Examining the XR Market

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IEEE 802.3ba, Extended Reach on MMF ad-hoc

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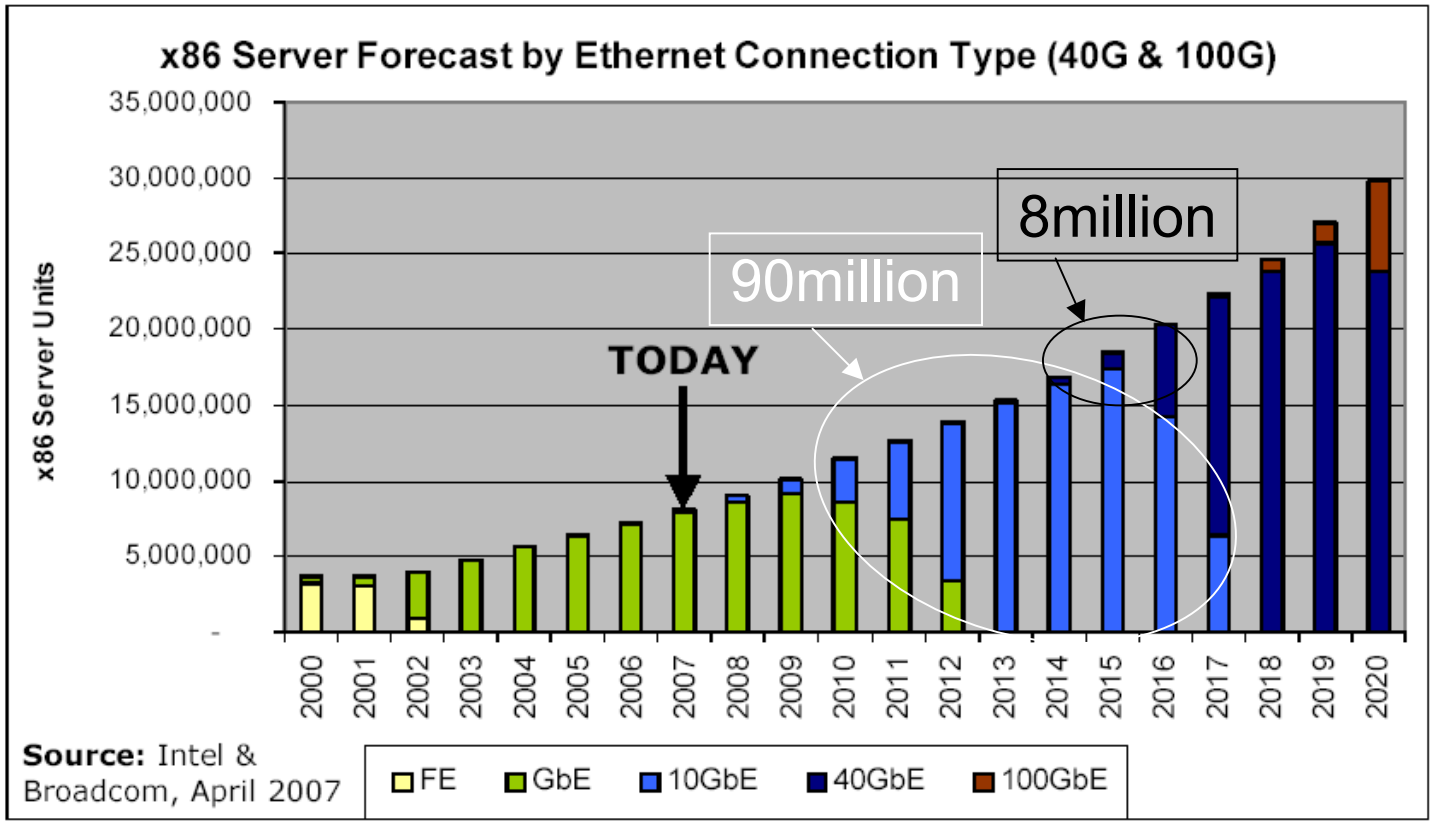
Background

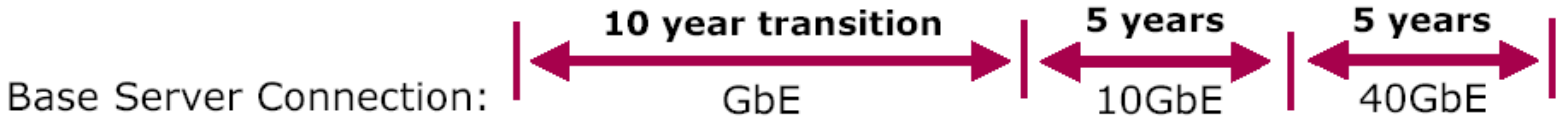
- A major criticism of opponents to providing XR MM optics is that the market size does not justify another PMD type
- The focus has been instead on addressing the <100m market, that is well suited to HPC environments and server access, at the lowest cost
- I have argued that the client-to-access (C-A) “horizontal” channels of the data center should be considered separately from the access-to-distribution (A-D) and distribution-to-core (D-C) “backbone” channels, just as we do in LANs
  - They serve different purposes
  - Their need for higher-rate services occurs at different times

- This material will offer some analysis to show these differences are sufficient basis for adding XR MM optics to the standard

Server Market Evolution

x86 Server Ethernet Connection Speeds with 40GbE & 100GbE





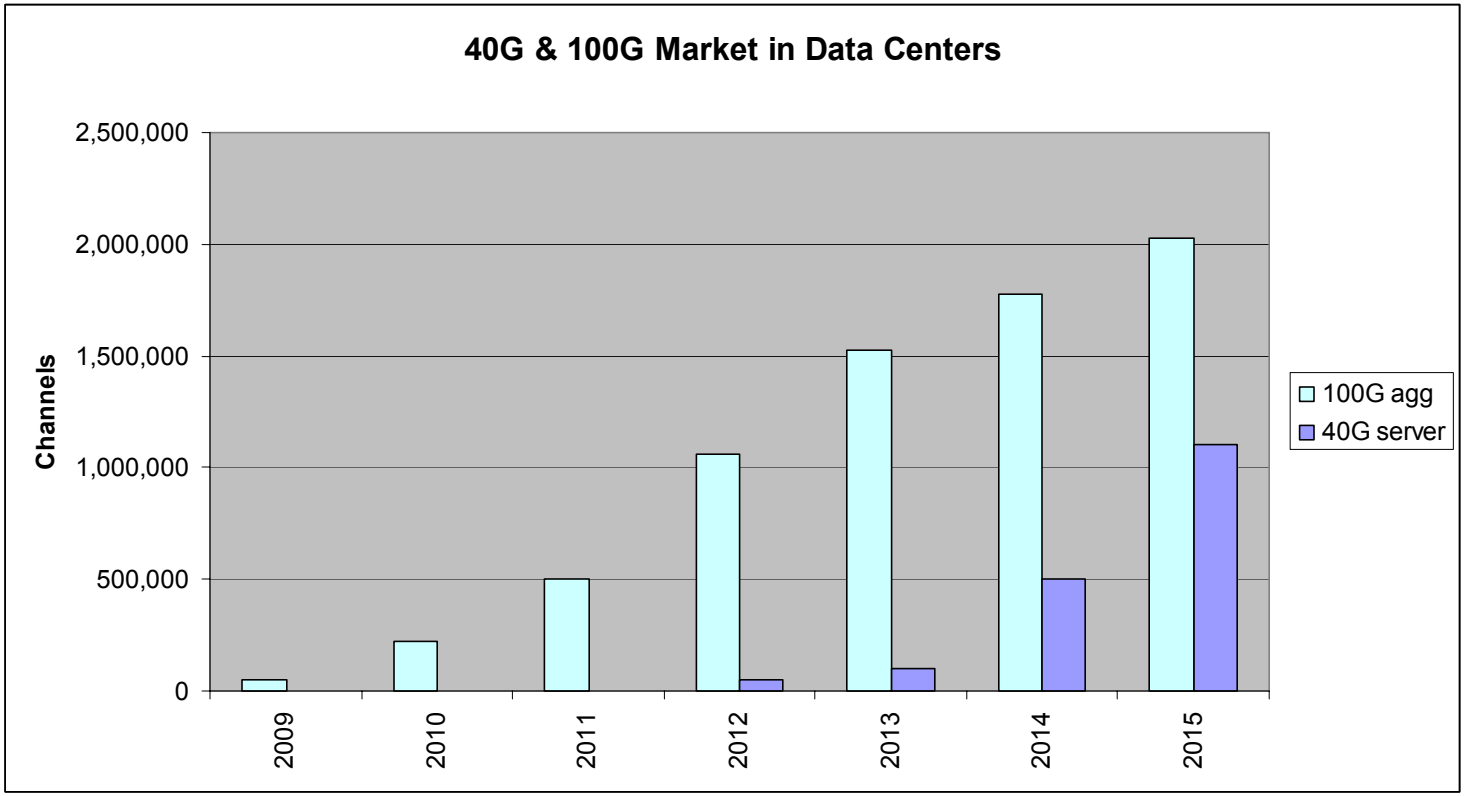
Extracted from hays_01_0407

Server Market Impact

- Sub 10G servers dominate thru 2011, 74 million units
  - These require aggregation in backbones at 10 (& maybe 40G)
  - 7.4 million 10G backbones at 10:1 aggregation
- 10G servers dominate thru 2016, 90 million units
  - These require aggregation in backbones at 40 & 100G
  - 9 million 100G channels in A-D at 10:1 aggregation
- 40G servers non-existent until 2012, not dominant until 2016
  - Small “horizontal” market for 40G until 2014
  - This is viewed as the big market, supported by Flatman’s data center survey that shows it outnumbers backbones by 13:1, but it is not the primary market until 2016

40G & 100G Market in Data Centers

Based on aggregation of server channels in hays_01_0407

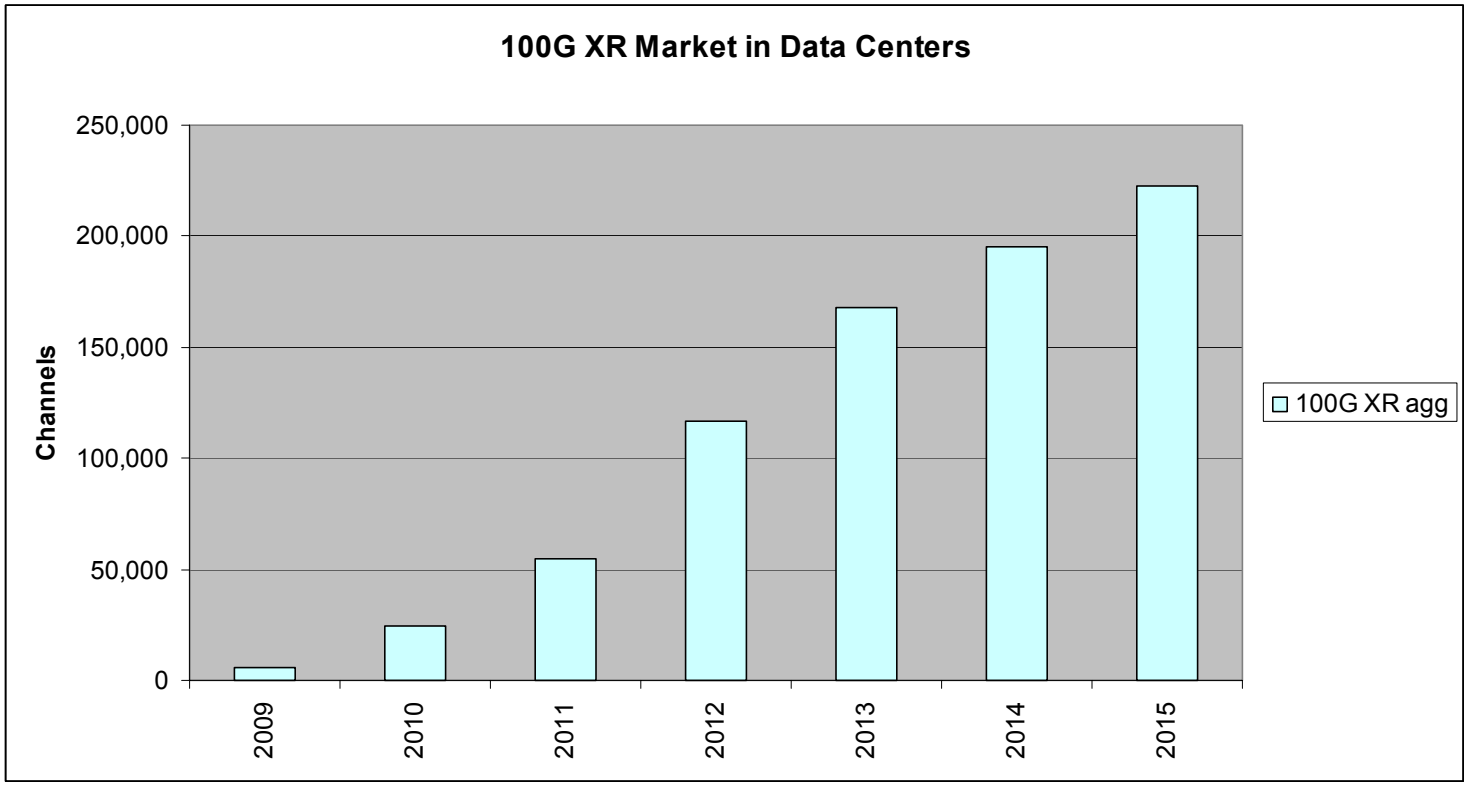


Each channel requires two PHYs/PMDs

Backbone Aggregation Market

- **Data Center market will predominantly deploy 40G / 100G for aggregation thru 2015**
  - **> 7,000,000 backbone channels needed to support server aggregation at 100G**
  - **If 40G is substituted for 100G, double this number**
- **If the XR market is just 11% of all backbones**
  - **~ 800,000 100G XR channels are needed thru 2015**
  - **~ 1,600,000 if 40G XR is used instead**

100G XR Market in Data Centers

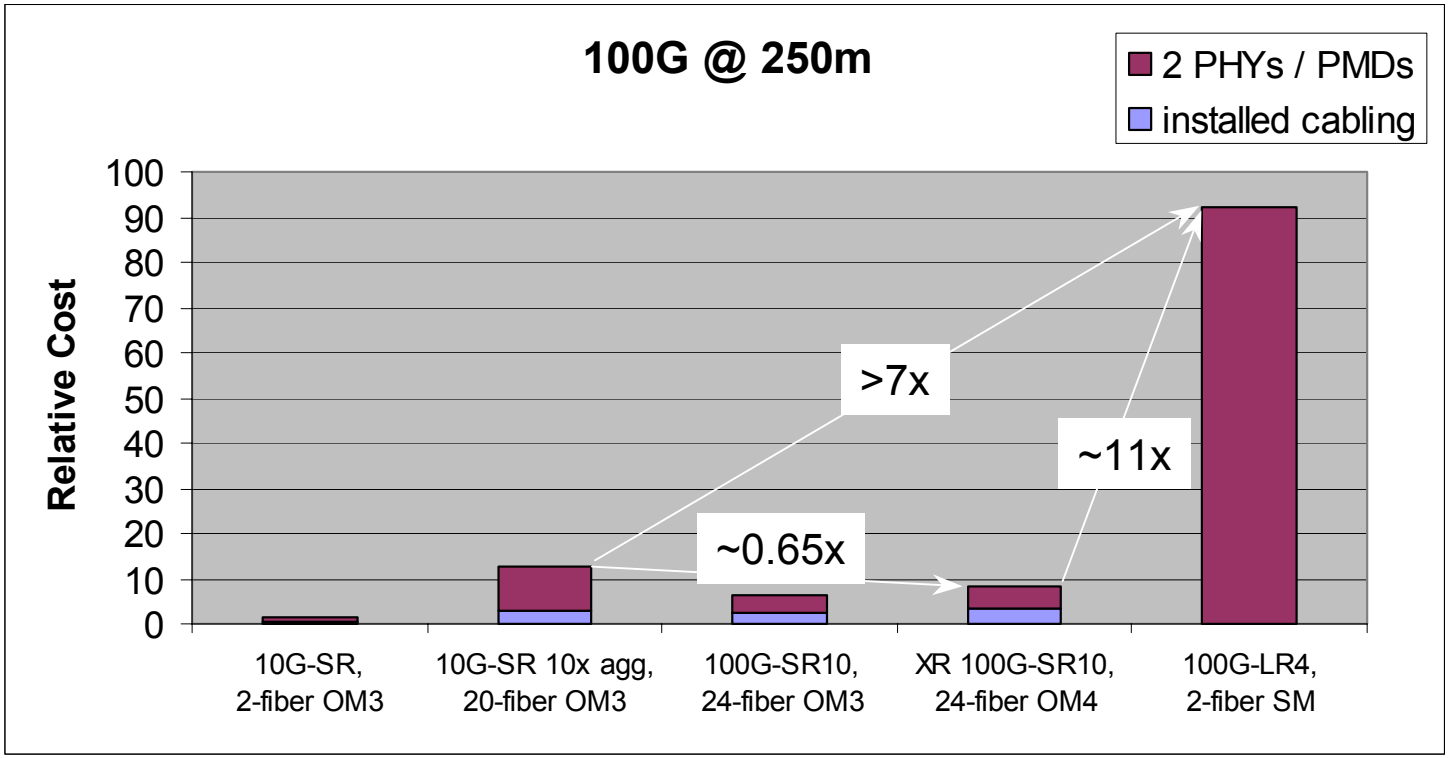


Each channel requires two PHYs/PMDs

Economic Feasibility Issues of Present Objectives

- **Analysis of total channel cost shows 100G-LR4 channel is > 10x the cost of XR 100G-SR10 channel**
- **If just 11% of backbone channels exceed 100m, then the customer's cost to use 100G-LR4 in these channels is greater than the cost for all sub-100m 100G-SR10 backbone channels combined**
- **This is neither economically feasible nor offers broad market potential. Instead it erects market barriers**

100G Channel Cost Comparisons



- **SM channel is over 7 times the cost of 10x aggregated 10G-SR**
  - **Using 10x 40GBASE-LR4 cost factor for 100GBASE-LR4 PHY/PMD per cole_40_02_0208**
- **Extended Reach SR10 is only ~65% the cost of 10x agg 10G-SR**
  - **Using 20% PMD cost premium per Jewell and 34% OM4 cabling cost premium**
- **SM channel is ~11x the cost of the Extended Reach SR10 channel**

Conclusion

- **The great cost disparity between SM and XR MM solutions, combined with the early need for aggregation in data centers, makes this an acute problem that must be addressed**
- **The market for XR MM aggregation channels develops years ahead of that for 40G servers and can broadly pave the way for server upgrades if a cost-effective solution is offered**
- **The market for XR MM PMDs is sufficiently large to warrant standardization and would address these issues with an interoperable solution**