
Point to Multipoint (P2MP) 802 Architecture Conformance Issues

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Outline

- Characterize point to multipoint media (P2MP)
- Summarize IEEE 802 architecture requirements
- Describe solutions for 802 conformant MAC/PHY design
- Discuss layering options for the solutions



Point to Multipoint – P2MP

- Definition – P2MP
 - Any media with a root station that can broadcast on a single frequency through a trunk and branch structure to leaf stations, and with
 - leaf stations that can unicast on a single common frequency or lambda through a branch and trunk structure to the root station, but in which
 - the leaf nodes may not communicate peer to peer.

NOTE: the common frequency/lambda characteristic distinguishes this from another P2MP model in which separate and unique frequencies/lambda are used between each pair of peer stations.



INITIAL ASSUMPTION

- That it is required that the broadcast attribute of the P2MP media be utilized.
- Subsequent alternatives will be shown in which this requirement is removed.



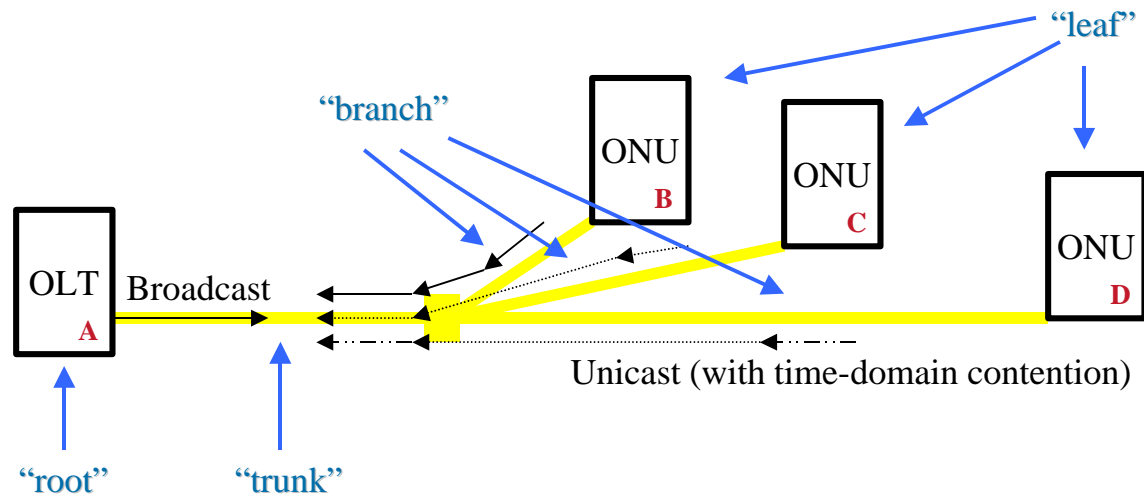
P2MP Media Examples

- Fiber P2MP
 - fiber, passive splitter, shared lambdas, MAN
- HFC Cable (802.14)
 - coax, passive splitters, shared frequencies, MAN
- 10Base36
 - coax, passive splitters, shared frequencies, LAN
- 802.16 Wireless
 - passive RF, shared frequencies, MAN



802.3ah EPON – MAN P2MP

MAN is a special P2MP category with long-reach (vis-à-vis latency) from “root” to “leaf” in which it is deemed undesirable to repeat all “upstream” traffic to “downstream”.



Review of IEEE 802 MAC Architecture

- “The MAC sublayer performs the functions necessary to provide packet-based, connectionless-mode data transfer between stations ... for LANs that support it.”
- “...an IEEE 802 LAN or MAN ... provides sufficient capabilities to support the MAC service ... between two or more MSAPs. This requires the ability to convey LLC data from one MSAP to n other MSAPs, where n can be any number from 1 to all of the other MSAPs on the network.”
 - Note: the interpretation of “one to n ” is “as required by the addressing mode.” I.E. the MAC layer is responsible for all peer-to-peer forwarding within a single access domain.
- Source: IEEE 802 LAN/MAN Architecture



Forwarding @ MAC or below



- As required by current IEEE 802 architecture
- P2PM network modeled as a single access domain (because of broadcast mode)
- Most architects would require the forwarding connectivity in the PHY layer
- Note that raw P2MP media (fiber, air, coax) does not provide such connectivity



The 802-conformance P2MP Design Issue

Raw physical media (fiber, coax,RF) does not support direct paths between leaf stations, thus some sort of augmentation is required to achieve such paths.



Augmentation #1 – drop broadcast

- Emulate pure point to point
 - Disable broadcast
 - P2MP simplifies to PTP (unicast mode only)
 - 1 → “n” independent PTP access-domains share single root
- “n” “HDTV” flows require “n” “HDTV” frame copies

à Example: EPON Point-to-Point Emulation mode



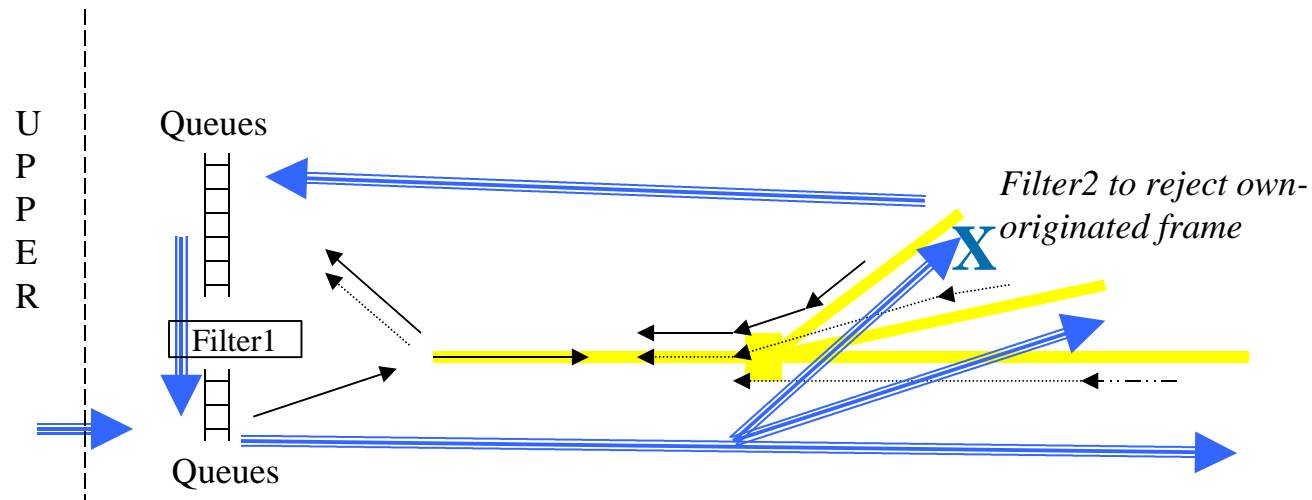
Augmentation #2 – drop link efficiency

- Flood all upstream traffic to downstream
 - Root contains promiscuous repeater function
 - Potential pass-through link capacity drops by 50%

à Example: 10Base36



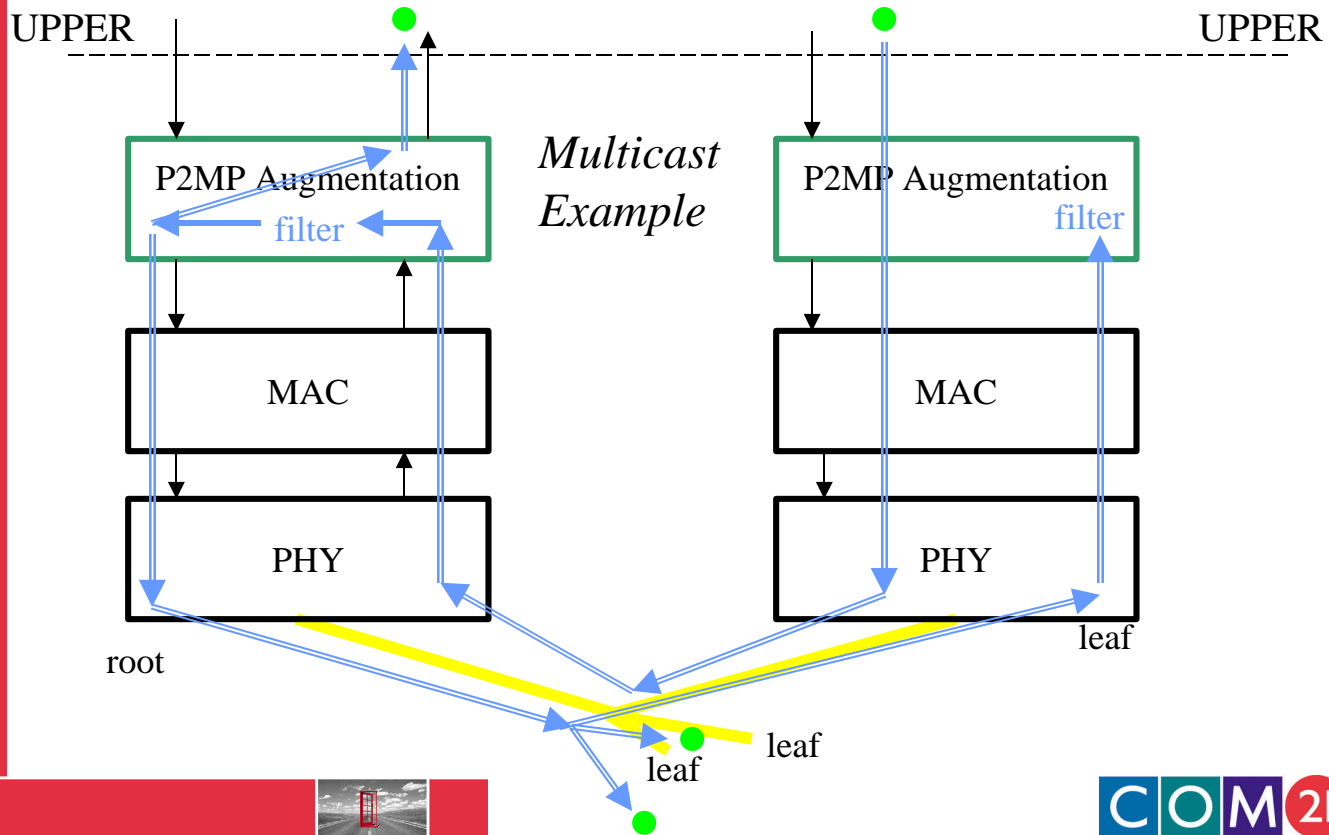
Augmentation #3 – retain all requirements



- No specific layering model implied
- Root has choice of using unicast or multicast PHY service
- Filter1 assures that only necessary subset of upstream traffic is reflected downstream
- *Because of learning function and forwarding rules this seems “bridge-like”*



Layering of Augmentation #3



Augmentation #3: Layering Models

- Regardless of layering (MAC, above-the-MAC, .1D, upper) there are at least two models which the MAC layer can present to the augmentation layer.
- (1) Media is a simple shared LAN in which leaf-to-leaf forwarding is disabled. [partial LAN]
- (2) Media is a point to point media which also contains a parallel point to multipoint service for broadcasting to leafs. [PTP+PTMP]
- A few observations about each of these two views.



Model: Partial Shared LAN/MAN

- Identical port model as today.
- Identical M_UNITDATA abstract interface as today.
- Above-the-MAC layer requires filtering and forwarding rules
- Sample rules (not exhaustive) – root forwards frame received from leaf back downstream when:
 - Administrative controls permit peer forwarding and
 - DA is known and is in leaf attached to LAN/MAN, or
 - DA is multicast and multicast group member(s) is(are) present and VLAN members is (are) present in the attached LAN/MAN, or
 - DA is broadcast, or
 - DA is unknown

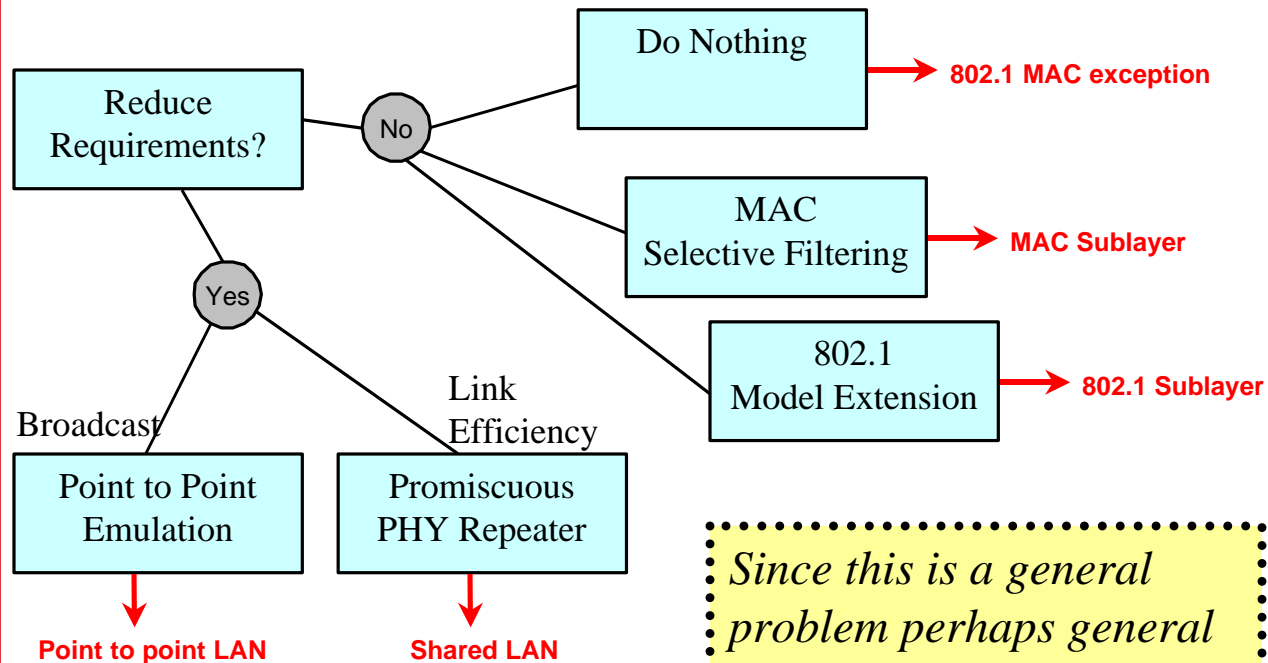


Model: PTP with PTMP service (@root)

- LAN/MAN port model expands to contain sub-ports
- Each sub-port corresponds to a leaf
- M_UNITDATA for unicast-service transmission to single sub-port
- M_UNITDATA_BROADCAST for broadcast-service transmission to all sub-ports
- Each leaf can be reached by both M_UNITDATA and M_UNITDATA_BROADCAST
- The mechanisms whereby the root decides between broadcast service and unicast service are undefined.
- Above-the-MAC layer still requires learning and filtering rules for leaf-to-leaf forwarding (because of broadcast)



P2MP Design Decision Tree



Since this is a general problem perhaps general solutions are worth considering

