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IEEE802 Introduction and Overview

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ICM N Advanced Standardization, 2004-03-11

Overview

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- **Where IEEE802 fits in...**
- **IEEE P802 procedures**
- **Active wireless working groups in IEEE P802**
  - Overview about activities in IEEE P802
  - Latest enhancements to IEEE802.11
- **'Wireless Mobility' in IEEE P802**
  - IEEE802.20: procedural and technical issues
  - IEEE802.16e: Mobility Enhancements to IEEE802.16a
- **The market for WiMAX/IEEE802.16e & IEEE802.20**

Network standardization in protocols: IEEE802 & IETF

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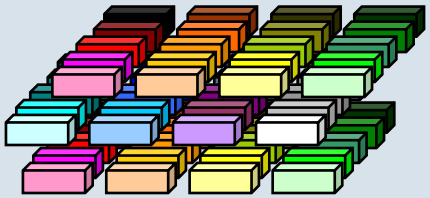
Protocol

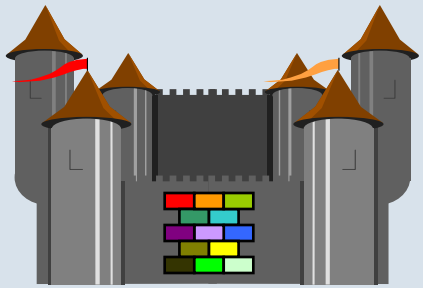
IETF, IEEE802



- General building blocks
- Single protocol functions
- Adoption open to market
- Contribution by individuals

Architecture

3GPP/3GPP2



- Network architecture
- Specification of a network
- Often compulsory
- Corporate membership

- the other leg of the Internet

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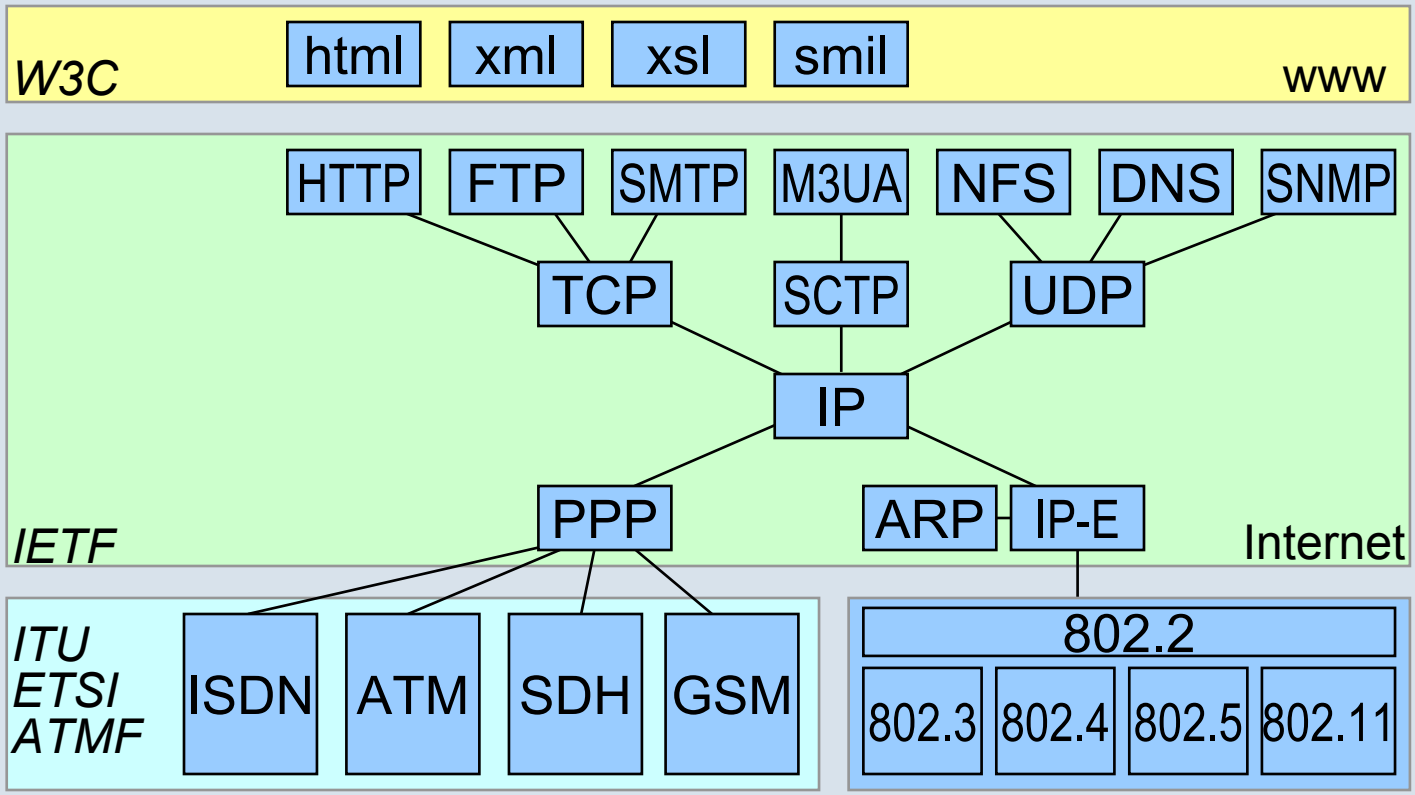

Application

Transport

Network

Link

Physical

- IEEE Project 802 develops LAN and MAN standards,
  - Only Link and Physical Layer of the OSI reference model
- Some standards published by ISO as international standards
- International participation, some meetings held outside the U.S.

Wireless topics in IEEE802

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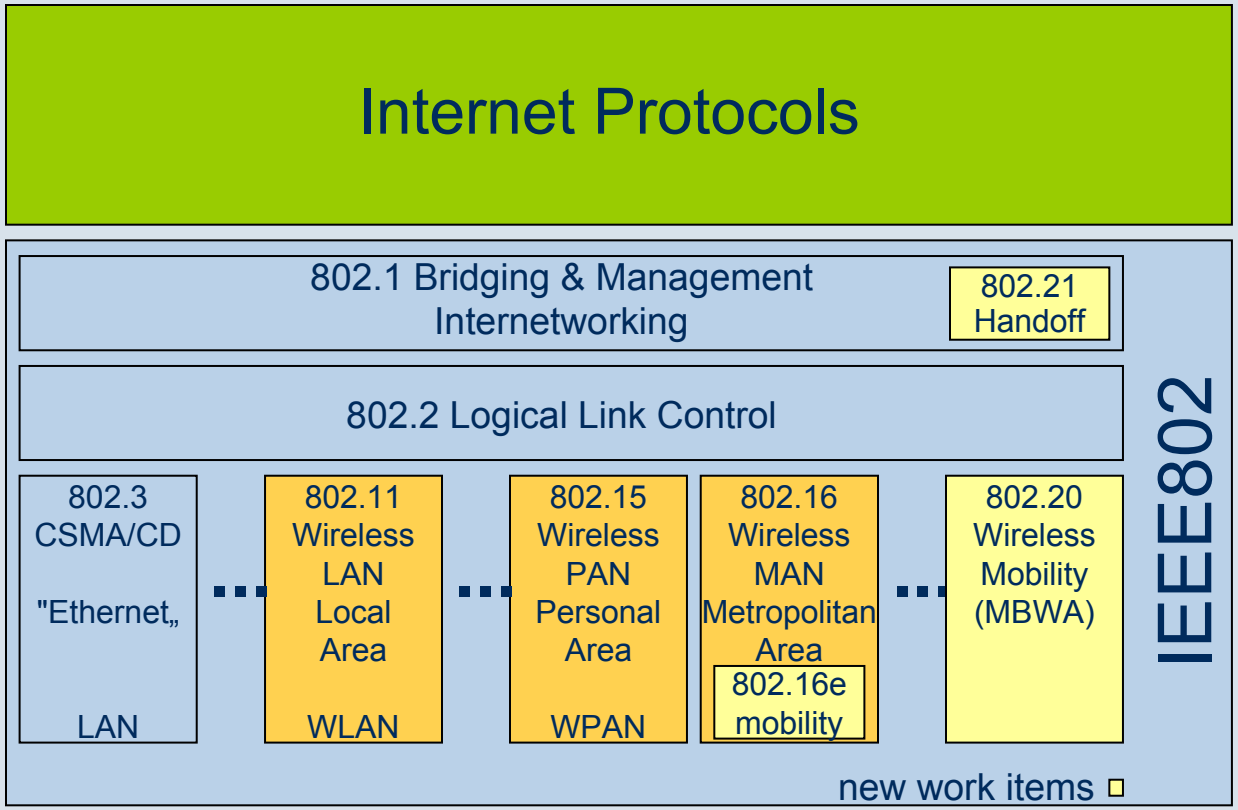

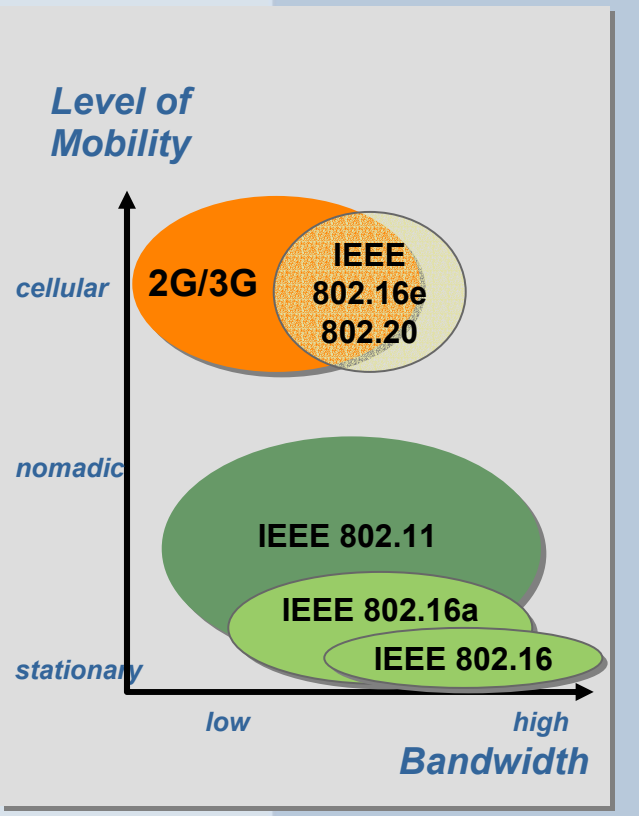

- IEEE802 provides a complete set of standards for carrying IP
- IEEE802 defines only the Physical and Link Layer of a network
- IEEE802 just recently started activities for mobile Internet access

IEEE P802: Active Groups

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- **802.1: High Level Interface (HILI) Working Group**
  - Chairman - Tony Jeffree (tony@jeffree.co.uk)
- **802.3: CSMA/CD Working Group**
  - Chairman – Bob Grow (bob.grow@intel.com)
- **802.11: Wireless LAN (WLAN) Working Group**
  - Chairman - Stuart Kerry (stuart.kerry@philips.com)
- **802.15: Wireless Personal Area Network (WPAN) Working Group**
  - Chairman - Bob Heile (bheile@ieee.org)
- **802.16: Broadband Wireless Access (BBWA) Working Group**
  - Chairman - Roger Marks (r.b.marks@ieee.org)
- **802.17: Resilient Packet Ring (RPR)**
  - Chairman - Mike Takefman (tak@cisco.com)
- **802.18: Radio Regulatory Technical Advisory Group**
  - Chairman – Carl Stevenson (carl.stevenson@ieee.org)
- **802.19: Coexistence Technical Advisory Group**
  - Chairman – Jim Lansford (jim.lansford@mobilian.com)
- **802.20: Mobile Wireless Access Working Group**
  - Chairman – Jerry Upton (jerry.upton@ieee.org)
- **802.21: Handoff Working Group**
  - Chairman – D.J. Johnson (dj.johnston@intel.com)

IEEE P802 Process

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- **Membership**
  - **Individuals (engineers)**
    - *other Telecom standardization bodies, e.g. ITU, 3GPP: Governmental Representatives, Companies*
- **Process**
  - Call for Contributions
    - Specific topics for discussion at next meeting
  - Receive and post written contributions
  - Discuss and debate at meeting
    - Create draft by 75% vote
  - Working Group Ballot
    - Ballot Responses: "Approve" or "Disapprove": indicate what needs to be changed
    - Comments have to be resolved by working group
  - IEEE "Sponsor Ballot“
    - same as above, but with more open group

IEEE P802 Membership

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- **Membership can be acchieved by**
  - participating in the initial meeting of the working group
  - participating at two out of the last four plenary sessions in the meetings of the working group
    - One interim meeting may be substituted for one of the two plenary sessions
    - Participation is defined as at least 75% presence at a meeting.
- **Membership starts at the third plenary session attended by the participant.**
- **Membership belongs to the individual, not an organization, and may not be transferred.**
- **Membership privileges may be revoked if any one of the following occurs:**
  - Failure to respond and vote on 2 out of 3 consecutive mandatory working group letter ballots
  - Failure to participate in 2 out of 4 consecutive plenary sessions. (Note: one interim can be substituted for one plenary session)

IEEE 802.11
Wireless LAN Standardization

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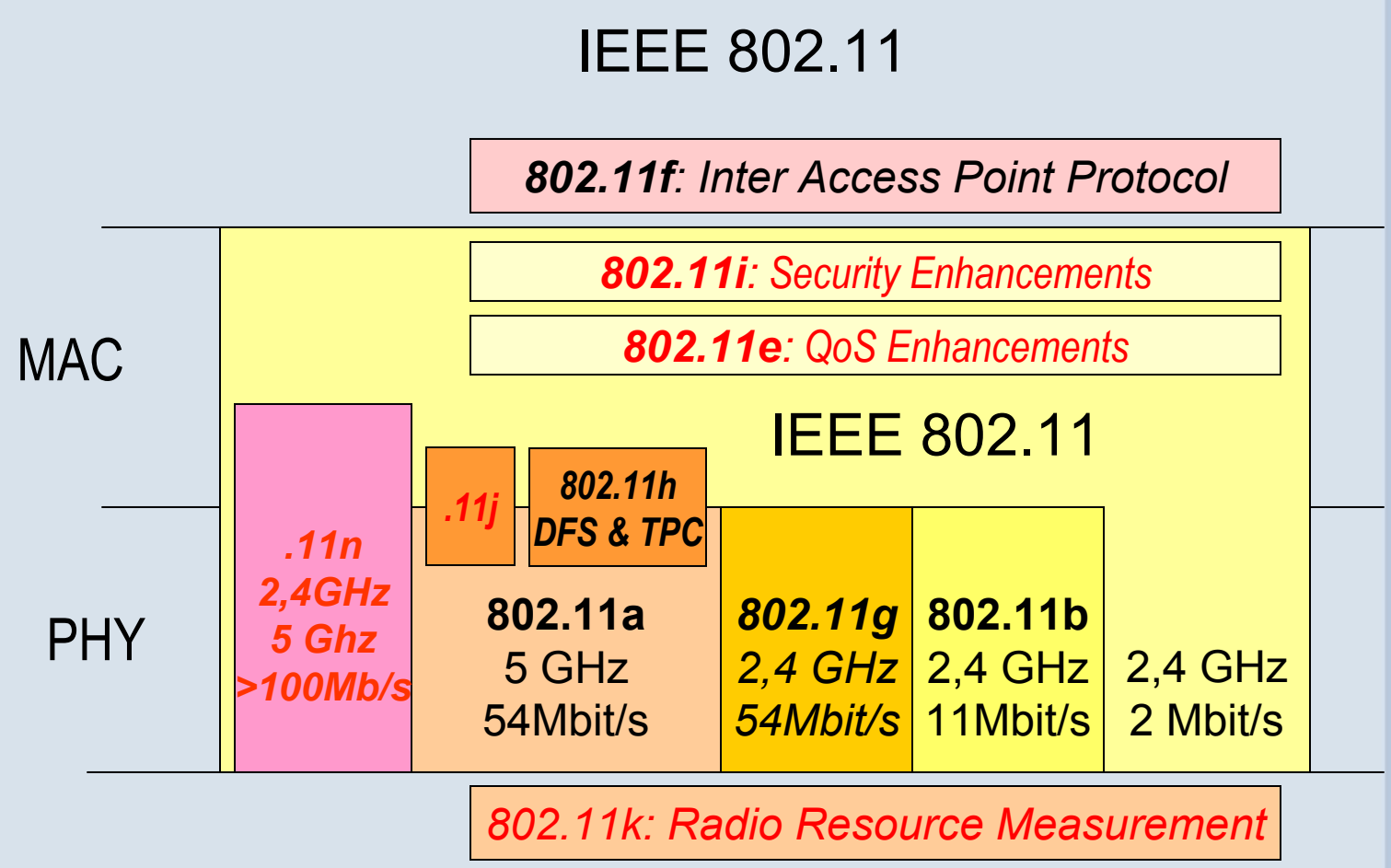

IEEE802.11 Wireless LAN
Status and latest topics

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Task group	Item	Status	completion expected
802.11e	MAC Enhancements in QoS	LB re-circulation	2004
802.11i	MAC Enhancements in Security	SB re-circulation	2004
802.11j	4.9-5.1 GHz for Japan	LB re-circulation	2004
802.11k	Radio Resource Measurements	Draft available	2005
802.11m	Maintenance 802.11	Interpretation requests	-
802.11n	High Throughput	Call for proposals March	2006
802.11p	*Wireless Access for the Vehicular Environment*	*PAR approved by WG*	*2005*
802.11r	*Fast Roaming*	*PAR approved by WG*	*2008*
802.11s	*ESS Mesh Networking*	*PAR approved by WG*	*2007*
WPP SG	*Wireless Performance Prediction*	*Started 01/2004*	*?*
WIEN SG	*Wireless Interworking with External Networks*	*Started 01/2004*	*?*
WNM SG	*Wireless Network Management*	*Started 01/2004*	*?*
WNG SC	Wireless LAN Next Generation Standing Committee	Creation of new groups	long time
Security SC	WLAN Security SC	Started 01/2004	long time

IEEE 802.16 Broadband Wireless Access

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Active Projects:

- **802.16REVd: Revision of 802.16, 802.16a and 802.16c including PHY enhancements for mobility support**
- **802.16e: *Mobile Wireless MAN* project**
- **802.16.2: 10-66 GHz Test Purposes project**

more details later...

802.18 - the Radio Regulatory TAG

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- **IEEE 802, the LAN/MAN Standards Committee, currently has 3 Working Groups with projects on standards for radio-based systems:**
  - 802.11 (WLAN),
  - 802.15 (WPAN), and
  - 802.16 (WMAN).
- **Therefore, monitoring of, and active participation in, ongoing radio regulatory activities, at both the national and international levels, are an important.**

IEEE 802.19 Coexistence TAG

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- Develop and maintain policies defining the responsibilities of 802 standards developers to address issues of coexistence with existing standards and other standards under development.
- Up to now only radio issues are investigated.

IEEE 802.20
Mobile Broadband Wireless Access

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- **Scope:**

  Mobile Broadband Wireless Access Network Operating in Licensed Frequency Bands and Supporting Mobility at Vehicular Speeds

more details later...

IEEE802.21 Handoff

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- **Scope:**
  Developing a standard specifying a common handoff framework applicable to 802 standards, wired and wireless

IEEE802 goes mobile: 802.20 and 802.16e

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- **March 2002: BOF held in P802.16 on mobile extensions**
- **July 2002: SG for mobile extensions failed in P802.16**
- **IEEE802 SEC sets up the MBWA ECSG on mobile radio interface**
  - supported by Flarion and Arraycomm
- **P802.16 sets up a SG for mobile extensions of 802.16a**
  - supported by InterDigital, Wi-Lan, Alvarion
- **November 2002: SEC approves both SGs driven by chair**
  - lobbying against: Nokia, Ericsson, Siemens
  - lobbying in favour: Cisco, Motorola
- **First activities on January 03 Interim to complete PARs**

802.20 and 802.16e (Unique Identities) Claiming 'Two Markets – Two Projects'

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Dimension	802.16e	802.20	3G
Technology	■Extensions to 802.16a MAC & PHY	■New PHY & MAC optimized for packet data and adaptive Antennas	■W-CDMA, cdma2000
	■Optimized for and backwards compatible with fixed stations	■Optimized for full mobility	■Evolving of GSM or IS-41
	■Licensed bands 2-6 GHz	■Licensed bands < 3.5 GHz	■Licensed bands < 2.7 GHz
	■Typ. Channel BW >5 MHz	■Typ. Channel BW < 5 MHz	■Typ. Channel BW < 5 MHz
	■Packet oriented architecture	■Packet oriented architecture	■Circuit oriented architecture – evolving to packet on the downlink
	■Channelization and control for multimedia services with QoS	■Channelization and control for mobile multimedia services. Mobile-IP Based	■Channelization and control optimized for mobile voice services. MAP/SS7 based
	■High efficiency data uplinks and downlinks	■High efficiency data uplinks and downlinks	■Medium efficiency data downlinks, low efficiency uplinks
	■Low Latency architecture	■Low latency data architecture	■High latency data arch.

802.20 Requirements from PAR

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Characteristic	Target Value
Mobility	Vehicular mobility classes up to 250 km/hr (as defined in ITU-R M.1034-1)
Sustained spectral efficiency	> 1 b/s/Hz/cell
Peak user data rate (Downlink (DL))	> 1 Mbps*
Peak user data rate (Uplink (UL))	> 300 Kbps*
Peak aggregate data rate per cell (DL)	> 4 Mbps*
Peak aggregate data rate per cell (UL)	> 800 Kbps*
Airlink MAC frame RTT	<10 ms
Bandwidth	e.g., 1.25 MHz, 5 MHz
Cell Sizes	Appropriate for ubiquitous metropolitan area networks and capable of reusing existing infrastructure.
Spectrum (Maximum operating frequency)	< 3.5 GHz
Spectrum (Frequency Arrangements)	Supports FDD (Frequency Division Duplexing) and TDD (Time Division Duplexing) frequency arrangements
Spectrum Allocations	Licensed spectrum allocated to the Mobile Service
Security Support	AES (Advanced Encryption Standard)

Sprint's wish list:

- up to 120 km/hr
- 2 b/s/Hz/Cell
- 1 Mbps/512 kbps
- 256/128 kpbs

- higher than 5 MHz
- link budget > 160 dB

- 2.5 GHz

IEEE802.20: Political fights from the beginning

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- **Proponents: Flarion, Arraycomm, Nextel**
  "Please rubberstamp our proposals"
- **Opponents: Qualcomm, Lucent, 3G vendors**
  "Go away!"
  - 802.20 is aiming to compete especially with 1X-EVDO
- **Bystanders: Motorola, Navini, Sprint**
  "We want something different"

- **None of the parties have reached sufficient majority to start productive work in the WG**

802.20: Status/Results from IEEE802 Interim meeting in January 2004

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- **About 80 people with about 40 voters were present**
  - there has been no quorum (no binding decision)
- **Standardization process is still in its very beginning**
  - Requirements, evaluation criteria and usage models
- **Lucent is still delaying progress by endless discussions**
  - in steady cooperation with Qualcomm
- **Monitoring participants from Japan and Korea**
- **Continuing interest from operators (T-Mobile, Vodafone, Cingular, Sprint, Nextel, France Telecom)**
- **Nextel and Sprint are trying to form operator alliance but DoCoMo is not interested**
- **Outlook**
  - Future will mainly depend of officer election in March
  - In the best case, the 1st draft may be available in first half of 2005

Comparison between 802.20 and 802.16e

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	IEEE 802.20	IEEE 802.16e
Estimated IEEE standard approval	2005 - 2006	2004 (802.16-rev 2003) → 2005 (802.16e)
Licensed frequency	Below 3.5 GHz	2 - 6 GHz
Bandwidth (TDD/FDD)	1.25 – 40 MHz	1.5 – 24, 1.75 – 28, 2.5 – 15 MHz
Spectral efficiency	> 2 bps/Hz/Sector DL	Not specified
# of simul. Sessions	> 100	Not specified
Data rate per user	> 1 Mbps DL > 300 kbps UL	>1 Mbps (4-24 Mbps in 6 MHz BW)
Mobility support	Up to 250 km/h	Target at 150 km/h
QoS	IETF	Connection-oriented
Latency	< 10 ms (RTT)	Not Specified
Cell deployment	Hierarchy, P2MP, Mesh	Hierarchy, P2MP
Handover	Soft and hard	Soft and hard mobileIPv4
Backward compatibility	None	802.16a

Ongoing discussions

IEEE 802.16 Standards Family

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	802.16	802.16a	802.16e
Completed	December 2001	January 2003 (802.16a)	Estimate mid '04
Spectrum	10 - 66 GHz	< 11 GHz	< 6 GHz
Channel Conditions	Line of Sight Only	Non Line of Sight	Non Line of Sight
Bit Rate	32 – 134 Mbps in 28MHz channel bandwidth	Up to 75 Mbps in 20MHz channel bandwidth	Up to 15 Mbps in 5MHz channel bandwidth
Modulation	QPSK, 16QAM and 64QAM	OFDM 256 sub-carriers QPSK, 16QAM, 64QAM	Same as 802.16a
Mobility	Fixed	Fixed, Portable	Nomadic Mobility
Channel Bandwidths	20, 25 and 28 MHz	Scalable 1.5 to 20 MHz	Same as 802.16a with UL sub-channels
Typical Cell Radius	2-5 km	7 to 10 km Max range 50 km	2-5 km

802.16: Status/Results from IEEE802 Interim meeting in January 2004

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- **About 150 participants**
  - remarkable increase since last meeting
  - currently 63 voting member, about 30 present on the meeting
- **Apparently broad interest in 802.16d/e**
  - caused by WiMAX and Korean interest
  - Samsung and Intel are now heavily driving completion
  - Extremely high participation from Korea
    - especially in TGe more than 50% coming from Korea
  - Many participants from Intel, mostly in TGd
- **Nokia, Qualcomm showed up (again)**
  - many other companies started monitoring
- **A liaison letter was received from Korean TTA PG05 (HPi Standardization Project) asking for cooperation on the mobile WMAN specification**
  - Intel actively promoted the use of WiMAX instead of home-grown HPi in Korea end of last year.

Koreans' interest in IEEE802.16e/WiMAX
original HPi Physical Layer Specification

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Frequency Band	2.300GHz ~2.400GHz
Channel Bandwidth	10MHz
Multiple Access	OFDMA-TDD
Modulation	QPSK, (8PSK), 16QAM, 64QAM
Channel Coding	CTC (Convolution Turbo Code)
Frame Length	5msec
Maximum Data Rate	30Mbps (without SA/MIMO)
	50Mbps (with SA/MIMO)
AP Synchronization	GPS
Cell Coverage	Urban ~1Km
	Suburban ~5Km

Intel's interest in IEEE802.16e/WiMAX

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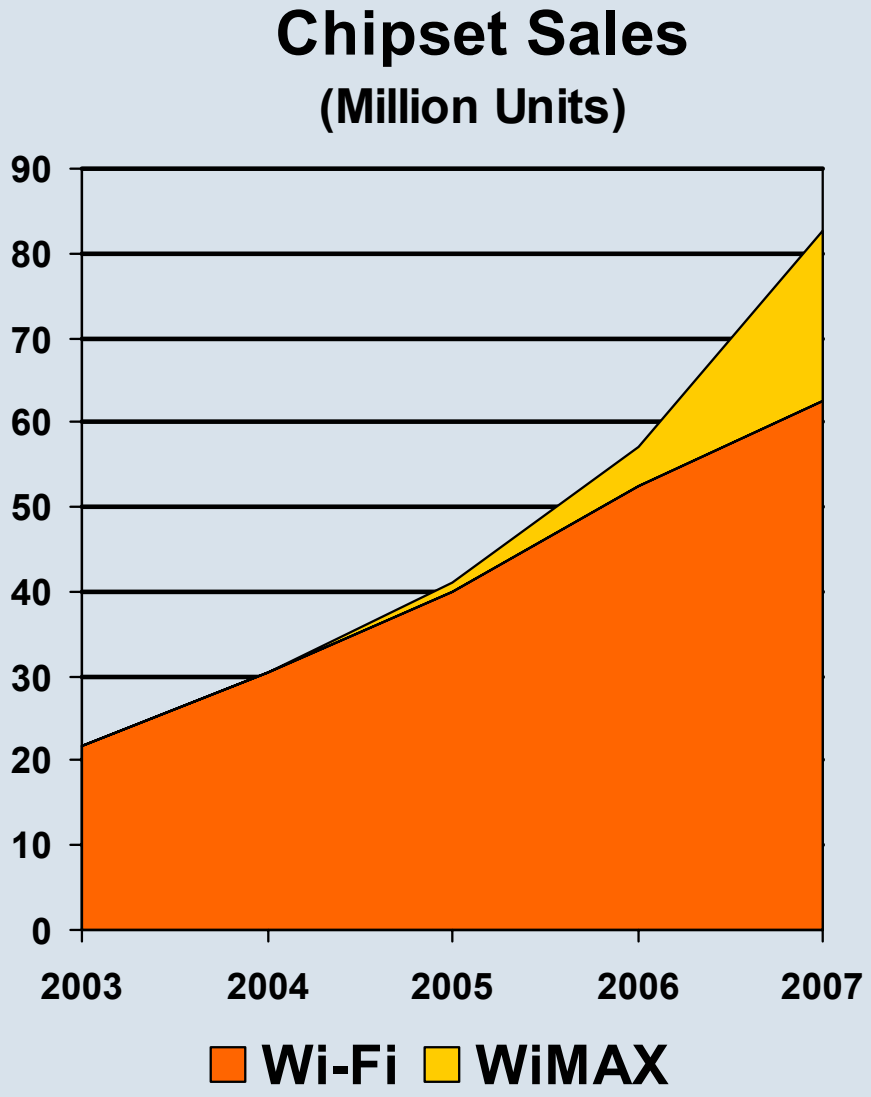

- **Wi-Fi**
  - Expanding from laptops to consumer desktops, then handhelds & handsets
  - 802.11b becoming the Wi-Fi equivalent of a 28.8 modem
- **WiMAX**
  - '04 and '05: CPE chip-set creates the category
  - ***'06 and beyond: Mobile chip-set enables volume ramp***

Sources: Dell'Oro (Wi-FI) and ICG (Wi-Max)

Intel's view of WiMAX Market Evolution
Fixed Outdoor in '04

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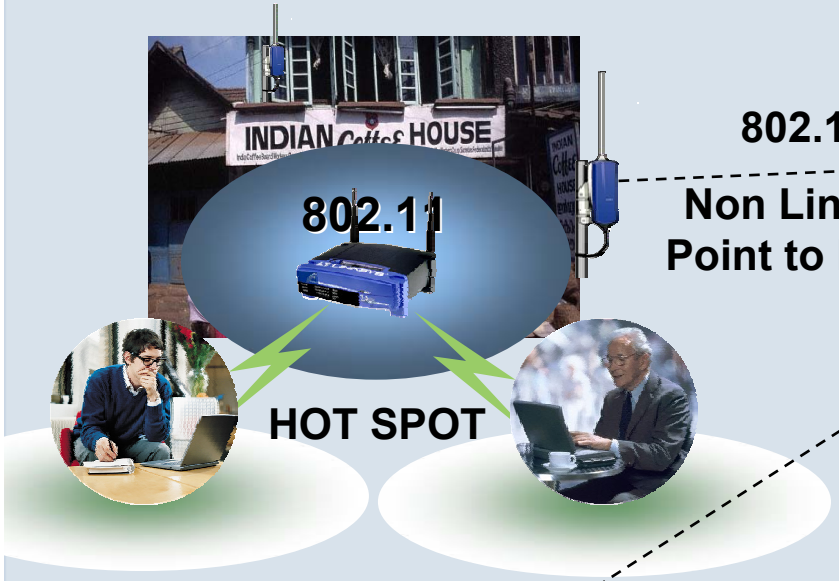
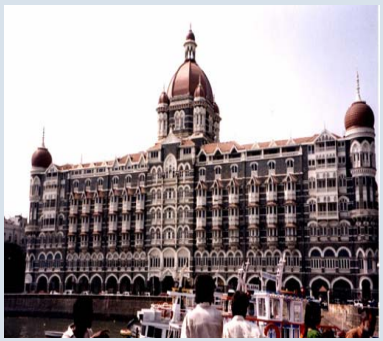


802.16a
Non Line of Sight
Point to Multi-point

Point to Point
BACKHAUL

802.16a



E1/T1+ LEVEL
SERVICE ENTERPRISE

FRACTIONAL E1/T1
for SMALL BUSINESS

Solution
Fixed location
Outdoor installed
Applications
E1/T1 level service
Backhaul for Hotspots
Residential BBA

Internet
Backbone

Intel's view of WiMAX Market Evolution
Consumer Indoor in '05

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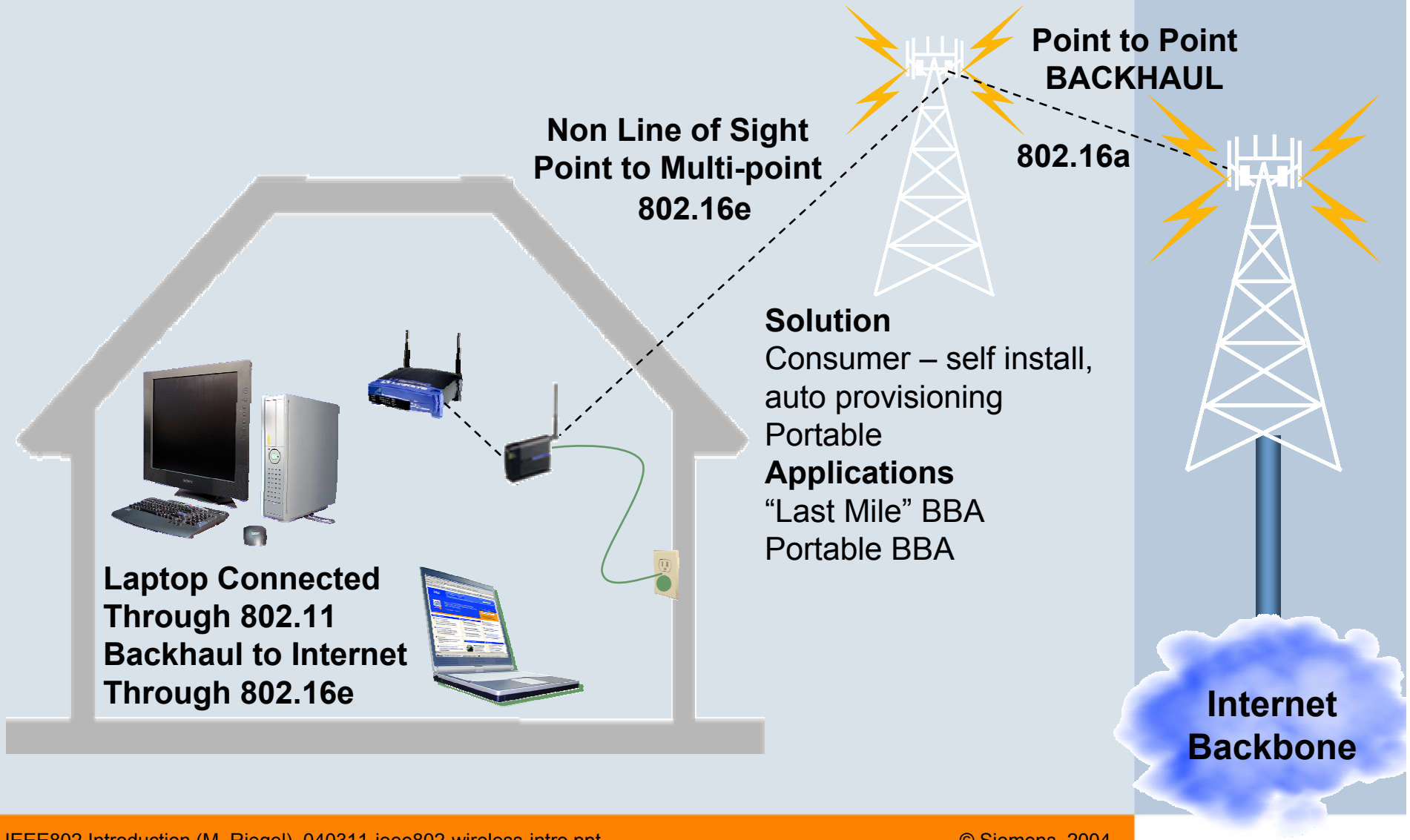

Intel's view of WiMAX Market Evolution
Mobile Consumer in '06

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Non Line of Sight
Point to Multi-point

802.16e

Point to Point
BACKHAUL

802.16a

802.16e
802.11 indoors
Always
Best
Connected

Solution

- Native in Mobile PC
- Roam at varying speeds

Applications

- "Mobile" BBA for consumers
- Simple Network Selection

Internet Backbone

Telecommunication Market Segmentation: ‘WiMAX’ is addressing a new market

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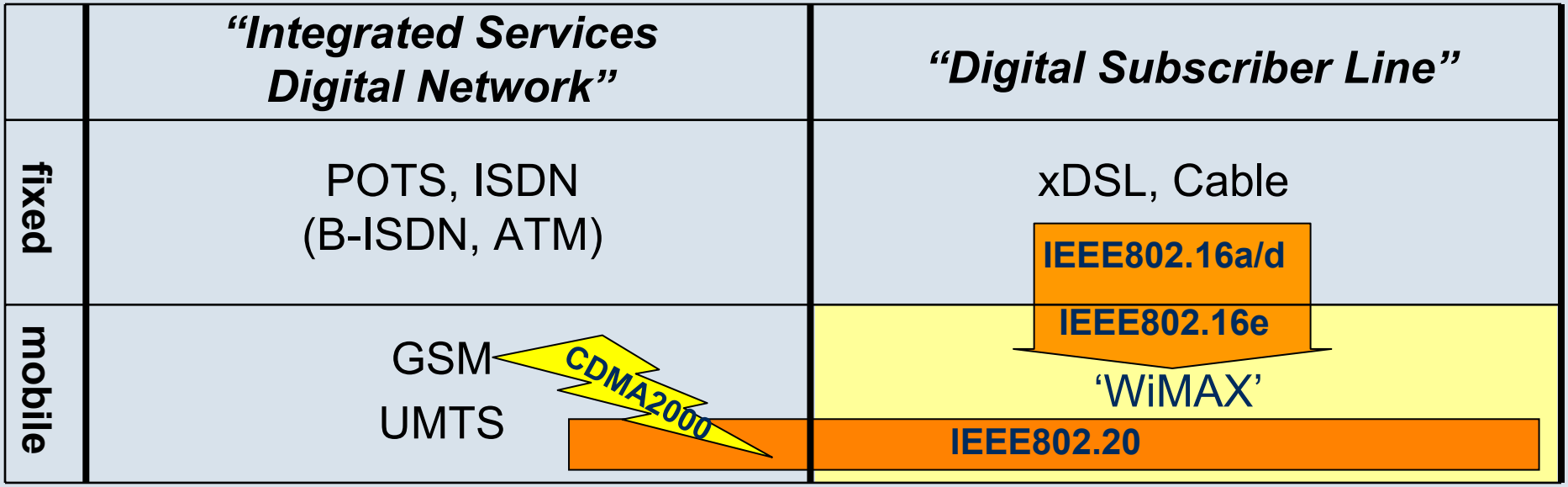

- **Voice, realtime messaging, realtime streaming**
- **Services tied into the network**
  - Services are provided by operator
- **Defined, guaranteed QoS**
- **Detailed accounting, charging and billing**

- **Web, e-mail, streaming, file download, (VoIP)**
- **Access to the Internet**
  - Services are anywhere in the Internet
- **Best effort, diffserv enabled**
- **Simple billing, often flat-rate**

Getting the latest status of activities in IEEE802

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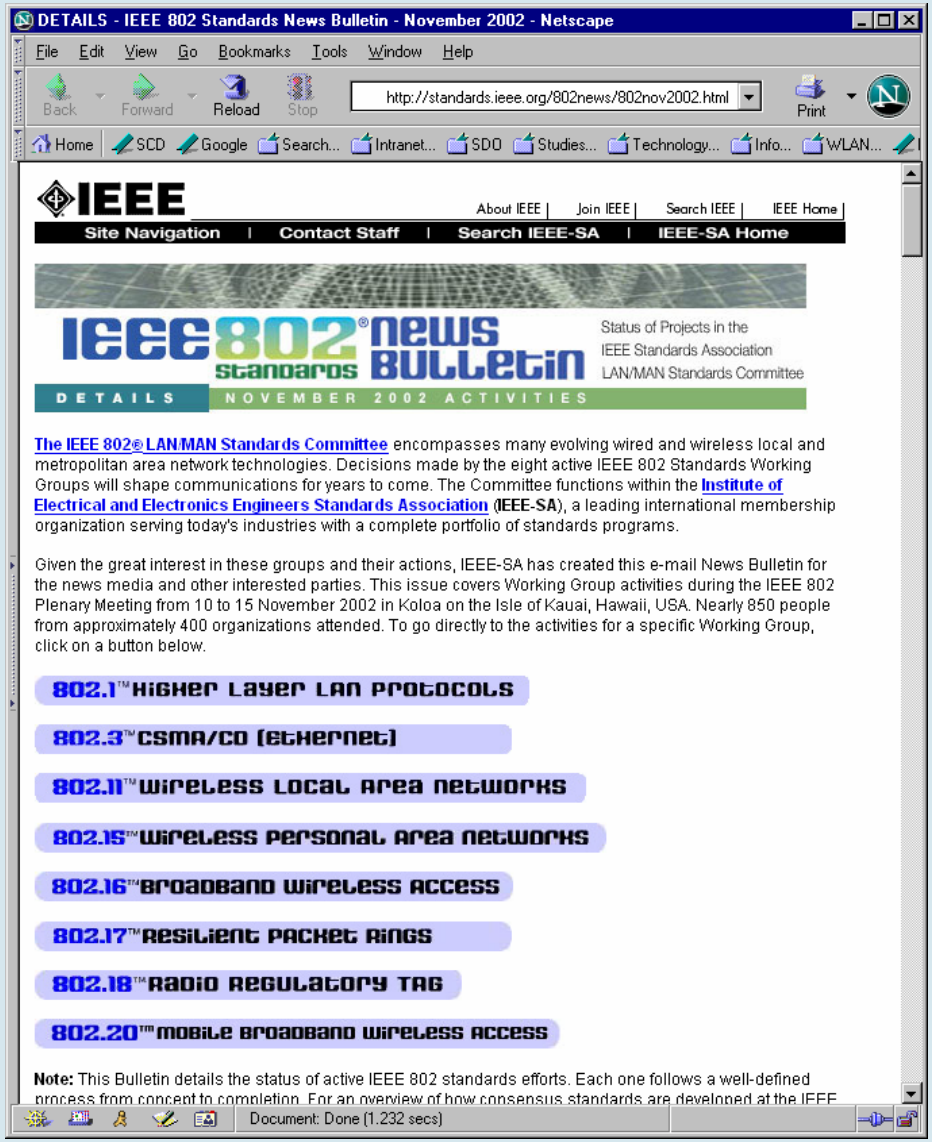
Directly after each Plenary Meeting (March, July, November) a News Bulletin on all active working groups is published on the IEEE Standards Association web-site.

Link:

http://standards.ieee.org/802news/



The end

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- Thank you for your attention.
- Questions and comments?
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