1000 Mbit/s MAC

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Two Approaches

- **MAC*lite***
  - **Cheap long-term, expensive short-term**
  - **Extensive committee work**
  - **Significant development effort to implement**
- **Current MAC**
  - **Relatively quick development**
  - **Difficult work already done for HSTR**

Current MAC

- **1000 Mbit/s indicated by FxMRO=3**
- **Most state transitions "just work"**
- **Some specific areas need careful attention**

Gigabit is very like HSTR to the MAC. The state tables divide neatly into "old" media rates of 4 Mbit/s and 16 Mbit/s (where phantom is required and token operation is allowed), and "new" media rates of 100 Mbit/s and 1000 Mbit/s (where link_status is used and phantom is optional).

The work for this division was carried out for HSTR and simply setting FPMRO=3 / FSMRO=3 means the majority of state transitions are the correct thing when controlling a Gigabit Port or Station.

The main exception to this is Speed Tradeup.

Registration

- **TXI at 1000 Mbit/s works with no changes**
- **Reserve top bits of AP_MASK for future MAC*lite* registration process**
  - **compatible with legacy devices**
  - **allows exchange of capability data in existing frame format**

The basic Registration process does not need modification. Registration is a request to make a connection *at the current speed* so by definition does not need alterations for Gigabit.

The AP_MASK value passed from Station to Port during Registration has a number of unused bits. If an enhanced version of Registration were to be added at some future date (for example, to include MAC*lite* or exchange of speed capabilities) these bits can easily utilised without breaking existing devices. Legacy devices will just reject the request with an "Access Denied" response.

Auto-negotiation

- **Requirement for 1000BASE-T**
  - **Is used to resolve phy port/station**
  - **Could be used to autodetect MAC port/station**
- **Optional for 1000BASE-X**

Auto-negotiation is a requirement for 1000BASE-T. Phy vendors must allow setting of IEEE802.5 in the Advertisement register if Token Ring is to use 1000BASE-T.

A Gigabit Token Ring MAC could use the Multiport/Singleport information from the 1000BASE-T Phy to decide whether to open as a C-Port or as a Station. This would guarantee successful auto-port/station detection.

1000BASE-X auto-negotiation is not mandatory and the information it provides is of little use to a Token Ring MAC (Multiport/Singleport is left to the cable plant). Therefore it may be better to not include support for auto-negotiation for 1000BASE-X Phys.

Phantom Drive

- **Mandate that phantom is not used**
- **PD_MASK=0002**
  - **Current state tables need no alterations**

Superimposing phantom drive on a Gigabit copper link presents serious technical problems.

Speed Tradeup

- **Is this required?**
  - **From 4 Mbit/s and 16 Mbit/s?**
  - **From 100 Mbit/s?**
- **Tradeup is not an extensible protocol**
- **Add AP_MASK request for 1000 Mbit/s**
  - **Station must request 1000 Mbit/s, 100 Mbit/s, then TXI**
- **Tradeup requires reliable Link_Status**
  - **Does cross detection between 1000 Mbit/s and 100 Mbit/s occur?**

Tradeup from 100 Mbit/s to 1000 Mbit/s would seem more sensible than 4/16 Mbit/s to 1000 Mbit/s.

There is a big question over the feasibility of producing a token ring port that can support Gigabit with an existing technology, either HSTR or 4/16 Mbit/s. This uncertainty exists for fibre and copper solutions.

If Gigabit tradeup was to be implemented, work would need to be done to ascertain the effects of 100 Mbit/s idles on Gigabit Link_Status and vice-versa.

Tradeup could be tackled cleanly by introducing the concept of Speed Capability to Registration. A more simple but messier approach would be to implement Gigabit tradeup in parallel with HSTR-100 tradeup.

Lobe Test

- **1000 Mbit/s technology must guarantee the minimum acceptable Token Ring BER**
- **More likely to see lobe-test failures since 1000 Mbit/s technology is more sensitive to bad cabling**
- **No MAC changes are required**

Lobe test becomes a much more important feature of Token Ring at Gigabit speeds because of the phy's higher sensitivity to cabling defects.

It is important that 1000BASE-T offers a Bit Error Rate low enough to reliably and consistently pass lobe test.

Other Considerations

- **Timers**
  - **Keep the current timer values**
- **Maximum Frame Length**
- **Error Handling**
  - **No change needed**
  - **Could add symbol errors**

There are no timers that require changes.

Maximum frame length placeholder. This value may change depending on which phy is in use (1000BASE-X or 1000BASE-T).

Conclusion

- **Solution based on current MAC is achievable within our committee's time and resource constraints**
- **Solution is relatively low risk**
- **Approach does not preclude MAC*lite***