Gigabit
Full Duplex Repeater Proposal

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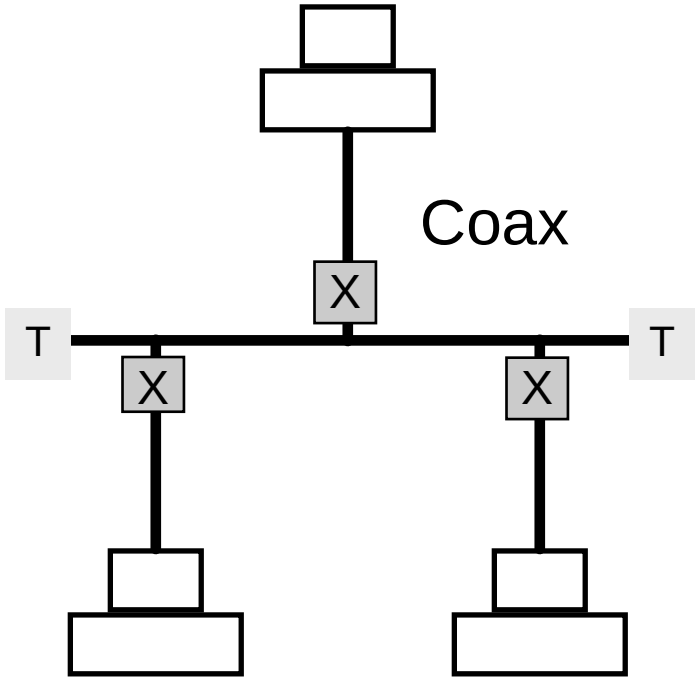
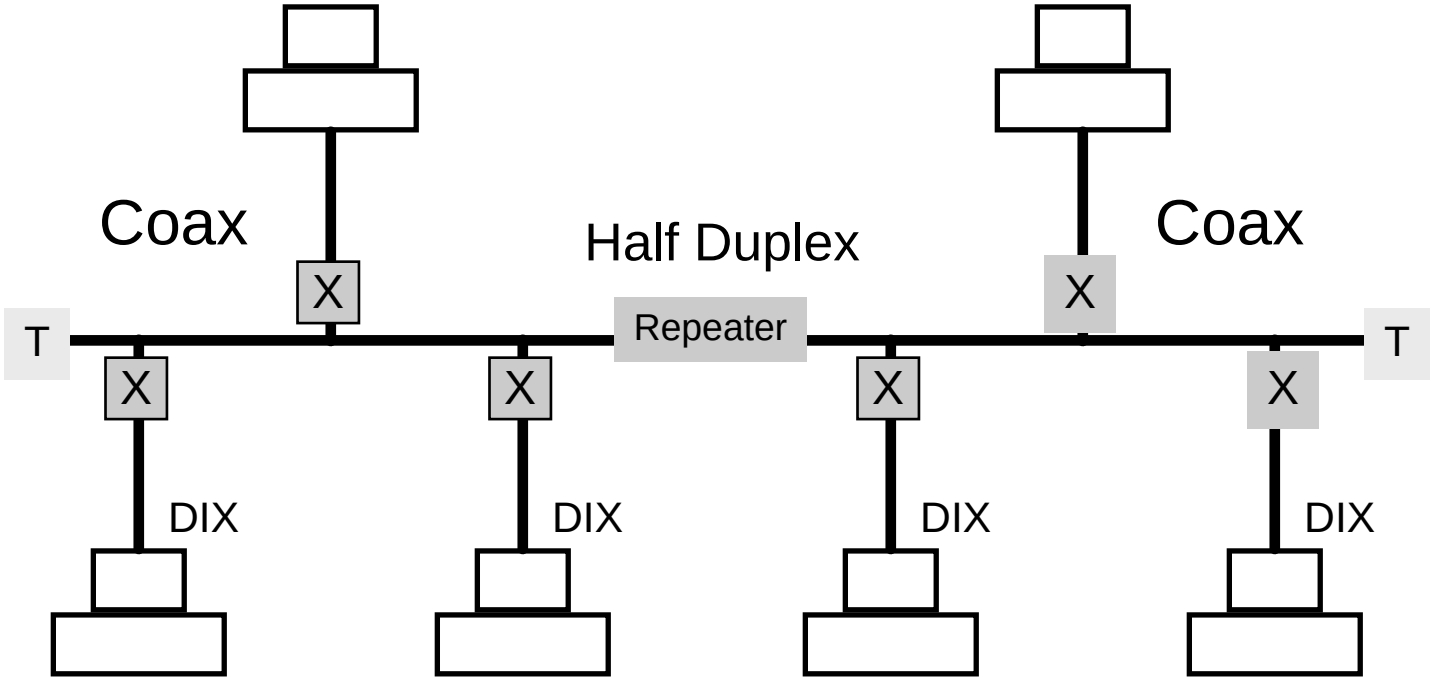
In The Beginning…

<u>could not</u> support full duplex
(half duplex media)



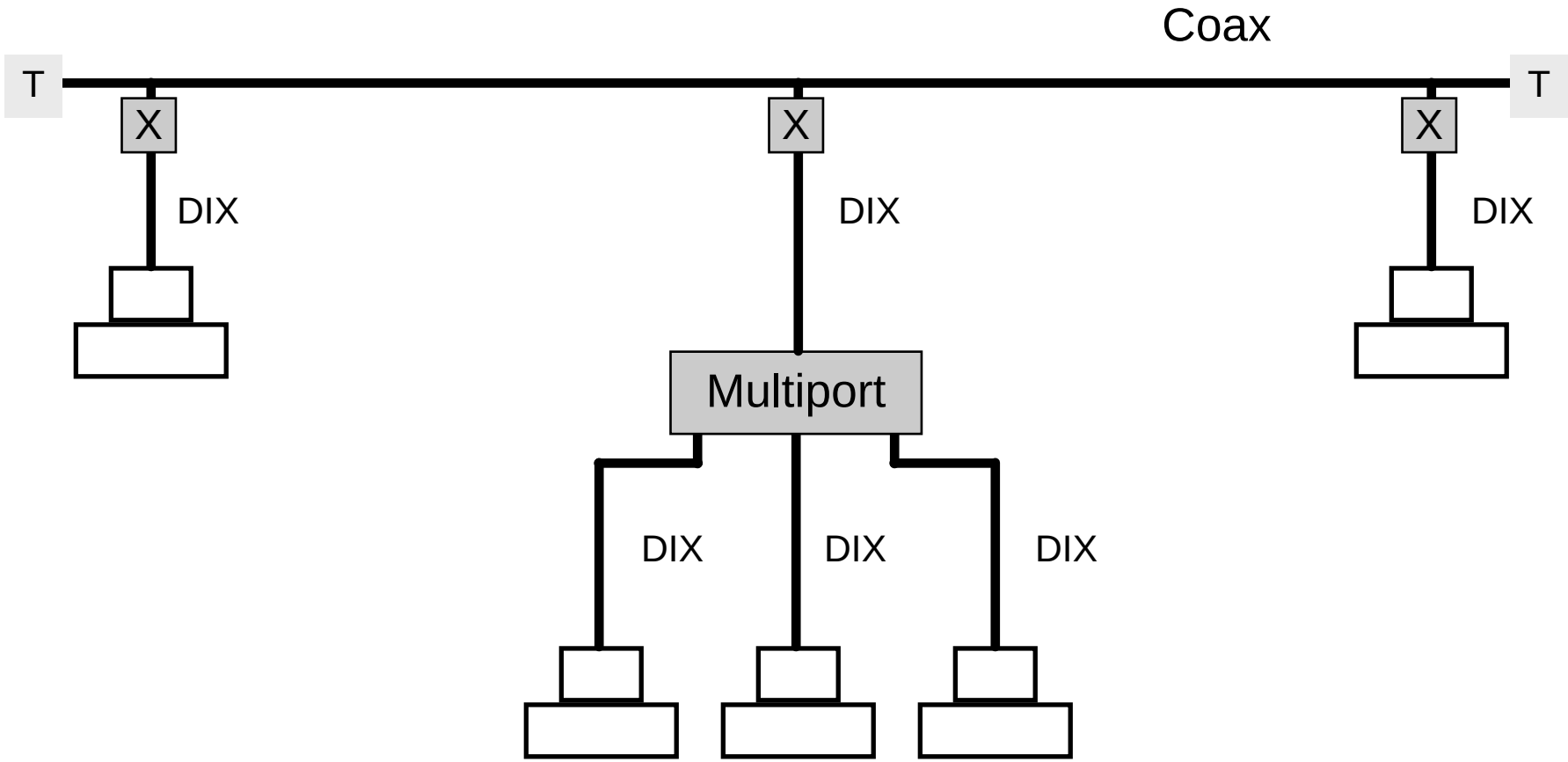
X = Transceiver T = Terminator

Then Came The Original Repeater

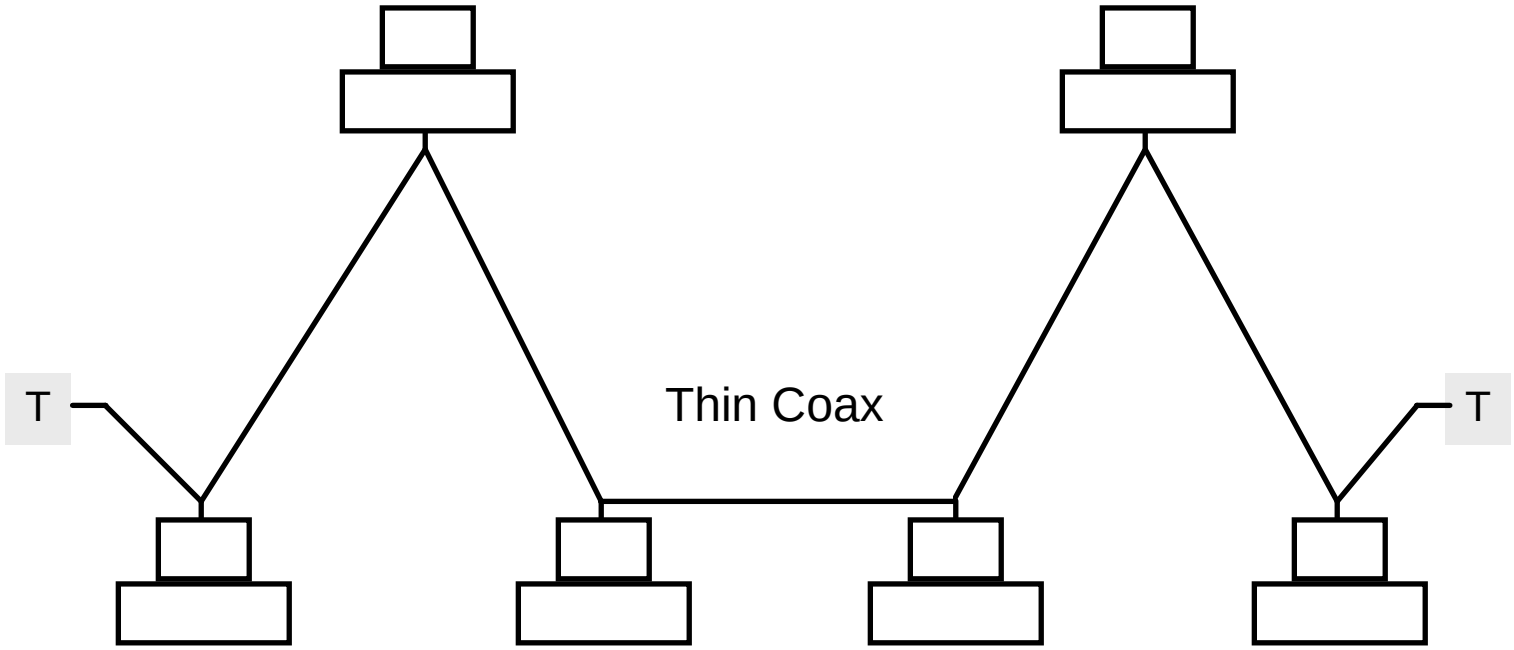


X = Transceiver T = Terminator

Then Came The Half Duplex Multiport

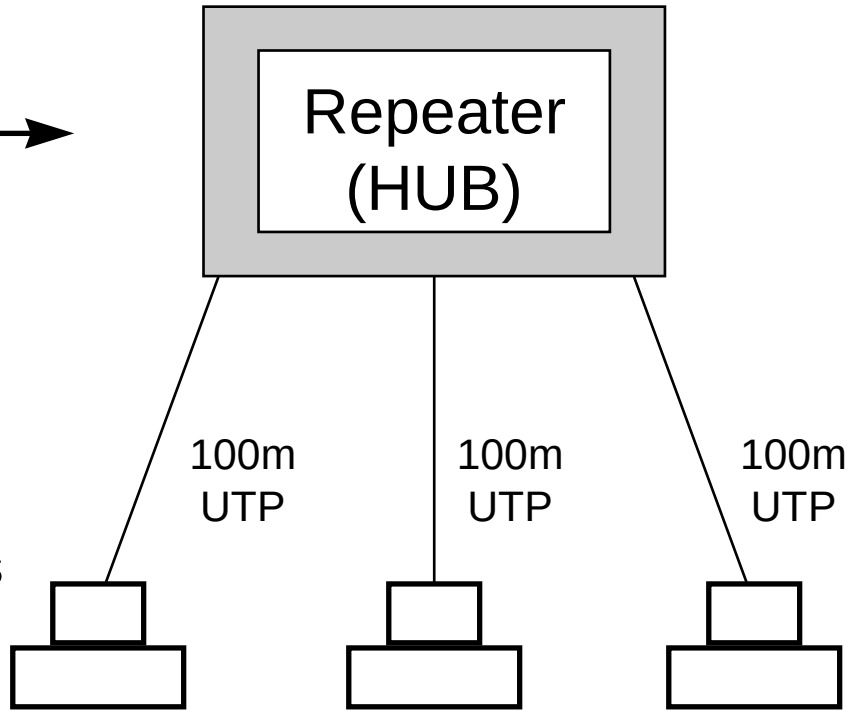


Thinnet Was Still Half Duplex



As Time Passed…10BASE-T

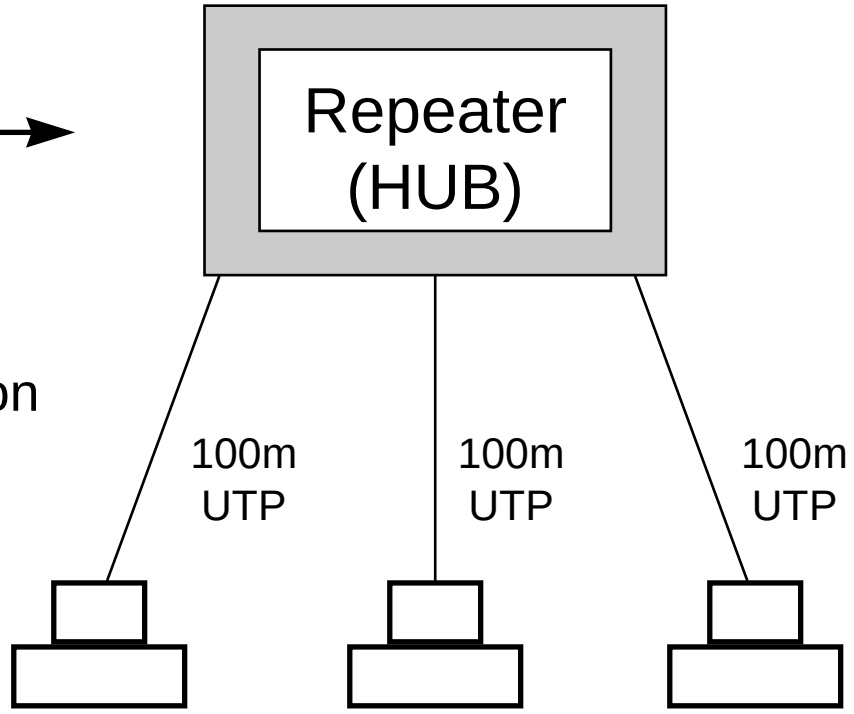
(Bus In A Box) →



- Coax bus went to twisted pair star
- Links could support full duplex
- Forced half duplex by repeater mechanism and emulation of coax bus

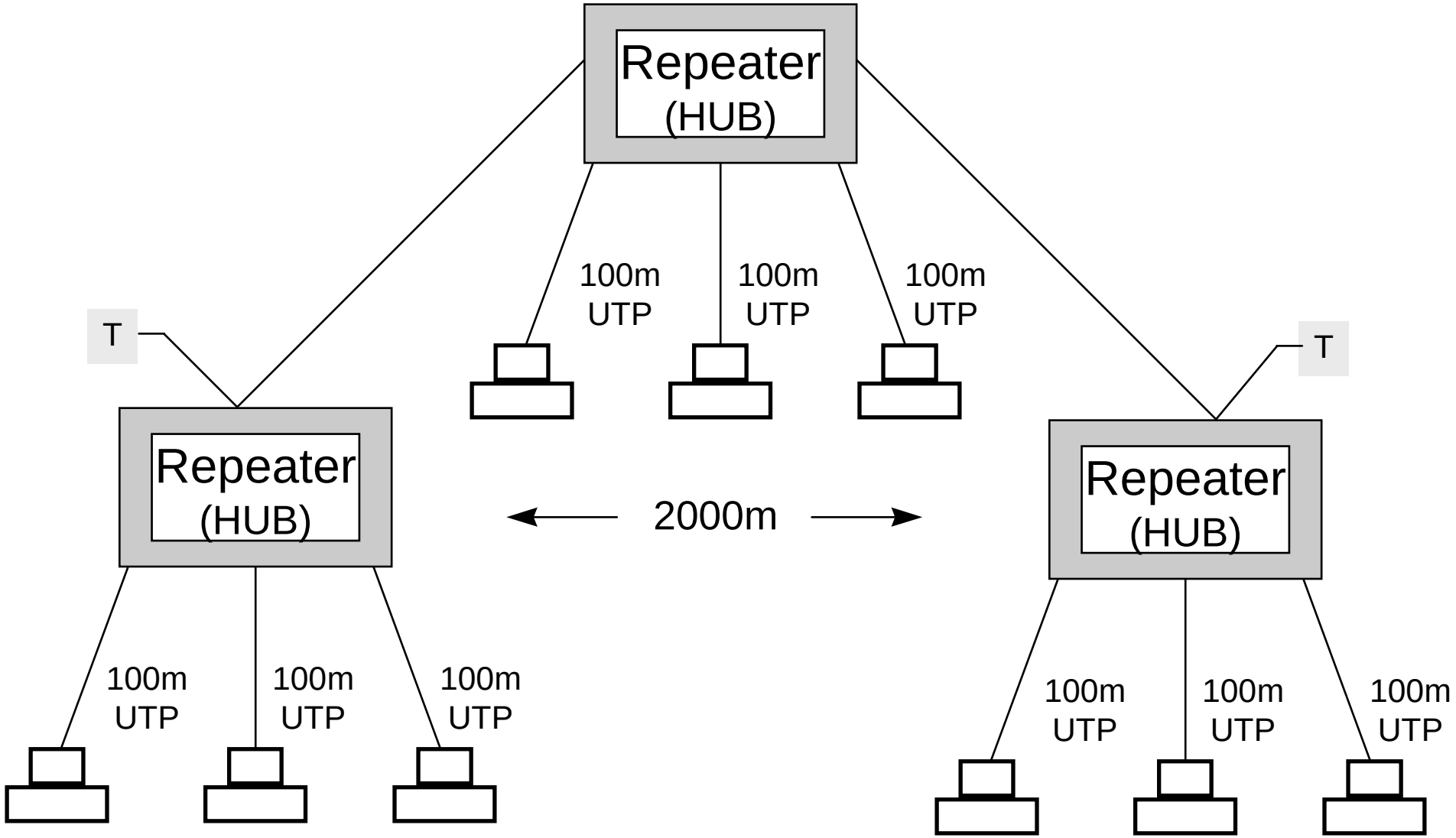
More Time Passed…100BASE-T

(Bus In A Box) →

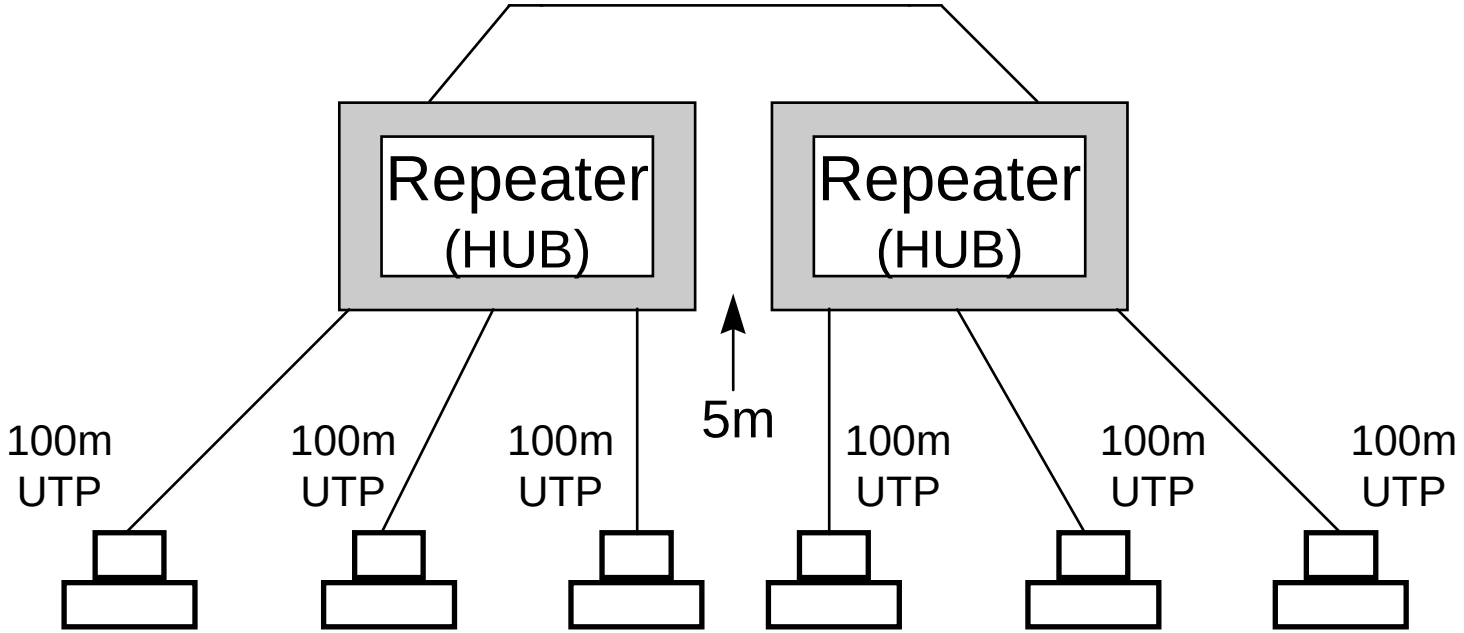


- TX links could support full duplex
- TX forced half duplex by repeater mechanism, T4 and continued emulation of coax bus
- Still star
- Still twisted pair
- Still 100m

10BASE-T Accommodates Multiple Repeaters



100BASE-T Accommodates Multiple Repeaters, *Almost*



Now For Gigabit Ethernet

WE HAVE

FULL DUPLEX MEDIA

FULL DUPLEX PHY's

FULL DUPLEX MAC's

WHY SETTLE FOR HALF DUPLEX USE?

But the problem with Gigabit CSMA/CD is the collision domain diameter -- perhaps 10 meters

- Solutions
  - call it a feature
  - extend it by extending the carrier event around a minimum packet
  - localize CSMA/CD theater of operation

Problem with carrier extension for 1000BASE-T/F is absymal small packet performance

Problem with packet packing , etc. is complexity and complexity

An Important Point!

MOTIVATION FOR GIGABIT REPEATER

IS COST VS. GIGABIT SWITCH

NOT

AN INHERENT NEED TO ACCOMMODATE

HALF DUPLEX MEDIA

AS WAS THE CASE IN ORIGINAL ETHERNET

PACKET ENGINES INCORPORATED

There May Never Be Any Half Duplex Media

- Two Fibers
- Two Coaxes
- Multiple Cat-5's

The Breakthrough!

CSMA/CD IN A BOX

The Understanding!

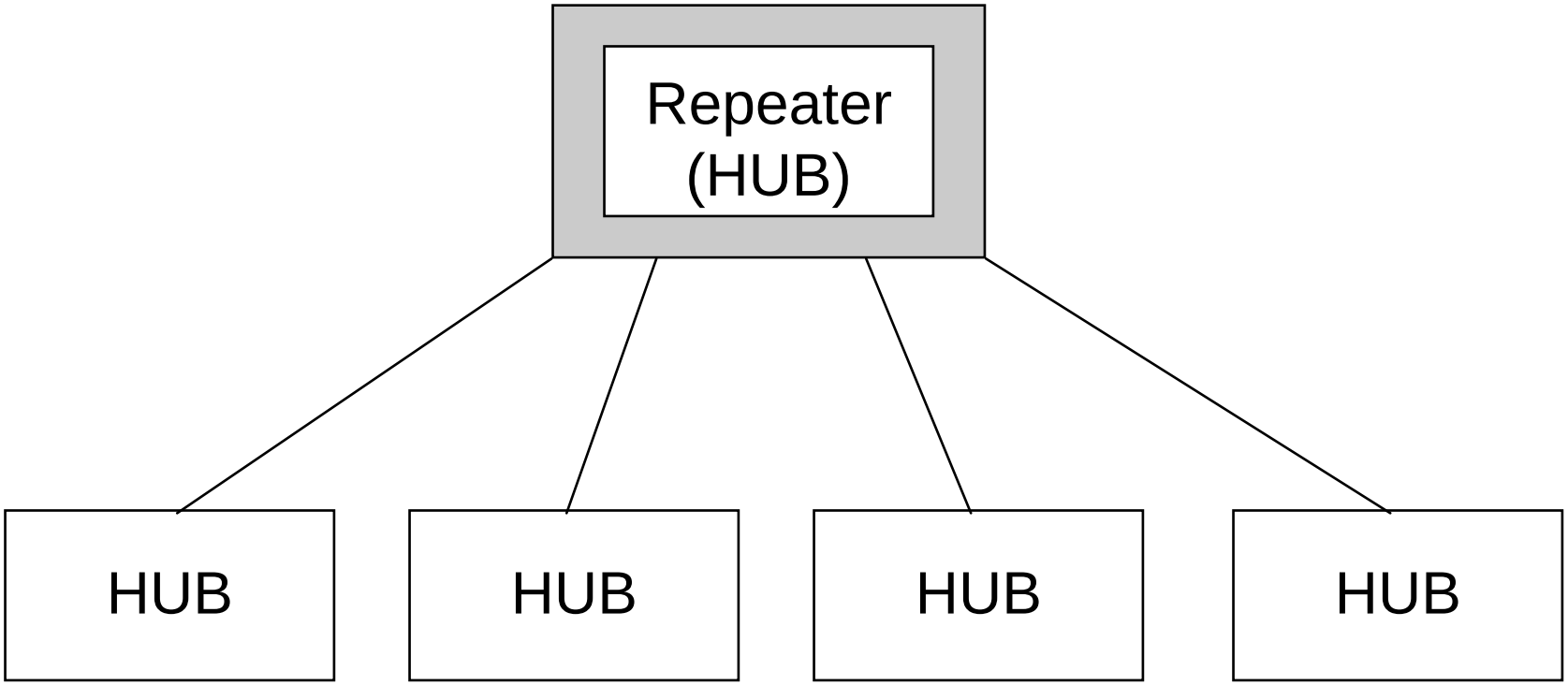
CSMA/CD is the access method
to the network segment
not
the access method to the link!

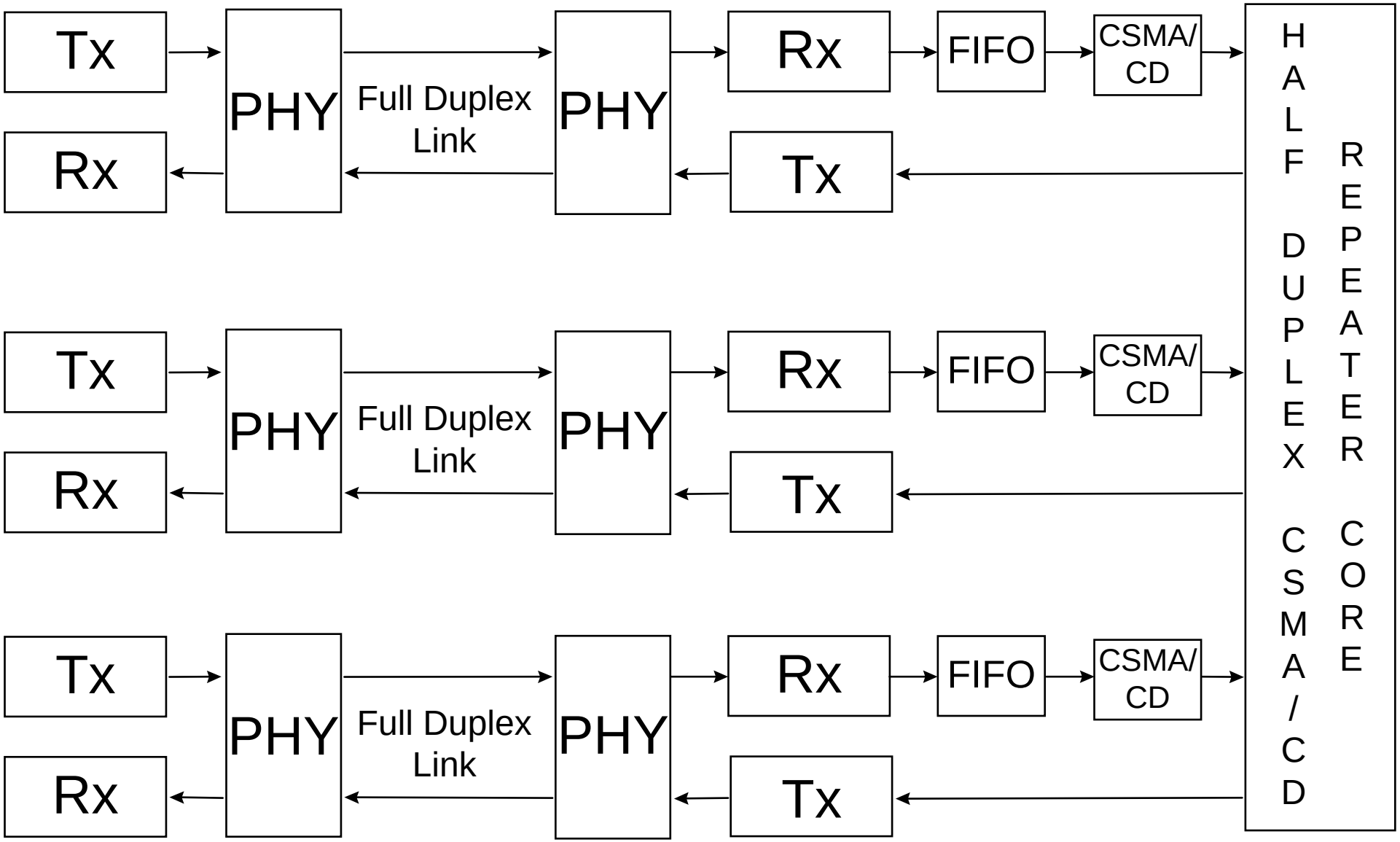
Solution!

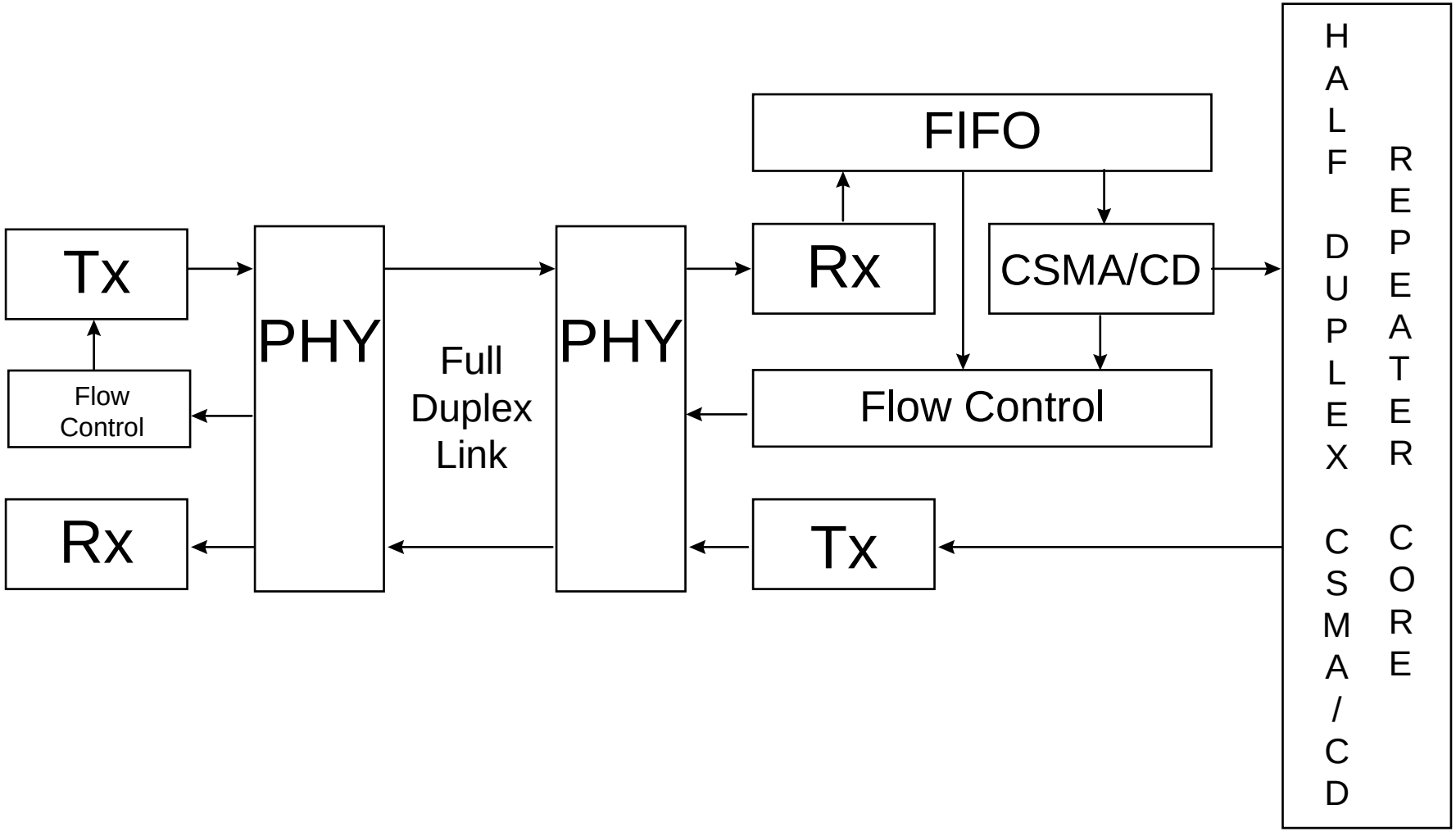
Frame based flow control avoids need to extend carrier event around minimum packet for full duplex links.

1000BASE-T/F

Just One Repeater!




Tx
Rx
PHY
Full Duplex Link
PHY
Rx
FIFO
CSMA/ CD
Tx
HALF DUPLEX CSMA/CD REPEATER CORE


FIFO
Tx
PHY
Full
Duplex
Link
PHY
Rx
CSMA/CD
Flow
Control
Flow Control
Rx
Tx
HALF DUPLEX CSMA/CD REPEATER CORE

Mechanism

802.3x frame based
flow control messages

ISSUES

Link Length (100m - 2km)

Buffer Size (2K - 10K)

Repeater Core Algorithm (CSMA/CD)

Outbound FIFO ?

Patent Issues ?

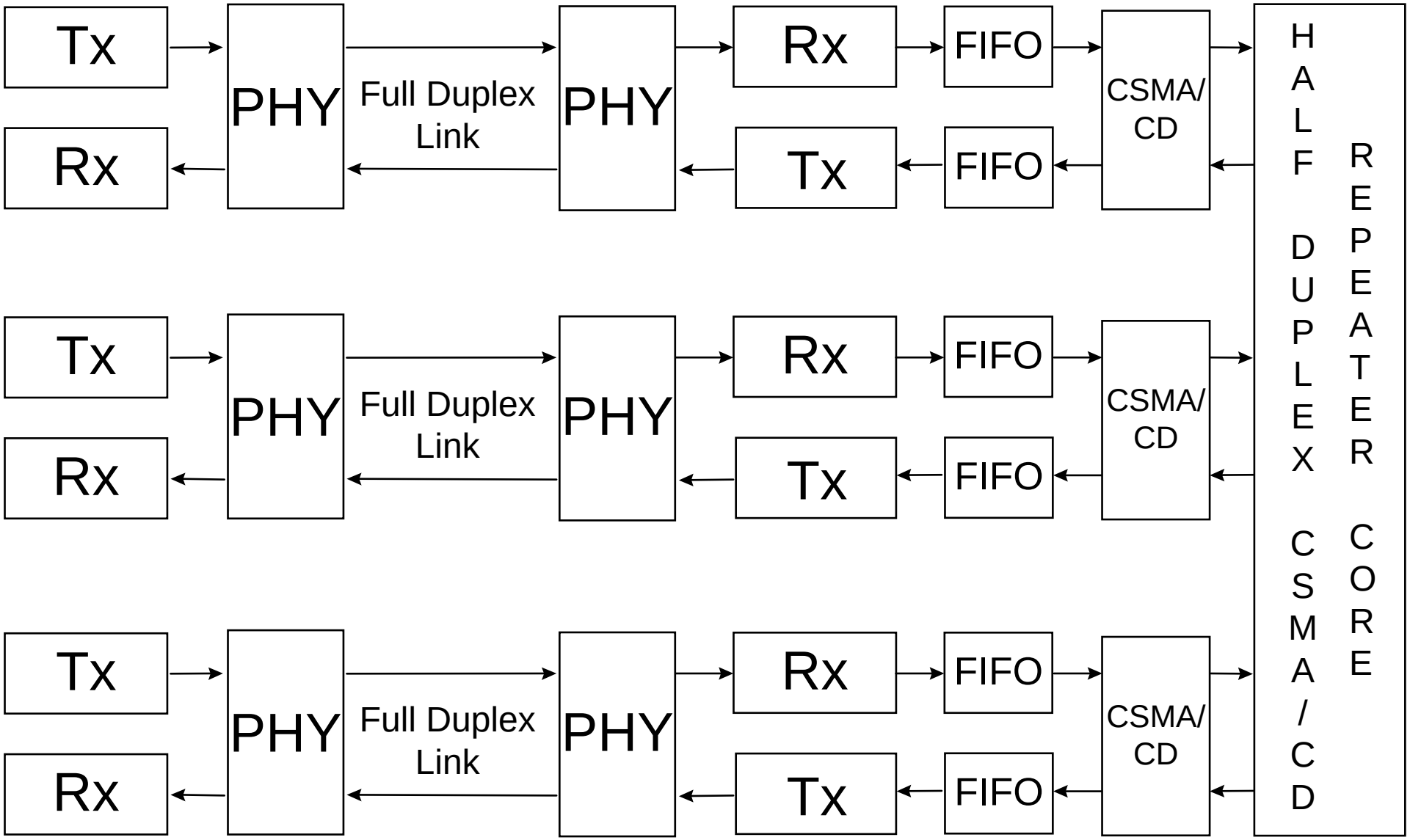
Receiver FIFO Size Required

Goal is to allow the link to operate at full throughput.
This requires FIFO “high-low” watermarks as follows:

BUSY:	1 max size packet that causes BUSY event
	+1 Max size packet before BUSY is transmitted
	+1 RTD (round-trip-delay)
IDLE:	1 max size packet before IDLE event
	+1 RTD (round-trip-delay)
TOTAL:	3 max size packet + 2 RTD

8 Kbyte FIFO allows for 3 packets + 2*1km RTD

(contributed by Granite Systems)


Tx
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PHY
Full Duplex Link
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FIFO
CSMA/ CD
HALF DUPLEX CSMA/CD REPEATER CORE

Conclusion

- Formalize one repeater topology
- Standardize flow control signaling rules
- Standardize only minimal behavior of full duplex repeater leaving features and link lengths to implementors