Advanced Broadband Wireless Standards from ETSI and Co-operation with WiMAX

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- ETSI BRAN Chairman

Overview

- **ETSI BRAN structure**

- **Status of BRAN HiperAccess and HiperMAN**

- **Relations to standardization bodies and forums**

- **Co-operation ETSI - WiMAX Forum**

- **Conclusions**

ETSI
European Telecommunications Standards Institute

- **~700 member companies** from 55 contries in 5 continents

- **~11,000 technical standards and deliverables** since 1988

- **~60 co-operation agreements**

- **Market driven organization** members decide about work program and resource allocation

- **Established in 1988,** as non-profit making organization, based in Sophia Antipolis, Nice Cote d'Azur (France)

- **www.etsi.org**

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ETSI Working Methods

Decision Making

- **Members shall endeavour to reach consensus on all issues.**

- **If lack of consensus: voting can be performed using individual member company weights**
(1...45 depending on company revenues, one vote per company, approval requires 71%)

Open Standardization Process

- **Each ETSI member can actively or passively participate (incl. voting).**

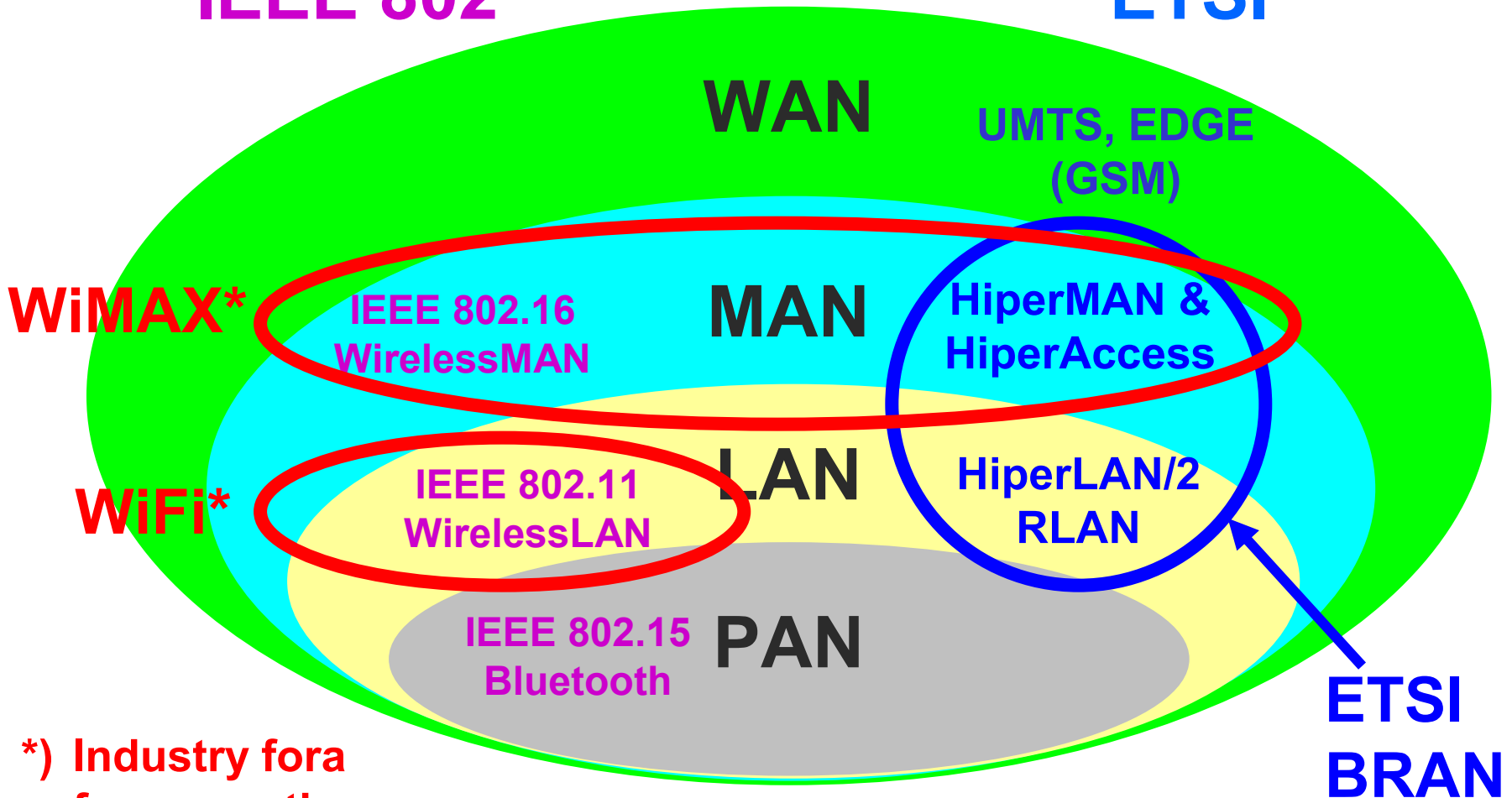- **All documents and standards are always freely accessible.**

IPR Policy

- **Each ETSI member has the obligation to inform about Essential IPRs it becomes aware of.**

- **IPR owners shall grant irrevocable licenses on FRAND (fair, reasonable and non-discriminatory) terms and conditions.**

Global Wireless Standards

IEEE 802

ETSI

WAN

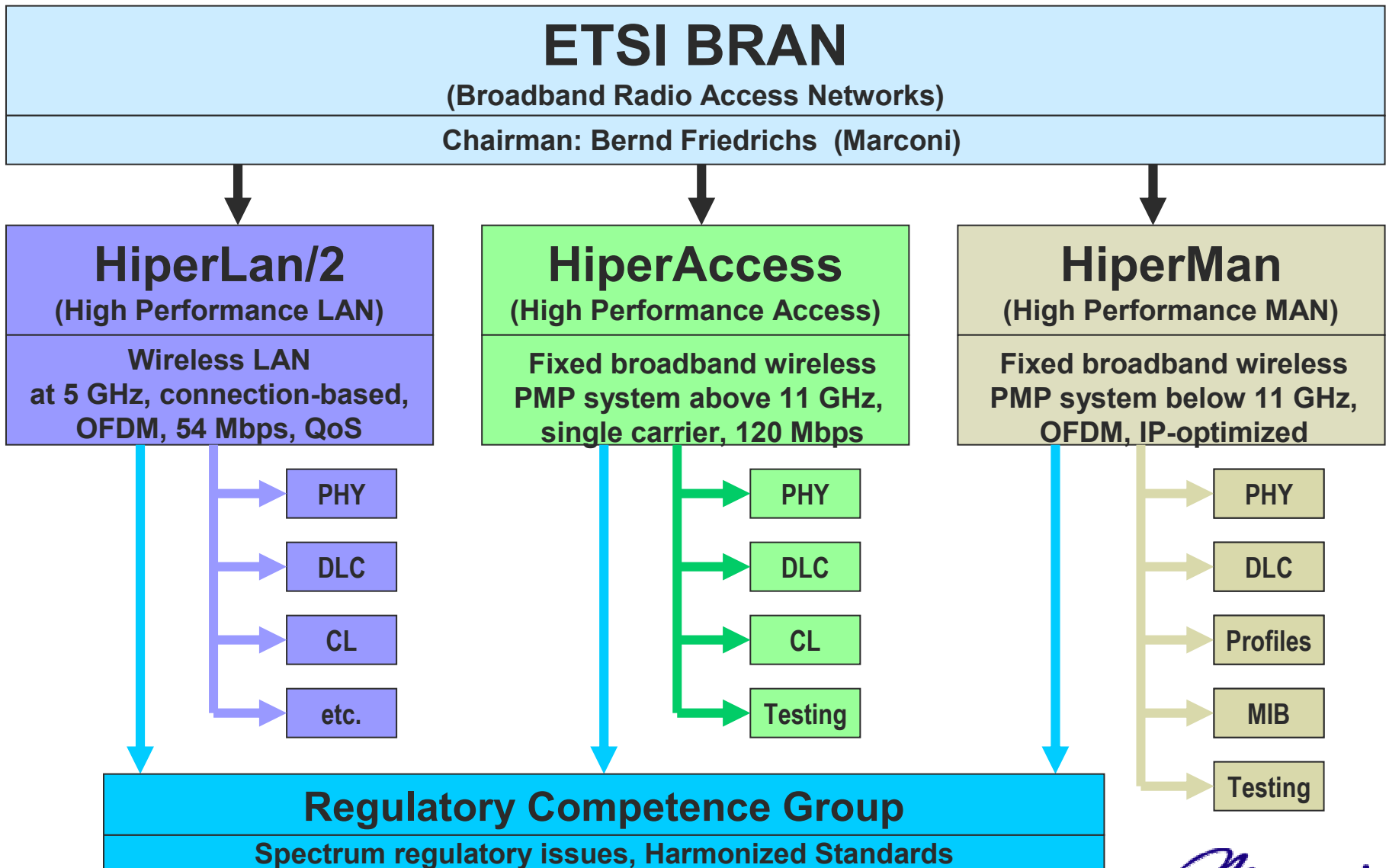UMTS, EDGE (GSM)

WiMAX*

IEEE 802.16 WirelessMAN

MAN

HiperMAN & HiperAccess

WiFi*

IEEE 802.11 WirelessLAN

LAN

HiperLAN/2 RLAN

IEEE 802.15 Bluetooth

PAN

ETSI BRAN

*) **Industry fora for promotion and certfication**

BRAN Structure

ETSI BRAN

(Broadband Radio Access Networks)

Chairman: Bernd Friedrichs (Marconi)

HiperLan/2
(High Performance LAN)

**Wireless LAN
at 5 GHz, connection-based,
OFDM, 54 Mbps, QoS**

- PHY
- DLC
- CL
- etc.

HiperAccess
(High Performance Access)

**Fixed broadband wireless
PMP system above 11 GHz,
single carrier, 120 Mbps**

- PHY
- DLC
- CL
- Testing

HiperMan
(High Performance MAN)

**Fixed broadband wireless
PMP system below 11 GHz,
OFDM, IP-optimized**

- PHY
- DLC
- Profiles
- MIB
- Testing

Regulatory Competence Group
Spectrum regulatory issues, Harmonized Standards

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BRAN Status

Transition to TC (Technical Commitee) in 2004

ToR (Terms of Reference)

- **BRAN is responsible for all broadband radio (access) systems**

- **Several vertical groups for technology-dependent activities**

- **Regulatory competence concentrated in horizontal RCWG**
  - to develop Harmonised Standards covering essential requirements under article 3.2 of the R&TTE directive,
  - to assist regulatory bodies to define spectrum requirements and radio conformance specifications for new broadband radio networks

Extensions under discussion

- **Non-interoperable systems (i.e. proprietary, coexistence specs)**

- **Transport systems (e.g. classical Point-to-Point hops)**

- **Higher layers including network aspects**
  (e.g. IRAP = International Roaming Access Protocols (WiFi))

- **Other**
  (e.g. WIGWAM = Wireless Gigabit (RLAN) with Advanced Multimedia Support)

- **Merger with ETSI TM4**

ETSI Experience

- **GSM, DECT, 3G, Tetra, etc.**
- **The working methods and approaches have given very good results in terms of interoperability**
- **3G considers the test specs *„very good value for money"***

Base standards (for air interface)

- **PHY and DLC layers independet of core network**
- **Convergence sublayers for packet- and cell-based core networks**

Base standards (for network)

- **The successful deployment of large-scale portable or mobile networks requires also the development of interfaces and protocols above the scope of the air interface**
- **Work already started on MIB and management**

Test specifications

- **Normative part of standard**

- **Controlled in the open forum in the same way as the base specs**

- **Actual testing and certification is left to industry and their associations**

Test methods

- **Good results from using advanced spec methods and languages**

- **For the first time, virtual protocol testing (UDP/IP based, via API) was used, showing the capability to detect and resolve potential problems in implementations before the HW becomes available**

Testing organization

- **Work is progressed through STF (Special Task Force)**
- **STF funded by ETSI, operating under the guidance of BRAN**
- **Supported by PTCC (Protocol and Testing Competence Center)**

BRAN STF

- **All BRAN conformance test specifications were produced in STFs**
- **More than 70 documents were published in the last two years**
- **About $ 2,000,000 funding was spent for BRAN STFs**
- **About $ 520,000 total cost were spent for HiperMAN / WiMAX**

Interoperability testing = Two implementations trying to interwork

- Can test only normal behaviour
- Can test exceptional behaviour only by chance

Golden unit testing = An implementation that is somehow representing a standard trying to interwork with an implementation under test

Conformance testing = A test tool evaluating an implementation under test

- Can test both normal and exceptional behaviour
- Can repeat the specific test any time and any number of times (following corrections for example)

ETSI has achieved good results using a combination of conformance testing followed by some level of interoperability testing

Basic protocol standard development

- **Abstract Syntax Notation** (ASN.1) message structure specification, ITU-T X.680
- **Packed encoding rules** (PER) for transfer encoding, ITU-T X.691
- **Message Sequence Charts** (MSC) for message flow description, ITU-T Z.120,
- **Specification and Description Language** (SDL) specification, ITU-T Z.100
  - SDL models used to precisely define the protocol behaviour.
  - Simulations and validations to early remove ambiguities and erroneous protocol behaviour.

Protocol test specifications   (ITU-T X.291...296, ISO/IEC 9646)

- **PICS**   **Protocol Implementation Conformance Statement**
- **TSS & TP**   **Test Suite Structure and Test Purposes**
- **ATS**   **Abstract Test Suite (TTCN)**
  - Significant effort was spent (30 man month of funded expert work plus voluntary contribution by member companies and ETSI PTCC work)

Radio test specifications

- **RCT**   **Radio Conformance Test**
- **EN**   **Harmonized Standard (European Norm)**, covering the essential requirements of article 3.2 of the EC R&TTE Directives

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BRAN HiperAccess (1 of 4) Overview

Main applications

- **Cellular backhauling**
- **SOHO, SME**
- **Typically too expensive for residential access / WLL / LMDS**

ETSI BRAN developed protocol stack and radio specifications

Optimized for ATM and Ethernet

Strong points

- **Suitable for immediate deployment in GSM and UMTS networks**
- **Technical quality**
  - Precision of specification
  - Well controlled optional features
  - Absence of ambiguities
  - Test specifications with ETSI strength (MBS2)
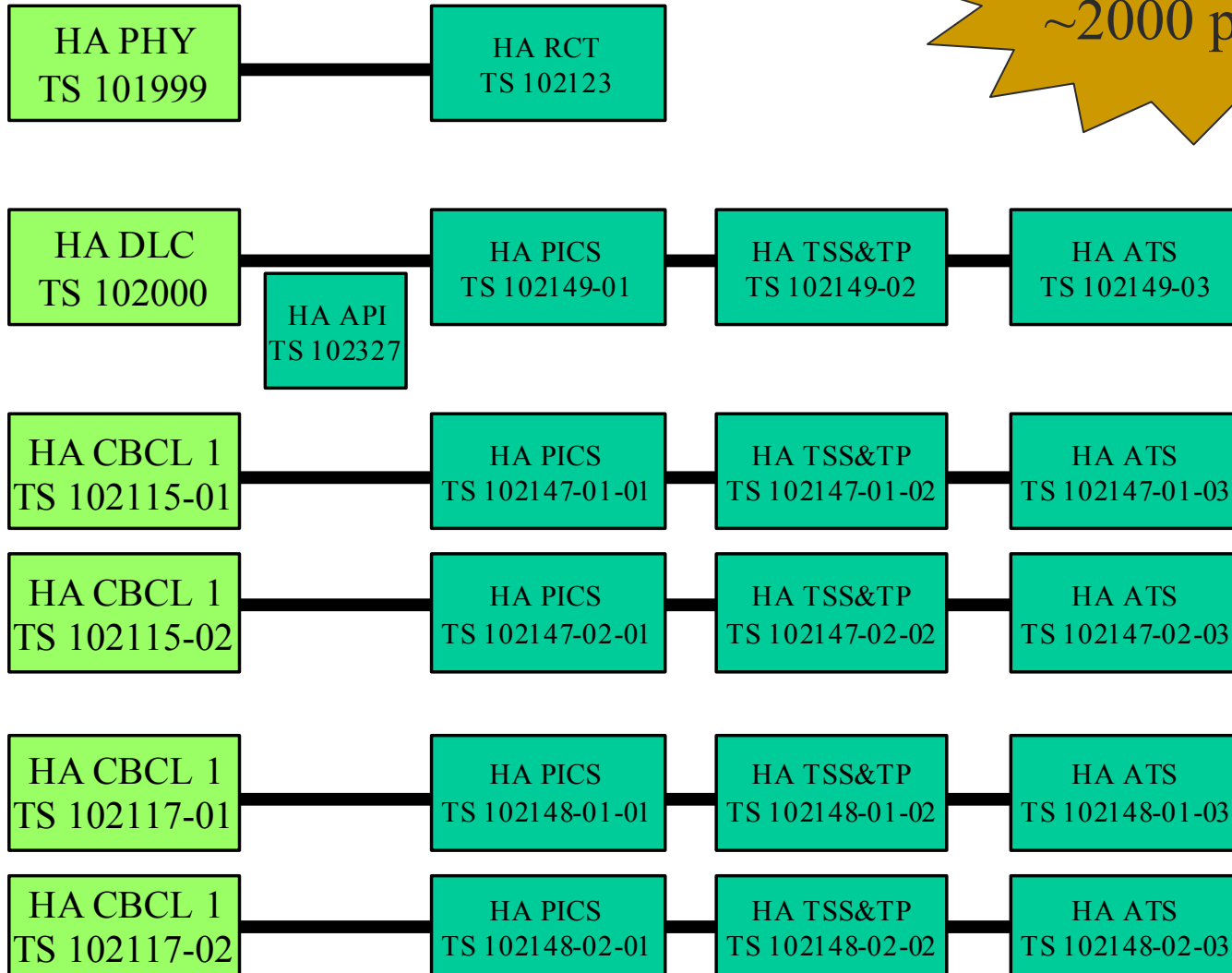- **High spectral efficieny, high QoS, high reliability**

Set of Specifications

Base Specs

Test Specs

in total
~2000 pages

| HA PHY TS 101999 | —— | HA RCT TS 102123 |

| HA DLC TS 102000 | —— | HA PICS TS 102149-01 | —— | HA TSS&TP TS 102149-02 | —— | HA ATS TS 102149-03 |

HA API TS 102327

| HA CBCL 1 TS 102115-01 | —— | HA PICS TS 102147-01-01 | —— | HA TSS&TP TS 102147-01-02 | —— | HA ATS TS 102147-01-03 |

| HA CBCL 1 TS 102115-02 | —— | HA PICS TS 102147-02-01 | —— | HA TSS&TP TS 102147-02-02 | —— | HA ATS TS 102147-02-03 |

| HA CBCL 1 TS 102117-01 | —— | HA PICS TS 102148-01-01 | —— | HA TSS&TP TS 102148-01-02 | —— | HA ATS TS 102148-01-03 |

| HA CBCL 1 TS 102117-02 | —— | HA PICS TS 102148-02-01 | —— | HA TSS&TP TS 102148-02-02 | —— | HA ATS TS 102148-02-03 |

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Focus on frequency bands

- **40.5 - 43.5 GHz**
- **31.8 - 33.4 GHz**
- **27.5 - 29.5 GHz**
- **24.5 - 26.5 GHz**
- **other lower frequencies**

Channel size = 28 MHz, Baudrate = 22.4 MBaud

- **Paired bands   (FDD mode, fixed asymmetric rates)**
- **Unpaired bands (TDD mode, adaptive asymmetric rates)**
- **Optimum trade-off between costs, peak data rate and statistical multiplex gain**

Important parameters

	Downlink (AP $\to$ AT)	Uplink (AT $\to$ AP)
Data rates (Mbit/s)	20...120 (typically 80)	20...80 (typically 50)
Transmit power	15 dBm	14 dBm
Range	up to 12 km (hard limit from ranging, effectively depending on availability and rain zone)	

High stability of base and test specifications achieved

- **Only minor corrections expected in 2005**
- **Further harmonization with IEEE 802.16-WirelessMAN-SC**

Commercial roll-out

- **First BRAN-compliant product was rolled-out in December 2004 (Point-to-Point derivative of HA)**
- **Full HiperAccess-compliant products will be available in 2005**
- **High interest from numerous operators**

BRAN HiperMAN (1 of 2)
Overview

Main applications

- **First release: FWA below 11 GHz**
- **Residential (self installation), SOHO, SME (wireless DSL)**
- **Mesh radio networks (radio based routers)**

Features (100% selected by WiMAX Forum)

- **Optimized for IP traffic, full QoS support**
- **Both FDD and TDD, including H-FDD CPE**
- **High spectral efficiency and data rates, up to 25 Mbit/s in 7 MHz**
- **Adaptive modulation (from QPSK to 64-QAM)**
- **Interoperability profiles for 1.75 MHz, 3.5 MHz and 7 MHz**
- **Uplink OFDMA (high cell radius possible, up to 50 km in PMP with directive antenna)**
- **Hooks for advanced antenna systems**
- **High security TEK encryption algorithms**

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Standards (published in 2004)
- **ETSI TS 102 177 PHY layer**
- **ETSI TS 102 178 DLC layer**
- **ETSI TS 102 210 System profiles**

Functional Requirements
- **ETSI TR 101 856**

System Reference Documents
- **ETSI TR 102 079 for the band 5.725 GHz to 5.875 GHz**

Drafting activity
- **MIBs for Network Management**
- **Test standards (PICS, TSS&TP finished in 2004, ATS)**
- **Support for nomadic systems**
- **etc.**

BRAN RCWG
Regulatory Competence Working Group

5 GHz Harmonized EN (RLAN)

- **To be used for European type approval in < 5.725 GHz**
- **ETSI EN 301 893 v1.2.3 - 5 GHz high performance RLAN; Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive**

5.8 GHz Harmonized EN (FWA)

- **To be used for European type approval in 5.725 - 5.975 GHz**

System Reference Document (HiperMAN)

- **Fixed - nomadic convergence of BWA systems**
- **To be used by ECC for more spectrum allocation**

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BRAN Relationship with Other Bodies and Forums
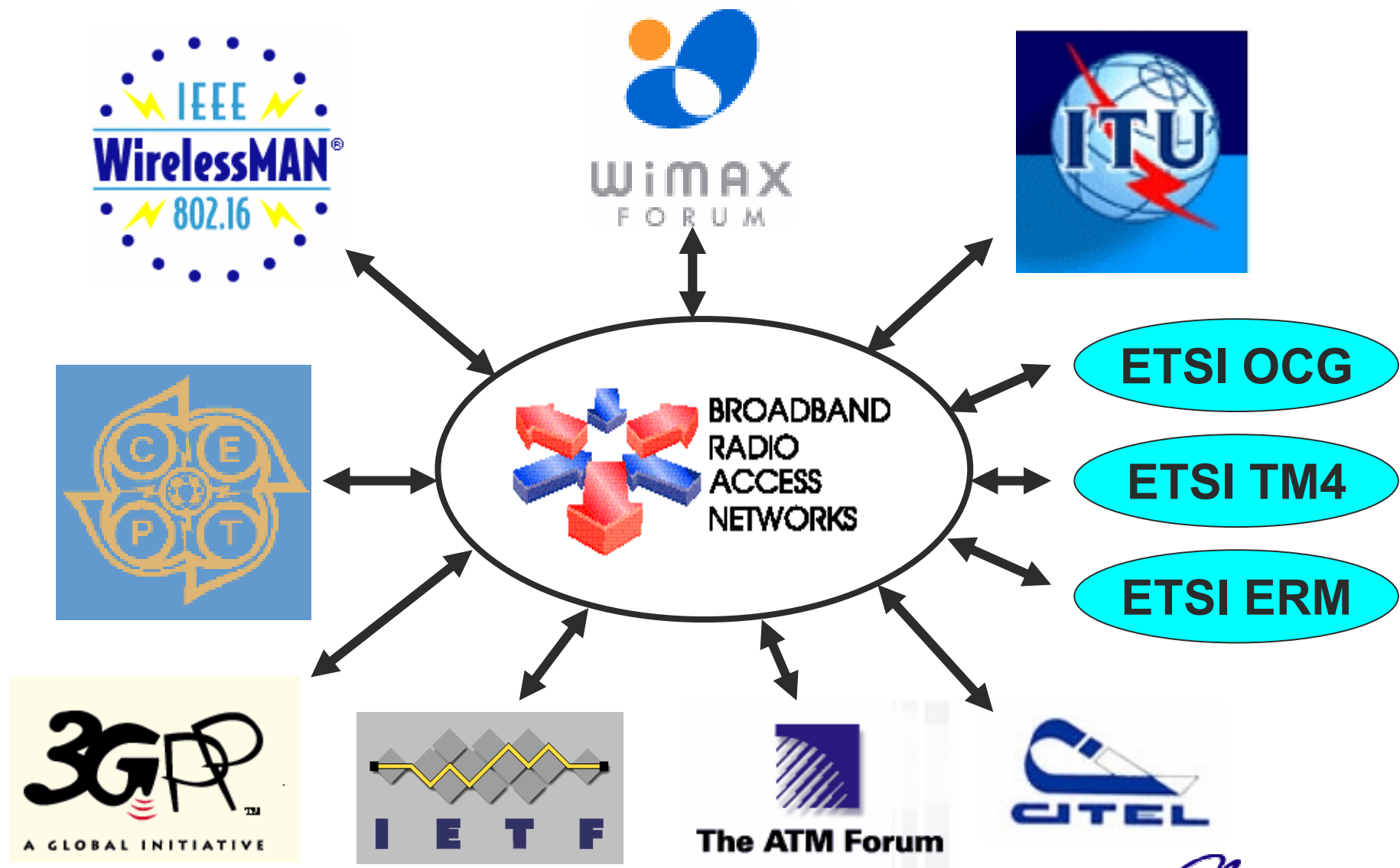
Relation BRAN - ITU

Draft ITU-R Recommendation on Radio Interface Specifications (Requirements and Standards)

- **BRAN and IEEE 802.16 provide harmonized inputs**

ITU-D Report on Broadband Technologies (ITU-D Q20/2)

- **BRAN provided input**

ITU-APT Seminar on BWA (Busan, Korea, Sept. 2004)
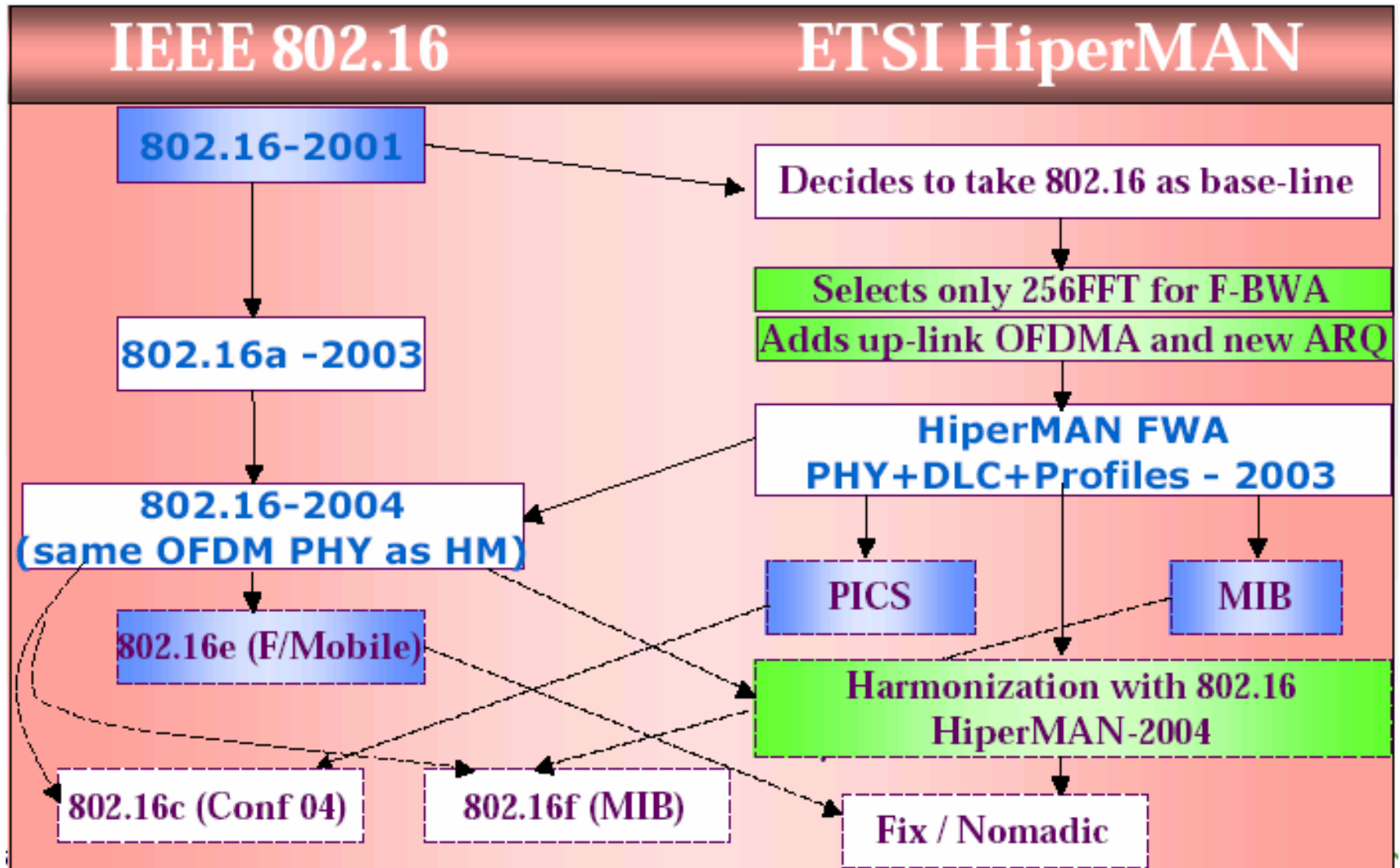
- **Presentations from BRAN Vice-Chair**

	IEEE 802	ETSI BRAN	Remark
WLAN promotion:	**802.11a** **WiFi**	**HiperLAN2** **H2GF**	same PHY layer
WMAN promotion:	**802.16 (10-66 GHz)**	**HiperAccess**	same PHY layer (except one FEC detail), further harmonization intended (TC layer, protocol stack)
	802.16 (<11 GHz) (16e mobile extension)	**HiperMAN** (fixed or nomadic operation)	Base spec: HM harmonized with IEEE Test spec: Norm. ref. in IEEE to HM PICS and TSS&TP
	WiMAX Forum		formal co-operation agreement expected soon
WPAN	802.15	currently no activities	
MBWA	802.20	mobile extension for HM tbd.	
Roaming	802.21	currently no activities	

Source: Mariana Goldhamer, ITU-APT Seminar on BWA, Busan, Korea, Sept. 2004

ETSI and WiMAX Forum have a common interest

- **to perform and promote standardization with the aim of a global information infrastructure**

- **in avoiding duplication of technical work**

ETSI and WiMAX Forum co-operate for testing and certification

- **to develop conformance test specifications**

- **to validate the test suite**

Status of Agreement

- **Details of agreement almost agreed (some legal issues to be fixed)**

- **Signature expected soon**

- **Technical experts are already working on this basis since mid 2004**

WiMAX Forum

- **set up the certification scheme to assure interoperability of devices**
- **control all aspects of certification**

ETSI

- **is harmonizing and developing HiperMAN test specifications (PICS, TSS&TP, ATS) that could be used for certification**
- **offers unique resouces**
  - **TC MTS (Methods for Testing and Specification)**
  - **ETSI PTCC (Protocol and Testing Competence Center)**
  - **ETSI Plugtest Service**
- **has proven expertise in testing matters and has proven track record of working with industry fora like WiMAX**

Conformance and interoperability testing

- **Both complement each other**
- **For best probability of interoperability between products - do both!**
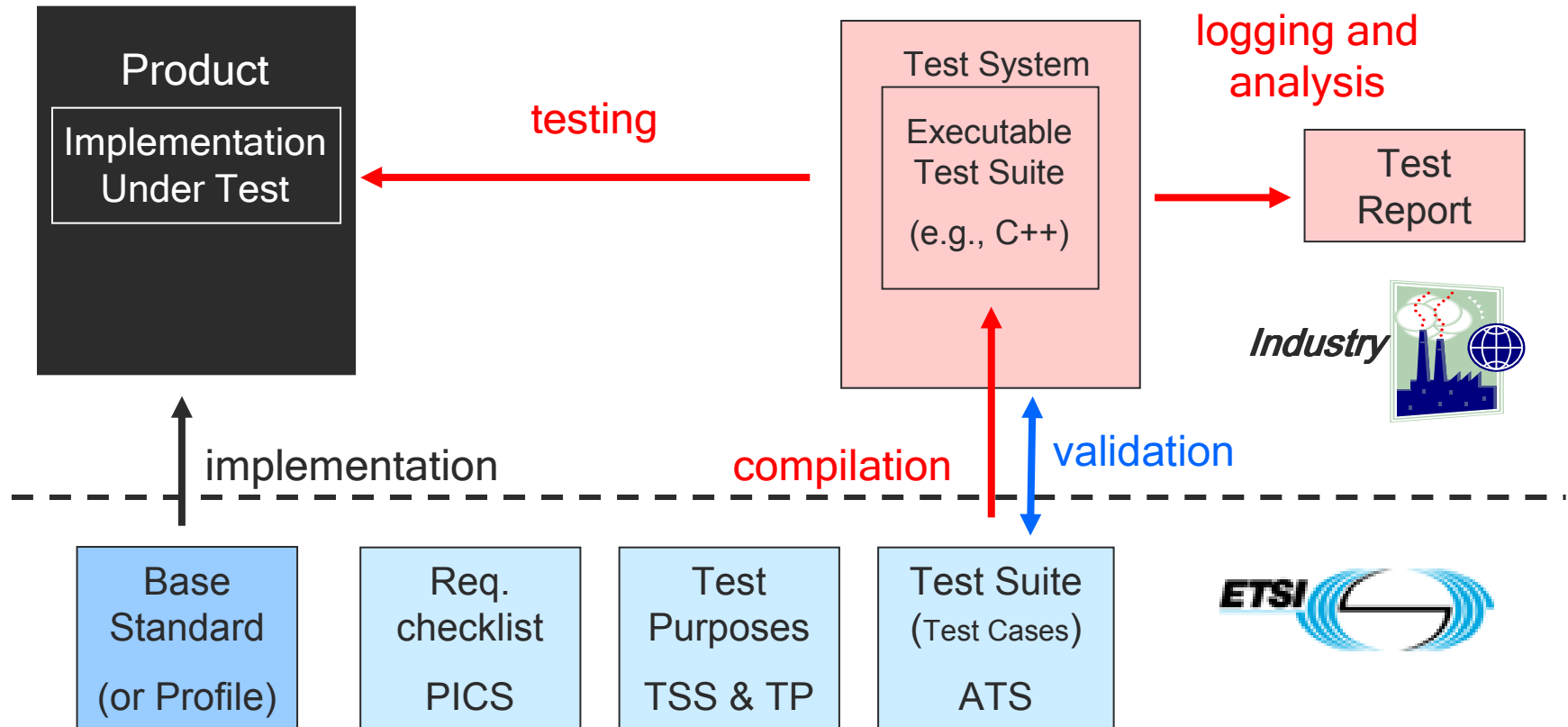
Conclusions

Wireless industry needs global standards

ETSI BRAN supports all harmonization efforts with other parallel standardization bodies

Co-operation BRAN - IEEE 802.16 shows
- what can be achieved
- how standard bodies can contribute to each other

Co-operation BRAN - WiMAX Forum
- Important signal to the market
- ETSI benefits from WiMAX marketing and certification strength
- WiMAX Forum benefits from ETSI experience and work approach

ETSI has access to regulatory bodies

For more information ...

- **http://portal.etsi.org/bran**
  (ETSI portal)

- **http://www.etsi.org/ptcc**
  (ETSI PTCC and testing issues)

- **bernd.friedrichs@marconi.com**
  (BRAN Chairman)