

IEEE 802.9 Wireless IS LAN MAC and PHY

IEEE 802 Tutorial
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Introduction -- Part I

- **Goal:** New Wireless IS LAN MAC and PHY for 802.9 IS LAN (IS = Integrated Services)
- Use of new NII Band frequency space--200 MHz at 5.25 GHz
- Consider for differentiation:
 - à *World-wide developments of Wireless ATM*
 - à *Completion of IEEE 802.11 Standard*
- **Action Request**--write/message to Dhadesugoor Vaman, the Chairman of 802.9: I / we support the formation of a Study Group to address the possibility of a PAR for a Wireless MAC and PHY for 802.9. Depending upon the direction taken, it is probable that (my organization) would participate in an effort to develop such a standard.

Service Definition at User Station

- **Packet LAN services**
 - à *802 LLC higher layer interface, and at this point:*
 - à *Successful transfers of errorless packets at wireline probability*
 - à *Low access delay (<1.5 msec) and high transfer rate after access (16 Mbps)*
- **Connection-type services**
 - à *ISDN/Telecom-based higher layers with on-demand up to 24/30 B channels one or two-way*
 - à *Future capacity reservation*
 - à *Low through-system transfer delay (<6 msec including quantization delay)*

System Suitability Definition

- **Near 100% area coverage within a building and nearly that within a campus**
 - **Intensive reuse of the channels for high Mbps per hectare/acre**
 - à *Interference-limited radio system design*
 - à *Robust rather than high bps/Hz radio modulations*
 - **One radio infrastructure for all supported services**
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External WAN Interconnectability Supported

- **Telecom ISDN (PRI) and customary transports (T-1, T-3, SONET)**
 - **Router Ports for 100BaseT and possibly FDDI**
 - **ATM UNI at selected transport interfaces (future)**
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Markets and Applications

- **In and out-of-building access to both external LAN, internet and telecom networks where ever that function is useful**
 - à *School, university, commercial and manufacturing campii or individual premises*
 - à *Wireless gateways to any existing private or public network*
 - à *Fast setup facilities for convention centers, disasters or construction sites*
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Value of Extending 802.9

- **802.9 is the primary Integrated Services group in 802 at workstation interface level**
- **There is no difference in the services provided by 802.9 now relative to those of a new PAR**
- **802.9 has defined an interface between a user station and a physical medium where a central manager serves multiple physical medium ports**
- **802.9 has already dealt with localizing the standard to a station interface when there is a multiport central machine external to the scope of the standard**
- **802.9 is more likely to recognize need for an ATM upward interface than pure LAN groups**

Why Not Extend 802.11?

- 802.11 has decided that their use of the NII band will use their existing MAC including distributed logic and LBT, but with modifications for increased medium transfer rate.
- 802.11 has no provision for telecom connection-type services
- 802.11 has no provision for central coordination of many channel sharing access points
- In this radio band, a variant of HIPERLAN /1 is an existing standard; and it might be a better MAC for an LBT access method with distributed logic

Do WAND and HIPERLAN /2 make this project redundant?

- WAND (Wireless ATM Network Demonstrator) is the European wireless ATM development. ETSI RES 10 HIPERLAN /2 is the development of the physical layer.
- The headline statement will be true when and if PC's commonly execute ATM setup logic. Winsock 2 is a step in this direction. When the general purpose PBX's use an ATM rather than an ISDN interface, it is here.
- The proposal is that stations use legacy protocol stacks, and that the formal transition to ATM, when required, comes at a central hub equipment

Request for Action:

- Address the Chairman of IEEE 802.9:
Professor Dhadesugoor Vaman <vaman@ati.stevens-tech.edu>
- In writing use words like the following:

I / we support the formation of a Study Group to address the possibility of a PAR for a Wireless MAC and PHY for 802.9. Depending upon the direction taken, it is probable that (my organization) would participate in an effort to develop such a standard.

Signature and organizational identification

Technology--Part II

- **Segmentation is Inevitable and Beneficial**
- **The 802.9 Protocol Stack Now (Figure)**
- **The MAC function should be common to both Packet and Connection bearing cells**
- **The 802.9 Protocol Stack After Adding a Wireless PHY/MAC (Figure)**
- **The Local Connection Concept**
- **Protocol Requirement for 90% Capacity Utilization**
- **Radio Propagation Problems Influencing MAC**
- **Important Details**
- **Anticipation of Changes in NII Band FCC Rules**

Segmentation is Inevitable and Beneficial

- **Segmentation to a 48 octet payload corresponds to a 12 millisecond accumulation delay at a 32 Kbps channel rate.**
- **The access delay experienced for packets and connections is a multiple of the average holding time per channel use**
- **802.11 “fragments” packets to 256 octets for transmission**
- **The shorter the segment the higher the probability of error-free reception and the less channel time invested in unusable transmission--and the higher the overhead**
- **For peer-to-peer communication where peers may or may not be served by the same access point, *no reassembly of segments is necessary for local relay***

The 802.9 Protocol Stack Now

- **There are separate LLC and MAC's for packet and connection type services**
- **The two stacks are use separate multiplexed space in the PHY frame**
- **The modem and line functions are common to both**

A Common MAC Function for Both Packet and Connection Bearing Cells

- All of the present IS Protocols (802.6, 802.9 and Telecom SDH) are an isochronous medium where time slots are dedicated to either packets or connections using a physical medium multiplexer
- Priority and queue management are more efficient using a common space rather than a fixed partition into one space for each service
- The total amount of logic equipment is reduced by shared rather than independent MAC's

The 802.9 Protocol Stack After Adding a Wireless PHY/MAC

- There are still two LLC and higher level interfaces for packets and connections
- The two services are separately segmented, multiplexed and sent as a common stream to the MAC
- There is now one common MAC and PHY

The Local Connection Concept

- Stations talk to the central Hub to request service and use of the radio medium
- After setup, station-originated connections and packets are repeated either to a second connection/path to an external network or to another station within the system
- Segmented packets are treated as a connection with a duration of one packet length between station and Hub
- Connection type services include bounded size reservation of future capacity managed by the Hub where the reservation is *not* that of a particular time slot

Protocol Requirement for 90% Capacity Utilization

- To achieve near 100% of capacity utilization, it is necessary that access for service requests be near out-of-band and near non-blocking
- The function must be that of Erlang C blocking to aid in calculation of probable wait delay as a function of traffic loading
- The delay experienced for both packets and cells is a multiple of the average holding time for each individual use of the channel--short bursts are essential to low access delay
- The channel(s) must be as large as possible for a given pool of users

Radio Propagation Problems Influencing MAC

- High inherent non-random error rate from multipath and interference
 - Variability of user station location and resulting propagation path
 - Need for access point diversity requires suspension of principle:
“only one path at a time to any user station”
 - Variable path to user station must be shielded from outside networks
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Important Details

- Forward error correction
 - MAC level repeat send
 - Positive ACK for all packet segments
 - NACK and one retry for connection segments
 - Modulation method optimized for resistance to like-signal interference
 - Transmitters are ON only when in use
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Anticipation of Changes in NII Band FCC Rules

- The WINForum SRDS Committee is working on sharing rules
- Results will be incorporated in a future filing with FCC
 - à *It is improbable that LBT will be either required or prohibited*
 - à *Probably, there will be defined channeling 20-25 MHz*
 - à *There might be duty cycle or transmitter ON time limitations*
 - à *There will almost surely be additional restrictions on out-of-band radiation*