

IEEE 802.11

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IEEE 802 Background

- **IEEE Computer Society**
 - Local Network Standards Committee
 - Project 802 (IEEE sequence number for standards projects)
 - First meeting 1980
 - Goal: LAN standard 1-20 Mb/s



Working Groups (WGs) Technical Advisory Groups (TAGs)

- Initially:
 - **PHY (Physical Layer)**
 - **MAC (Medium Access Control)**
 - **HILI (Higher Layer Interface)**



Initial standards

- **Three MACs:**
 - CSMA/CD
 - Token bus
 - Token ring
- **Common upper interface to LLC-sublayer (Logical Link Control)**



WGs and TAGs

802.1	a	Higher layer LAN protocols
802.2	i	Logical link control
802.3	a	Ethernet
802.4	i	Token bus
802.5	i	Token ring
802.6	d	Metropolitan area networks
802.7	d	Broadband TAG
802.8	d	Fiber optic TAG
802.9	i	Isochronous LAN
802.10	i	Security
802.11	a	Wireless LAN
802.12	i	Demand priority
802.13		???
802.14	d	Cable modem
802.15	a	Wireless PAN
802.16	a	Broadband wireless access
802.17	a	Resilient packet ring
802.18	a	Radio regulatory TAG
802.19	a	Coexistence TAG
802.20	a	Mobile broadband wireless access

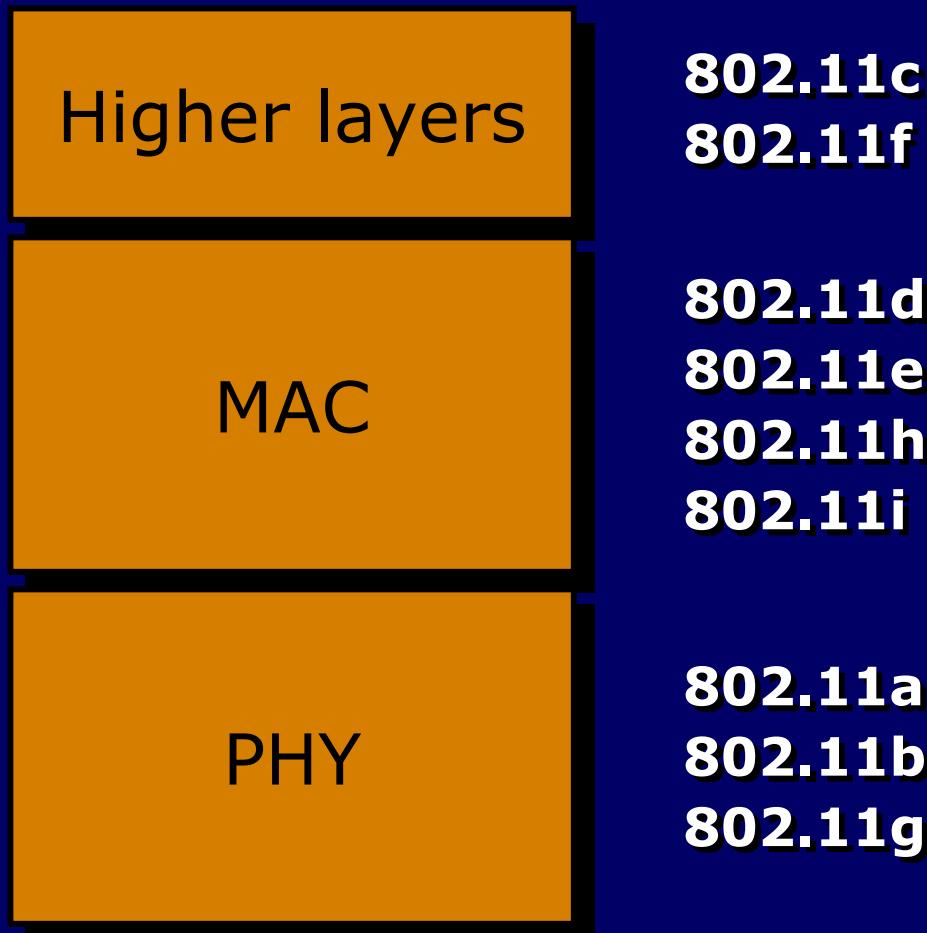


802.11 Task Groups (TGs)

MAC	WLAN MAC in conjunction with PHY
PHY	WLAN PHY: IR, 2.4 GHz FHSS and DSSS
TG _a	PHY for UNII (US 5 GHz)
TG _b	Higher rate PHY for 2.4 GHz ISM-band
TG _b _cor1	Corrections to 802.11b
TG _c	802.11 bridging (802.1)
TG _d	Operation in new regulatory domains, roaming
TG _e	QoS (previously also security, authentication)
TG _f	Inter-AP protocol, interoperability
TG _g	Higher data rates for 802.11b, > 20 Mb/s
TG _h	Enhance MAC and 802.11a PHY (for CEPT approval)
TG _i	Enhance MAC for security and authentication
TG _j	802.11 and 802.11a PHY 5 GHz operation in Japan
TG _k	Radio resource measurements (for higher layers)
TG _l	-
TG _m	802.11 standard corrections maintenance
TG _n	High throughput PHY



IEEE 802.11



IEEE 802.11

- **Wireless 802.3 LAN**
- **PHY (1 and 2 Mb/s)**
 - FHSS (frequency hopping)
 - DSSS (direct sequence)
 - IR
- **MAC**
 - CSMA/CD \Rightarrow CSMA/CA
- **Approved 1997**



IEEE 802.11a

- High rate PHY, 6 - 54 Mb/s
- 5 GHz UNII-band
- OFDM (Orthogonal frequency division multiplexing)
- Almost same PHY as HiperLAN2
- Approved 1999



IEEE 802.11b

- **High rate PHY, 5.5 and 11 Mb/s**
- **2.4 GHz ISM-band (83 MHz, 22 MHz channel)**
- **CCK (Complementary code keying)**
- **Approved 1999**



IEEE 802.11c

- Recommendations about bridge operation procedures
- Used by AP manufacturers
- Interoperability of APs
- Approved 1998



IEEE 802.11d

- Extending operations to new regulatory domains
- Specifically 5 GHz
- Approved 2001



IEEE 802.11e

- New MAC
- QoS and improved efficiency of 802.11 MAC
 - Max delay
 - Min data rate
 - Max packet error probability
- Service set provided (802.2 service primitives)
- Priority (3 bits) \Rightarrow 8 levels (4 classes)
- Packet-by-packet handling
- Delay probability distribution for each packet priority
- Delay vs. timeout (dropping)
- Modify CWmin, CWmax etc.
- Multiple packet transmissions at a time
- Client-to-client transmissions



IEEE 802.11f

- Higher layer protocol
- Communication between APs
- Roaming between multi-vendor APs
- Fast hand-off



IEEE 802.11g

- Higher rate PHY for 2.4 GHz ISM-band
- > 20 Mb/s (max 54 Mb/s)
- Backward compatibility with 802.11b (through CCK and RTS/CTS)
- CCK and OFDM mandatory
- Other optional modulation schemes



IEEE 802.11h

- Use of 802.11a in 5 GHz-band in Europe
- Include dynamic frequency selection (DFS) and transmit power control (TPC)



IEEE 802.11i

- Enhanced security and authentication in 802.11i
- WEP not enough



IEEE 802.11j

- Use of 802.11a in the Japanese 4.9 GHz band



IEEE 802.11k

- Radio resource measurement provisions to higher layers
- Improve deployment of large 802.11 networks



IEEE 802.11m

- Maintenance of existing standards



IEEE 802.11n

- High throughput PHY and MAC
- 108-320 Mb/s
- Reduced overhead
- Year 2005-2006!

