Role of Satellites in 3G and B3G Mobile / Wireless Systems

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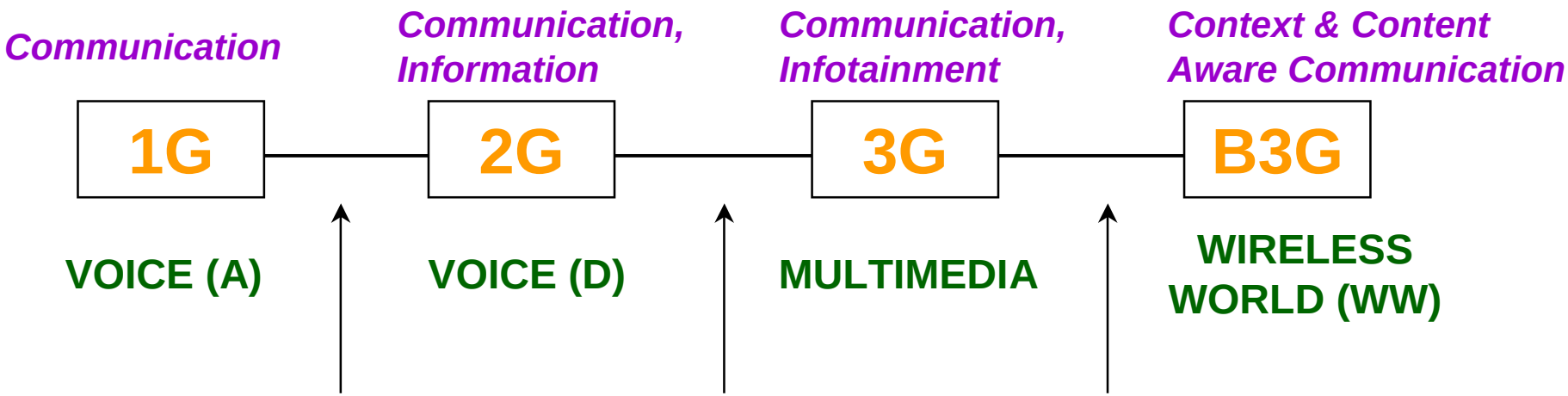
Mobile / Wireless Evolution



Digital
- Quality
- Security
- Reliability
- Capacity
- Roaming

Services
- Mixed services
- Capacity
- Flexible billing
- Personalisation

Integrated WW
- Mixed networks (WAN,WLAN,DVB,etc.)
- IP based/connected
- Ambient awareness
- Ubiquity/flexibility
- 'Always connected'

Satellite – just content delivery mechanism!

- Why are satellites treated with suspicion by terrestrial operators
- Competition! – their role is to complement
- Economic! – depends on the application area
- QoS and availability are no longer issues
- The answer is **integration** not **separation**

What are the messages?

1. Integration ‘satellite/terrestrial’

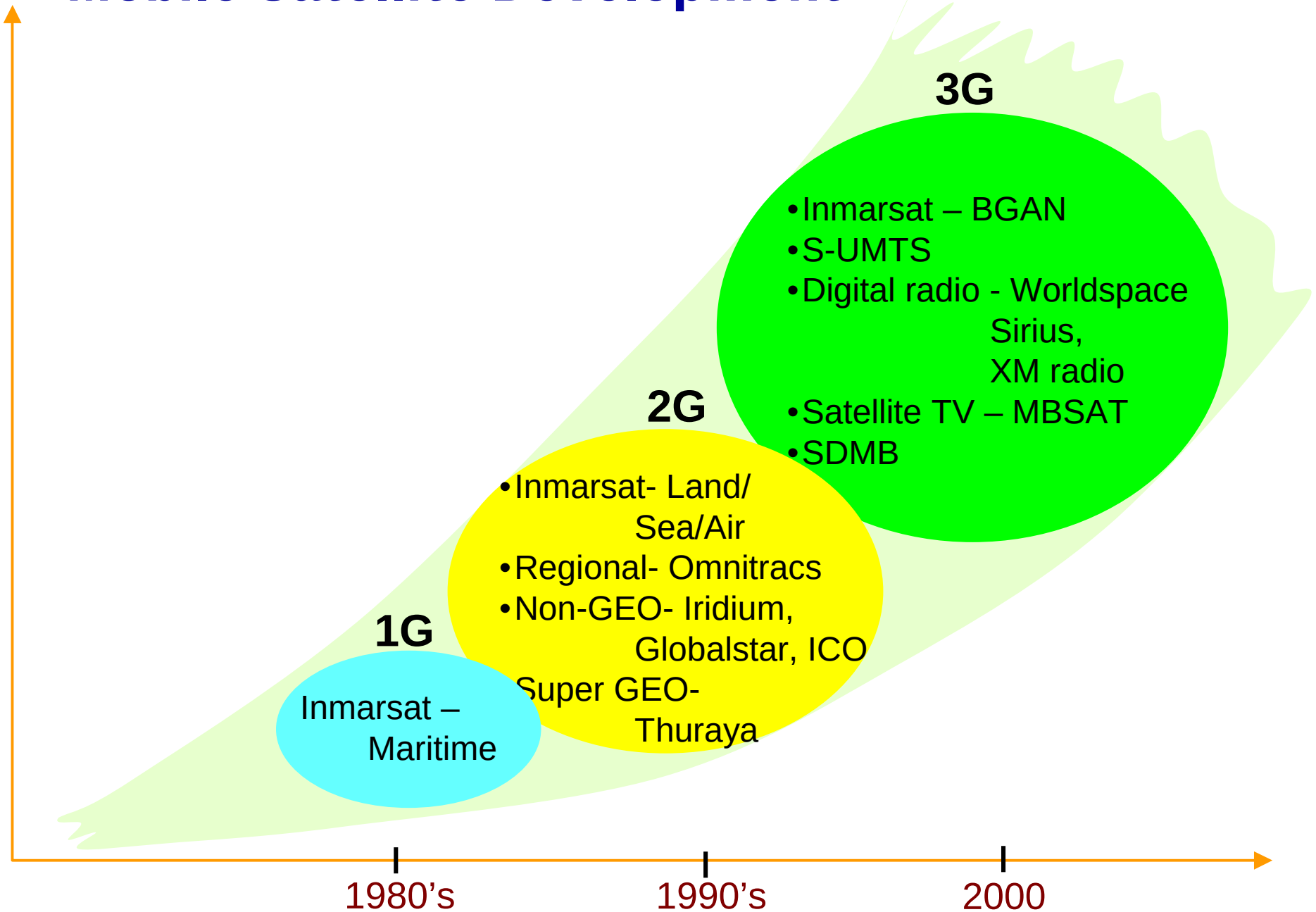
2. Use satellite for broadcast/ multicast services

3. Use satellites in non-urban/ suburban areas

→ Interesting that in (2) & (3) terrestrial systems have problems where satellites are strong

→ Use the delivery that best fits the applications as in (2)

Mobile Satellite Development



Satellite Role in 3G

ETSI Standard - GMR

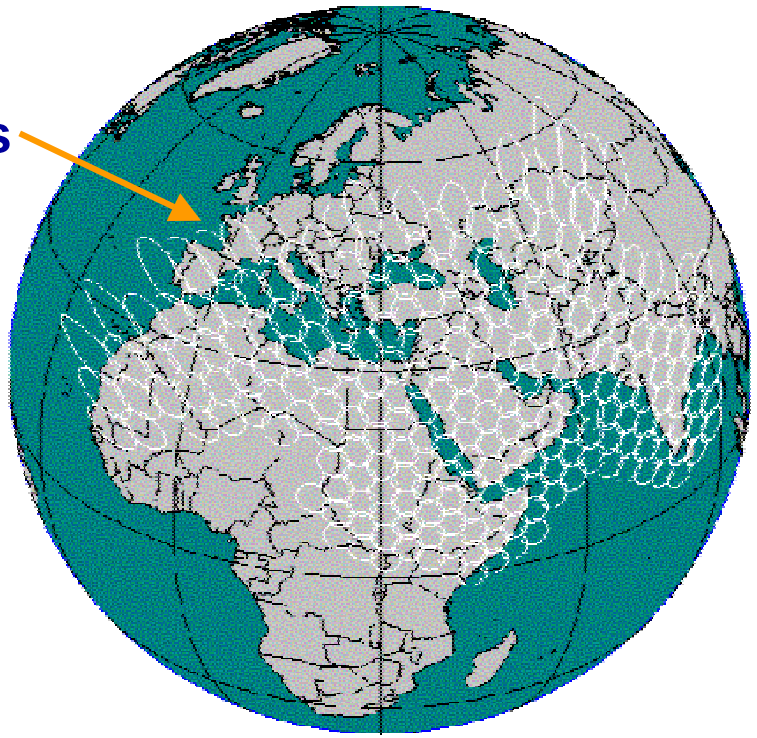
Circuit Switch

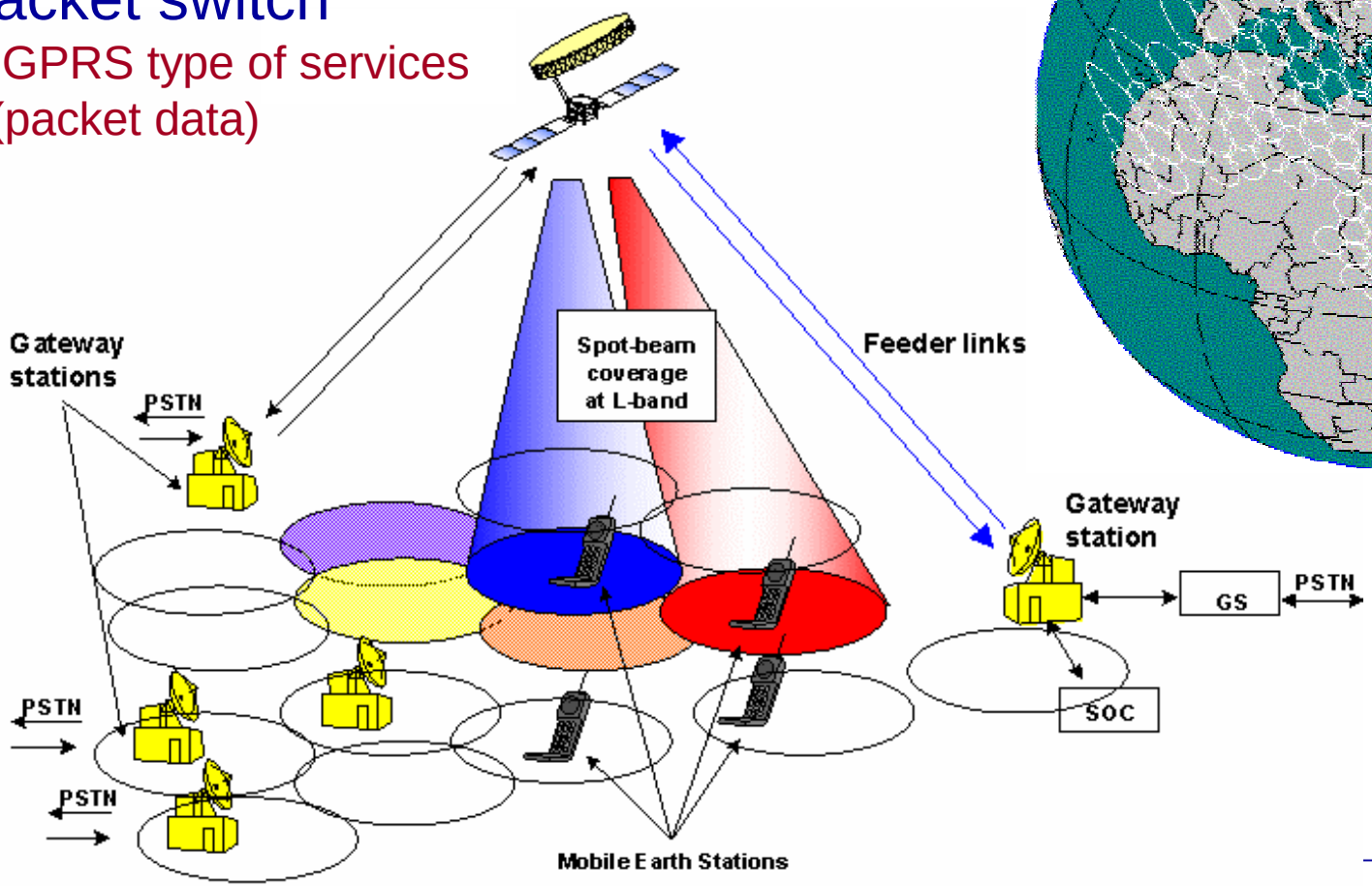
- GSM type of services (Voice, SMS, cell BC)

Packet switch

- GPRS type of services (packet data)

- **5kW**
- **100-200 spots**

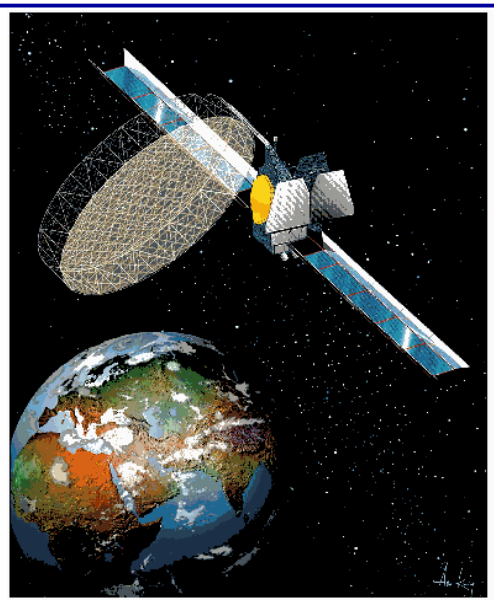




Super GEO - Thuraya

Satellite features

- 250-300 spot beams
- Digital beam forming
- Single hop link for mobile-to-mobile
- High power capacity
- Dynamic power control providing 10dB link margins



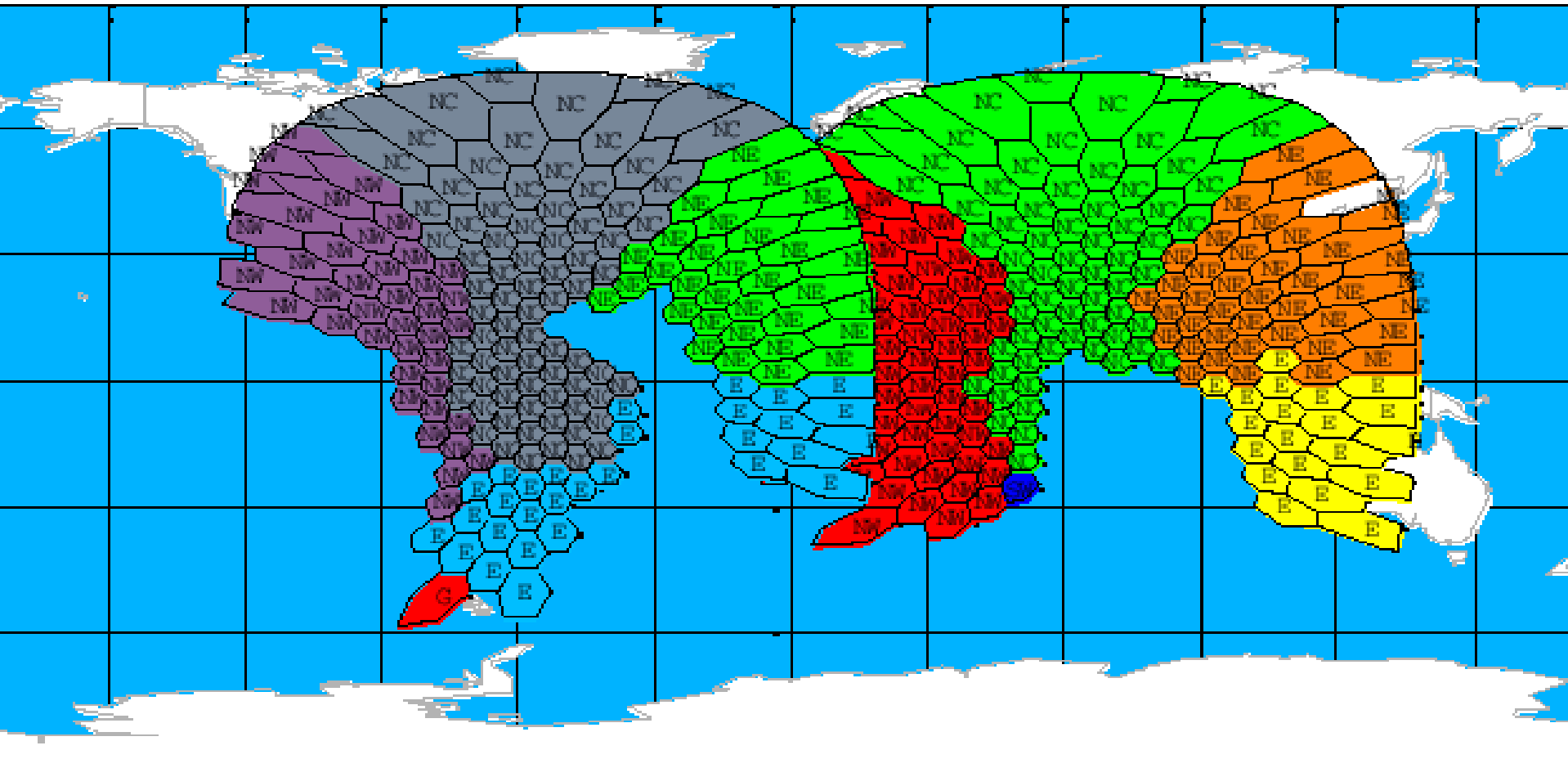
Service Features

- Voice telephony, Fax, Data, Short Messaging, Location Determination, Emergency Services, High Power, Alerting, Regulatory Data

Frequencies:

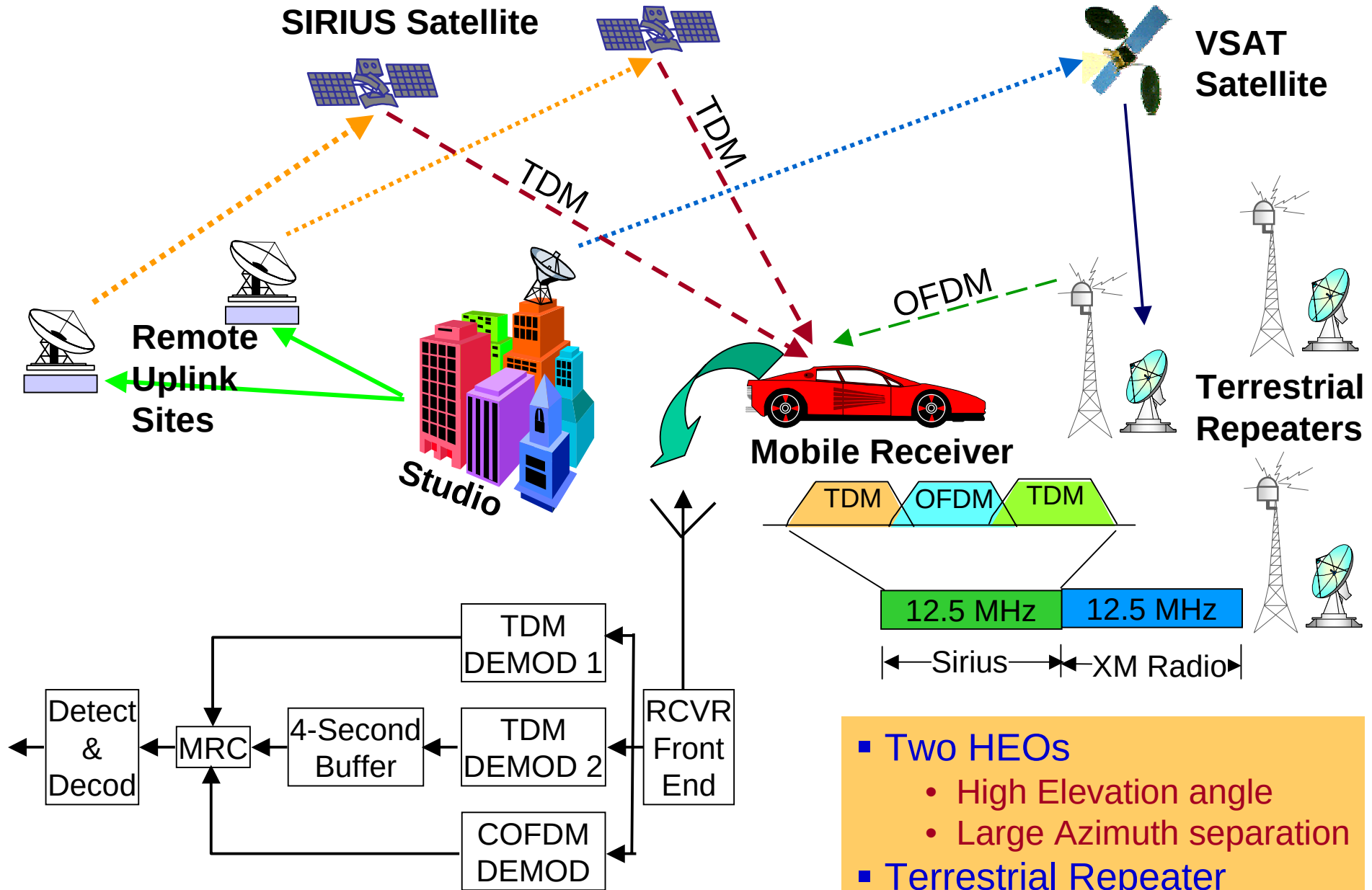
- Mobile Links
  - Earth-to-space 1626.5-1660.5 MHz
  - Space-to-Earth 1525.0-1559.0 MHz
- Feeder Links
  - Earth-to-space 6425.0-6725.0 MHz
  - Space-to-Earth 3400.0-3625.0 MHz

Spotbeam Coverage



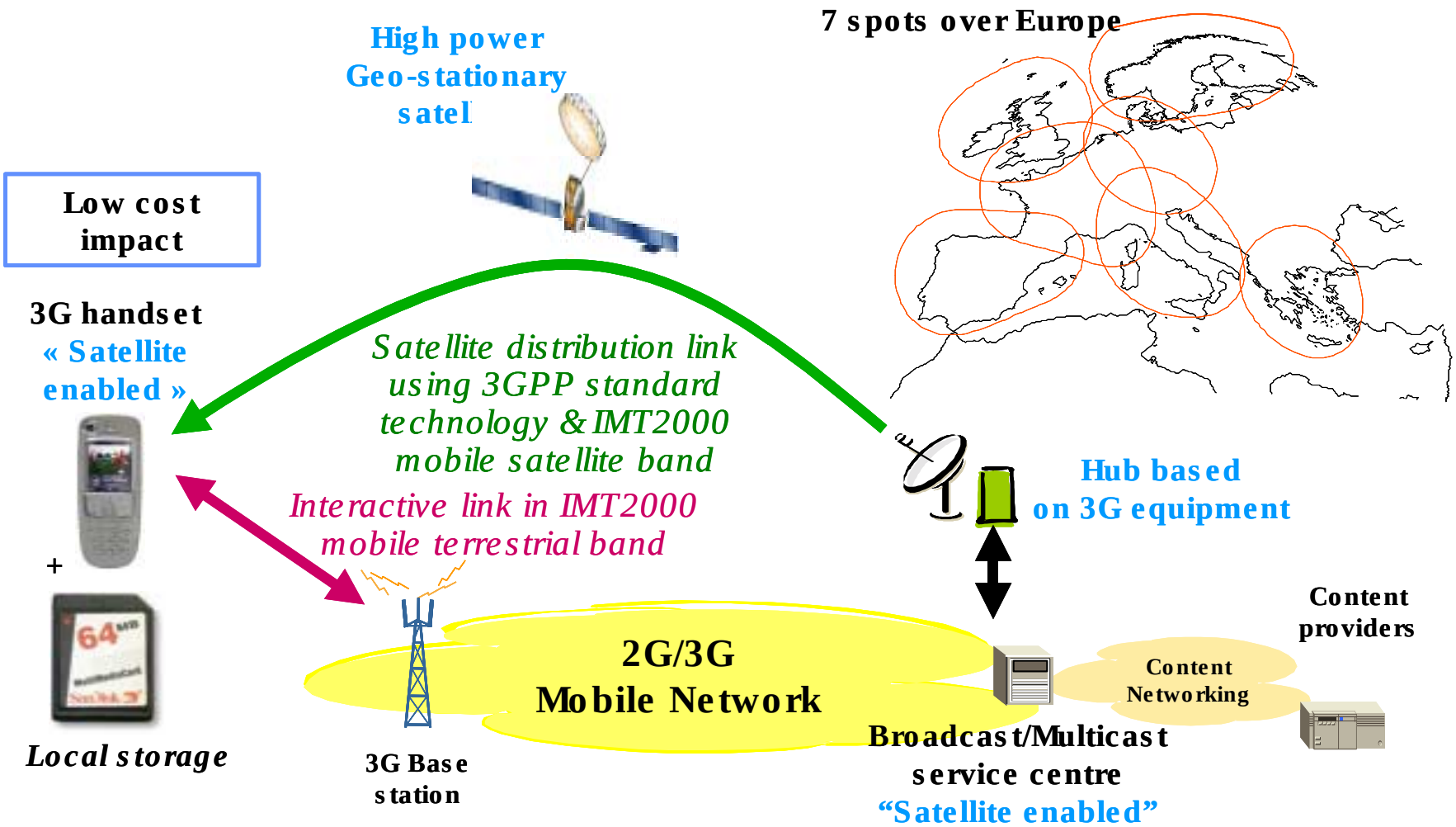
INMARSAT IV

Satellite Digital Radio - Sirius



- Two HEOs
  - High Elevation angle
  - Large Azimuth separation
- Terrestrial Repeater

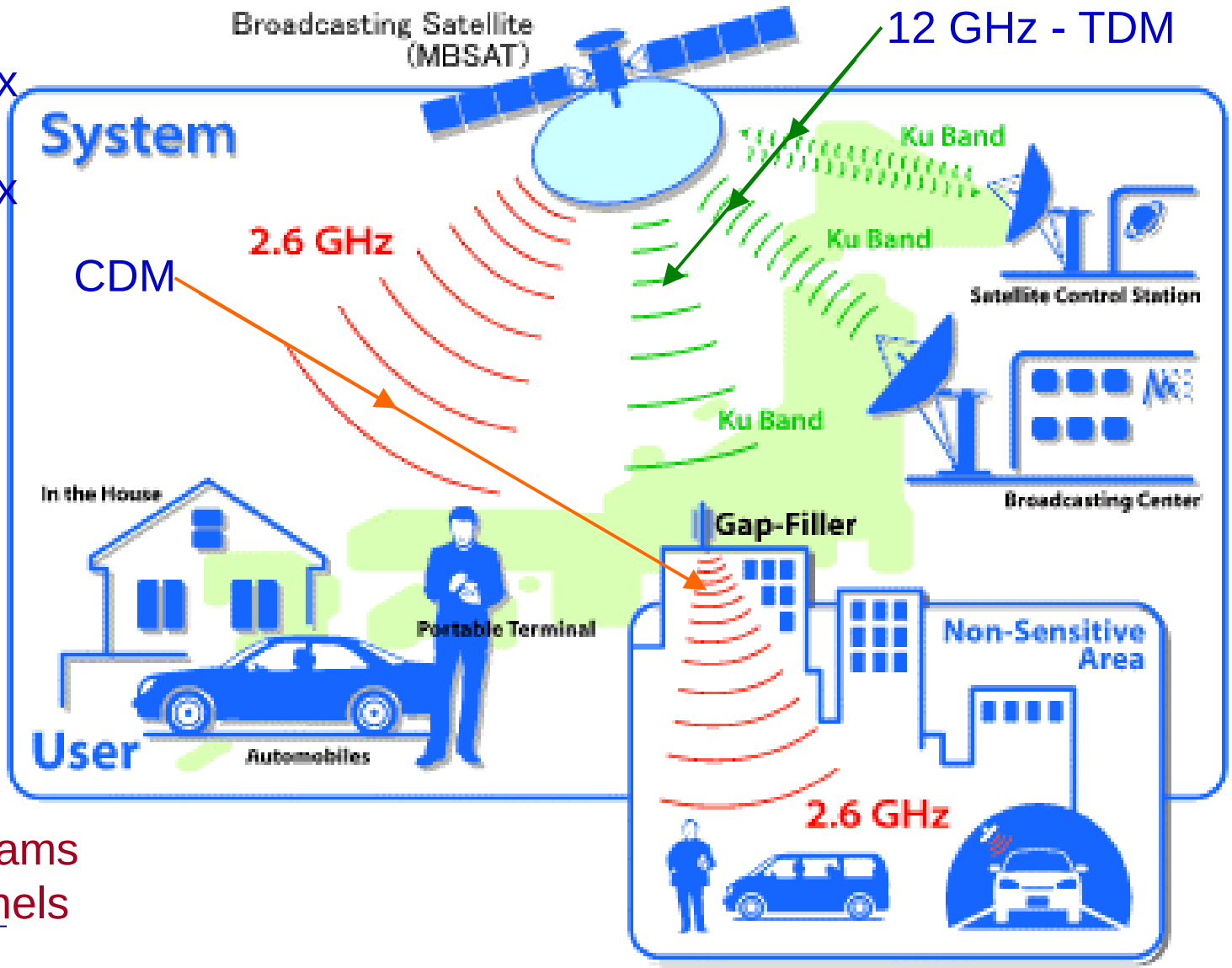
MAESTRO (FP6)


High power
Geo-stationary
satel
7 spots over Europe
Low cost
impact
3G handset
« Satellite
enabled »
+
Local storage
Satellite distribution link
using 3GPP standard
technology & IMT2000
mobile satellite band
Interactive link in IMT2000
mobile terrestrial band
Hub based
on 3G equipment
Content
providers
2G/3G
Mobile Network
Content
Networking
3G Base
station
Broadcast/Multicast
service centre
"Satellite enabled"

Japanese MBSAT

CDM – Code Division Multiplex

RDM – Time Division Multiplex

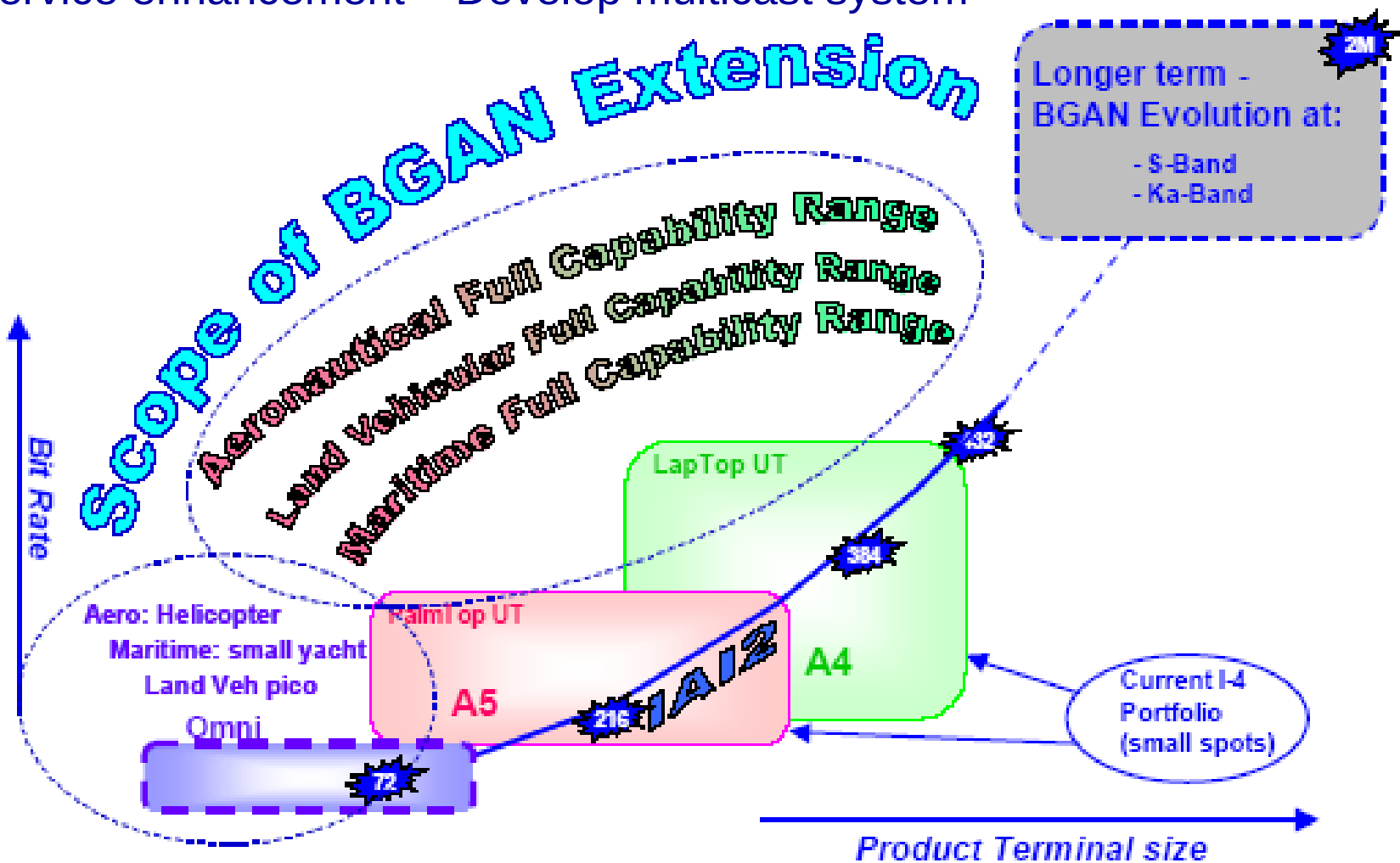


70 Channels

- 55 Audio programs
- 10 Video channels

Inmarsat Systems Evolution

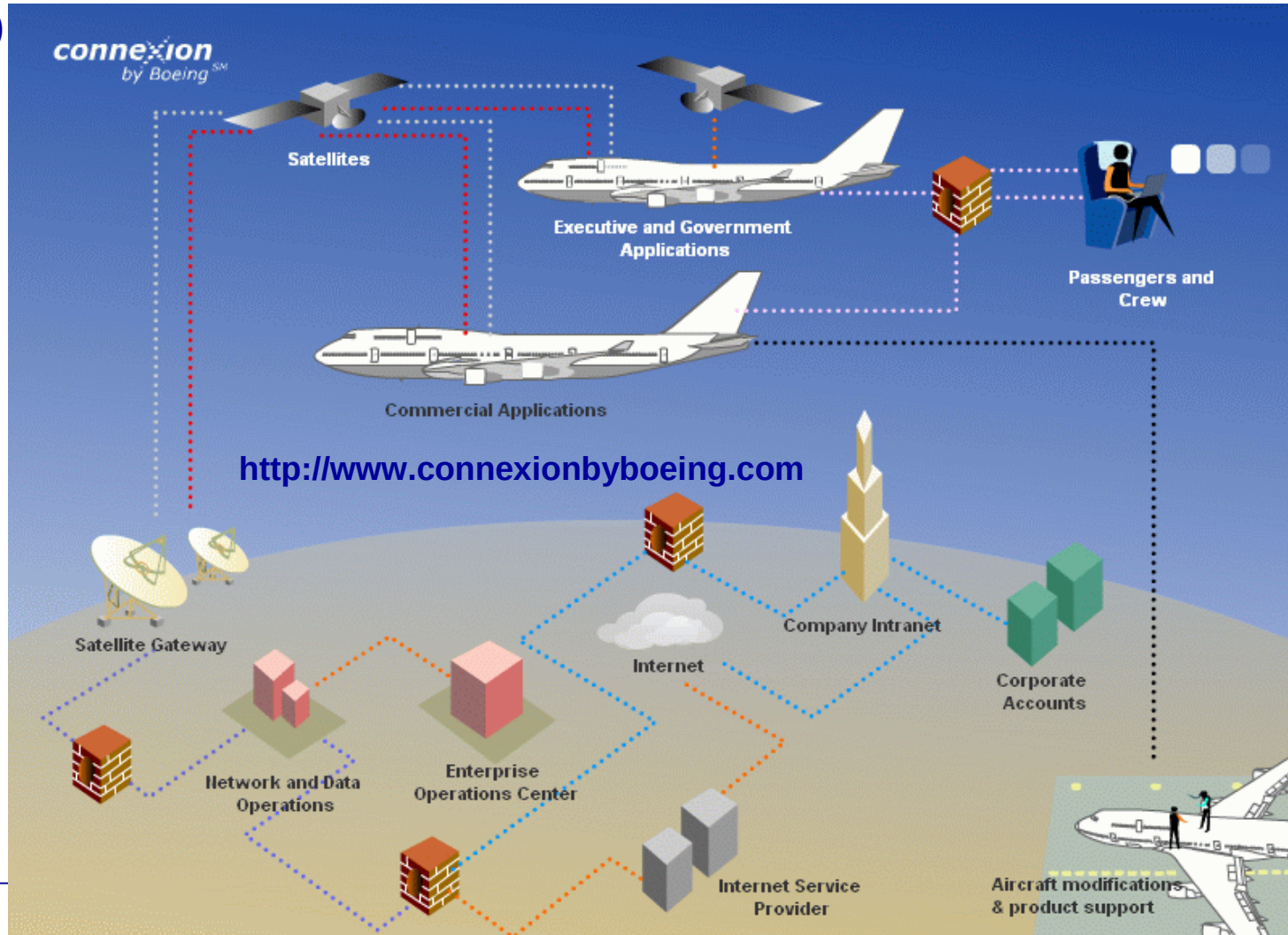
- BGAN Extension to Aeronautical and omni-directional terminals
- BGAN service enhancement – Develop multicast system



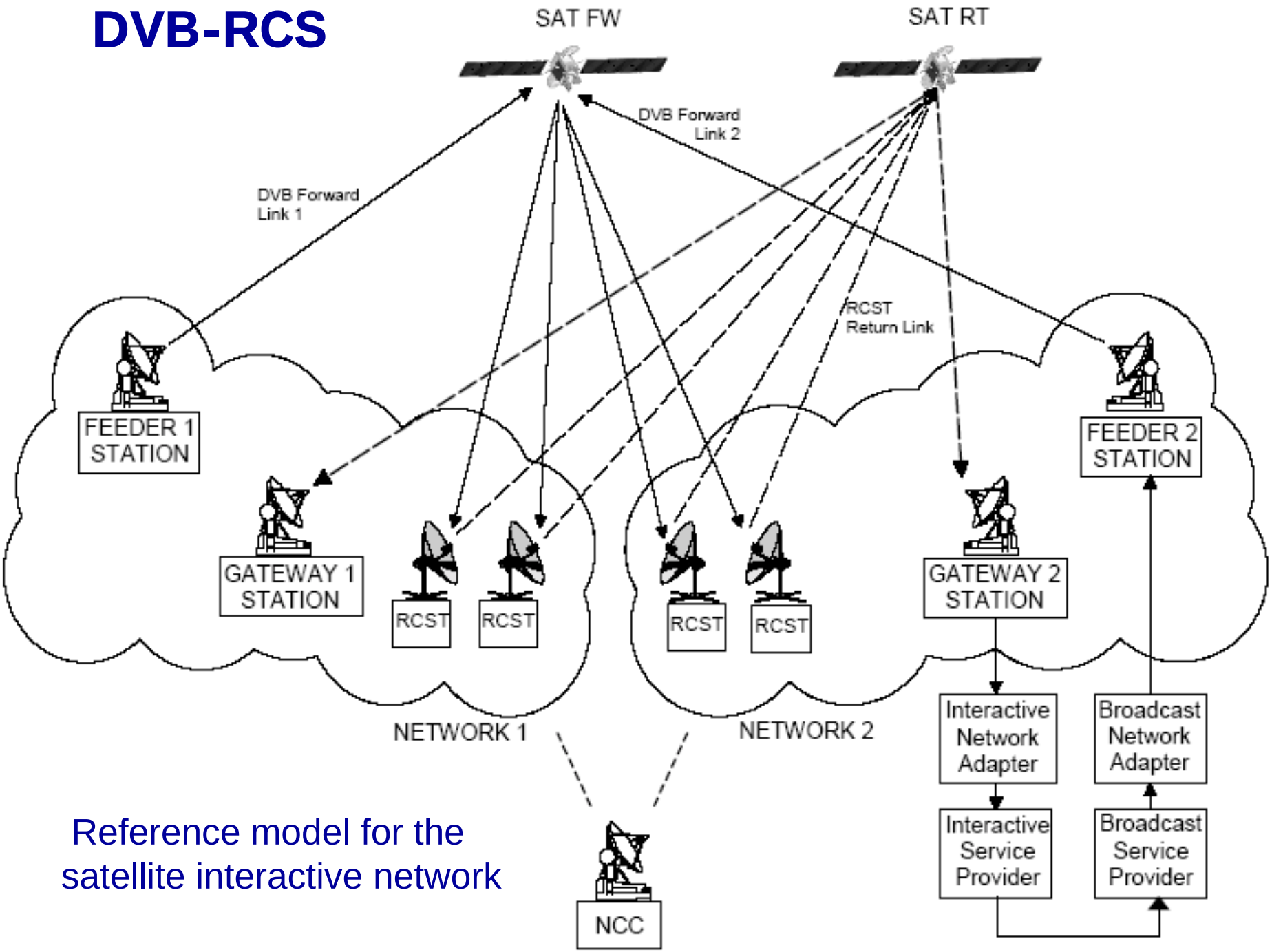
http://telecom.esa.int/telecom/www/object/index.cfm?fobjectid=11369

Connection by Boeing broadband Network

- GEO satellite with direct sequence spread spectrum waveform
- Ku band – 14.0-14.5GHZ (Mobile platform to space link) – 11.2-12.75 GHz (space to Mobile platform)

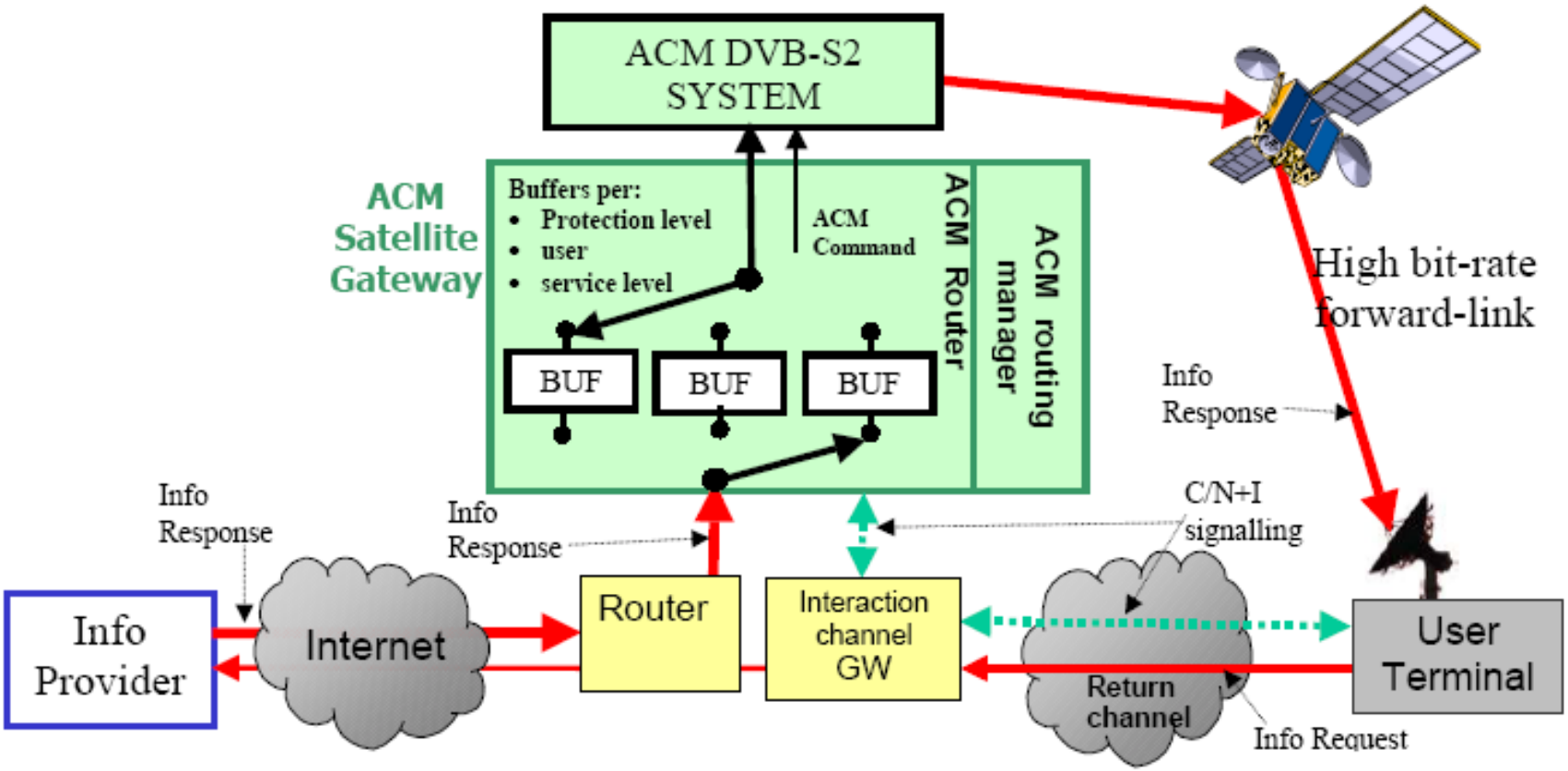


DVB-RCS



Reference model for the satellite interactive network

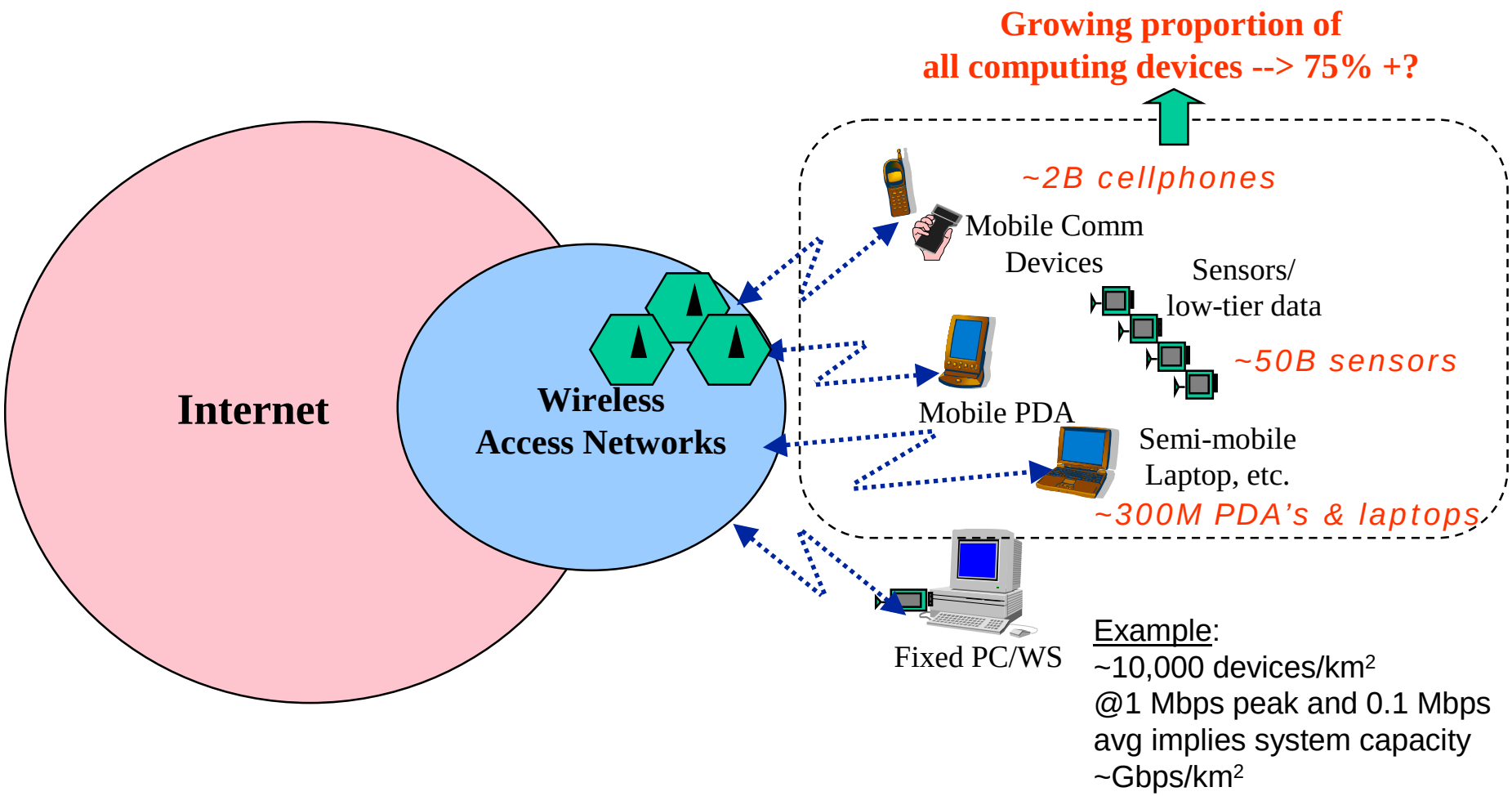
DVB-S2


ACM DVB-S2 SYSTEM
ACM Satellite Gateway
Buffers per:
• Protection level
• user
• service level
ACM Command
ACM Router
ACM routing manager
BUF
BUF
BUF
High bit-rate forward-link
Info Response
Info Response
Info Response
C/N+I signalling
Info Provider
Internet
Router
Interaction channel GW
Return channel
User Terminal
Info Request

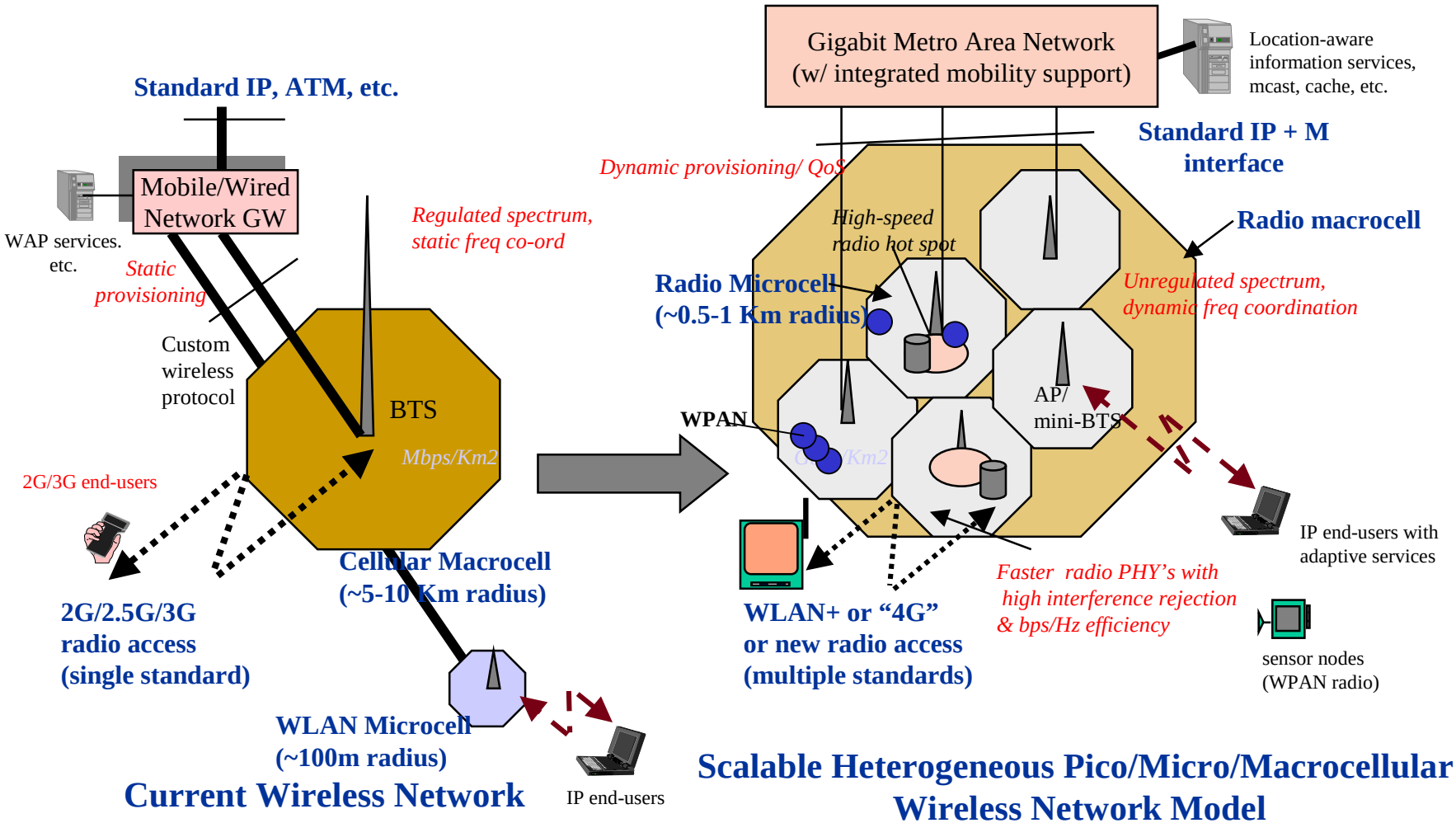
Terrestrial B3G Concept and Issues

B3G System Issues: Scaling of Capacity

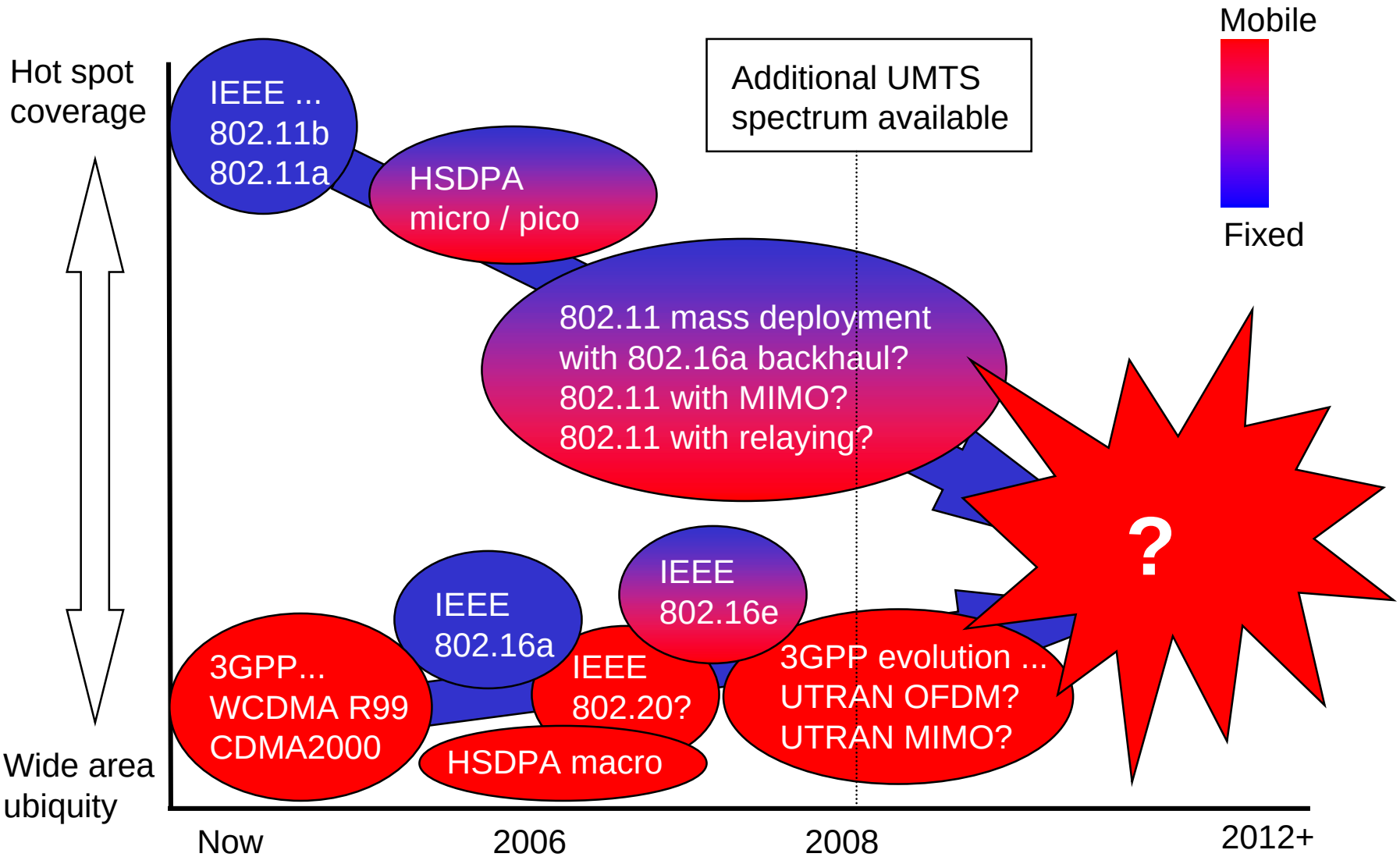
- The grand vision of ubiquitous wireless and pervasive computing leads to a serious capacity problem



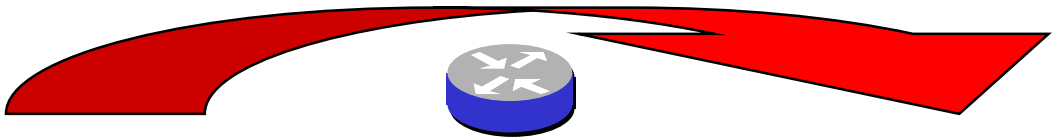
B3G System Issues: Network Evolution



B3G System Issues: Convergence of wireless for IP connectivity

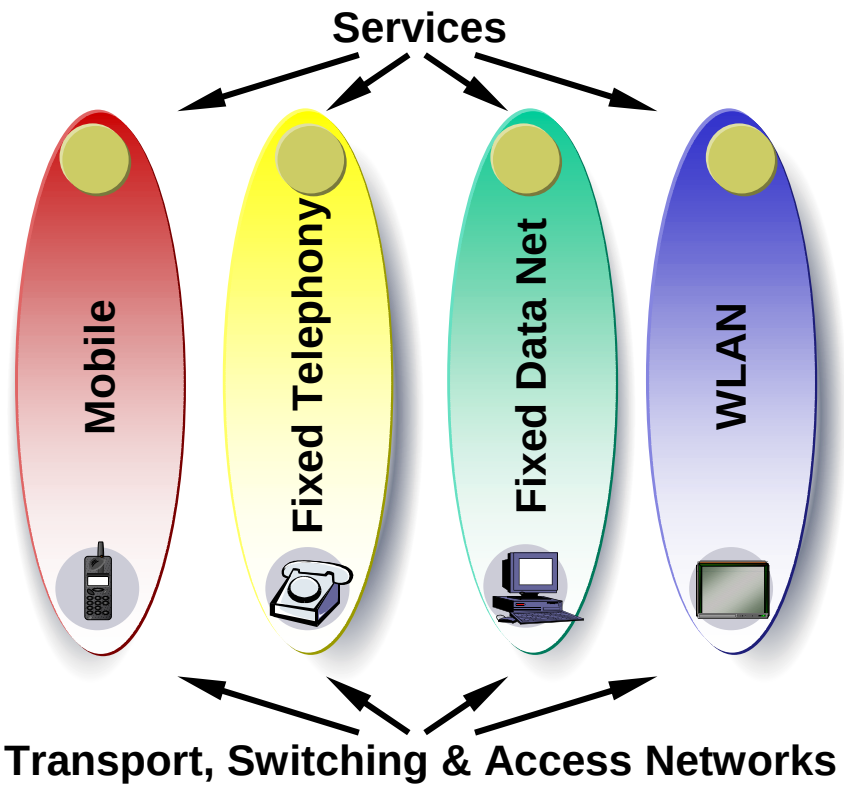


Towards an IP multi-service network



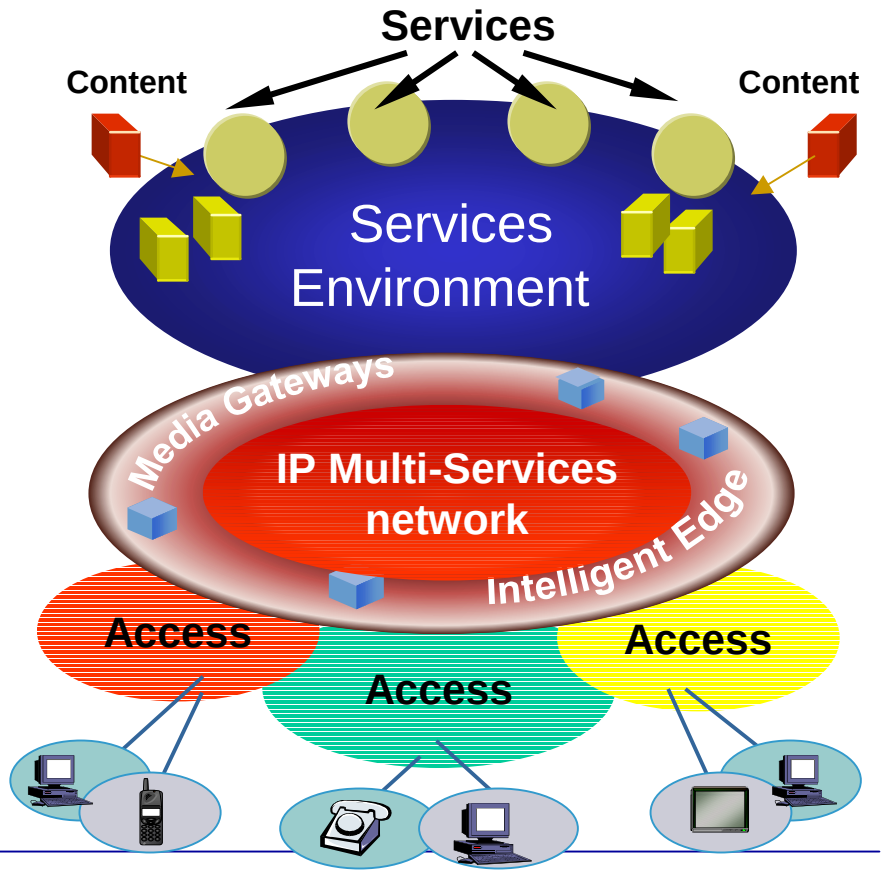
Today

Vertical Networks (single service)

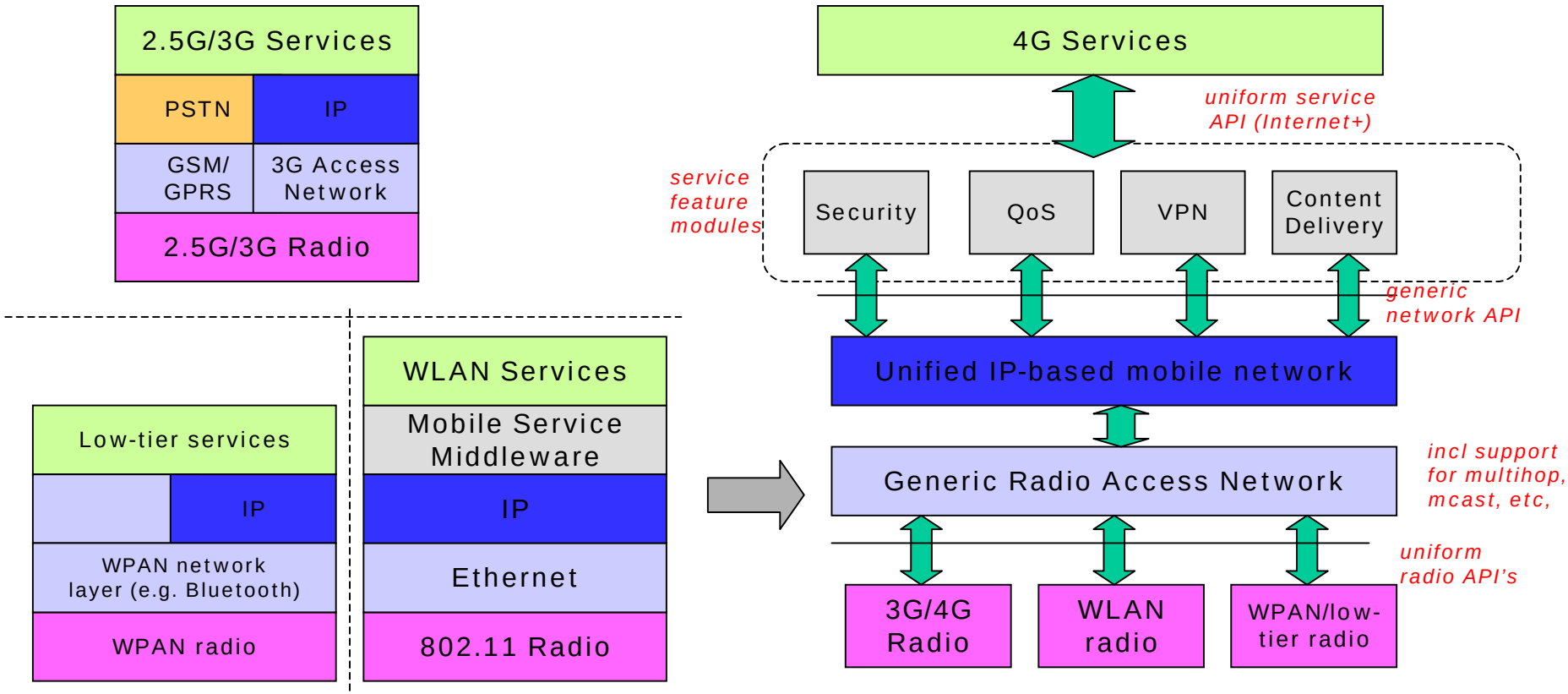


Tomorrow

Horizontal Network (multi-services)



Towards all IP Network: Protocol Evolution



Radio-specific vertically integrated systems with complex intetworking gateways

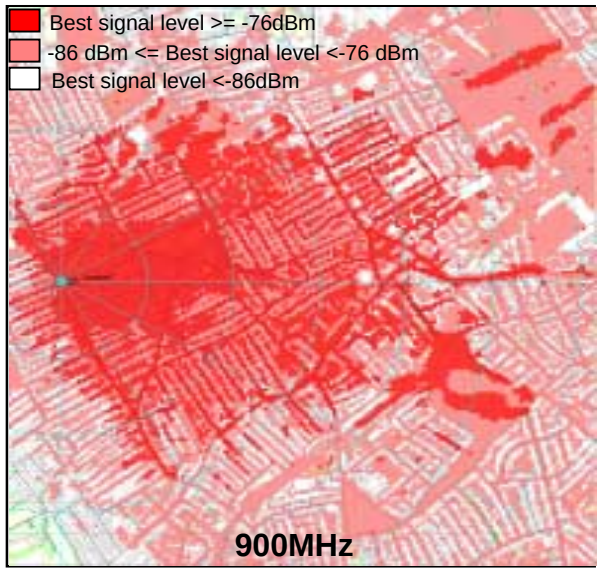
Today's Wireless Systems

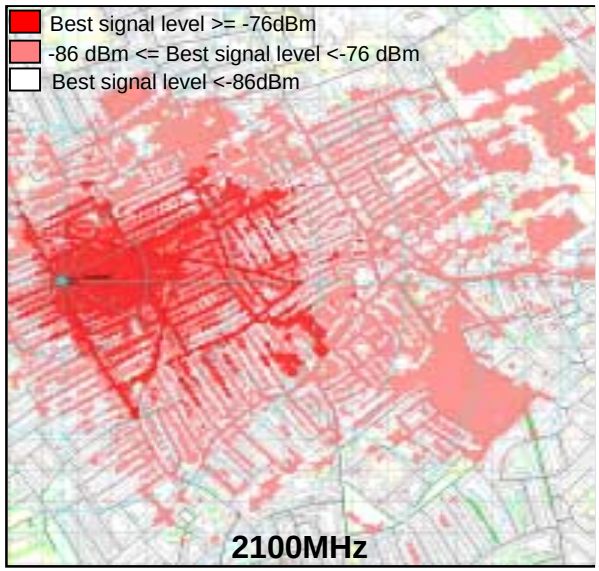
Radio Independent modular system architecture for heterogeneous networks

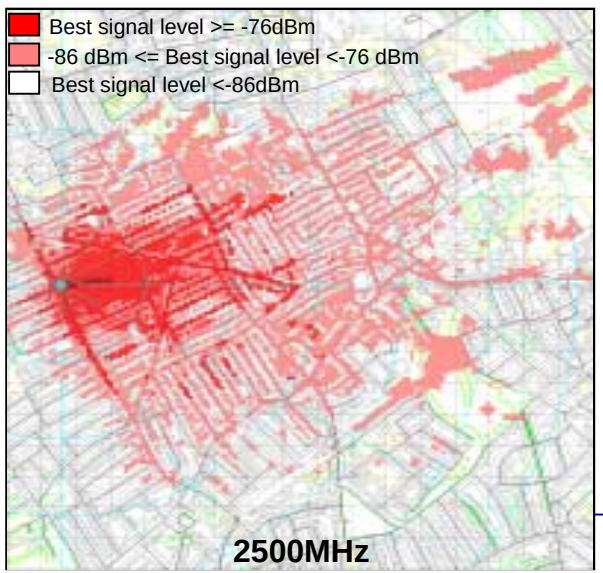
The Future

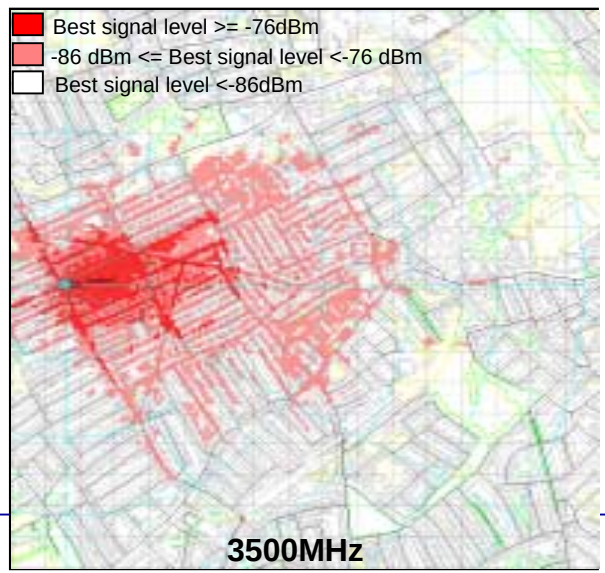
Suburban broadband coverage vs freqency

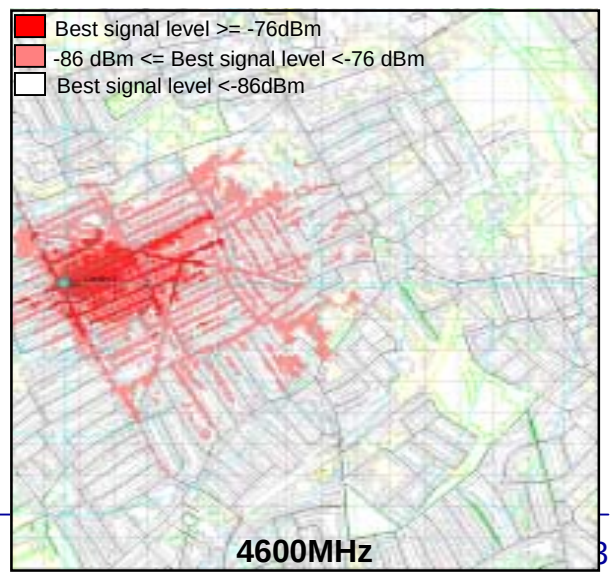
Best available sector antenna at 10m above ground





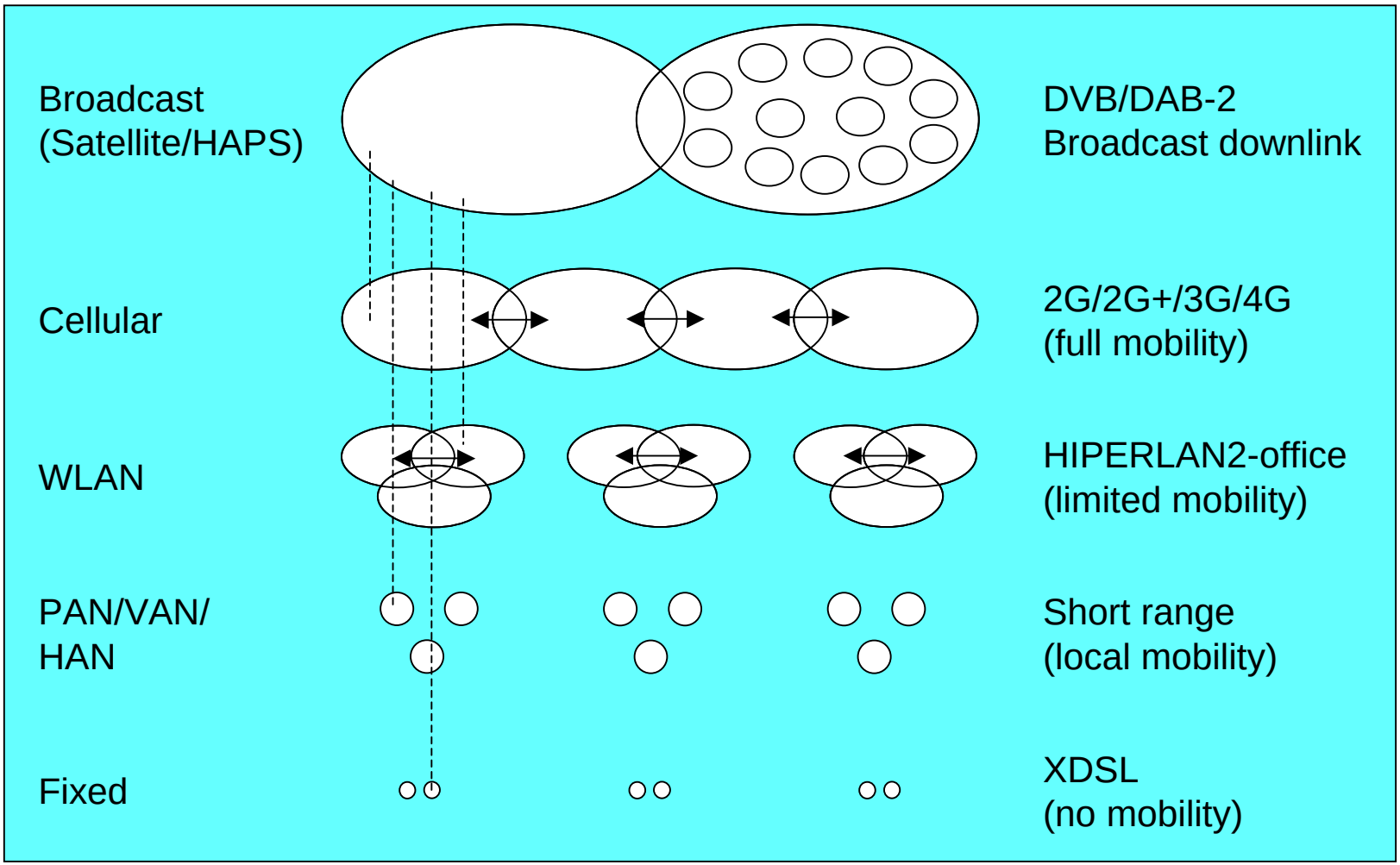




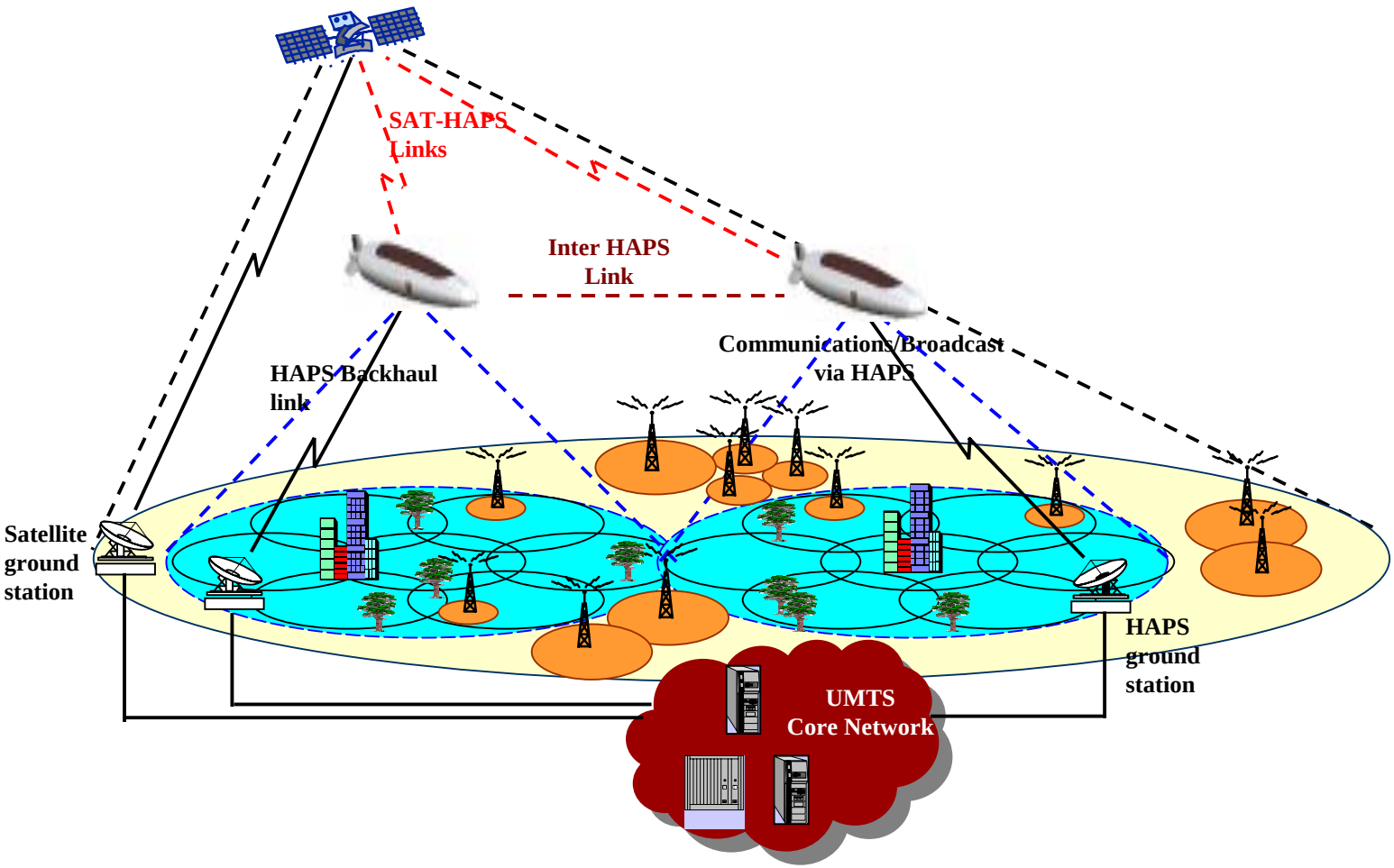


Satellite Role in B3G

Integration



Possible Architecture for 4G



B3G Mobile Research Issues

- Reconfigurable & Ad-hoc networking
- Software networks & cognitive radio
- Ambience & context awareness
- Personalised, trusted secure services
- Mixed sensor/ comm networks
- Really efficient radio IP stacks
- Management of complexity
- Efficiency to reduce the “cost per bit”

B3G Future role of satellites (1/3)

- Providing seamless migration
- Integration of mobile/ broadcast/ multicast
- Providing broader band services
- Service & geographical level integration

B3G Future role of satellites (2/3)

Facilitating the cellular drivers

- Satellite role in Ad-Hoc networking
- Location/ positioning integration
- Provision of security across networks
- Satellite sensor networks
- Cognitive radio – S/T spectrum sharing

B3G Future role of satellites (3/3)

Crystal-ball gazing

- Revolution created by cheaper and smaller satellites
- IP switched network in the sky
- Clusters/ Swarms – networked (ad-hoc)
- Facilitate the network of hybrid constellations

B3G – Satellites

- Satellites do have a role in B3G
- **Integration** of satellite/ terrestrial is the key
- Technology advances in satellites provides exciting prospects
- Need to stop treating satellite & terrestrial separately in standardisation fora
- Operators/ network providers need to embrace a culture change to include satellites