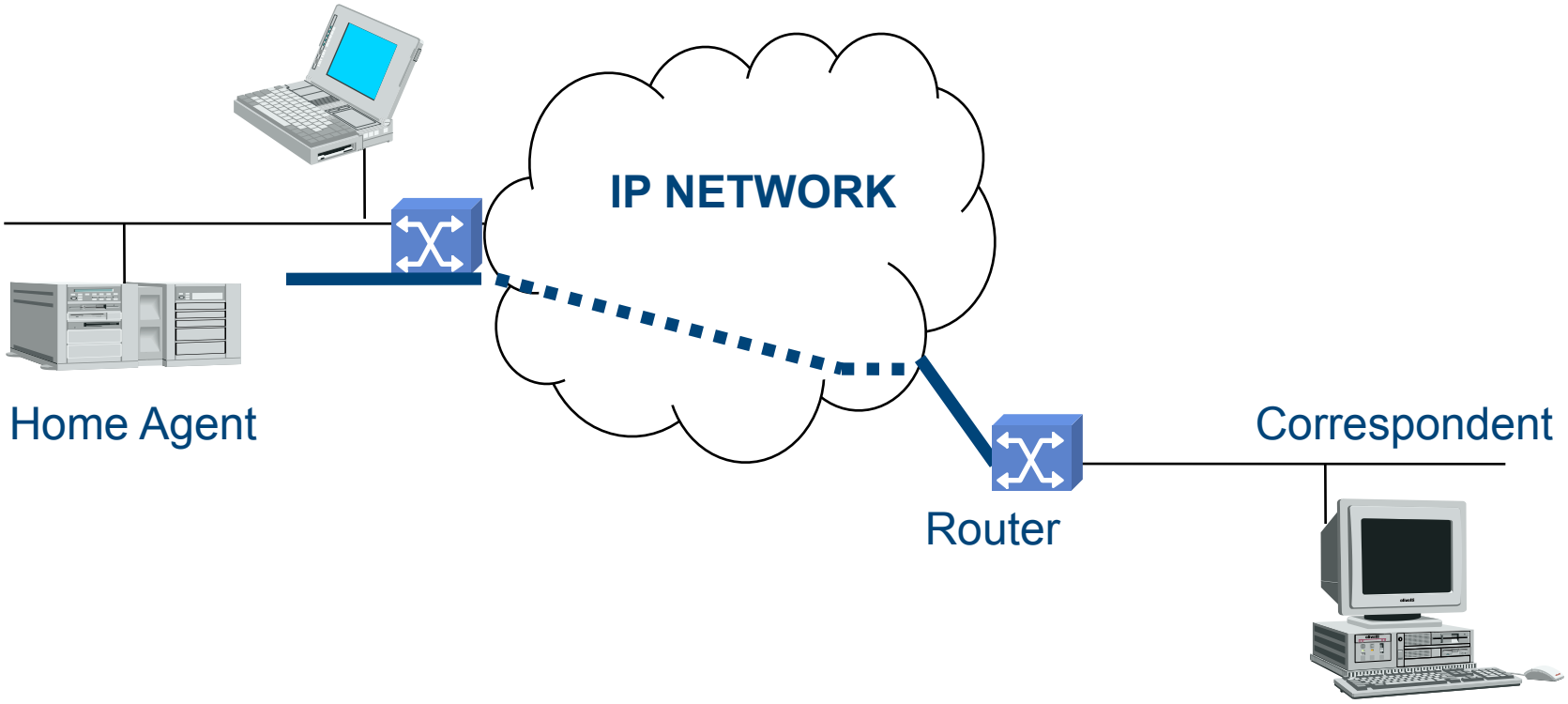
System level results: ETSI FDD

			Indoor		Pedestrian		Vehicular	
			UL	DL	UL	DL	UL	DL
Speech								
	Bit-Rate	kBit/s	8	8	8	8	8	8
	maximum Range	m	1030	900	1020	910	5900	7350
	Spectrum efficiency	(kBit/s)/MHz/cell	135	74	123	125	90	71
	Simultaneous Users	Erlang	169	92	154	157	112	89
	E_b/N_0	dB	3,2	6,0	3,3	6,1	5,4	7,9
LCD-MM								
	Bit-Rate	kBit/s	2048	2048	384	384	384	384
	maximum Range	m	210	230	450	520	2800	3900
	Spectrum efficiency	(kBit/s)/MHz/cell	176		269	461	192	177
	Simultaneous Users	Erlang	0,43		3,5	6	2,5	2,3
	E_b/N_0	dB	1,8	1,6	1,3	1,1	2,9	3,2
UDD-HM								
	Bit-Rate	kBit/s	2048	2048	384	384	384	384
	maximum Range	m	310	350	500	520	2600	3900
	Spectrum efficiency	(kBit/s)/MHz/cell	273	453	449	668	216	
	Simultaneous Users	Erlang	50	82	91	135	42	
	E_b/N_0	dB	0,6	0,1	0,4	0,1	2,4	2,0

UMTS network simulation: less than 1 Mbit/s

MobileIP Mobility

- Mobile IP – the long term vision (UMTS rel. 6)
  - HA, FA
  - IPv6
  - real-time requirements?



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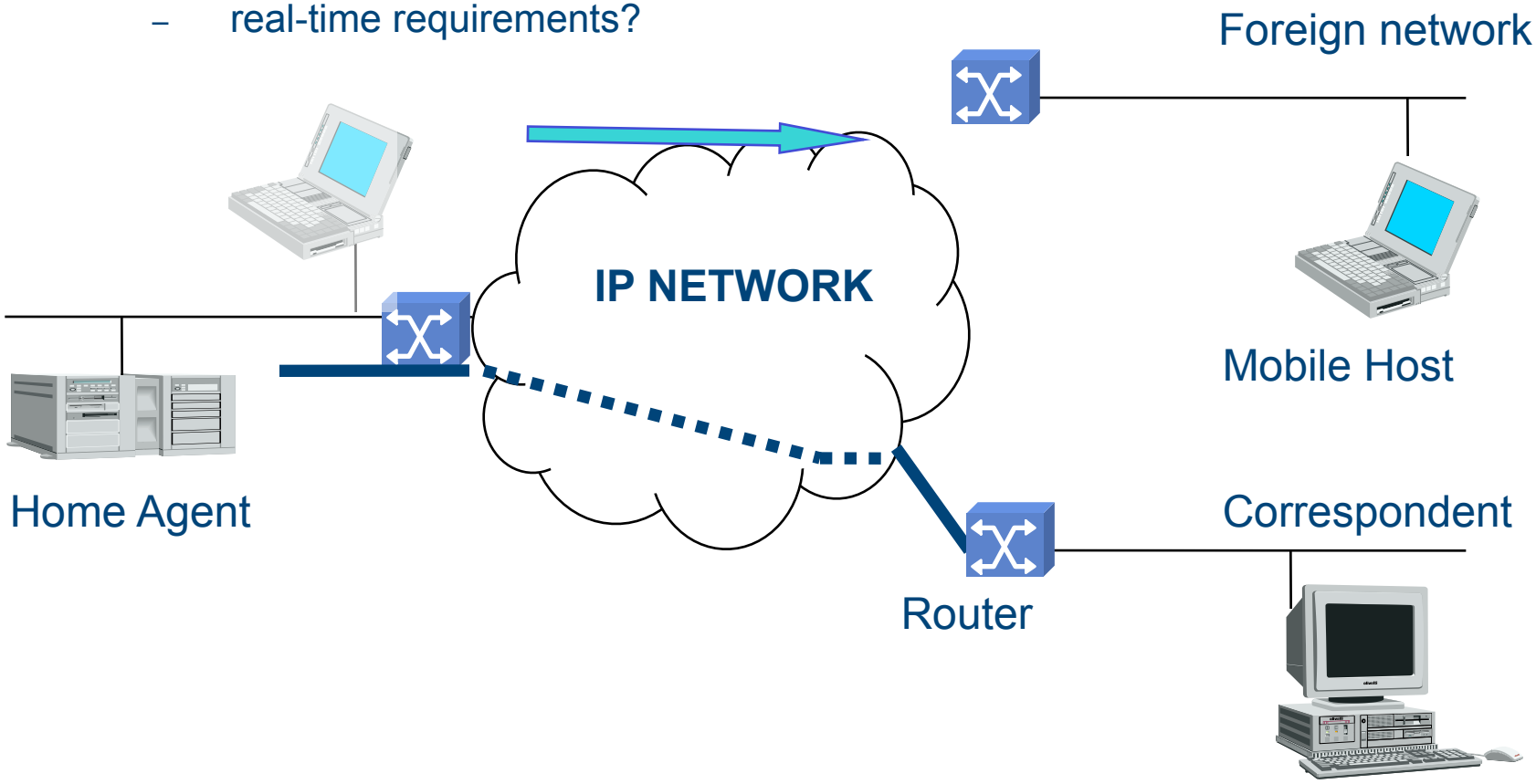

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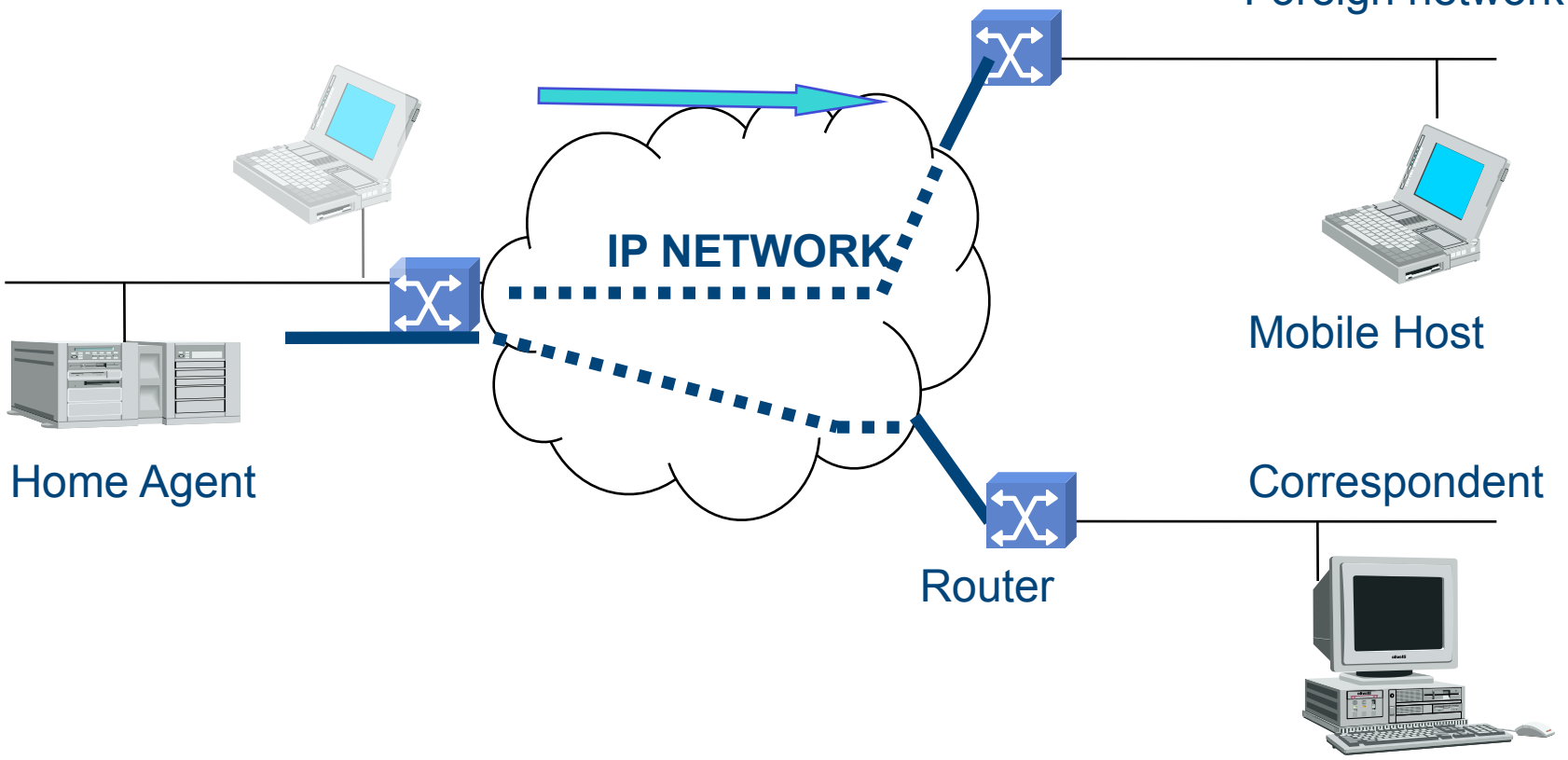

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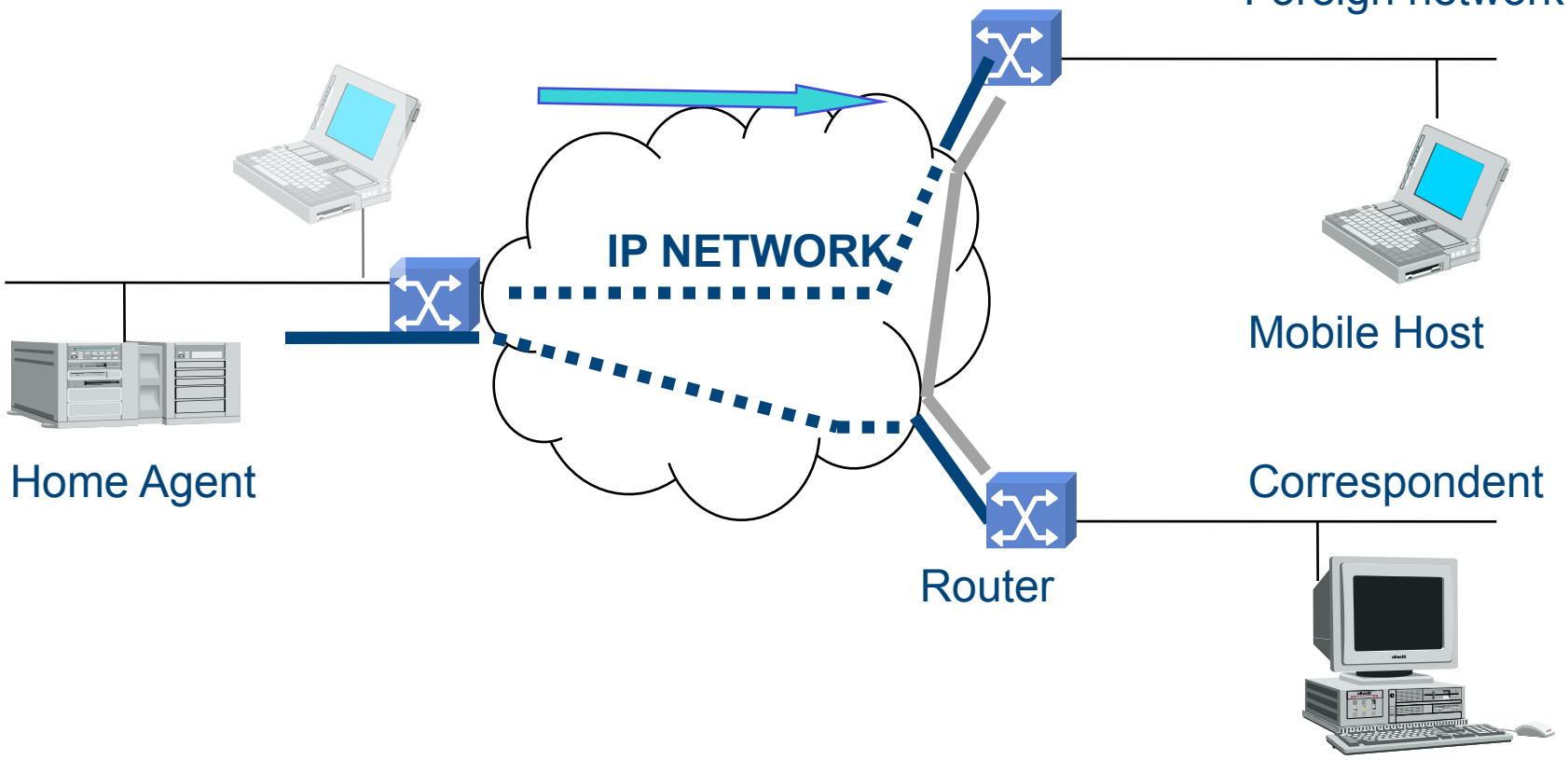


Mobile IPv4 to Mobile IPv6

- replace triangular routing, keep address
- route optimisation
- defined for low-speed mobility

Intra-domain mobility

- Host based routing
- Data integrity protection,

Security

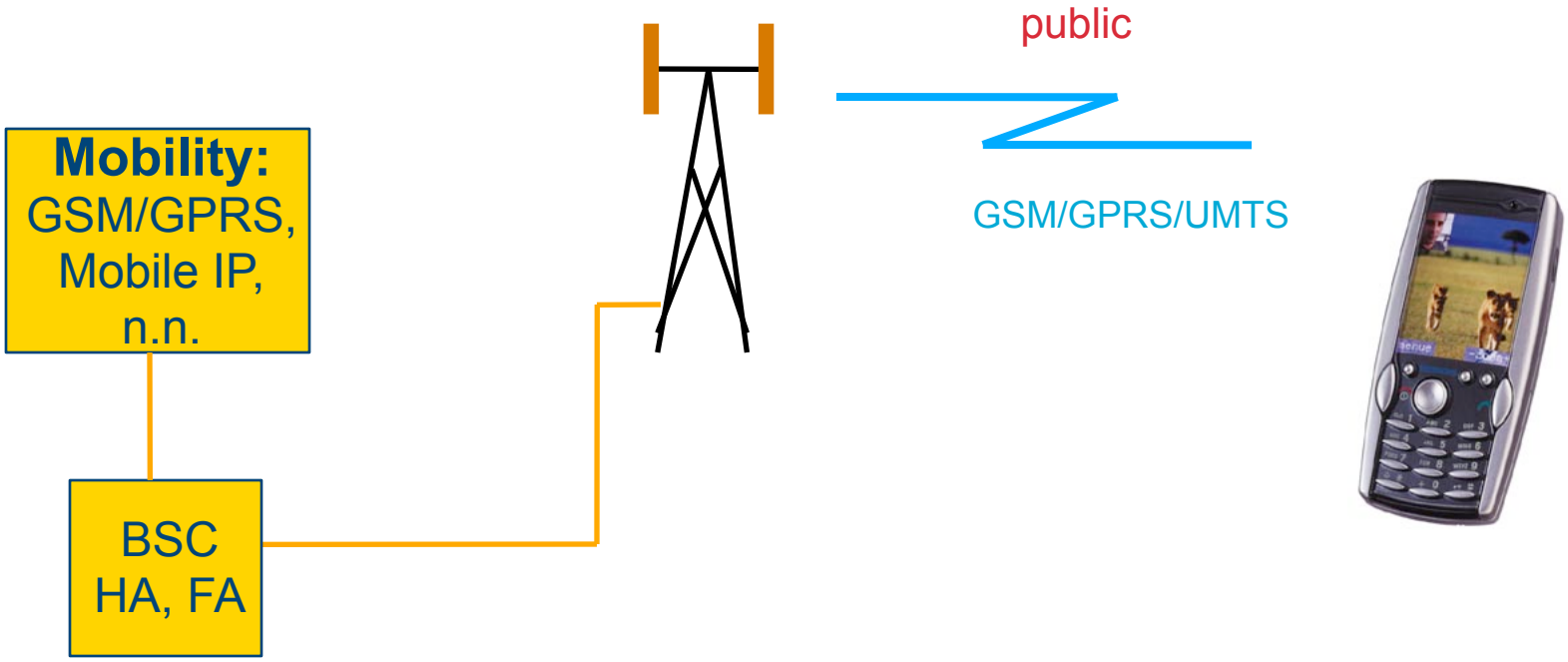
- Sender authentication,
- Data integrity protection,
- Replay protection

B3G concept: Seamless access

Mobility:
GSM/GPRS,
Mobile IP,
n.n.

BSC
HA, FA

B3G concept: Seamless access



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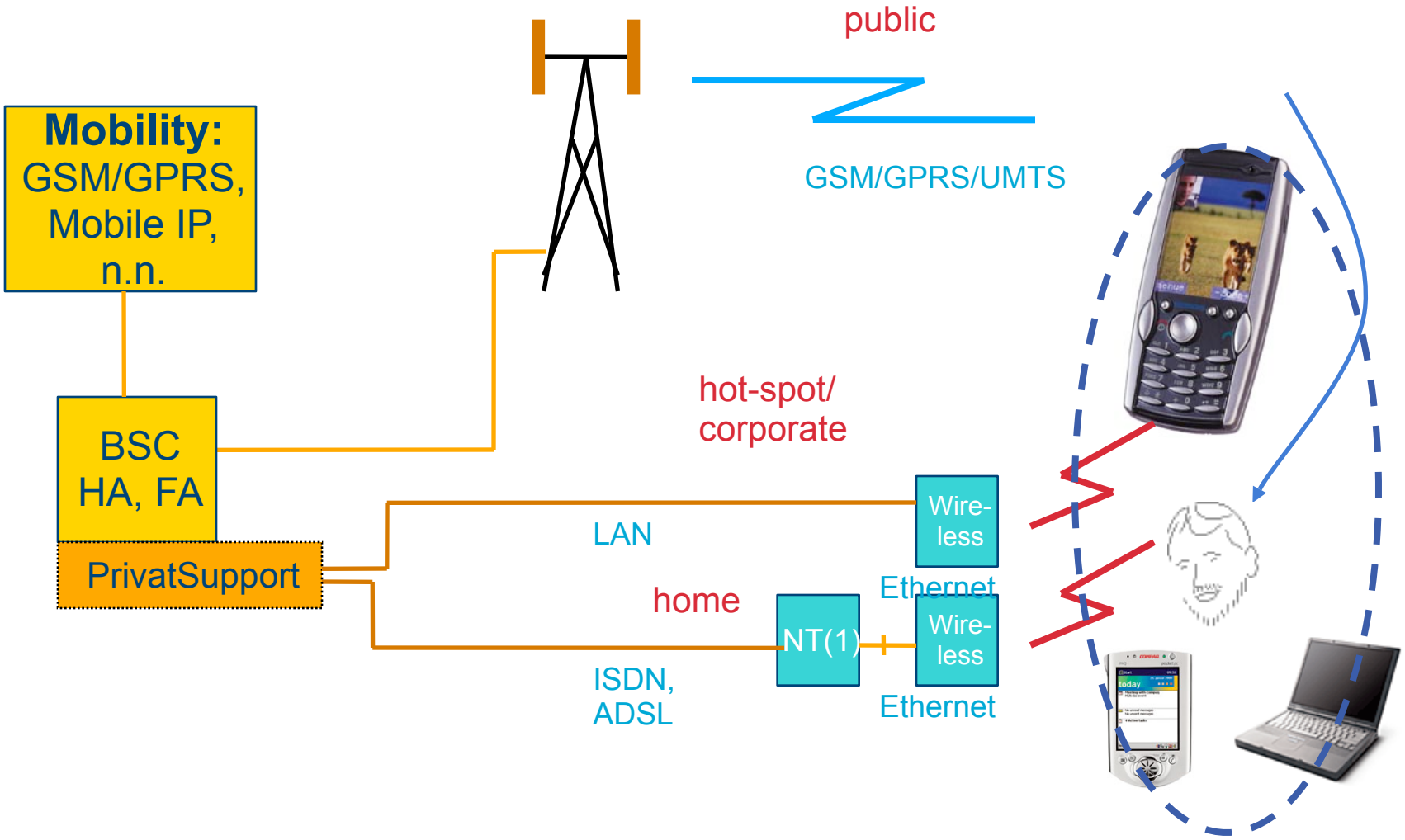
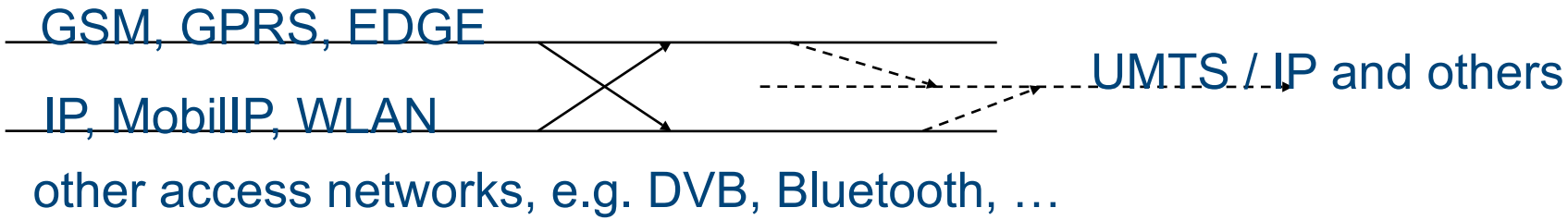


Summary and future work



- Mobile dominates MFI (Mobile Fixed Integration)
- MFI requires Mobility Management across heterogeneous access networks

Upcoming work

- overview GSM mobility (or UMTS)
- methods for seamless IP mobility

Mobile IP mechanisms

- Mobile-IP
- IDMP - intra-domain mobility protocoll
- Hawaii
- Cellular IP, Cellular IPv6 (CIPv6)
- Hierarchical Mobile IPv6 (HMIPv6
- Fast Mobile IPv6

- Tasks:
- explain approaches, discuss advantages and deficiencies

List of references

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- Future work (critics of)
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