Spyder-LAN

A conceptual proposal for
Residential Synchronous Ethernet

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Why do I call it Spyder-LAN

- It seemed like a catchy name.
- It is a repeater than has a spider-like relationship to a bridge, as you will see.

Description (1)

- The core spider element is a gigabit physical layer repeater-like device suitable for standardization in 802.3
- It does not look like previous 802.3 repeaters in terms of its state machine
- Practical implementations require an 802.1 bridge that can connect to all of the same ports.

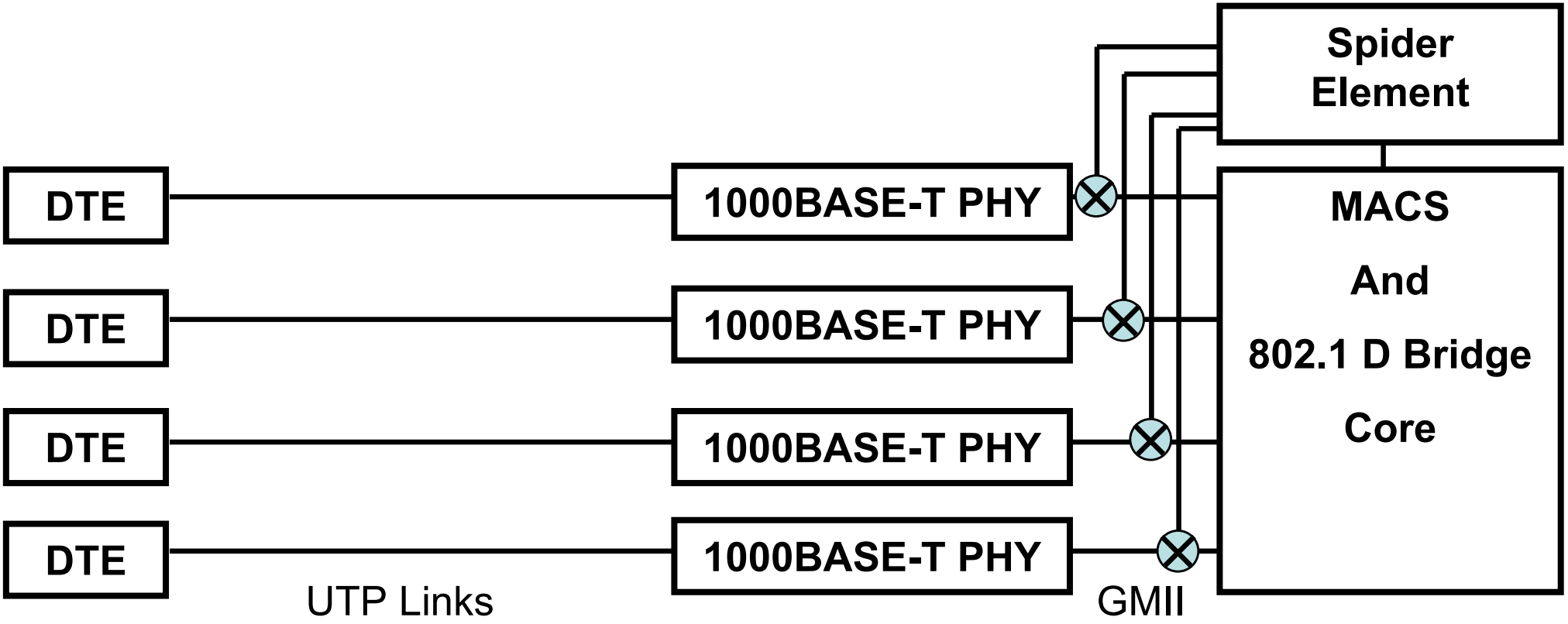
Description (2)

- The purpose of the spider element is to provide a fast path around the bridge to selected ports.
- The element is a non-filtering device.
- The spider element is a conceptually a bit level forwarding device, like the 10 Mb/s repeater.
- The spider element is a actually an octet level forwarding device, because it operates on 1000BASE-T coding units.

Description (3)

- The spider element operates on a TDMA basis that gives it exclusive ownership of its* network during its transmit window.
  * (There can be more than one spider-net set up in a physical net at a time)
- TDMA requires a different MAC than that used for “Classical Ethernet”. Such a MAC was developed for 802.3 EFM PON and is now part of the 802.3 standard.

Spider Bridge physical relationship



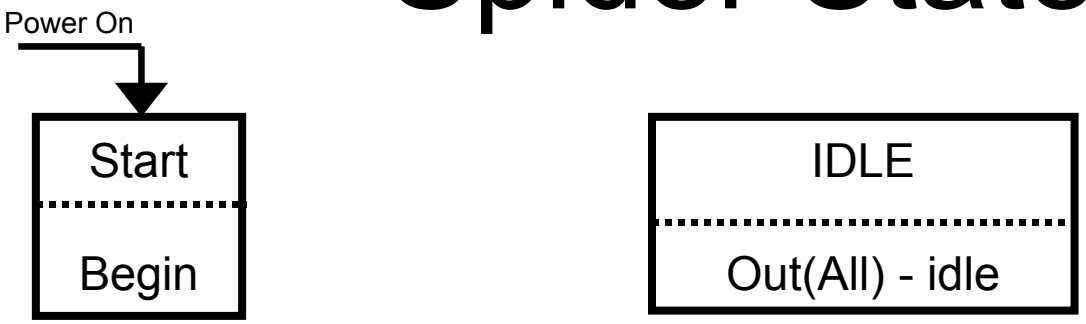
Spider Bridge logical relationship

- A Spyder-LAN DTE can operate in normal mode or spyder mode
- Each mode has an Auto-Negotiation value
- The bridge carries the burden of setting up the diversion of DTE traffic to the spider and managing the network.
- Only control (esp. Auto-Negotiation) and topology information should need to be passed between bridge and spider

Spider Functionality

- Full duplex.
- Spider is only a data distributor, does not regulate access
- Arriving packet sets originating receive port. All other receive ports disabled for (packet or slot, TBD) time.
- All transmit ports (incl. the one assoc. w/ the originating receive port) copy/xmit the received data.
- Everything else is error handling

Spider State Machine



Ahh, it's too hard to draw just for a concept !
For a close approximation refer to the 100 Mb/s repeater state diagram
Ref: 27.3.3.2, Fig 27-2, in IEEE Std 802.3 -2002, Vol. 1, page 193
And think in terms of each full duplex port appears in this state diagram as 2 half duplex ports, one locked in receive and the other locked in xmit.

How entering Sync Mode works

- A DTE sends a packet message to an entity in the bridge that says it wants to join the spider.
- The bridge sends a control msg to the spider (via ctrl interface) to switch the port from bridge to spider and reformulates the Auto-Negotiation advertisement from 1000BASE-T to Spider.
- Spider port cycles link integrity to force renegotiation
- DTE will switch from 1000BASE-T to Spider as highest common denominator. Mandates a DTE switch to TDMA mode MAC.
- TDMA mode MAC joins just as in EPON

Delay and Jitter numbers

- 1000BASE-T transmits an octet/clock
- Clock rate is 125 Mbaud, i.e. 8 ns/clock
- (Surprise, it works out to 1 ns/bit !)
- UTP delay is ~5 ns/meter
- PHY delay: <340 (bt/ns)/pair (47.11)
- Fifo depth for clock skew & async resolution: 4 octets = 32 ns

Expected Delay and Jitter

- Cabling delay ~ 1 byte/yard
- Hub delay ~ (340 + 32 ns)
- Hub delay ~ 50 meters of cable
- Hub jitter should be ~ +/- 8 ns
- Delay mismatch reduced by xmit station operating off hub broadcast just like everyone else (i.e. delay = 1 round trip time from source)
- Other jitter will come from source asynchrony & cueing/access delay (mitigation possible w/ synchronous sources)

Conclusion

- Sub microsecond GMII to GMII delay is possible in a homogeneous 1000BASE-T Spyder-LAN network.
- The network will have trivial added jitter in the digital domain, typically 8 ns/hub.
- Transmitting sources will have a synchronous cueing tick to work from

“Service” on Spyder-LAN

- The proposal is a shared media TDMA 1000BASE-T network.
- Service would be granted on a time slot reservation basis.
- Granularity (and therefore service bandwidth) is TBD.
- Minimum granularity would be 1 max. packet time + 1 RT time per access
  (2048 byte times sounds good, 16 uSec
  See EFM work on guard band times.)

“Service” on Spyder-LAN

- Minimum granularity would be 1 max. packet time + 1 RT time per access (2048 byte times sounds good, 16 uSec See EFM work on guard band times.)
- Traditional clock ticks are 125 uSec
- 125/16 = ~ 8 channels of something like 100 Mb/s (avg rate) each.