# IEEE 802.3x and Asymmetrical Flow Control

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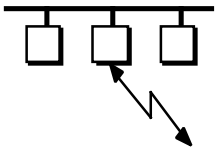

IEEE 802.3z, November 1996, Vancouver, BC

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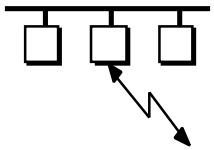
# What is 802.3x?

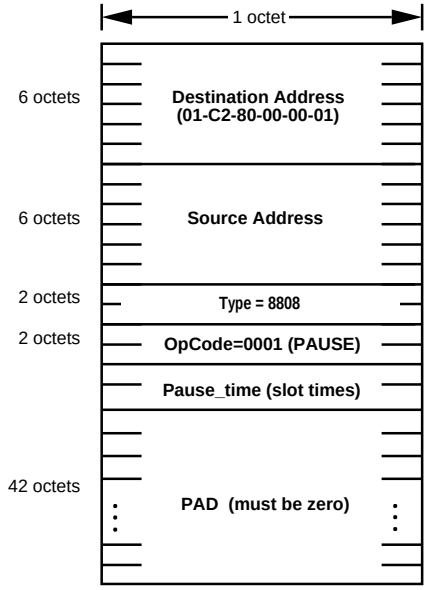
802.3x comprises two main elements:

- Modifications to the 802.3 MAC to support Full Duplex Operation
- Addition of a mechanism for flow control on Full Duplex links



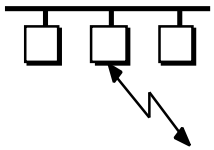
# Current 802.3x PAUSE (Flow Control) Operation

- Devices wishing to "stop the flow" from their partner can send a PAUSE frame
  - Frame contains a time, in slot-times, for the partner to PAUSE
  - Time may be extended or cancelled with further PAUSEs (later PAUSEs override any current PAUSE in progress)



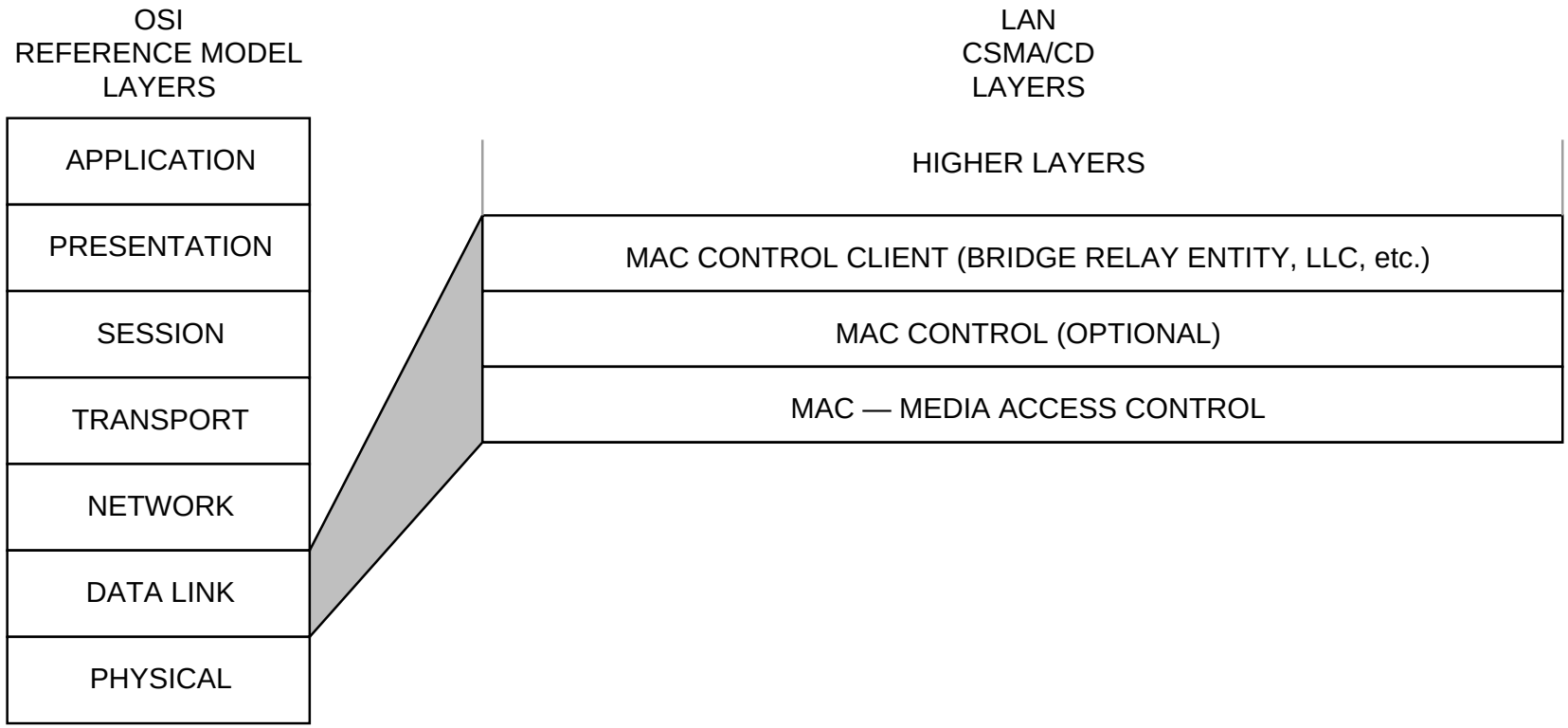
## Some Important Points to Remember

- The use of PAUSE is currently Auto-Negotiated on copper media
  - Manual configuration is also allowed, and required on fiber
- Nothing in 802.3x requires that a device capable of sending a PAUSE ever actually do so
- Any symmetry in 802.3x is a result of the Auto-Negotiation, not the protocol
- 802.3x says nothing about the POLICIES used to send PAUSE frames
- 802.3x is not data rate dependent, and is applicable at 10/100/1000 Mb/s

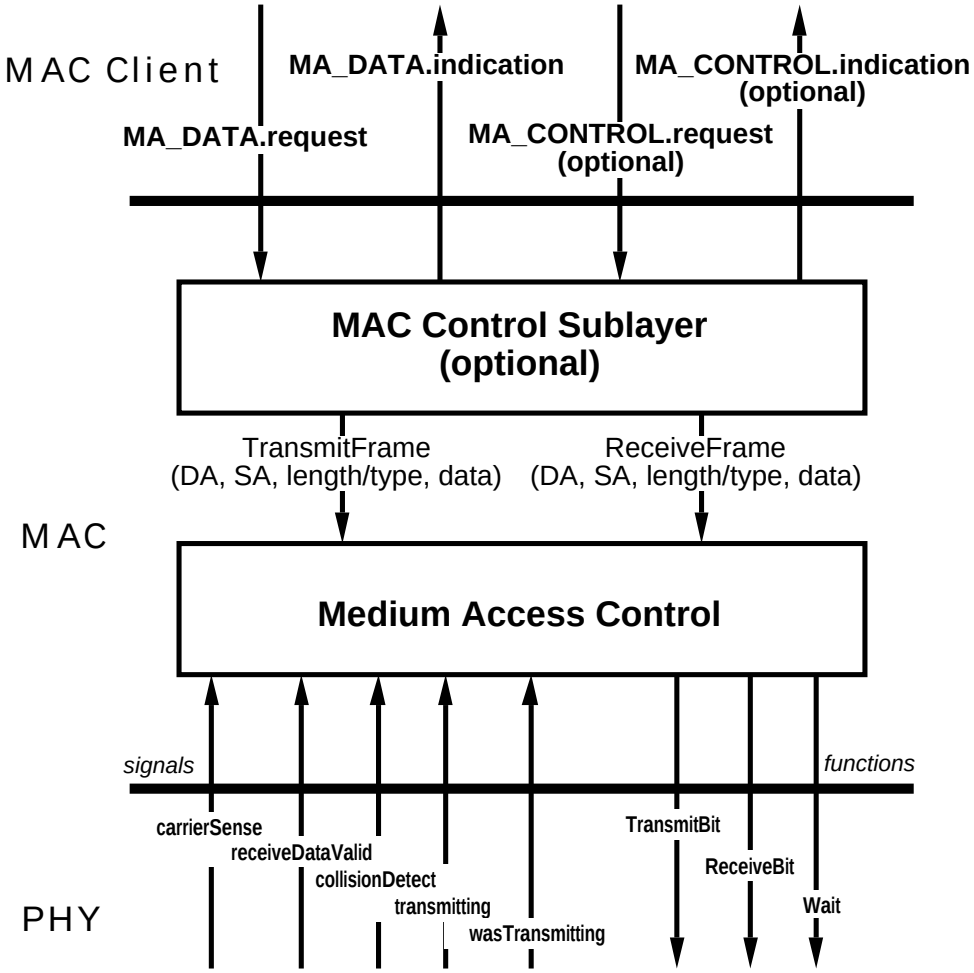


# MAC Control Layering

- 802.3x inserts a MAC Control sublayer between the 802.3 MAC and the normal client of the 802.3 MAC (e.g. LLC or Bridge Relay Entity)



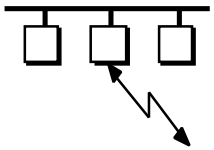
# Service Interfaces in 802.3 (with MAC Control)



# Why 802.3x Flow Control?

- The purpose of 802.3x Flow Control is to allow switches to be built that have limited memory, yet don't have to resort to dropping frames as a congestion control method on Full Duplex ports

- 802.3x is NOT intended as a solution to end-end flow control, or as a solution to steady-state congestion

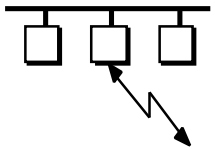


# Why Asymmetrical Flow Control?

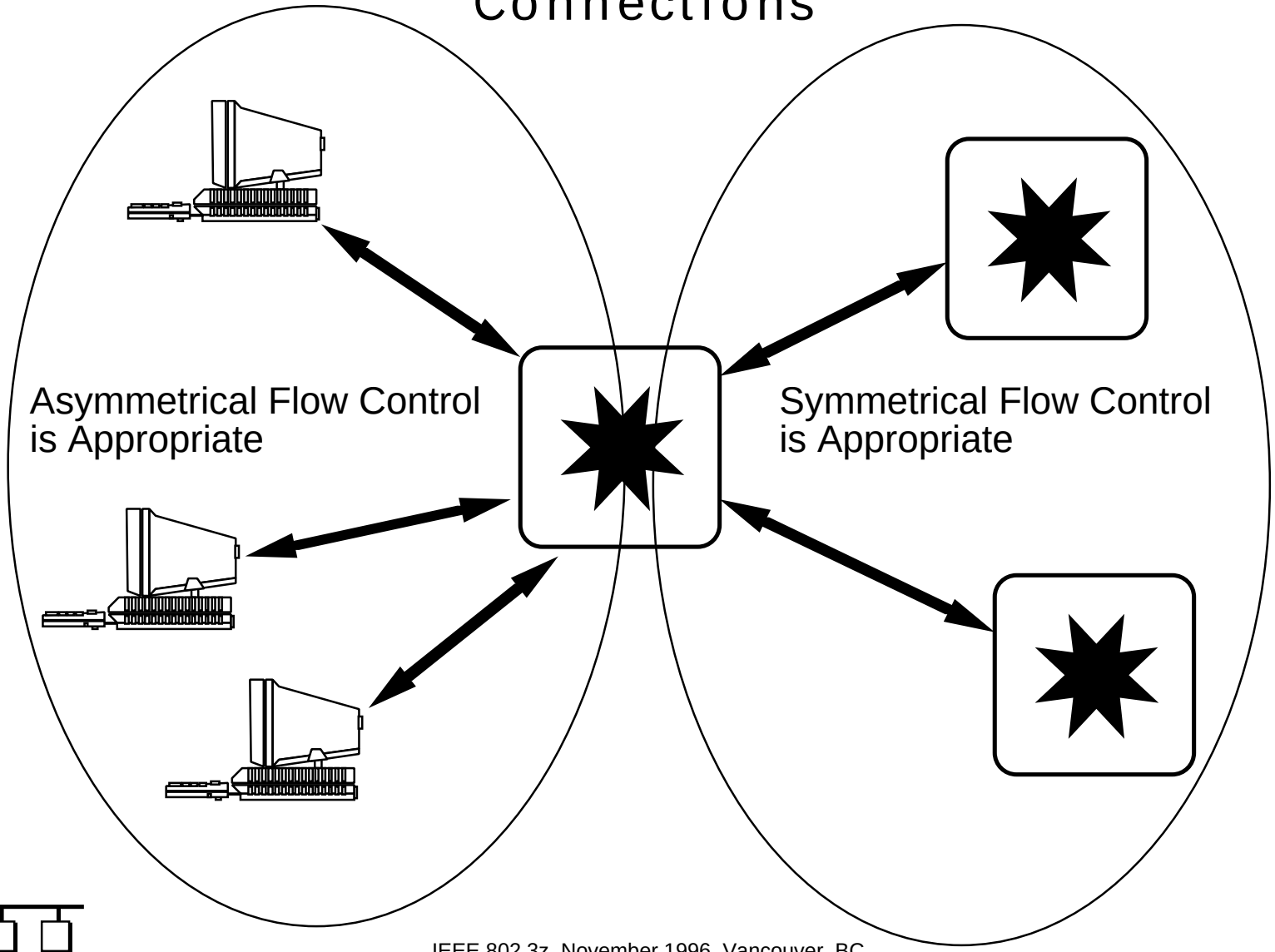
- The ideal place to "push the congestion" is back on the original source of the data, i.e., the end station application generating frames

- In a workgroup switch, asymmetrical flow control allows a switch to "throttle" an end station without allowing an end station to throttle the switch
  - Simplifies switch/hub design (No need for an 802.3x receiver)
  - Prevents end stations from *creating* congestion by throttling "the network"

- On a switch-to-switch link, symmetrical flow control makes more sense, since there is no "natural" asymmetry.



# End Station Attachments vs. Switch-Switch Connections



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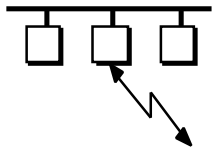
# What it takes to do Asymmetrical Flow Control

- No change is required to the specifications in 802.3x (Clause 31)
- One (possibly two?!) additional Auto-Negotiation capability bits are needed to allow negotiation of symmetrical and asymmetrical flow control with full backwards compatibility

… in short, very little!



# Summary

- 802.3x provides a simple tool for implementing flow control on full duplex links
- Nothing in 802.3x prohibits asymmetrical flow control
- Asymmetrical flow control is DESIRABLE in devices attaching directly to end stations
- The only change required is to the Auto-Negotiation of flow control, but even that is nothing out-of-the-ordinary