Regional Development Forum 2008

"Bridging the Standardization Gap in Developing Countries"
for the Asia-Pacific Region
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Wireless broadband access and solutions for rural communication

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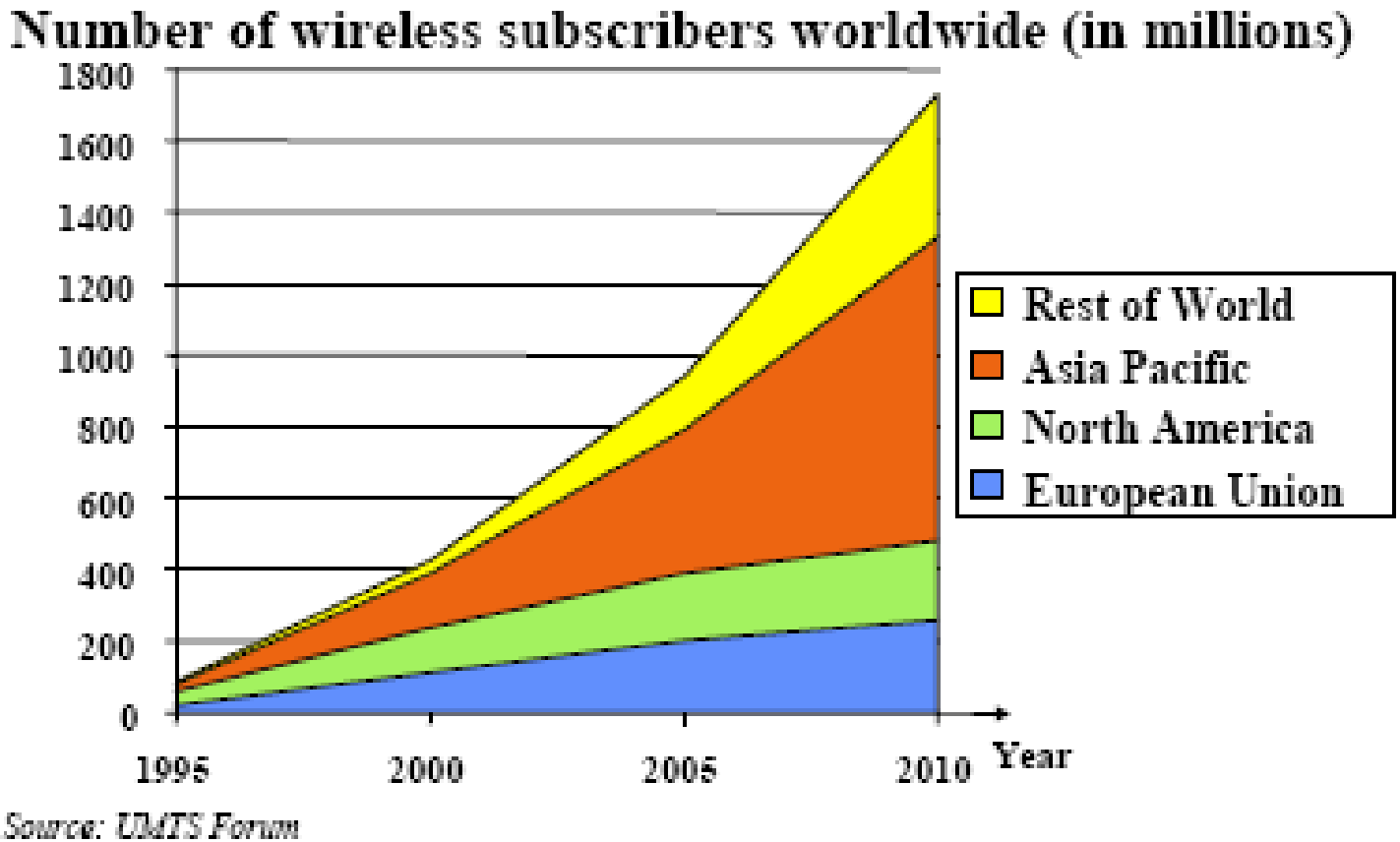
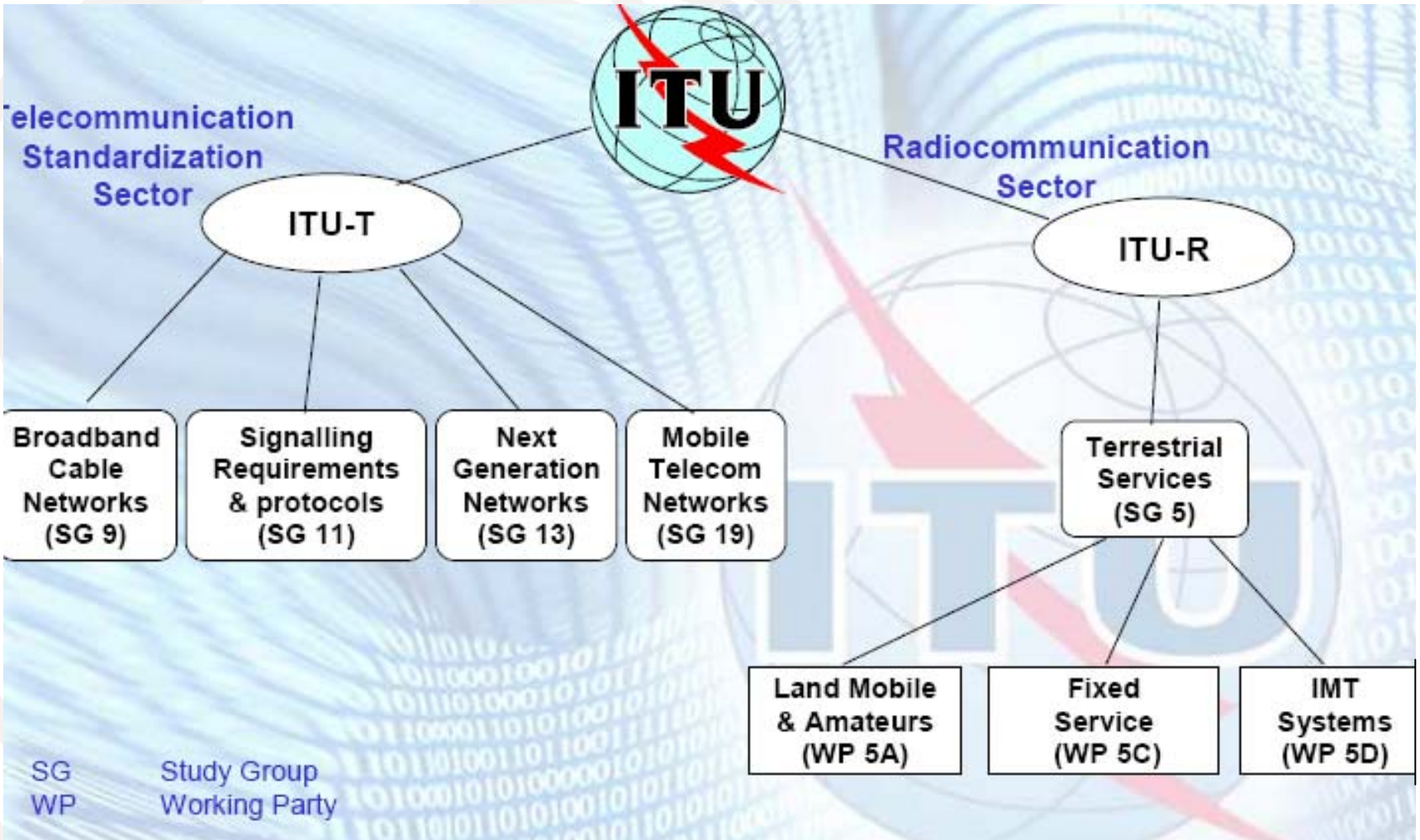
Wireless World



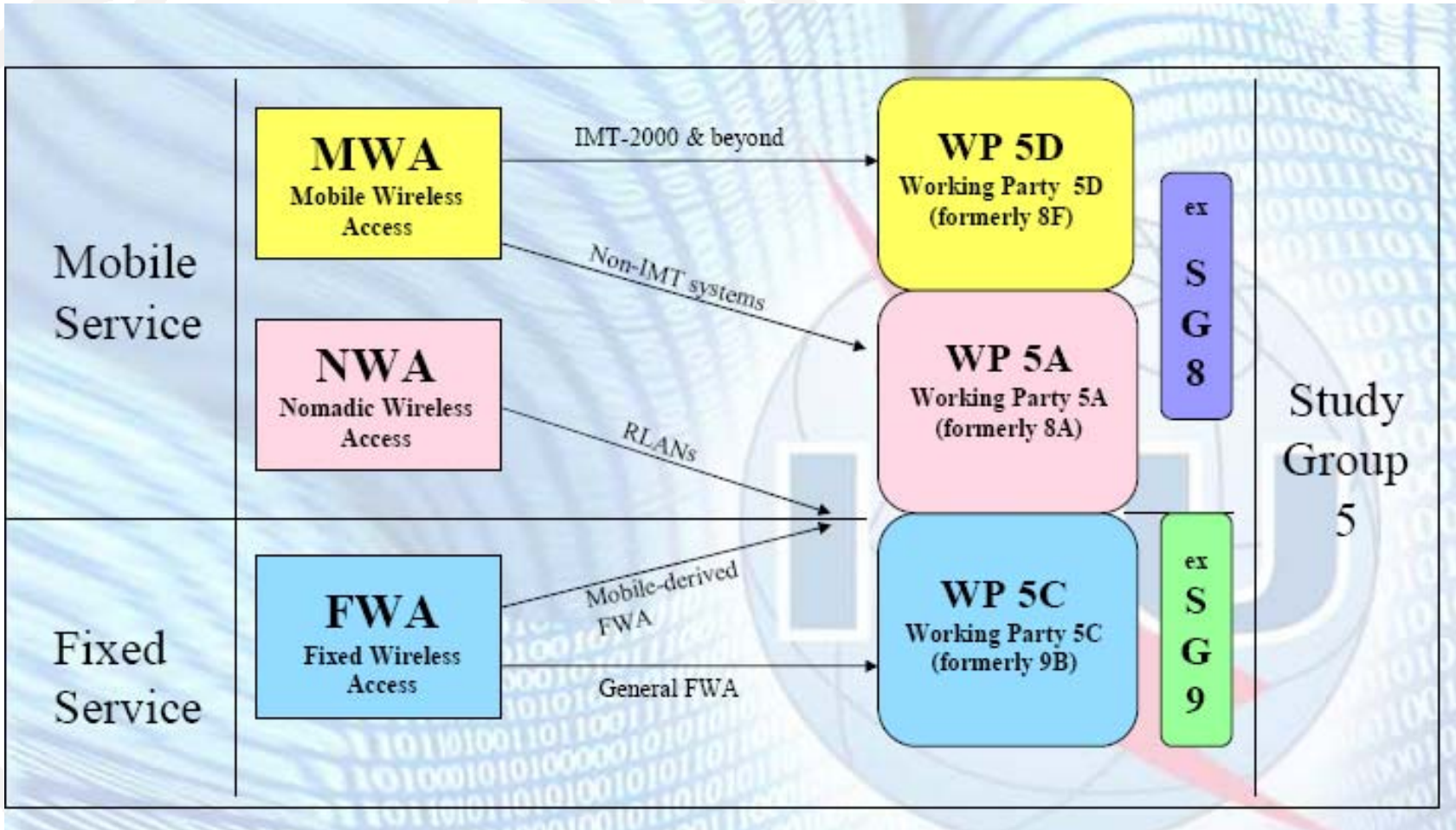
ITU and Wireless Technologies

- Radiocommunication Sector
  - Frequency spectrum (harmonization) RR
  - Radio interface specifications
    ITU-R Recommendation
  - Sharing and interworking studies
- Standardization Sector
  - Network aspects
- Development Sector
  - Broadband Technologies Report (ITU-D Q.20/2)
  - Seminars on BWA
  - Country case studies

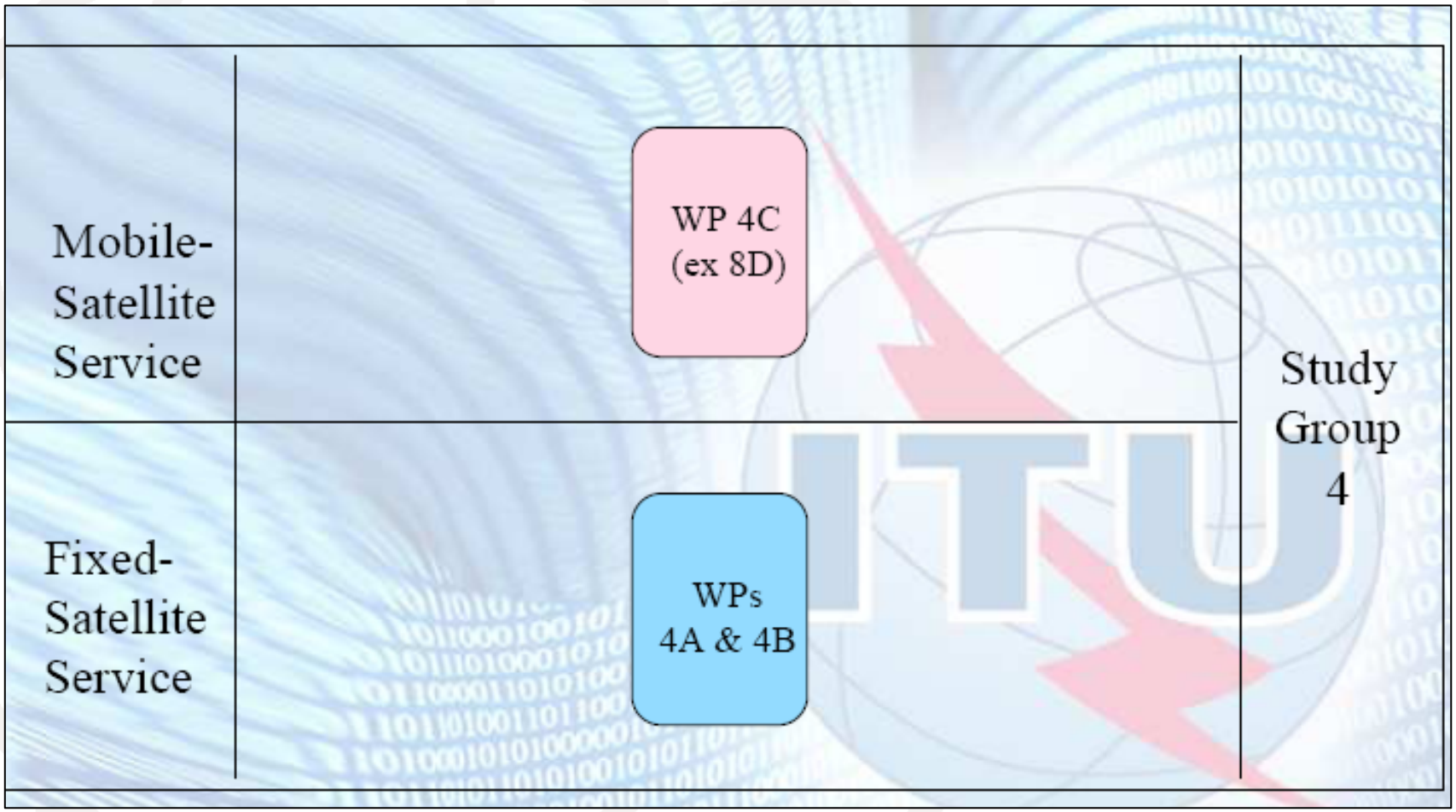
ITU


ITU
Telecommunication Standardization Sector
ITU-T
Radiocommunication Sector
ITU-R
Broadband Cable Networks (SG 9)
Signalling Requirements & protocols (SG 11)
Next Generation Networks (SG 13)
Mobile Telecom Networks (SG 19)
Terrestrial Services (SG 5)
Land Mobile & Amateurs (WP 5A)
Fixed Service (WP 5C)
IMT Systems (WP 5D)
SG Study Group
WP Working Party

Studies on terrestrial wireless access in ITU-R



Studies on satellite wireless access in ITU-R



ITU-R Studies on BWA

Service	Fixed	Mobile		Satellite
Study Question	236/9 (Fixed wireless systems for BWA)	212/8 (Nomadic wireless including RLAN	229/8 (IMT-2000) and systems beyond	269/4 (Global broadband Satellite)
Scope	•Specifications	•Specifications •Sharing •Spectrum	•Objectives •Specifications •Spectrum •Migration •Global circulation	•Specifications •Spectrum
ITU-R Rec.	F.1763	M.1450 (RLANs) M.1801	M.1457…., (IMT-2000) M.1645 (vision	S.1709

Example: ITU-R Recommendations for FWA systems

	Rec.	Short Title
Terminology	F.1399	Vocabulary of terms for wireless access
Performance & Availability Characteristics	F.757	Basic system requirements and performance objectives for FWA using mobile-derived technologies
	F.1400	Performance and availability objectives for FWA to PSTN
	F.1490	Generic requirements for fixed wireless access (FWA) systems
	F.1499	Radio transmission systems for fixed BWA based on cable modem standards
	F.1763	Radio interface standards for broadband wireless access systems, including mobile and nomadic applications, in the mobile service operating below 66 GHz
Radio frequency arrangements	F.1401	Considerations for the identification of possible frequency bands for fixed wireless access and related sharing studies
	F.1488	Frequency block arrangements for FWA systems in the range 3 400-3 800 MHz
	F.1496	Radio-frequency channel arrangements for fixed wireless systems operating in the band 51.4-52.6 GHz
	F.1497	Radio-frequency channel arrangements for fixed wireless systems operating in the band 55.78-59 GHz
	F.1519	Guidance on frequency arrangements based on frequency blocks for systems in the fixed service
	F.1567	RF channel arrangement for digital fixed wireless systems operating in the frequency band 406.1 to 450 MHz
	F.1568	RF block arrangements for FWA systems in the range 10.15-10.3/10.5-10.65 GHz
Sharing & Compatibility	F.1402	Frequency sharing criteria between a land MWA system and a FWA system using the same equipment type as the MWA system
	F.1489	A methodology for assessing the level of operational compatibility between FWA and radar systems when sharing the band 3.4-3.7 GHz
	F.1613	Operational and deployment requirements for FWA systems in Region 3 to ensure the protection of systems in the EESS (active) and the SRS (active) in the band 5 250–5 350 MHz
Other	F.1671	Guidelines for a process to address the deployment of area-licensed fixed wireless systems operating in neighbouring countries

Development of FWA systems in different environments

FWA application	Preferred frequency bands		ITU-R REC	Other access media	Factors to be considered
Urban area FWA **(Last-1000 m connection)**	**Upper SHF**	10.5 GHz	F.1568	Optical fibre	・High-density deployment ・Sharing with space services
		18 GHz	F. 595		
		26-28 GHz	F. 748		
		38 GHz	F.749		
Residential area FWA **(Last-100m connection)**	**Lower SHF**	2.4 GHz	-	・Optical fibre ・DSL ・Wireless LAN	・Compatibility with ISM application ・Line-of-sight condition ・License-exempt use of nomadic wireless access systems for FWA
		3.4 GHz	F.1488		
		5.3 GHz	-		
		5.5-5.7GHz	-		
Rural area FWA	**UHF**	450 MHz	F.1567	Cellular phone	・Line-of-sight condition ・Sharing/compatibility with other radio services
		Below 1 GHz	-		

General Characteristics of Developing Regions

- Growing demand for Broadband
- Lack of wireline infrastructure needed to meet the growing demand for Broadband
- BWA, economical and easy to install, is a good high performance solution to address the needs of developing regions
- Deployment of wireless broadband services in rural and remote areas can help to address a variety of challenges posed by the distance
  - Examples include e-health, e-learning, e-government, etc…

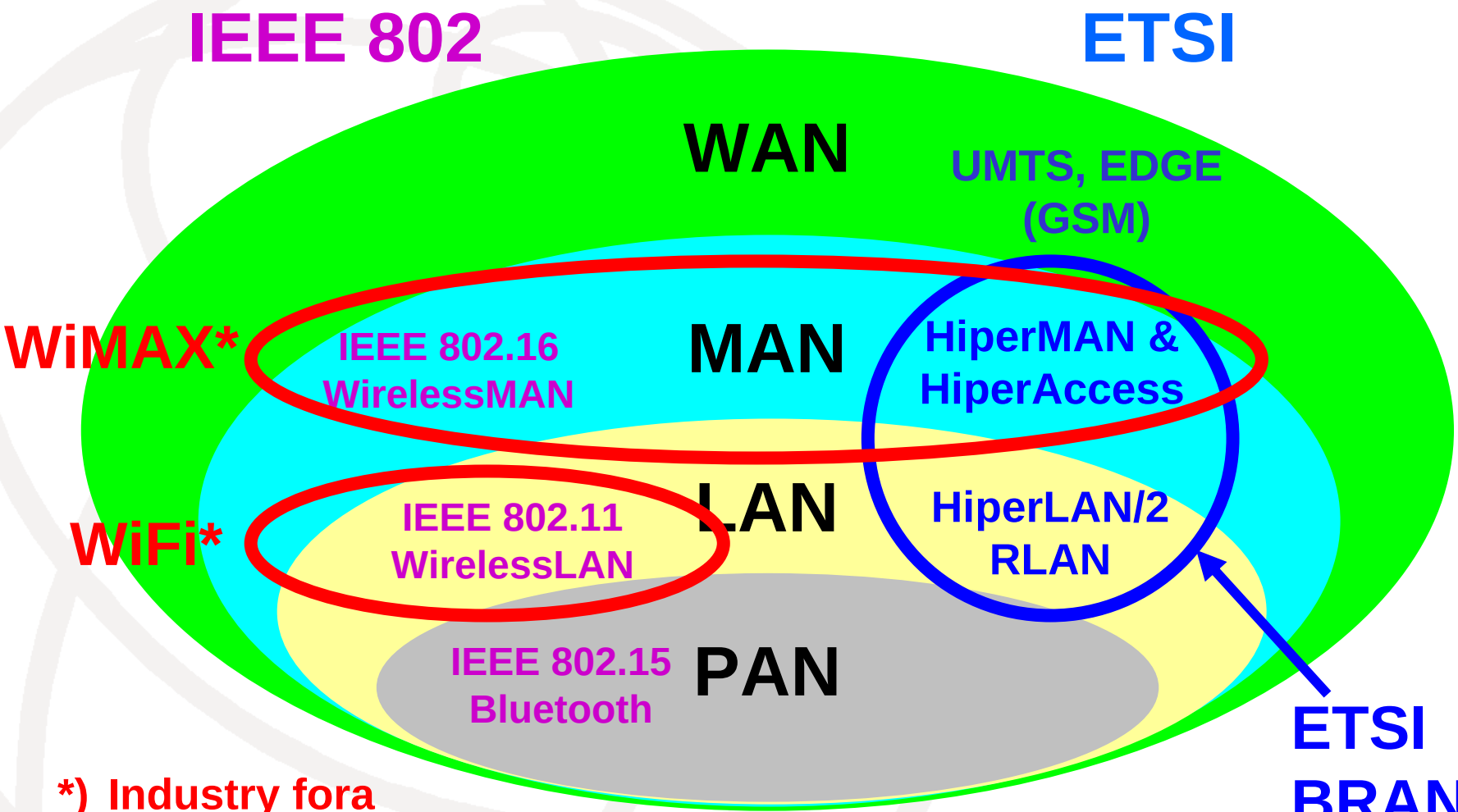
ITU-D Study Group 2
Question 20-1/2
Broadband Access Technologies

- The Report is divided into 3 main sections:
- General Broadband Matters:
  - Social and Economic Benefits
  - Broadband Applications
  - Broadband Deployment
- Technology Matrices
  - Wireline Broadband Access Technologies (ex: DSL)
  - Wireless Broadband Access Technologies
  - Fixed Broadband Wireless Access (ex: IEEE 802.16 2004 standard)
  - Mobile Broadband Wireless Access (ex: ITU approved IMT-2000 standards)
  - Technologies in the Process of Standardization (ex: Canopy Solution)
- Country Experiences

ITU-D Study Group 2
Question 20-1/2:
Broadband Access Technologies

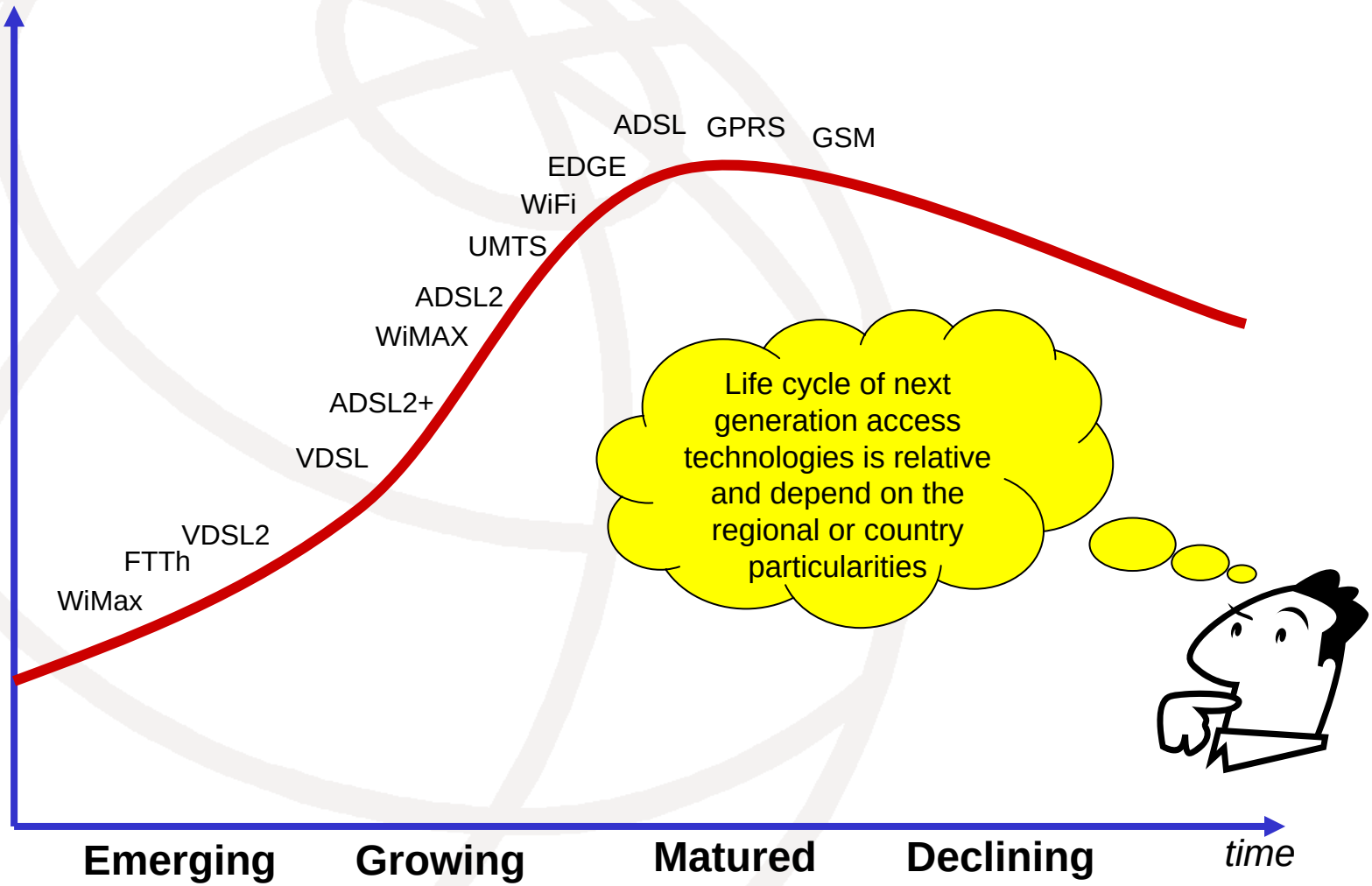
- **Approved for the ITU-D study cycle from 2006 – 2010.**
- **The following inputs are called for in Q20 for the next ITU-D Study**
  - Collection of developing Member States' requirements through a questionnaire.
  - An assessment of developing countries' experience with broadband access technologies using the same questionnaire referred to above.
  - An update of ITU-T and ITU-R outputs, relevant to broadband access technologies.
  - Contributions of concerned industry on the development of broadband access technologies for both wired and wireless.
  - Contributions on economic factors relevant to the deployment of wired and wireless broadband technologies, this might include information on tariffs, equipment costs, interconnection charges, licensing fees for wireless applications, etc.

Overview - Global Wireless Standards

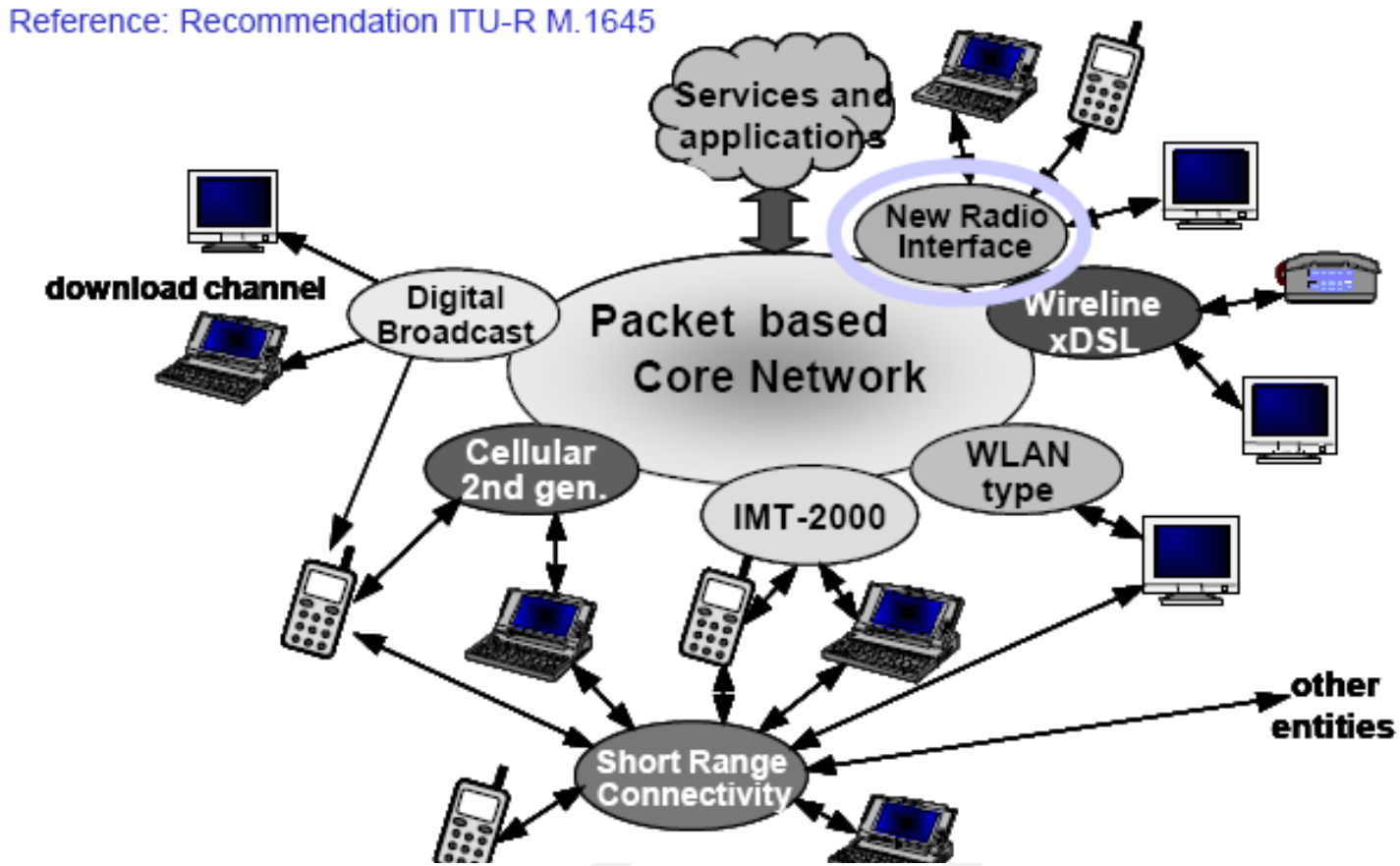


*) Industry fora for promotion and certification

Life of Next Generation Access Technologies



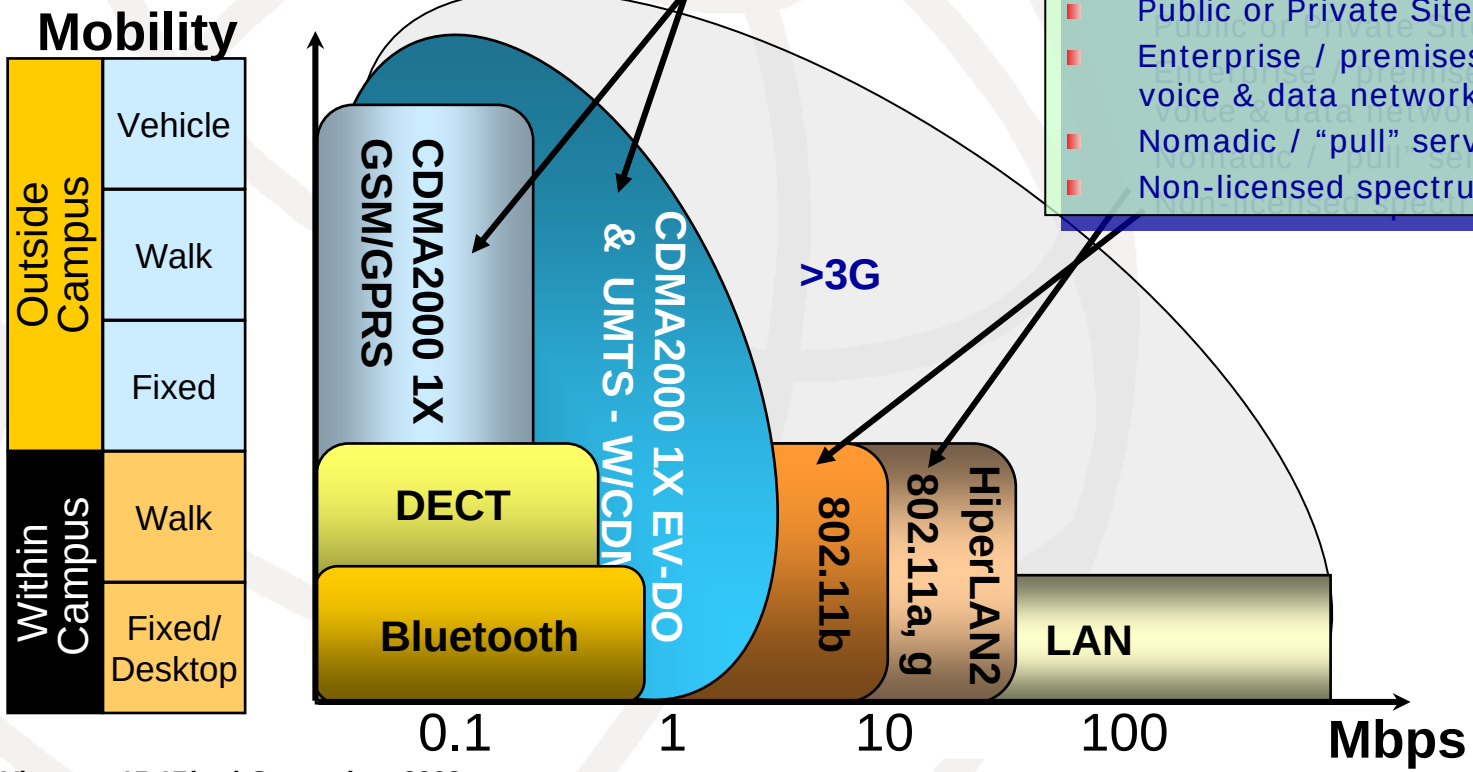
Future Network of Systems with Variety of Access Systems



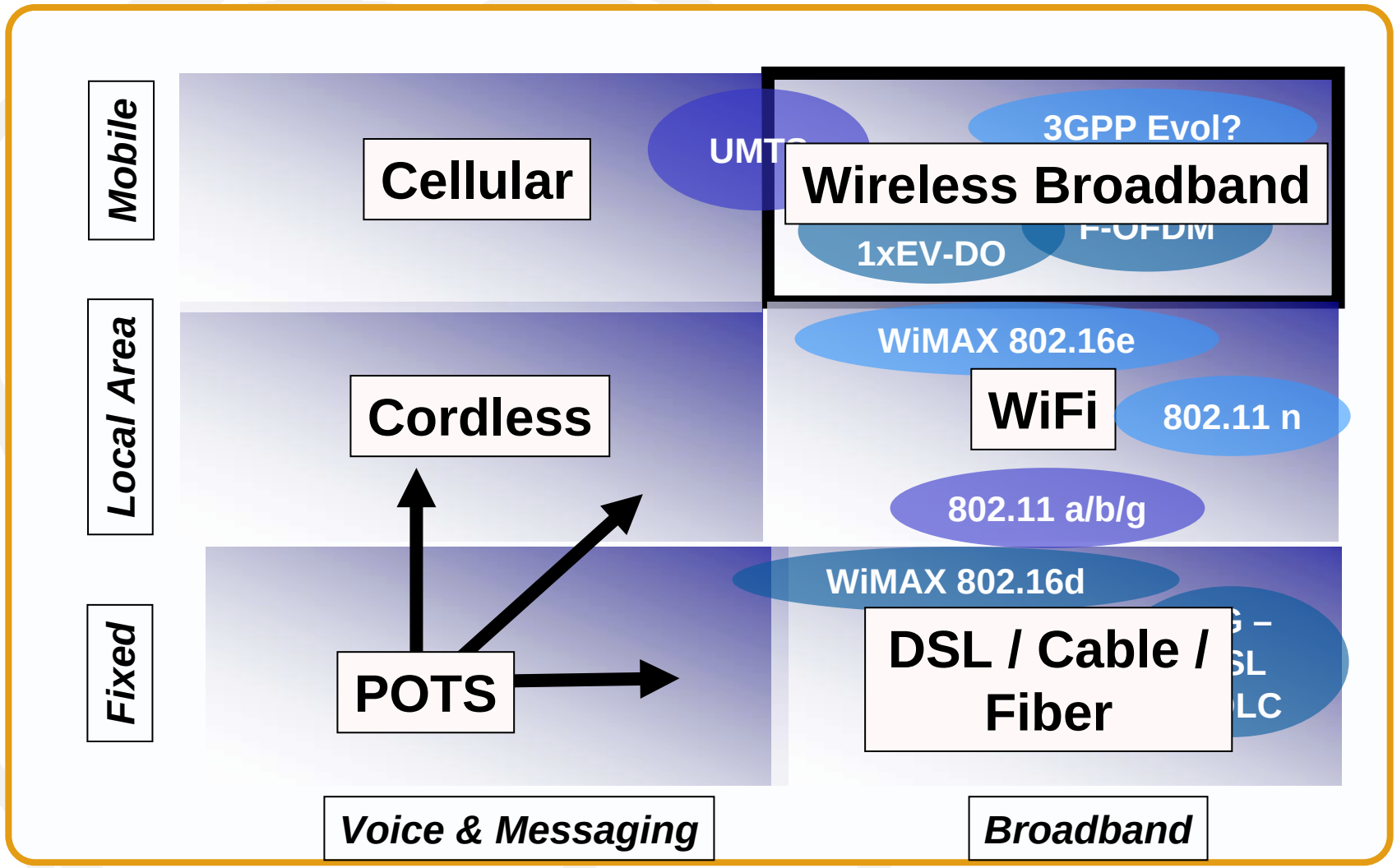
Wireless Landscape: what the access technologies can deliver

Wireless Wide Area Network (WWAN)
- Metro/Geographical area
- "Always On" Services
- Ubiquitous public connectivity with private virtual networks

Wireless Local Area Network (WLAN)
- Public or Private Site or Campus
- Enterprise / premises application voice & data network extension
- Nomadic / "pull" services
- Non-licensed spectrum



Wireless Broadband – The New Category



Existing 2004-2006 Rollout 2006+

Wireless Technologies for Rural Areas

- Mobile services
  - Cellular 2nd generation
  - IMT-2000 (WCDA, CDMA AND WiMAX in 2,5GHz)
  - Satellite
- Fixed services
  - WiMAX
  - WLAN
  - Cable
  - Satellite
  - Digital broadcast

Cellular 2G Networks and Rural Areas –Case of Serbia-

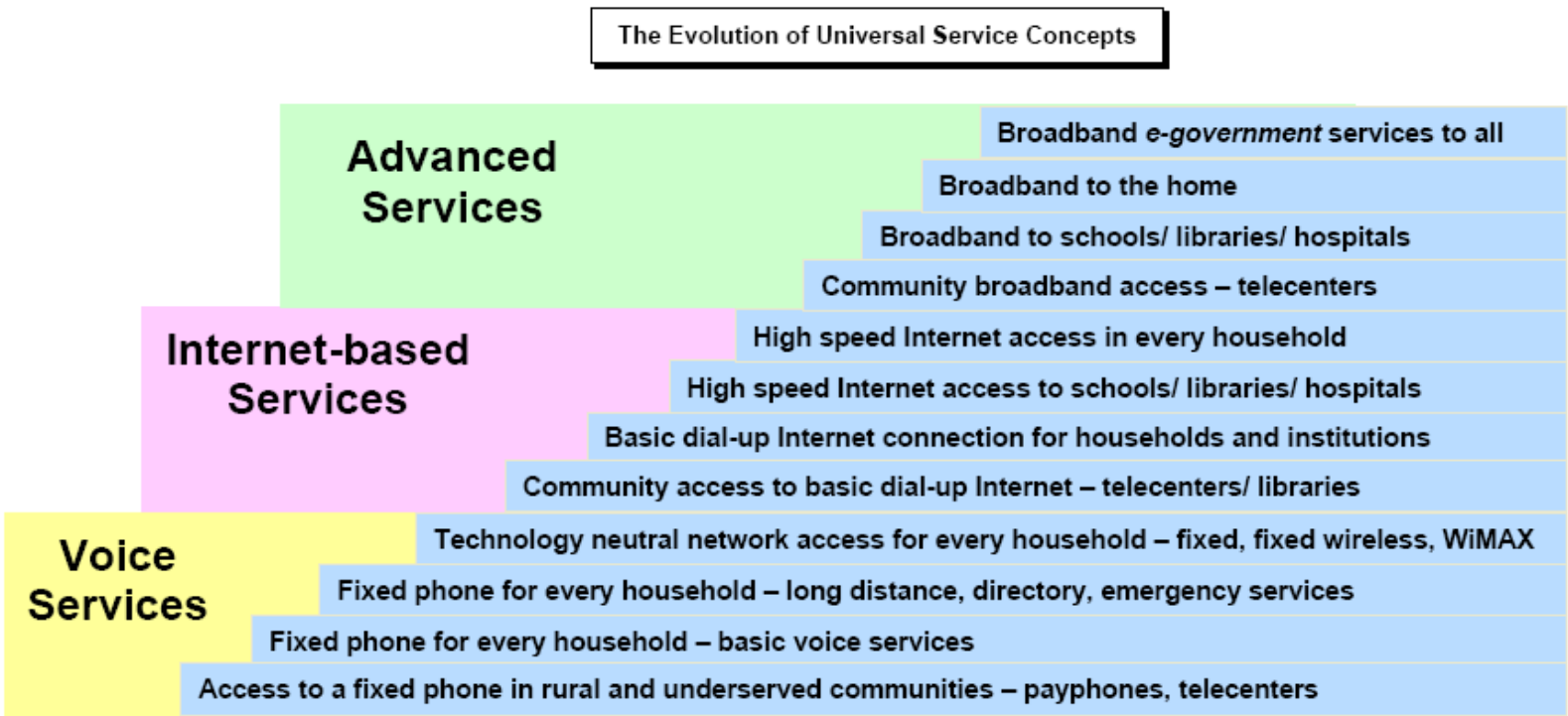
- Identified 921 settlements without fixed phone.
- 700 settlements have coverage of at least one GSM network
- 338 settlements have coverage of two GSM networks
- In summary:
  - 75 % of settlements have mobile signal
  - 15% of settlements have no mobile signal
  - 10% of settlements have partial signal
- Basic set of Universal services can be resolved by GSM
- Open questions: Tariff policy and **Broadband services**

Spain:

- National Program for Broadband Roll-Out in Rural and Remote Areas
- Technologies Deployed Throughout the Program per Application:
  - ADSL 47%
  - Satellite 30%
  - WiMAX 16%
  - ADSL/Satellite 3%
  - ADSL/WiMAX 4%
  - WiMAX/Satellite 0,1%

Rural Areas: Universal Service

As technology has evolved, the scope of Universal Service has also expanded to include more advanced services



Same Conditions for all:
-Rural Areas-

Advantages of IMT-2000, Wi-Fi and WiMAX

IMT-2000 Technologies

- 3G offers ubiquitous access to toll-quality voice & broadband data services within a wide area
  - Voice capacity and broadband data capabilities continue to grow
- 3G economies of scale are enormous, leading to greater product availability and lower costs
  - Advanced 3G technologies such as HSDPA/HSUPA and EV-DO Rev. A/B highly leverage existing 2G/3G network build outs and coverage

Wi-Fi

- Wi-Fi offers a high-speed, low cost, wireless LAN connection for homes, campuses and enterprises
- 802.11n will enable 100+ Mbps throughputs

WiMAX

- WiMAX offers a cost effective backhaul alternative for 3G base stations and Wi-Fi hotspots
- WiMAX may supplement existing broadband services
  - Fixed broadband access in areas where it is not cost effective to deploy DSL, cable, fiber, landline, etc.

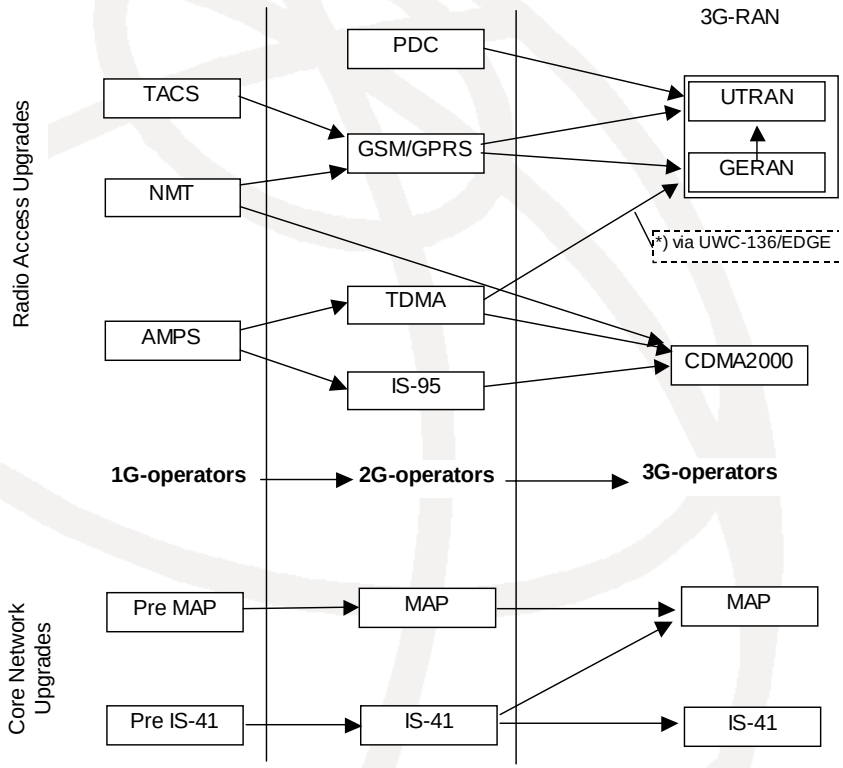
ITU-D SG 2
QUESTION 18/2

- Guidelines for Smooth Transition of the Existing Mobile Networks to IMT-2000 (GST) was approved by ITU-D SG 2 meeting, September 2005.
- Special needs of developing countries:
  - Government development policy
  - Operator perspective
  - Regulator perspective
  - Consumer-user perspective
- Link: http://www.itu.int/ITU-D/imt-2000/index.html

Structure of the GST

- SUMMARY
- 1 - INTRODUCTION
- 2 - DEVELOPMENT OF POLICIES FOR TRANSITIONING OF EXISTING NETWORKS TO IMT-2000
- 3 – TRANSITION PATHS
- 4 - ECONOMICS OF TRANSITION TO IMT-2000
- 5 – CONCLUDING REMARKS
- 6 - DEFINITIONS
- 7 - ABBREVIATIONS/GLOSSARY
  - REFERENCES
  - ANNEX I – OPERATOR'S EXPERIENCES IN TRANSITIONING TO IMT-2000 SYSTEMS

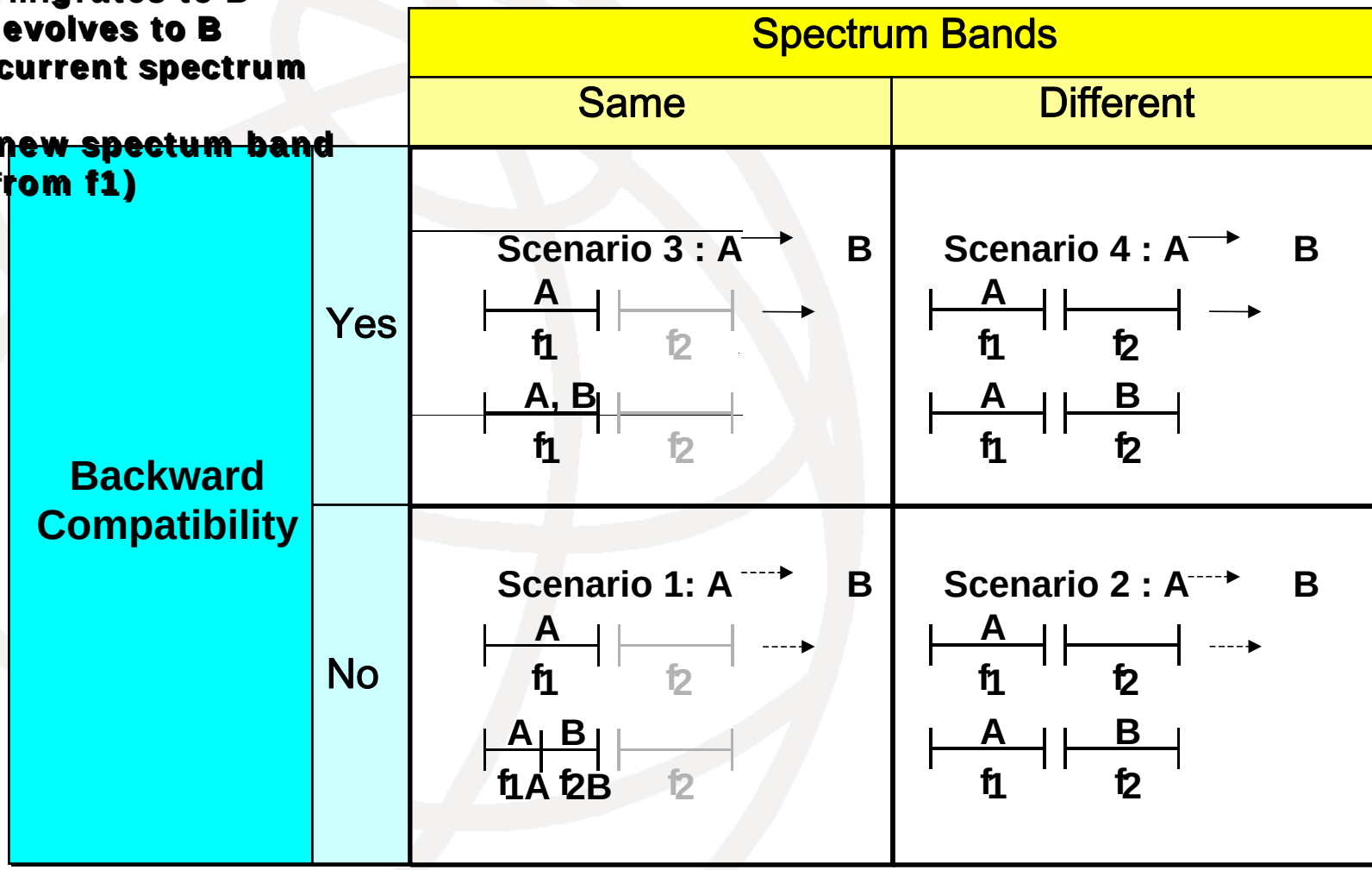
Transition Paths to IMT-2000



Transition Paths to IMT-2000 Systems -Spectrum Usage

KEY

A: pre-IMT-2000 system
B: IMT-2000 system
A -------> B: A migrates to B
A - - - - > B: A evolves to B
f1: operator's current spectrum band
f2: operator's new spectum band (different from f1)



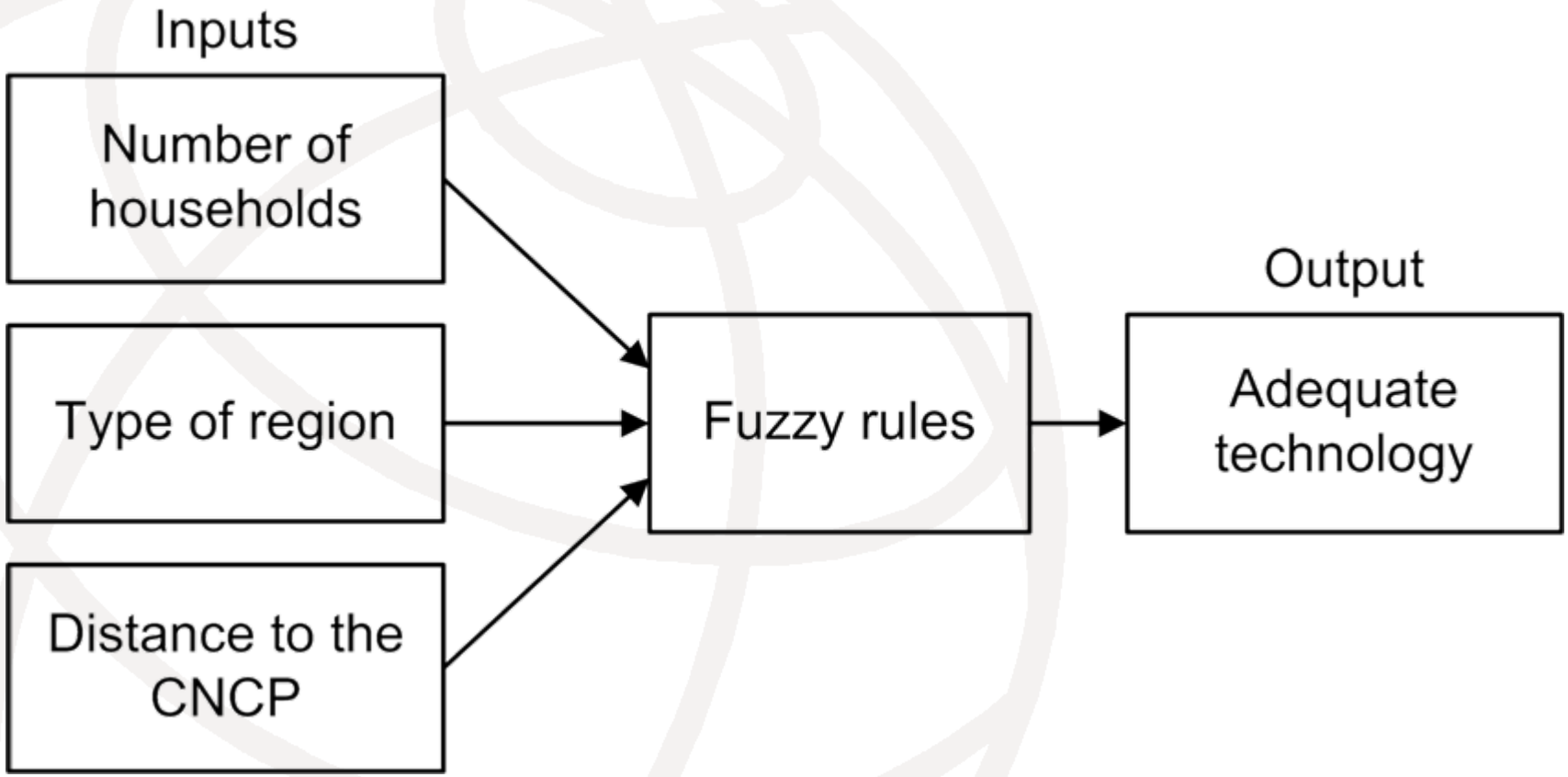
Methodology for Appropriate US Technology Selection- Case Serbia

- Methodology of choosing the adequate telecommunication technology is of significant importance.
- Within the EU directives, ITU studies, OECD approach and other available literature on US, the technology neutral approach is treated.
- Each of the available technologies has its own performance and economic characteristics, and its advantages and disadvantages for rural areas.

Methodology for Appropriate US Technology Selection

- In deciding which technology is appropriate the following criteria should be considered:
  - Density of population,
  - Distance to the closest network connection point (CNCP),
  - Geographic-topological characteristics of the region, and
  - Cost (infrastructure, equipment, operational expenses, etc.)
- In addition, it is possible to consider expected traffic per user, aggregated traffic for the whole region, regulatory factors, etc.

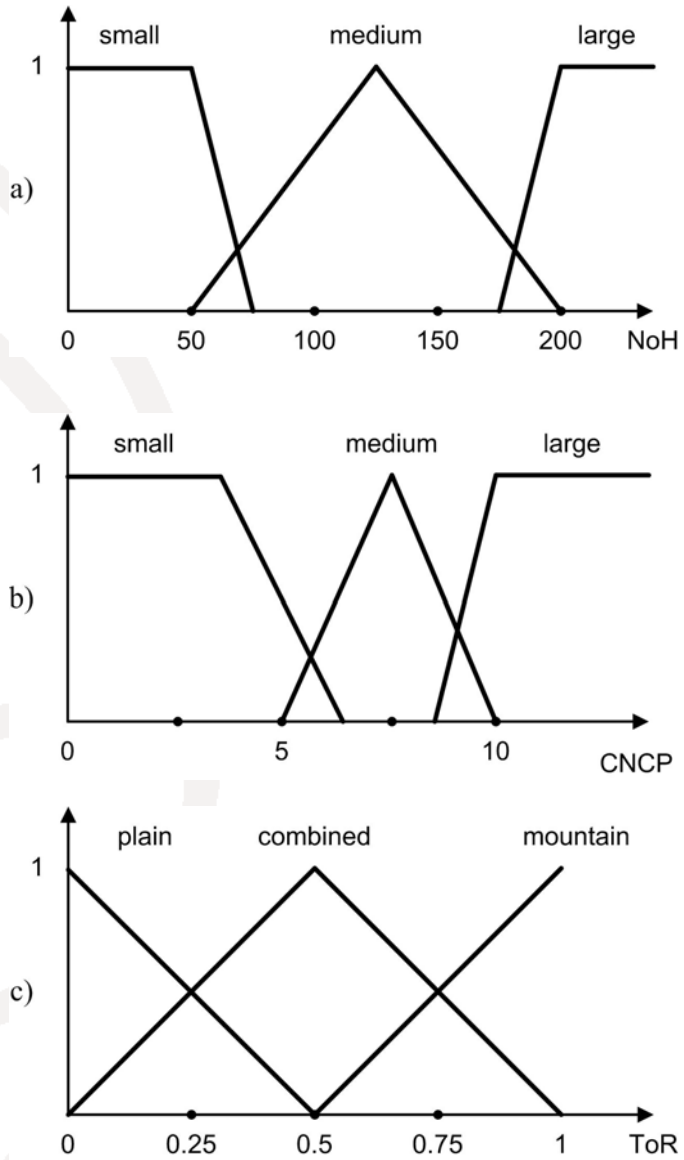
Methodology for Appropriate US Technology Selection



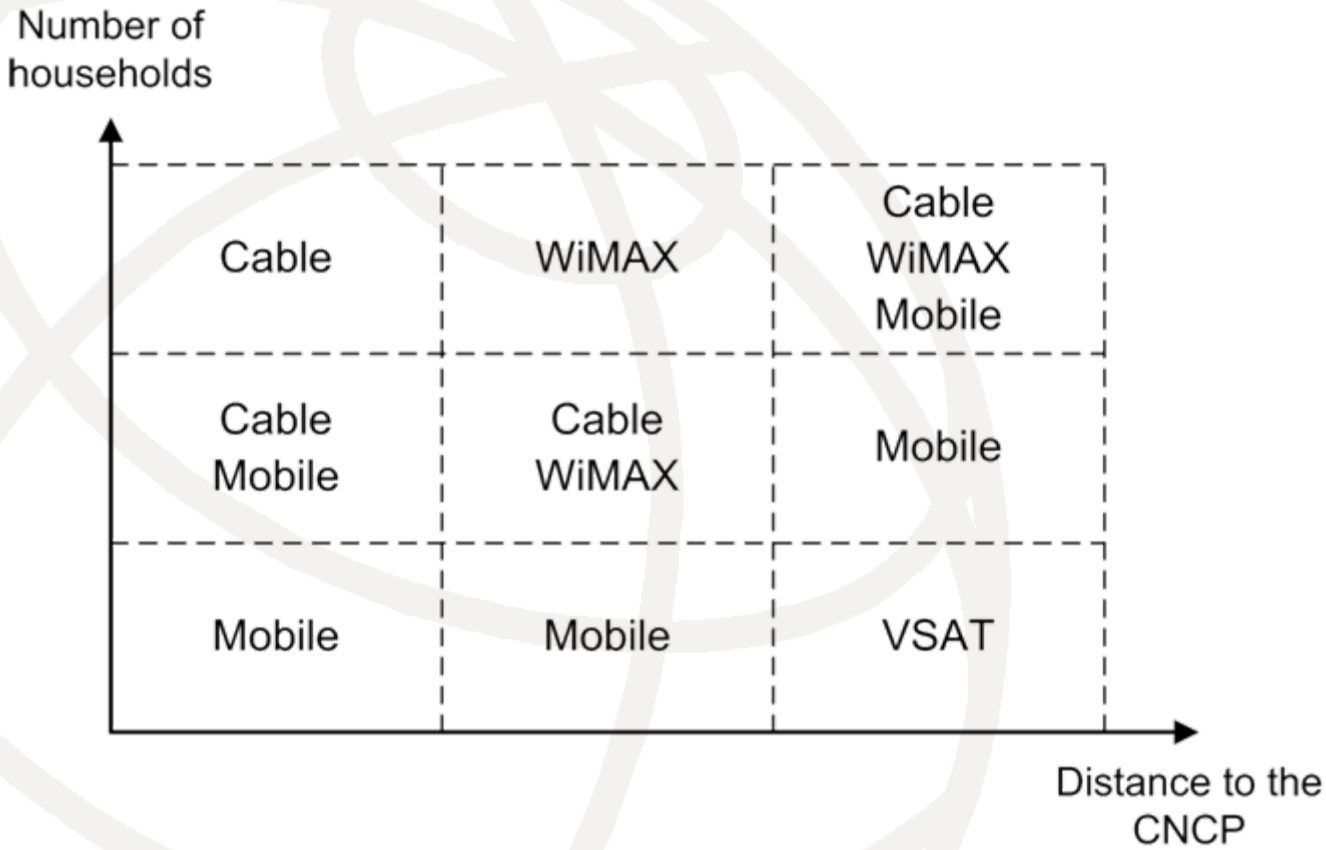
Fuzzy logic model

Methodology for Appropriate US Technology Selection

- It is necessary to define input and output variables as well as the set of rules.
- For the purpose of rural areas following input variables are considered: number of households, type of region, distance to CNCP
- In the model, the optimal technology exists as the single output variable [for example cable (FTTH, DSL), UMTS, WiMAX and VSAT].

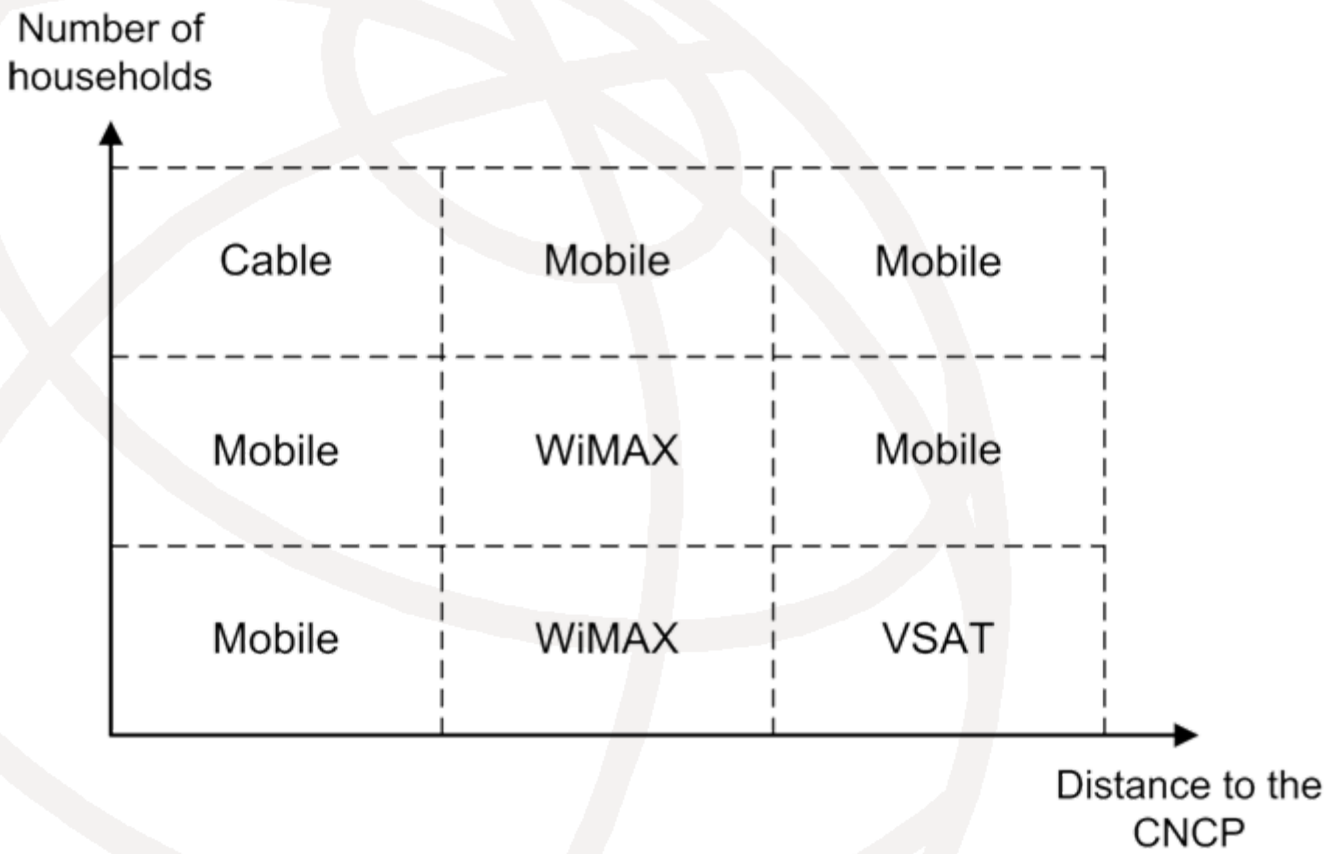


Methodology for Appropriate US Technology Selection



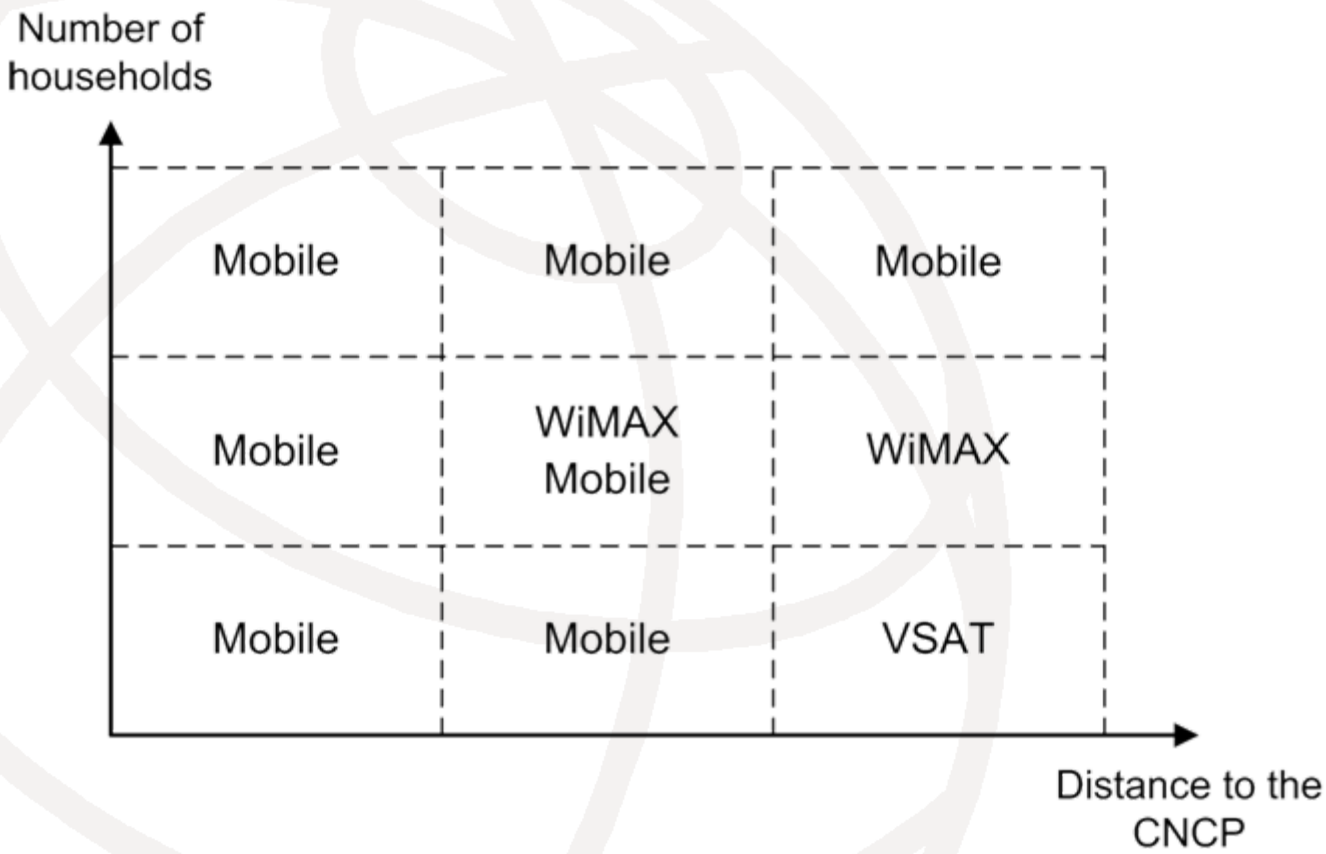
Graphical interpretation of fuzzy rules:
plain region

Methodology for Appropriate US Technology Selection



Graphical interpretation of fuzzy rules:
combined region

Methodology for Appropriate US Technology Selection



Graphical interpretation of fuzzy rules:
mountain region

Price Factor

- The use of fuzzy logic in determining US technology has a disadvantage that price as criteria is not introduced as input variable.
- If price factor is used drastic enlargement in number of the rules will appear.
- The enlargement of the number of rules would lead to unacceptable model complexity.
- The problem with the price factor could be exceeded by introducing it in cases where the output of the fuzzy systems is more than one technology.
- In that case the most adequate technology will be one with the lowest price per user *C*.

Price Factor

- In order to compare price differences between different technologies it is proposed that the price of the technology is calculated from the

$$C = n C_{ie} / u + C_s T + C_{te}$$

  - n is the number of installation equipment units
  - u the number of users
  - C_{ie} individual price of the installation equipment
  - C_s the service price per user for the one month period
  - T expected operation period in months
  - C_{te} individual price for the terminal equipment

Thank you for your attention!

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