The Wireless World Research Forum

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Outline

❑ Trends in mobile communications towards systems beyond IMT-2000

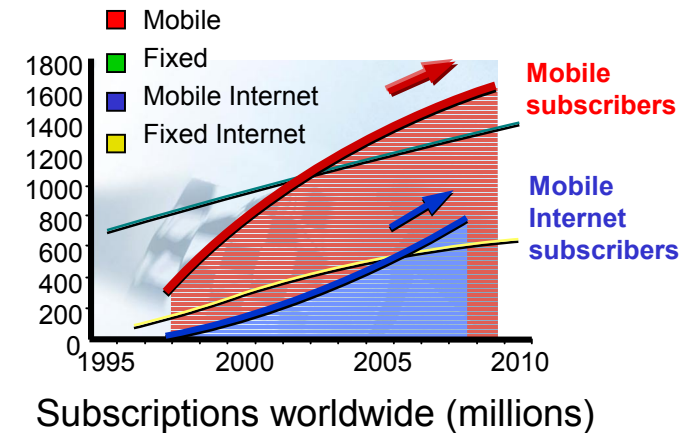❑ WWRF objectives and scope

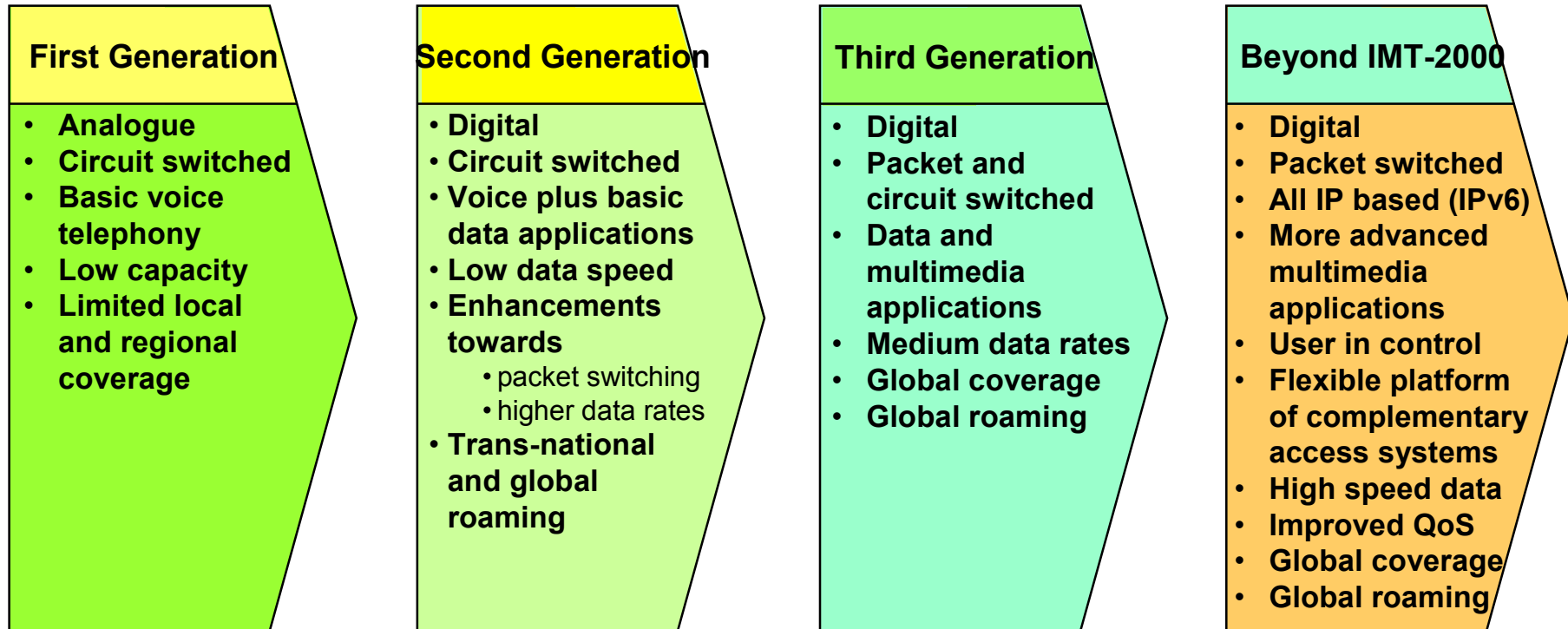❑ WWRF vision and approach

❑ Conclusions

Trends in mobile communications towards systems beyond IMT-2000

The major trends at a glance

❑ **Advance of the Internet**

The Internet became a mass medium and IP the leading network protocol.

❑ **Advance of mobile communication**

Communication via mobile radio networks is increasing enormously.

❑ **Bandwidth evolution**

The available bandwidth in backbone and access is exploding and the prices for bandwidth decrease dramatically.

❑ **Advance of e-commerce**

E-commerce changes and amend business processes tremendously.

❑ **Deregulation and globalization**

The I&C markets move fast.

Competition and differentiation are driven by deregulation and globalization.

❑ **Services are key**

The end user is interested in services only, the underlying technology is not relevant to him.

Subscriptions worldwide (millions)

Paradigm shift from 1st generation towards beyond IMT-2000

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First Generation

- Analogue
- Circuit switched
- Basic voice telephony
- Low capacity
- Limited local and regional coverage

Second Generation

- Digital
- Circuit switched
- Voice plus basic data applications
- Low data speed
- Enhancements towards
  - packet switching
  - higher data rates
- Trans-national and global roaming

Third Generation

- Digital
- Packet and circuit switched
- Data and multimedia applications
- Medium data rates
- Global coverage
- Global roaming

Beyond IMT-2000

- Digital
- Packet switched
- All IP based (IPv6)
- More advanced multimedia applications
- User in control
- Flexible platform of complementary access systems
- High speed data
- Improved QoS
- Global coverage
- Global roaming

WWRF objectives and scope

WWRF
Wireless World Research Forum

- ❑ WWRF launched on August 14, 2001
- ❑ Founding members:

  - ❑ ALCATEL

  - ❑ ERICSSON

  - ❑ MOTOROLA

  - ❑ NOKIA CONNECTING PEOPLE

  - ❑ SIEMENS

- ❑ Web site: **www.wireless-world-research.org**
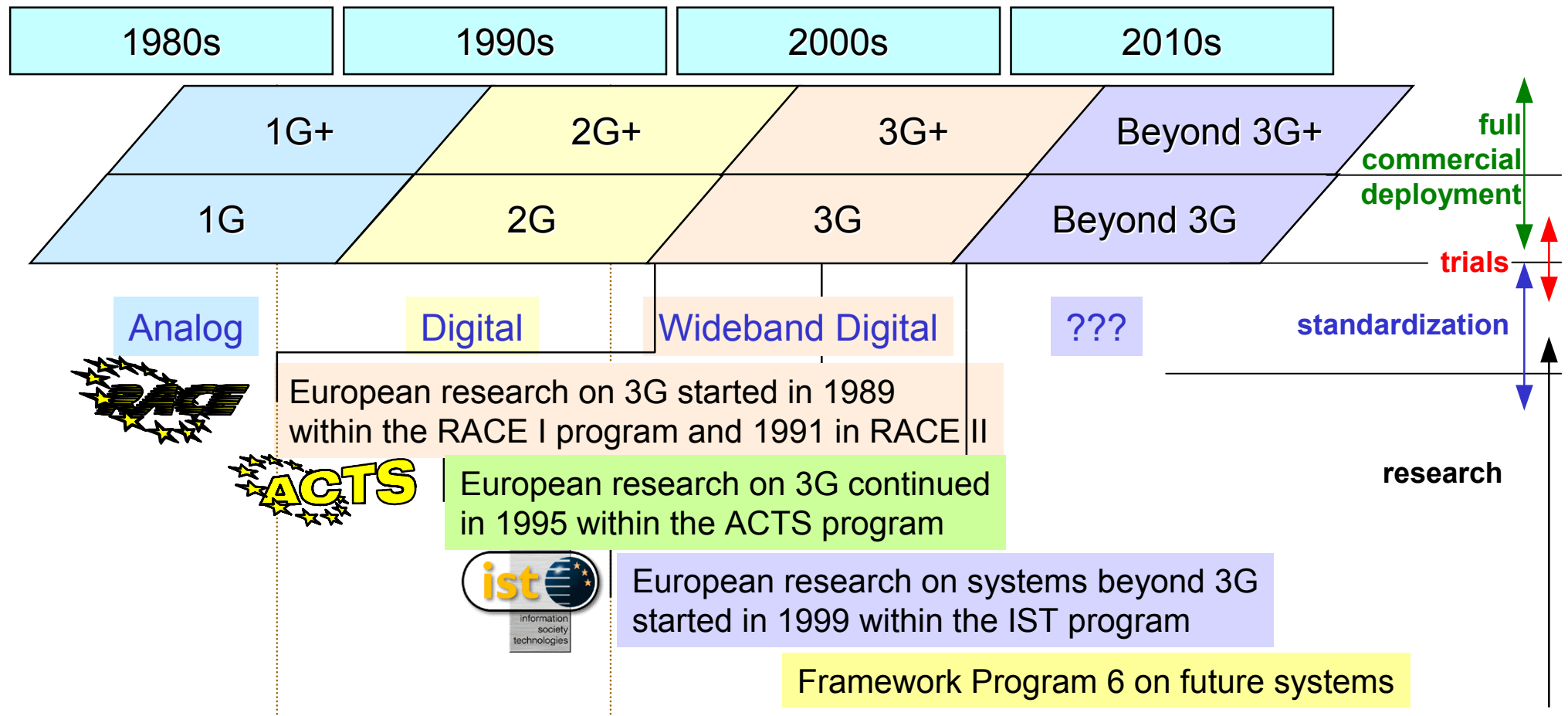
WWRF - Objectives and scope

❑ **Major objectives**

  ❑ to contribute to the vision of the Wireless World

  ❑ to develop and maintain a consistent vision of the Wireless World

  ❑ to generate, identify, and promote research areas and technical and society trends for mobile and wireless systems towards a Wireless World

  ❑ to identify and assess the potential of new technologies and trends for the Wireless World

  ❑ to contribute to the definition of international and national research programmes

❑ **Scope**

  ❑ concentrate on the definition of research items relevant to the future of mobile and wireless communications, including pre-regulatory impact assessments

  ❑ WWRF is not a standardisation body

  ❑ invite world-wide participation and is open to all actors

Evolution of mobile communication systems

1980s	1990s	2000s	2010s

1G+	2G+	3G+	Beyond 3G+
1G	2G	3G	Beyond 3G

full commercial deployment

trials

Analog	Digital	Wideband Digital	???

standardization

European research on 3G started in 1989 within the RACE I program and 1991 in RACE II

European research on 3G continued in 1995 within the ACTS program

research

ist — information society technologies

European research on systems beyond 3G started in 1999 within the IST program
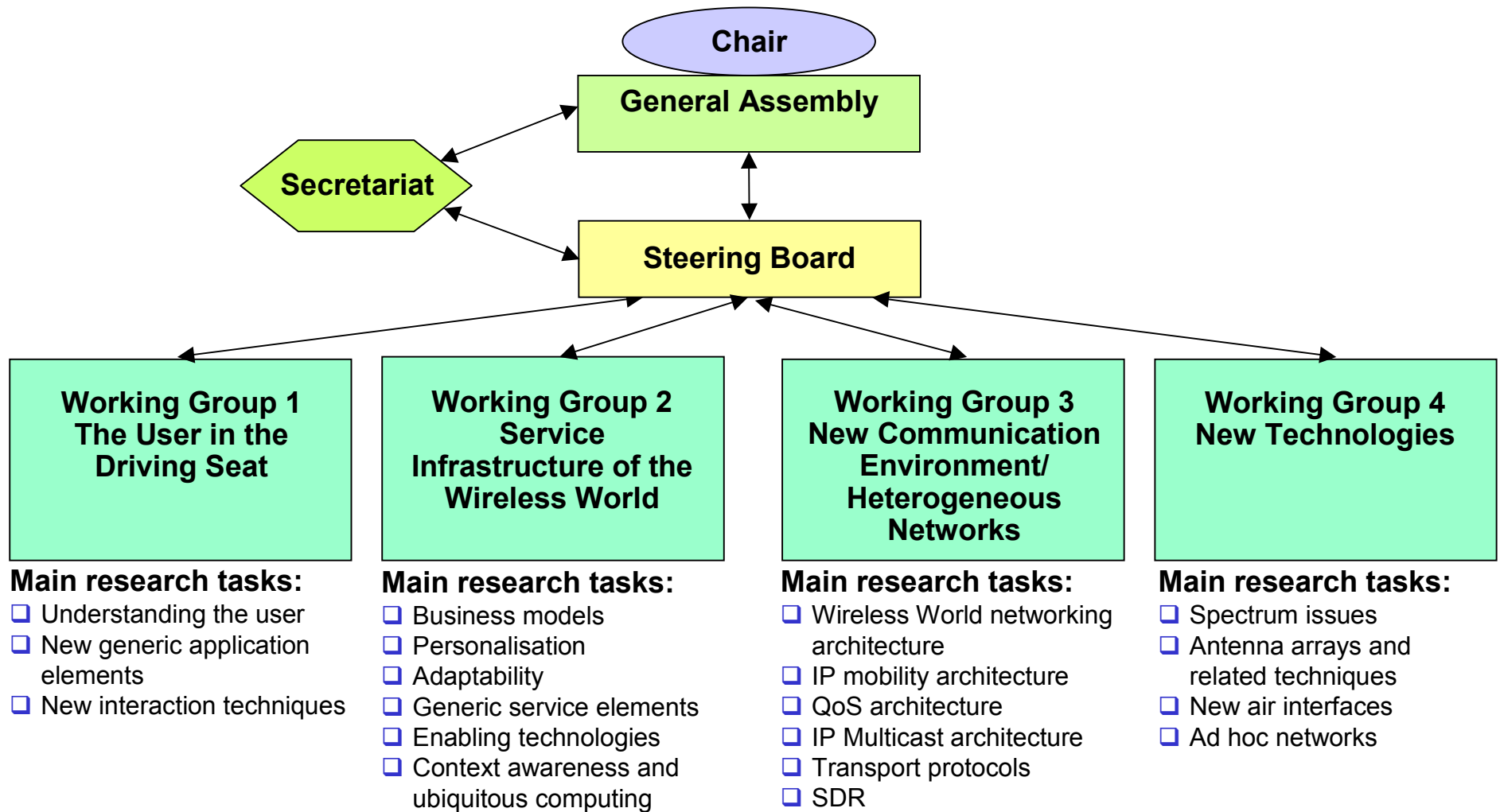
Framework Program 6 on future systems

WWRF - Important questions

❑ WWRF intends to answer these questions:

   ❑ How can advances in technologies be combined consistently in future systems?

   ❑ What essential demand (user needs and market requirements) will a Wireless World address?

   ❑ How can wireless communications become universally available for both people and devices/machines?

   ❑ What business models will drive the Wireless World (what are the fundamental laws)?

WWRF - Organisational set-up

Chair

General Assembly

Secretariat

Steering Board

**Working Group 1
The User in the
Driving Seat**

Main research tasks:
- ❑ Understanding the user
- ❑ New generic application elements
- ❑ New interaction techniques

**Working Group 2
Service
Infrastructure of the
Wireless World**

Main research tasks:
- ❑ Business models
- ❑ Personalisation
- ❑ Adaptability
- ❑ Generic service elements
- ❑ Enabling technologies
- ❑ Context awareness and ubiquitous computing

**Working Group 3
New Communication
Environment/
Heterogeneous
Networks**

Main research tasks:
- ❑ Wireless World networking architecture
- ❑ IP mobility architecture
- ❑ QoS architecture
- ❑ IP Multicast architecture
- ❑ Transport protocols
- ❑ SDR

**Working Group 4
New Technologies**

Main research tasks:
- ❑ Spectrum issues
- ❑ Antenna arrays and related techniques
- ❑ New air interfaces
- ❑ Ad hoc networks

WWRF vision and approach

MultiSphere Level Concept
Systems beyond 3G will cover different communication relations

① The PAN

② The Immediate Environment

③ Instant Partners
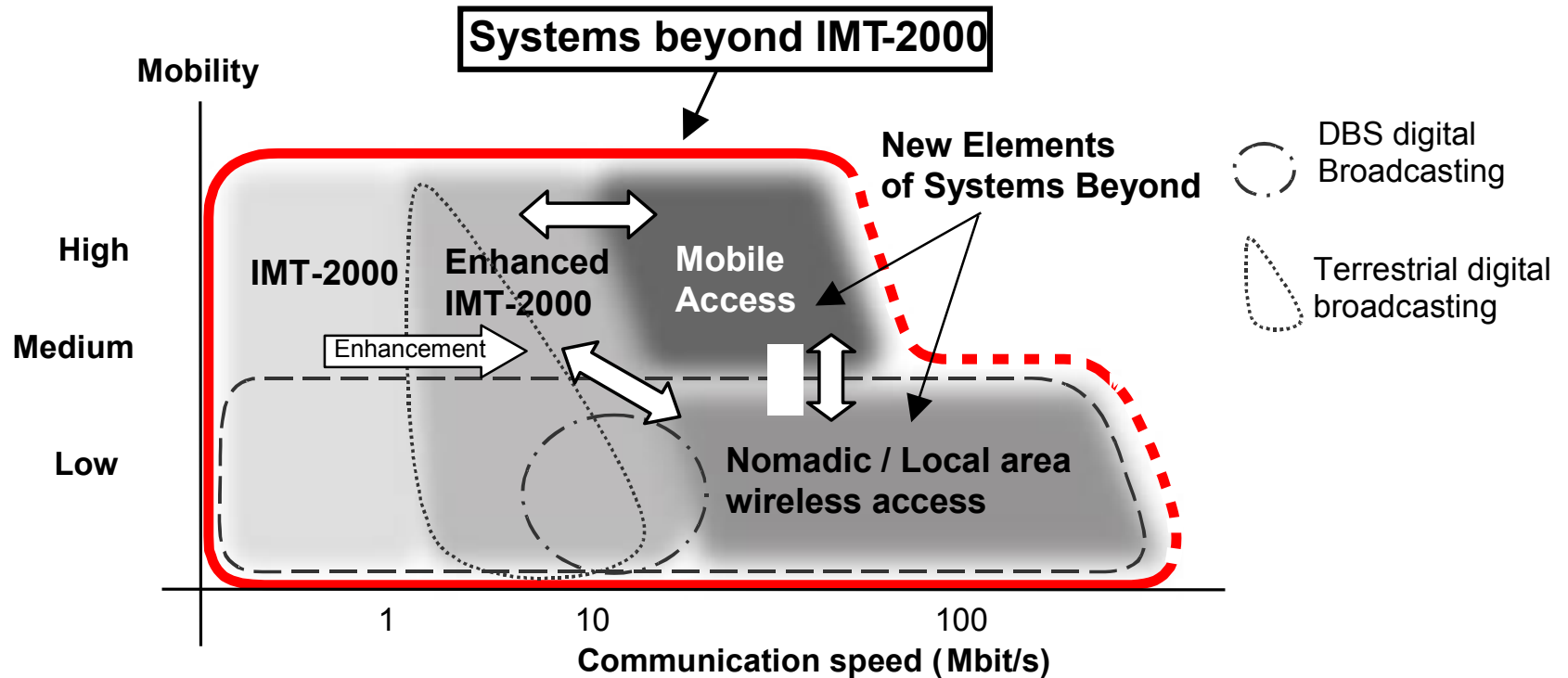
④ Radio Accesses

⑤: Interconnectivity

⑥ CyberWorld

Source: IST WSI Project

# System Capabilities for Systems Beyond IMT-2000, ITU-R WP8F

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Systems beyond IMT-2000

Mobility

New Elements of Systems Beyond

DBS digital Broadcasting

High

IMT-2000 **Enhanced IMT-2000** **Mobile Access**

Terrestrial digital broadcasting

Medium

Enhancement

Low

Nomadic / Local area wireless access

1   10   100

Communication speed (Mbit/s)

⟺ denotes interconnection between systems via networks or the like, which allows flexible use in any environments without making users aware of constituent systems.

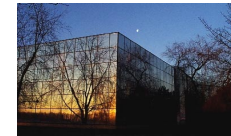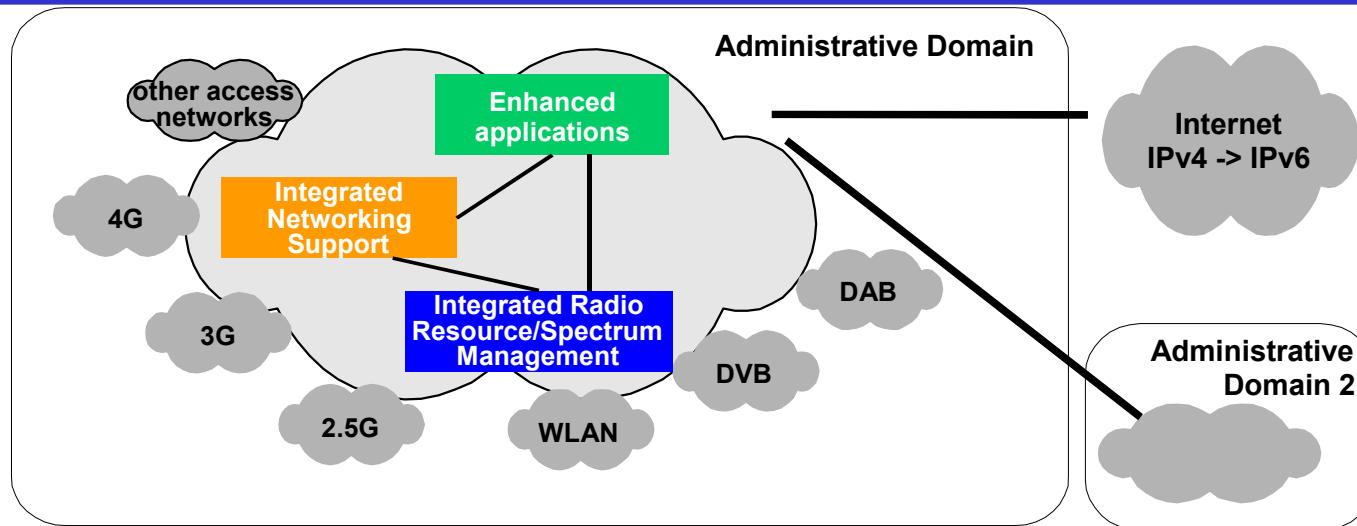Source: ITU-R WP8F, 7th Meeting, Queenstown, February 27 – March 5, 2001, TEMP 251r1e
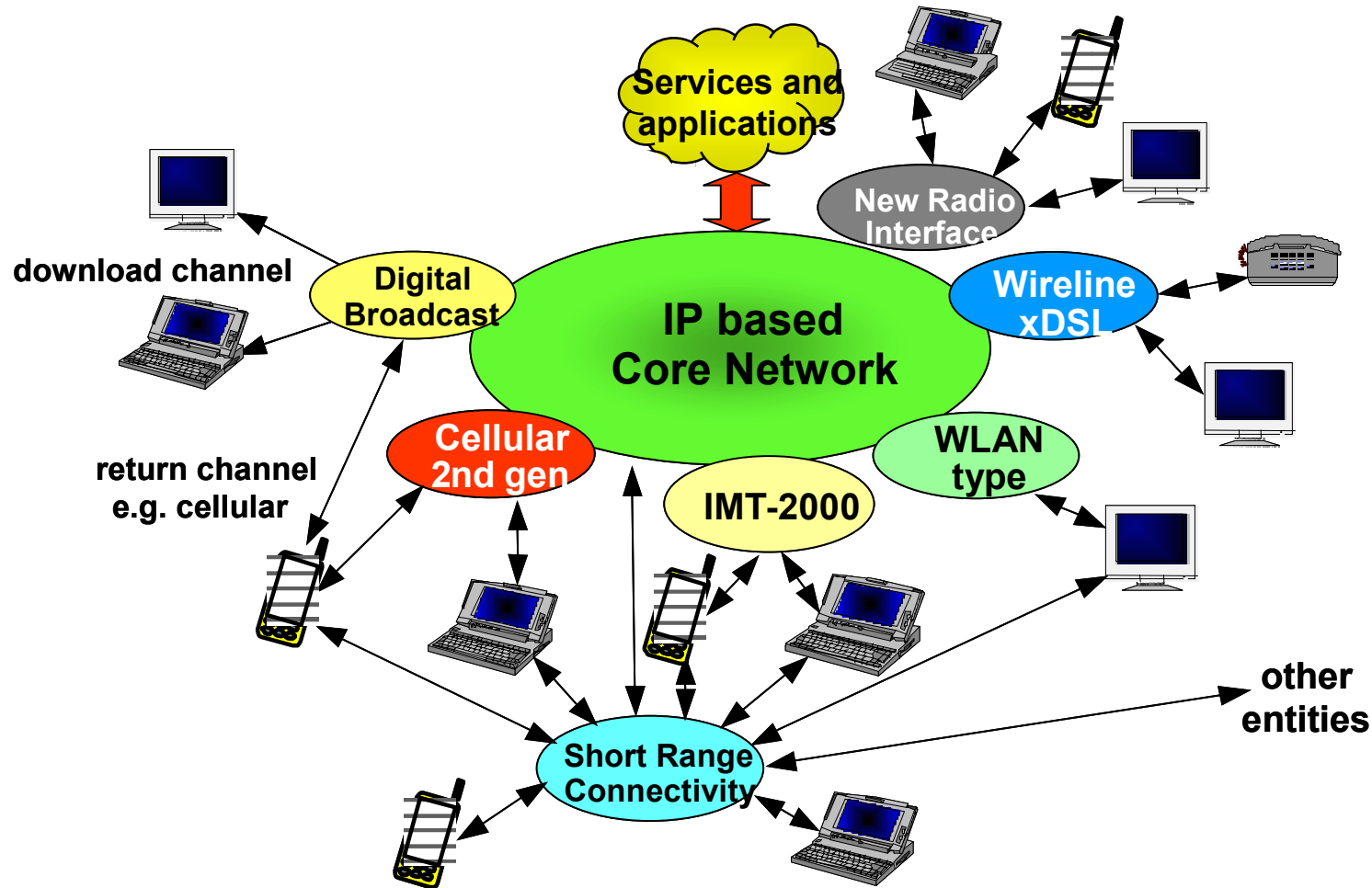
Source: ITU-R WP8F, 7th Meeting, Queenstown, February 27 – March 5, 2002, TEMP 251r1e

Networking in the Wireless World

Administrative Domain

other access networks

Enhanced applications

Internet IPv4 -> IPv6

4G

Integrated Networking Support

3G

Integrated Radio Resource/Spectrum Management

DAB

DVB

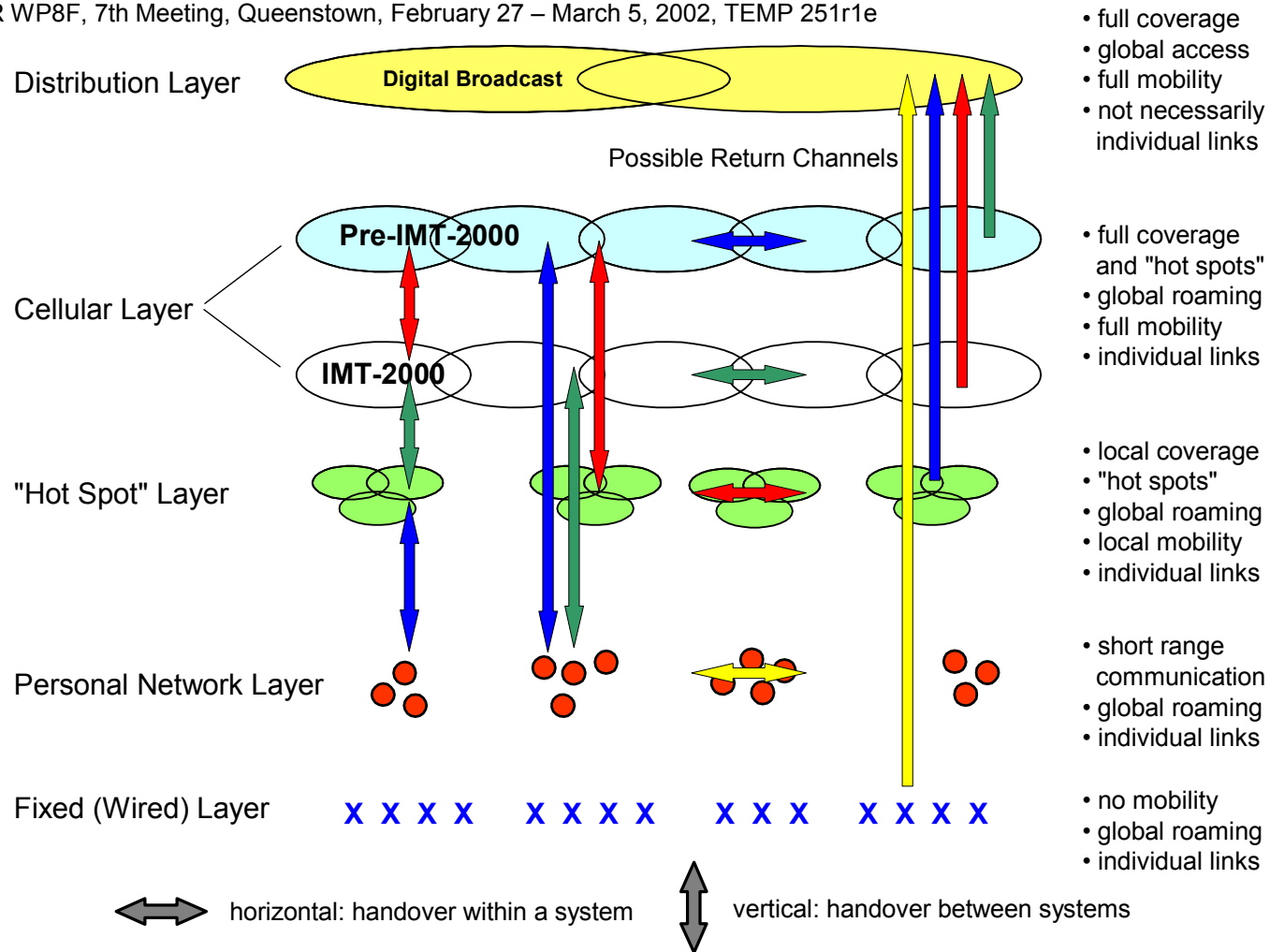**Administrative Domain 2**

2.5G

WLAN

IPv6- based networking

Multiparty multimedia communications
For mobile nodes and mobile networks (PAN, LAN)
With secure seamless mobility
With secure seamless mobility
Between access systems of same and different kinds
Within and between administrative domains
Across personal, home, car and enterprise spaces

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Layered system structure beyond third generation

Distribution Layer
- full coverage
- global access
- full mobility
- not necessarily individual links

Digital Broadcast

Possible Return Channels

Cellular Layer

Pre-IMT-2000

IMT-2000
- full coverage and "hot spots"
- global roaming
- full mobility
- individual links

"Hot Spot" Layer
- local coverage
- "hot spots"
- global roaming
- local mobility
- individual links

Personal Network Layer
- short range communication
- global roaming
- individual links

Fixed (Wired) Layer

x x x x   x x x x   x x x   x x x x
- no mobility
- global roaming
- individual links

horizontal: handover within a system   vertical: handover between systems
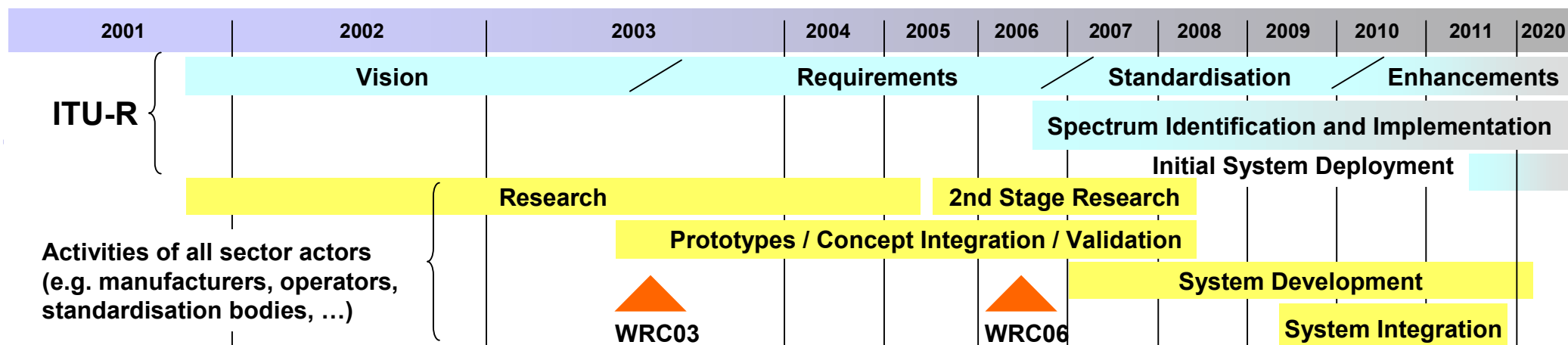
Book of Visions 2001 Structure

❑ Introduction with user-centred "MultiSphere Model" and Columns of the Wireless World

❑ 3 major parts

    1. "Visions and Issues" of particular subject areas

    2. "Research Tasks" that address the issues from Section 1
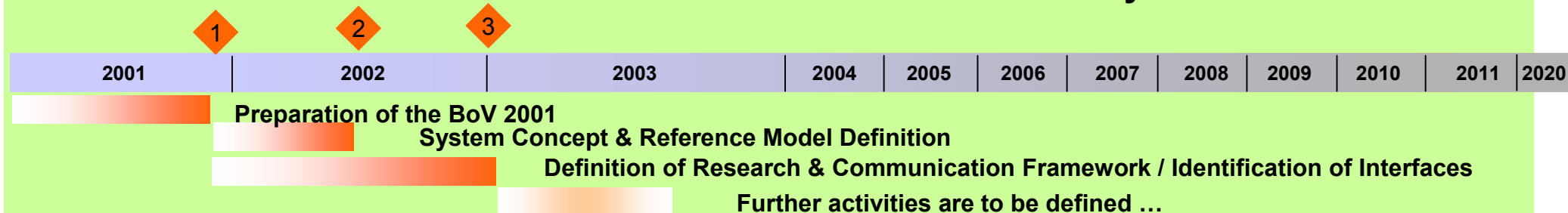
    3. "Contributions received during 2001"

Building Blocks of the Wireless World

Semantics aware Services

E2E Security & Privacy

Augmented Reality /Cyberworld

Software Defined Radio

Heterogeneous Ad-hoc

Smart Antennas & Basestations

Peer Discovery

Co-operative Networks & Terminals

4G Radio Interfaces

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The Global 4G Context

2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2020

ITU-R

Vision / Requirements / Standardisation / Enhancements

Spectrum Identification and Implementation

Initial System Deployment

Research | 2nd Stage Research

Prototypes / Concept Integration / Validation

System Development

System Integration

Activities of all sector actors (e.g. manufacturers, operators, standardisation bodies, …)

WRC03

WRC06

WWRF Milestones & Activities for 2001 and Beyond

2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2020

◆1 ◆2 ◆3

Preparation of the BoV 2001

System Concept & Reference Model Definition

Definition of Research & Communication Framework / Identification of Interfaces

Further activities are to be defined …

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1 • BoV 2001 published

2 • Initial system concept & reference model established for research + publication of specific topic reports

◆ = Milestone

3 • Initial WWRF research framework established and communicated to national & international research programmes and relevant standardisation bodies

+ Publication of specific topic reports

WWRF 2001/2002 Meeting Schedule

December 2000	**1st Call for Contributions**	
March 6 - 7, 2001	**WWRF Kick-Off Meeting**	Munich
May 10 - 11, 2001	**WWRF 2nd Meeting**	Helsinki
September 17 - 18, 2001	**WWRF 3rd Meeting**	Stockholm
December 6, 2001	**WWRF Workshop**	Paris
March 7 – 8, 2002	**WWRF 5th Meeting**	Phoenix, USA
June 25 – 26, 2002	**WWRF 6th Meeting**	London, UK
September 2002	**WWRF 7th Meeting**	The Netherlands

Conclusions

Conclusions

❑ WWRF is contributing to

    ❑ the development of a global vision on systems beyond IMT-2000,

    ❑ the identification of the necessary research areas and

    ❑ the investigation of technology and society trends

❑ WWRF will help to continue the success story of mobile and wireless communications

❑ Due to long cycles for research, standardisation and frequency assignment, research on systems beyond IMT-2000 has to start now

❑ International consensus building should be supported in all levels

Background information

WWRF Legal Arrangements

❑ **WWRF established**

   ❑ as a non-profit association

   ❑ under Swiss law (article 60 ss. of Swiss Civil Code)

   ❑ as an open and independent organisation

❑ **The WWRF is domiciled at Interhold AG, Zurich, Switzerland**

❑ **The following WWRF representatives were elected at the General Assembly in Stockholm on September 17 and 18, 2001**

   ❑ Chair: Dr. Werner Mohr   (Siemens, Germany)

   ❑ Vice Chair: Dr. David Borth   (Motorola, US)

   ❑ Treasurer: Dr. Fiona Williams   (Ericsson, Germany)

WWRF Membership I

- ❑ Any legal established corporation and individual firm, partnership, university and research institute, governmental body or international organisation supporting the purpose of the WWRF may apply for membership

- ❑ There are Founding Members, Sponsor Member, and Full Members
  All members are entitled
  - ❑ to send representatives to all Working Groups and the General Assembly
  - ❑ to one vote at the General Assembly
  - ❑ to nominate candidates as Executive Board Members of the Steering Board
  - ❑ to access all registered working documents, meeting minutes, etc., including full access to the Members Only area of the WWRF web-site

- ❑ Each **Founding Member** appoints a Non-Executive Board Member of the Steering Board

- ❑ Each **Sponsor Member** is eligible for election to the Steering Board to serve as Non-Executive Board Member

WWRF
Membership II

❑ There is an annual membership fee

    ❑ Fees and terms of payment are fixed annually by the General Assembly, based on a proposal by the Treasurer

    ❑ Sponsor Members: € 10.000

    ❑ Full Members: € 1.000

❑ Membership fee for the period of incorporation to December 31, 2002

❑ WWRF bank account opened with Credit Suisse, Zurich, Switzerland

❑ Membership (status beginning of April 2002)

    ❑ 86 members including 10 sponsor members

    ❑ 27 manufacturers

    ❑ 13 operators

    ❑ 46 universities, Research Centres and SMEs

The General Assembly is the Governing Body

❑ Main responsibilities of the General Assembly are to
  ❑ decide on membership issues
  ❑ approve the work program
  ❑ approve proposals for R&D issues
  ❑ review the work done by the other groups
  ❑ approve budget and membership fees
  ❑ approve the auditor's report
  ❑ approve reports, opinions, etc. intended for outside organisations

❑ Convened by the Chair, who is elected for one year

❑ Decision basis generally is 'by consensus'
  ❑ otherwise by simple majority in ordinary cases, or
  ❑ by a two-third majority in severe cases, such as dissolution of the Forum or revisions of the Articles of Association

The Steering Board is the Executing Body

❑ **Main responsibilities of the Steering Board are to**
  - ❑ act on decisions of the General Assembly and represent WWRF
  - ❑ address matters of the administration, management, and scheduling
  - ❑ process member applications and refer them to the General Assembly
  - ❑ establish / re-organise / dissolve Working Groups and monitor their work
  - ❑ initiate the development of proposals for R&D issues in the Working Groups
  - ❑ prepare the balance sheet for approval by the General Assembly

❑ **Composed of:**
  - ❑ Executive Board Members:
    Chair / Vice Chairs / Treasurer and Working Group chairs
  - ❑ Non-Executive Board Members (up to 15):
    Nominated representatives from the Founding Members and elected representatives from the Sponsor Members

❑ **Decision basis is 'by consensus'**

The Current Working Groups

- ❑ The Working Groups are established by the Steering Board within the framework of the work program

- ❑ Each Working Group elects its chair for one year amongst the member organisations

- ❑ The current Working Groups are addressing
  - ❑ The Human Perspective of the Wireless World
  - ❑ The Service Architecture of the Wireless World
  - ❑ New Communication Environment and Heterogeneous Networks
  - ❑ New Wireless Technologies

The Human Perspective of the Wireless World
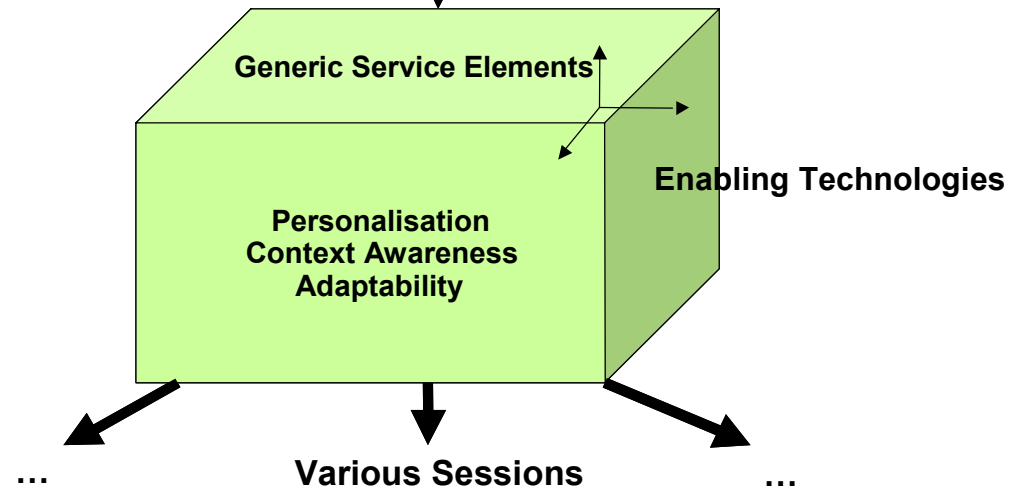
Main areas to identify research tasks:

❑ Understanding the user

❑ New generic application elements

❑ New interaction techniques

THE HUMAN PERSPECTIVE OF THE WIRELESS WORLD

NEW INTERACTION ELEMENT

UNDERSTANDING THE USER

NEW GENERIC
APPLICATION ELEMENTS
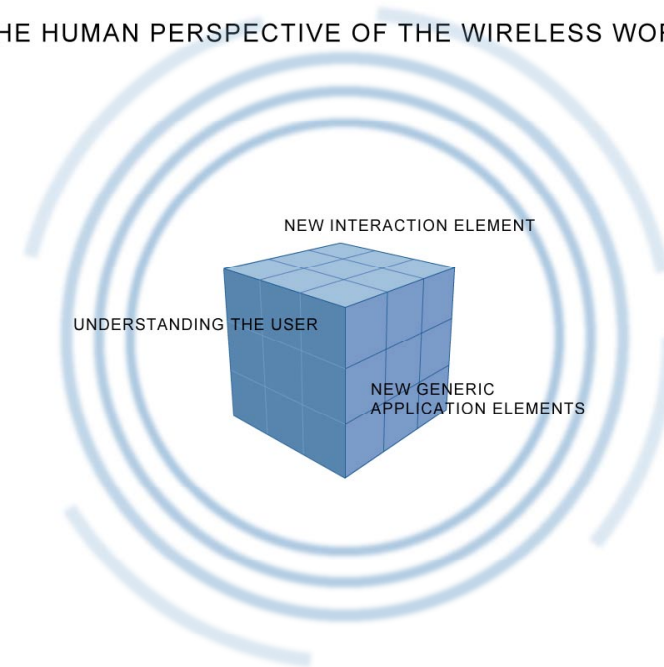
The Service Architectures for the Wireless World

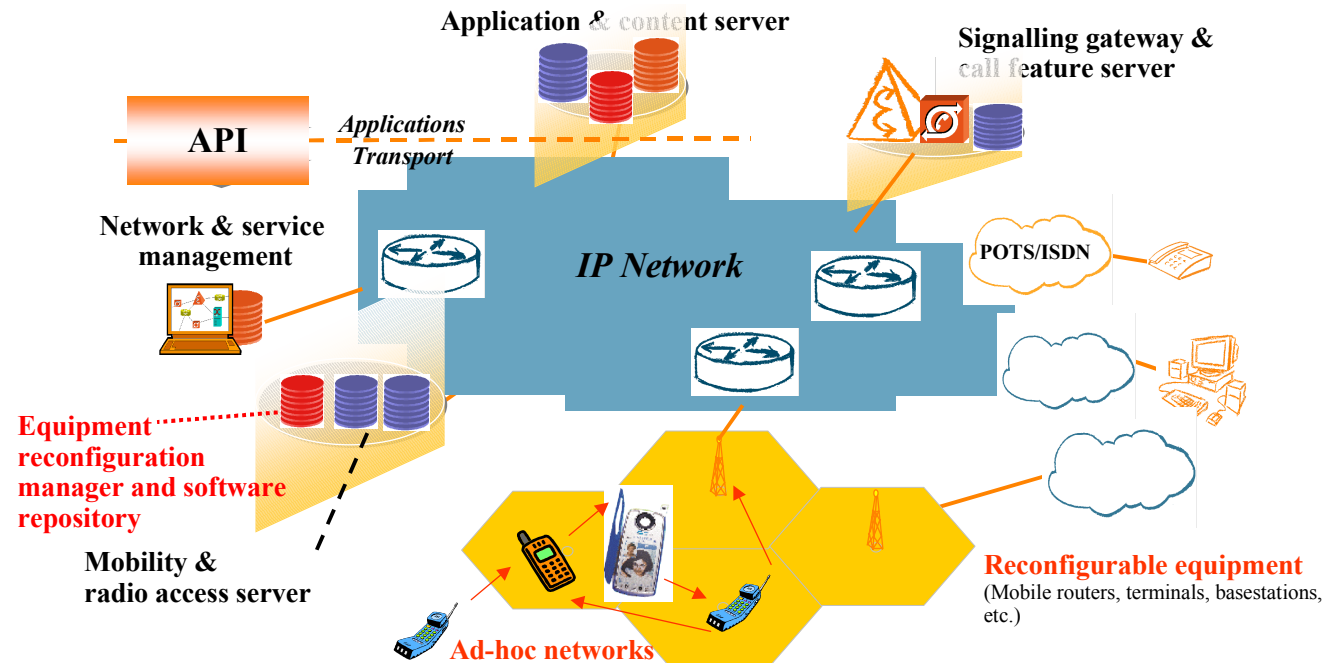OO (TINA) →   Business Model of the WW ← Internet (IETF)

Main areas to identify research tasks:

- ❑ Business model
- ❑ Personalisation
- ❑ Adaptability
- ❑ Generic service elements
- ❑ Enabling technologies
- ❑ Architecture for context awareness and ubiquitous computing

Generic Service Elements

Enabling Technologies

Personalisation
Context Awareness
Adaptability

...   Various Sessions   ...

New Communication Environment and Heterogeneous Networks

Main areas to identify research tasks:

- ❏ Wireless World networking architecture
- ❏ IP mobility architecture for the Wireless World
- ❏ QoS architecture for the Wireless World
- ❏ IP Multicast architecture for the Wireless World
- ❏ Transport protocols for the Wireless World
- ❏ SDR

Application & content server

Signalling gateway & call feature server

API

Applications
Transport

Network & service management

IP Network

POTS/ISDN

Equipment reconfiguration manager and software repository

Mobility & radio access server

Ad-hoc networks

Reconfigurable equipment
(Mobile routers, terminals, basestations, etc.)

New wireless technologies

Main areas to identify research tasks:

- ❑ Spectrum issues
- ❑ Antenna arrays and related techniques
- ❑ New air interfaces
- ❑ Ad hoc networks
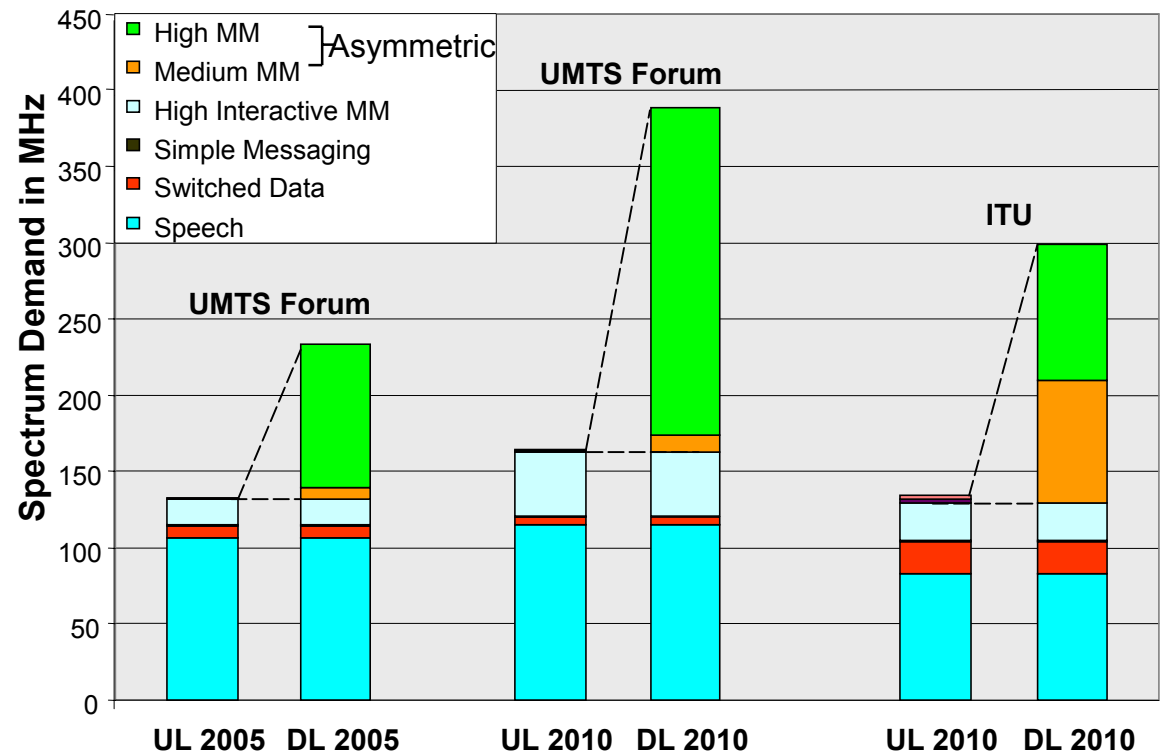
Sources: UMTS-Forum, Report No.6 and ITU-R Report M.[IMT.SPEC]

The Secretariat

❑ **Administrative services**
- ❑ front and back office,
  (e.g. Web-site maintenance, info, news, document maintenance)
- ❑ maintaining a document numbering and classification system,
- ❑ distributing the minutes of the General Assembly and Steering Board meetings on the Members Only section of the web-site

❑ **Meeting schedule & logistics**
- ❑ meeting planning from an organisational viewpoint, including mailing/notice of invitations, processing registrations,
- ❑ during the meeting, managing all event logistics, on-site registrations and materials for meeting attendees

❑ **Membership services**
- ❑ handling member applications, inquiries, etc.
- ❑ maintaining a member register

WWRF actual membership Status 04/2002

Manufacturers

Alcatel	France
Cybelius Software	Finland
EADS	France
Elektrobit GmbH	Germany
Ericsson	Sweden
Intracom	Greece
Lucent Technologies	UK
Mitsubishi Electric	France
NEC Europe	Germany
NOKIA	Finland
Nortel Networks	UK
Qualcomm Europe	France
Royal Philips Electronics	UK
Siemens AG	Germany
Sony Europe GmbH	Germany
ST Microelectronics	Switzerland
Thales Communications	France
Agere System	USA
Broadstorm	USA
Hughes Software Systems	USA
IBM	USA
Motorola	USA
Quicksilver Technology	USA
RAYTHEON	USA
Watercove Networks	USA
Chungwa Telecom Laboratories	Taiwan
Samsung Electronics	Korea

Operators

BT Exact	UK
Elisa Communications	Finland
EURESCOM	Germany
FINNET Group	Finland
France Telecom R&D	France
Sonera Corporation	Finland
Telefonica	Spain
Telenor	Norway
VODAFONE Group Services Ltd	UK
AT&T Wireless Services	USA
CELLCOM Israel Ltd	Israel
NTT DoCoMo Eurolab	Germany/Japan
Australian Telecom	Australia

Europe
America
Asia
Australia

WWRF actual membership Status 04/2002

SMEs, R&D Centers and Universities

Aachen University of Technology (RWTH)	Germany	University of Athens	Greece
Aalborg University	Denmark	University of Bologna	Italy
ACTICOM	Germany	University of Bremen, BIBA	Germany
CEA LETI	France	University of Bristol	UK
Chalmers University of Technology	Sweden	University of Helsinki	Finland
Dresden University of Technology	Germany	University of Ilmenau	Germany
ETH Zurich, Integrated Systems Laboratory	Switzerland	University of Karsruhe	Germany
Forschungszentrum Telecom	Austria	University of London	UK
Fraunhofer Gesellschaft	Germany	University of Oulu	Finland
German Aerospace Center (DLR)	Germany	University of Strathclyde	UK
Groups des Ecoles des Telecom	France	University of Surrey	UK
HERMES Partnership	Belgium	University of Twente	The Netherlands
IAMSR	Finland	Uppsala University	Sweden
IKOM	Germany	VTT Electronics	Finland
IMST GmbH	Germany		
Independent Consultant	UK	Carlton University	Canada
Institute for Communications and Info Engineering	Austria		
Instituto Telecom	Portugal	CCL/ITRI	Taiwan
King's College London	UK	Center for Wireless Communications	Singapore
KTH Stockholm, Center for Wireless	Sweden	National Chiao Tung University	Taiwan
Lesprojekt Sluzby	Czech Republic		
Mobile VCE	UK		
Robotiker Foundation	Spain		
Technical University of Berlin	Germany		
Telecommunication Technological Center of Catalonia	Spain		
Telematica Institut	The Netherlands		
TNO	The Netherlands		
Technical University of München	Germany		

Europe
America
Asia
Australia