# Introduction of IEEE P802.11

Prepared by Vic Hayes, Chair, AT&T
Utrecht, the Netherlands

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## Representation

- For the Frequency Hopping medium
  - Peter Chadwick, G3RZP
    - GEC Plessey Semiconductors, Inc
    - Wiltshire, United Kingdom
  - Naftali Chayat
    - BreezeCom
    - Tel Aviv, Israel
- For the Direct Sequence medium
  - Don Sloan
    - Aironet Wireless Communications Inc.
    - Akron, Ohio

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## Outline

- Organization
  - IEEE P802
  - IEEE P802.11
- Functional requirements
- Physical layers
- Medium AccessControl

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## IEEE PROJECT 802

- Local and Metropolitan Standards Committee (LMSC)
- Formed in 1980
- Sponsored by the Computer Society
  - Largest of 35 Societies
- Local Area Networks (LANs)
  - The only LAN standards development organization
- 8 Standards adopted as International Standard by ISO/IEC
  - International Standards Organization and International Electrical Committee
- Metropolitan Area Networks
- Over 450 Voting Members, over 600 Observers
- 11 Working Groups, 2 Technical Advisory Groups 802.1 through 802.14

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## IEEE PROJECT 802

- Local Area Network - Definition
  - Moderate to high signalling rate
    - > 1 Mbit/s
  - Moderately sized geographic area
    - Room to campus size
  - Generally owned, used and operated by single user
    - In contrast to wide area networks
  - Common shared medium

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## IEEE Project 802.11

- Wireless Local Area Networks Standards Working Group
- Established July 1990
- Membership
  - 79 voting members, 28 aspirant voting members
  - Membership is by individual, not by company
  - Complete mailing list with over 180 addresses
    - USA, Canada, Europe, Israel, Japan, Korea, Taiwan
  - Manufacturers
    - Computers
    - Micro-electronics
    - Infra-red
    - Radio equipment
  - Users
    - Government
    - Manufacturers

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# 802.11 Functional requirements

- Requirements study showed two types of networking needs:
  - asynchronous, that is bursty traffic, but when something to send: need for very fast delivery
  - isochronous, that is regular traffic, in small amounts at a time, but at a constant pace
- Therefore 802.11 adopted the following requirements:
  - Asynchronous MSDU delivery on all stations
    - MSDU is the MAC Service Data Unit
  - Optionally "time-bound MSDU delivery service"
- Pedestrian speed and vehicular speed
  - premises environment
- Security: first review 802.10 provisions
- Common MAC to support various PHYs
  - regulation dependency

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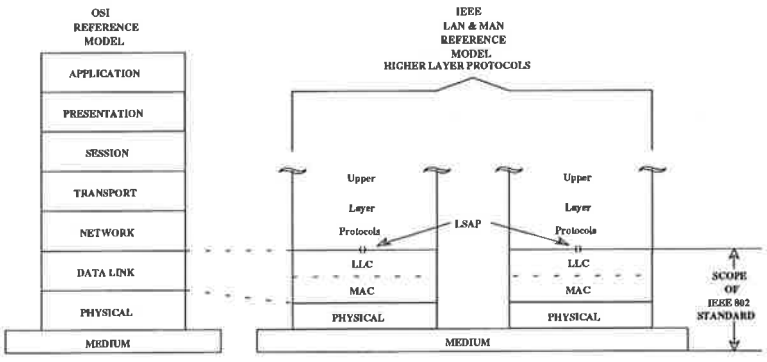
# Computer Architecture

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# Multiple PHYs

| | MAC | PHY | | |
|---|---|---|---|---|
| *wired* | 802.3 | 10BASE2<br>10BROAD36<br>10BASE-T<br>10BASE-FP<br>10BASE-FB | 10BASE5<br>1BASE5<br>10BASE-F<br>10BASE-FL | all Ethernet, but not inter-operable on the medium |
| *wireless* | 802.11 | DSSS<br>FHSS<br>IR | | possibly all 802.11, but not inter-operable on the medium |

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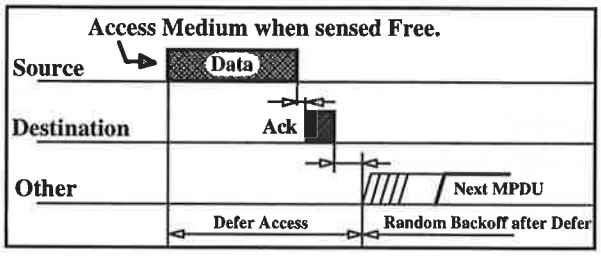
# 802.11, MAC: Basics




- "Distributed Medium Access Control Protocol" using an Ethernet like ***CSMA/CA + Ack*** scheme.
  - Collision "Avoidance" rather then a "Detection" scheme.
    - Effectiveness demonstrated in ***Wavelan*** product.
  - Allows MAC level recovery of "Lost Packet" using a retransmission algorithm.
  - Includes provisions to deal with "Hidden Nodes".

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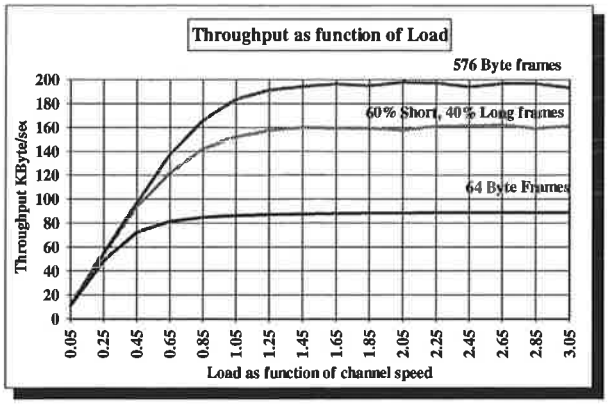
# 802.11, MAC: Performance




- Efficient and stable throughput.
  - Example: Based on 2 Mbps ***Wavelan*** speed.

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# 802.11, MAC: Other Functions

- Roaming through the Wireless Infrastructure
  - Maintain Continuous connectivity
  - Station will "Re-Associate" with Access Points based on "Signal / Link Quality".
  - Support multi channel roaming.
  - "Distribution System" will adapt to logical location changes of the station.
- Provisions to use minimum Battery Power
  - Strategy: Switch nodes off as much as possible, while maintaining network configuration.
  - Traffic buffering functions are included in the Access Point to support this.
- "Wired Equivalent Privacy" encryption algorithm is included.

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## 802.11, PHY, Radio

- Concentrate radio work on the 2.4 GHz band (ISM)
  - Most promising globally Spread Spectrum required
- Also allowed to start work in 1.9, 5.2 and 5.8 GHz bands
  - no activity yet

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## Direct Sequence Spread Spectrum

- Direct Sequence uses an 11 chip Barker Sequence to multiply the transmitted data
- Receiver divides received signal by same Sequence to recover the data
  - narrow band interference deminished
  - implementations can resolve multipath in the correlation
- modulation of 2 Mbit/s in DQPSK (Differential Quaternary Phase Shift Keying)
- fall back modulation of 1 Mbit/s in DBPSK (Differential Binary PSK)
  - 3 channel pairs for USA
  - 3 channel pairs for Europe (1 pair with single channel)
  - 1 channel for Japan

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## Frequency Hopping Spread Spectrum

- Frequency Hopping uses one of out 79 channels at a time
- hops from one frequency channel to the next at a 2.5 hops/s
  - 3 sets of 22 hop sequences defined
- modulation for 1 Mbit/s in 2 level GFSK (Gaussian Frequency Shift Keying)
- modulation for 2 Mbit/s in 4 level GFSK, channel permitting

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## 802.11, PHY, Infra-Red

- Modulation for 1 Mbit/s (basic rate) in 16-PPM (Pulse Position Modulation)
- Modulation for 2 Mbit/s (enhanced rate) in 4 -PPM
- Transmitter illuminates the ceiling with a diffuse

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## Status

- Second draft ballot conducted
- 47.5 % approval (75 % required, unanimous preferred)
  - 31 (17) approving
  - 33 (66) disapproving
  - 5 (11) abstaining
- Resolving negative votes at November/January meeting
- Second draft sent to ISO annexed to a Proposed New Work Item

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## IEEE P802.11 schedule

- WG Confirmation ballot Jan/Feb 1995
- Resolve issues at March 1996 meeting
- Sponsor Ballot Mar/Apr1996
- Resolve issues at May 1996 meeting
- Sponsor Confirmation ballot Jun 1996
- Resolve issues at July 1996 meeting
- Standards Board meeting September 17-18, 1996

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