PHY Layer Support

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GFP Support

- What is the performance impact of not pre-pending the length field to the RPR MAC frame for GFP support
- Is this performance penalty worth the additional complexity?
- should this complexity be optional or mandatory?

Elements of Delay

1. Queueing above the MAC
2. Delay through MAC
3. Delay due to GFP length calculation & Store Forward
4. Variable delay on passthru path due to arbitration for media
5. Fiber Delay
6. Delay out of MAC to the client

- 1 is dependant on fairness algorithm, transit path design and ring utilization
- 6 can be ignored as one time cost
- 2,3,4,5 recur hop by hop but 2 is small

Typical Delays

- SF or GFP Length Calculation Delay in uSec
  - Typical Voice packet is 64 - 800 bytes

Speed / Size	10 G	2.4 G	1 G	622 M
64	0.051	0.206	0.512	0.823
200	0.160	0.643	1.600	2.572
400	0.320	1.286	3.200	5.144
800	0.640	2.572	6.400	10.288

PB Delay

- Delay when add traffic starts just before PB packet available

Speed \ Size	1522	9000
10 G	1.22 usec	7.40 usec
2.4 G	4.89 usec	29.6 usec
1 G	10.5 usec	74.0 usec
622 M	19.6 usec	118 usec

Fiber Delay

- Fiber delay approx 5 us per km
- Total Ring circumferences range from 10's to 1000's of km
  - At 2000 km delay is 10 ms
  - At 200 km delay is 1ms
  - At 20 km delay is 100 us

Elements of Delay

- Majority of rings <= 16 nodes
- Typical ring size 200 - 1000 km
- Worst case delay occurs when the PB delay occurs at every node
  - need to design for worst case
- Total Ring Delay
  - N * (SFdelay+GFPdelay+Pbdelay) + Fiber Delay

Examples

- 8 Node, OC-192c, 50 km ring, 1522 byte MTU
- All times in us for next charts

Size	64	100	400	800
SF or GFP	0.05	0.08	0.32	0.64
PB Delay	1.22	1.22	1.22	1.22
Total GFP	0.41	0.64	2.56	5.12
Total	260.5	261.0	264.8	269.9
%	0.16%	0.25%	0.97%	1.90%

Examples

- 8 Node, OC-48c, 50 km ring, 1522 byte MTU

Size	64	100	400	800
SF or GFP	0.21	0.32	1.29	2.57
PB Delay	4.89	4.89	4.89	4.89
Total GFP	1.65	2.57	10.29	20.58
Total	292.44	294.29	309.72	330.30
%	0.56%	0.87%	3.32%	6.23%

Examples

- 8 Node, OC-12c, 50 km ring, 1522 byte MTU
- **Note: This provides only 80 Mb/s per node**

Size	64	100	400	800
SF or GFP	0.82	1.29	5.14	10.3
PB Delay	19.6	19.6	19.6	19.6
Total GFP	6.58	10.3	41.2	82.3
Total	419.8	427.2	488.9	571.2
%	1.57%	2.41%	8.42%	14.4%

Examples

- 64 Node, OC-12c, 50 km ring, 1522 byte MTU
- **Note: This provides only 10 Mb/s per node**

Size	64	100	400	800
SF or GFP	0.82	1.29	5.14	10.3
PB Delay	19.6	19.6	19.6	19.6
Total GFP	52.8	82.3	329	658
Total	1608	1667	2161	2819
%	3.28%	4.94%	15.23%	23.35%

Examples

- 64 Node, OC-12c, 500 km ring, 1522 byte MTU
- Note: This provides only 10 Mb/s per node

Size	64	100	400	800
SF or GFP	0.82	1.29	5.14	10.3
PB Delay	19.6	19.6	19.6	19.6
Total GFP	52.8	82.3	329	658
Total	3858	3917	4411	5070
%	1.37%	2.10%	7.46%	13.0%

Examples

- 64 Node, OC-192c, 500 km ring, 1522 byte MTU
- More realistic perhaps?

Size	64	100	400	800
SF/GFP	0.05	0.08	0.32	0.64
ADD	1.22	1.22	1.22	1.22
Total GFP	3.28	5.12	20.9	41.0
Total	334.5	338.2	369.0	409.9
%	0.98%	1.51%	5.55%	10.0%

Conclusion

- Carrying the GFP length in the MAC (not necessarily in the frame format) improves the delay characteristic of packets flowing around the ring
- Improvement is not enough to justify a requirement in all MACs to carry / calculate length at speeds at or above OC-12 (we could argue about OC12)
- The verb may or should can be used with regard to the MAC providing a length to the PHY layer
  - Allow vendors designing MAC and Framer chips to determine the best place for the logic given their existing products and schedules