INVITATION TO CONTRIBUTE for 802.16.1 MAC at Session #8
Revised: 1 June 2000
Deadline: 30 June 2000

The IEEE 802.16 Working Group on Broadband Wireless Access is in the process of defining the 802.16.1 broadband wireless access air interface specification in accordance the "Development Plan for the 802.16.1 Air Interface Standard" (Document IEEE 802.16-99/05). According to that document, selection of a draft was scheduled for Session #7 in May 2000, with refinement to follow. Task Group 802.16.1 selected an initial draft physical layer (PHY) specification at Session #7. However, a decision on the initial draft medium access control layer (MAC) was delayed until Session #8 (10-14 July in La Jolla, CA, USA) pending a **joint** proposal by the authors of the two invited MAC proposals presented at Session #7 (Documents IEEE 802.16.1mc-00/14r0 and IEEE 802.16.1mc-00/15r1).

In accordance with that decision, this Invitation to Contribute invites the individuals listed below to contribute a joint proposal for an 802.16.1 MAC specification. Should they reply responsively, their contribution will be accepted and published and they will be offered a position on the presentation agenda at 802.16 Session #8 to present and discuss the merits of their proposal. Uninvited co-submitters are welcome.

The contribution will be considered only if submitted using Revision 8 or higher of the 802.16 Document Submission Template <http://ieee802.org/16/docs/802_16_template.doc>.

The proposal will be evaluated based on the criteria in Tables 2 and 3 of the 802.16.1 Functional Requirements Document (IEEE 802.16s-99/00r1).

Contributions must follow the guidelines below:

• Submit a document in the format of a draft standard that complies with the requirements in the attached
  Technical Supplement.
• Include a descriptive title.
• Include an overview and a reference model that describes functions, including interfaces to other layers.
• Explain how the proposal relates to existing standards and note the differences.
• Describe the benefits of the proposal, including any unique features.
• Describe all drawbacks of the proposal.
• Include a statement on intellectual property rights and how 802.16 may utilize the proposal in a standard.
• **Address each item** in the "Media Access Control Layer" section of the "Outline of the 802.16.1 Air Interface Standard" (Document IEEE 802.16-99/06d0) or a slightly amended version of that outline.
• **Include a copy of the relevant Evaluation Tables specifically addressing each criterion.**

The contribution will be considered non-confidential and will be posted, as soon as possible following receipt, for public access on the 802.16 Web Site <http://ieee802.org/16>.

Email your contribution, for receipt by the **deadline of 30 June 2000**, to both of the following:

• 802.16 Chair Roger Marks <mailto:marks@nist.gov>
• 802.16.1 Chair Lou Olsen <mailto:louis.olsen@teligent.com>

Suggested improvements to and evaluations of the proposal will be welcome at Session #8.

**This invitation for a joint submission is issued to**:
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Technical Supplement

The MAC protocol shall respect the following guidelines:
- (a)   It shall have a parameterized protocol independent Service Access Point (SAP)
- (b)   Higher level SAP shall be done by TLV encoded messages
- (c)   The ability to assign different levels of QoS to MAC management messages shall be required
- (d)   A set of default SAP parameters shall be defined
- (e)   Connection Identifiers (CID) shall uniquely define the service flow
- (f)   The protocol stack shall be according to the one shown below
- (g)   An EUI-64 identifier shall be assigned for each subscriber station
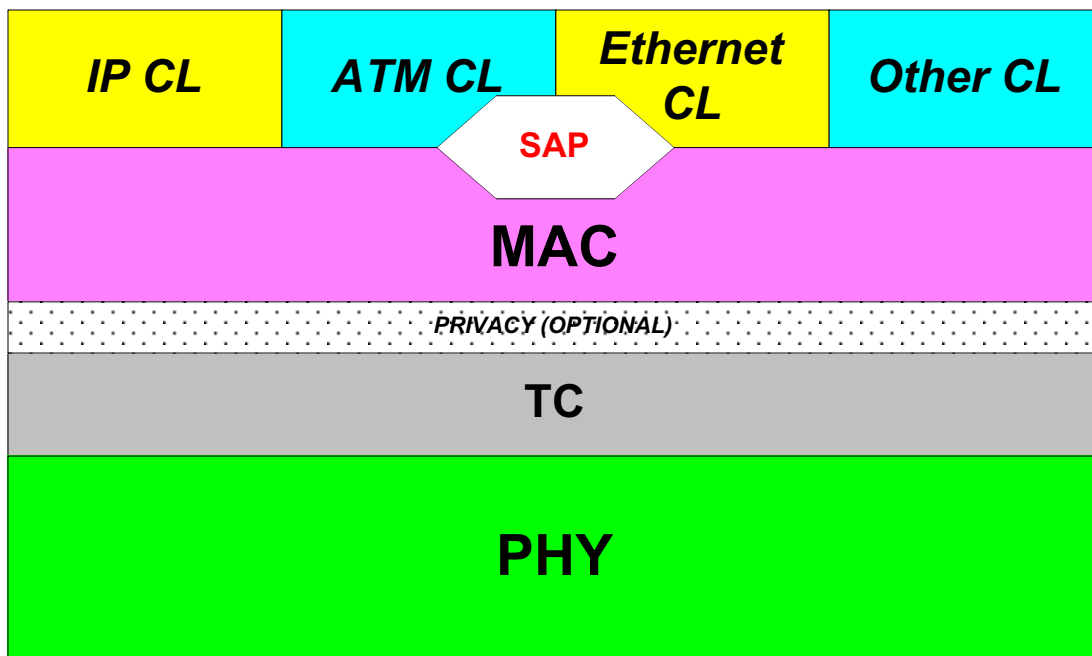
The SAP shall include the following primitives:

        MAC_DATA.req(down)
        MAC_DATA.ind(up)
        MAC_CREATE_SF.req(down)
        MAC_CREATE_SF.rsp(up)
        MAC_CREATE_SF.ind(up)

Discard priority information shall not be sent over the air, although it is part of the SAP.
The SAP shall include a master timing parameter.

The MAC shall support the following scheduling services
- Unsolicited Grant Service (UGS) Service
- UGS with activity detection
- Real-Time Polling
- Non Real-Time Polling
- Best effort (Contention based)

Data shall be transported over the air in Protocol Data Units (PDUs) with a header containing at least the following information:
- CID (16 bits)
- Payload Length (approximately 11 bits)
- BW Request / PDU Flag to notify type of message (1 bit)
- Encryption Key related fields
  - Sequence Cycle (4 bits)
  - Encryption On/Off flag (1 bit)
- Fragmentation information
  - Begin / Continue / End (2 bits)
  - Sequence numbering (4 bits)
- A single grant interval management byte that contains for:
  - (a) UGS connections: Poll me flag (1 bit), Slip buffer indicator (1 bits), Reserved (6 bits)
  - (b) UGS with activity detection connections: Dynamic grants per interval (7 bits), Slip buffer indicator (1 bit)
  - (c) Others: Piggy-back request (8 bits)
- Header protection field (TBD)

Bandwidth shall be requested on a per connection basis.
Bandwidth shall be allocated in one of the following fashions:
- Grant per Terminal mode (GPT): The grant is given to a terminal
- Grant per Connection mode (GPC): The grant is given to an individual connection

Support of both modes shall be compulsory in the base station.
The subscriber terminal shall support either one of the modes. The mode to be used shall be negotiated at registration.

The following rules for bandwidth allocation shall be applied:
- Full connection IDs shall be supported
- For terminals in GPT mode all grants shall be given to a basic CID. In the terminal, bandwidth shall be allocated to individual connections in accordance to its scheduling algorithm. The scheduling algorithm shall comply with the agreed QoS parameters for the connections
- For terminals in GPC mode all grants shall be given to the connections
- A common grant structure for the modes shall be included. The grant shall include:
  - The CID (16 bits)
  - Burst type (4 bits) indicating Data, Ranging etc.
  - Offset from previous grant (12 bits) expressed in ticks
  - Tick size is a system parameter defined as multiple of the duration of 4 symbols
  - Length calculated by using the next offset
- Null grant at the end
- First grant is referenced to frame/map start

For the PHY Mode B, a downstream transmission map shall be as follows:
- In the FSDD case the map is similar to the upstream map.
- In TDD (TDM) the map consists of 16 bit modulation change locators.

The following general concepts shall be applied
- Burst profiling similar to the one described in 802.16.1mc-00/14
- Frame
  - Definition: "Frame" is PHY related while "Scheduling Interval" MAC related
- "Time stamps"
  - In PHY Mode B, the frame concept shall provide the time base
  - The map shall be at the "scheduling interval" start and referenced to a PHY related time base
  - Sync. Message
    - Common format for supporting both PHY modes
- Registration
  - Initial registration process, registration sequence, general format and content of the messages as defined in 802.16.1mc-00/14.
- Policing shall not be considered as part of the MAC functions
- Ranging, including Power Control and Adaptive Modulation
  - General messaging structure as defined in 802.16.1mc-00/14
  - Using either the ranging interval *or* a MAC management connection to notify base station for a modulation change (downstream)
  - Definition of statistics to be collected by terminals and base stations, as well as additional TLVs to support adaptive modulation
- Encryption & Authentication
  - Key mgt. Protocol as defined in 802.16.1mc-00/14
- Dynamic service messages following the concepts defined in 802.16.1mc-00/14.
- Include definition of Convergence Sub-layers for ATM, IP, and Ethernet.
- A truncated binary exponential back-off algorithm shall be used for contention resolution.
- Base line for registration shall be based on contention.