Multi Rate PHY

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Nariman Yousefi

Broadcom

List of Supporters

Dave Koenen - HP servers
Dan Dove - HP Networking
Steven Hunter - IBM
Rich Hernandez - Dell servers
Kevin Ketller - Dell
Rich Graham - Enterasys
Terry Cobb - Avaya
Richard Mei - Avaya
Luc Andriaenssens - Avaya
Nariman Yousefi - Broadcom
Scott Powell - Broadcom

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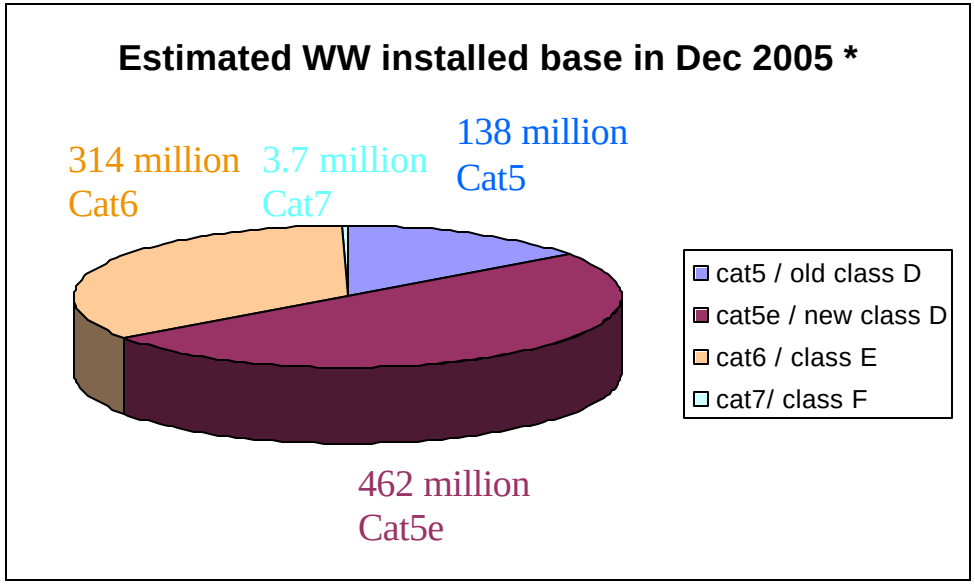
Prediction on Cable Installed Base



100m Media/Data Rate Capability Table

	Old Class D /Cat5	New Class D / Cat5e	Class E / Cat6	Enhanced Class E / Cat6e	Class F / Cat7
2.5G	yes	yes	yes	yes	yes
5G	No	No	Mostly	yes	yes
10G	No	No	No	Maybe	yes

* BISRA and
Alan Flatman Jan 03

925 million outlets by Dec 2005
Large installed base and growing

Multi Rate PHY

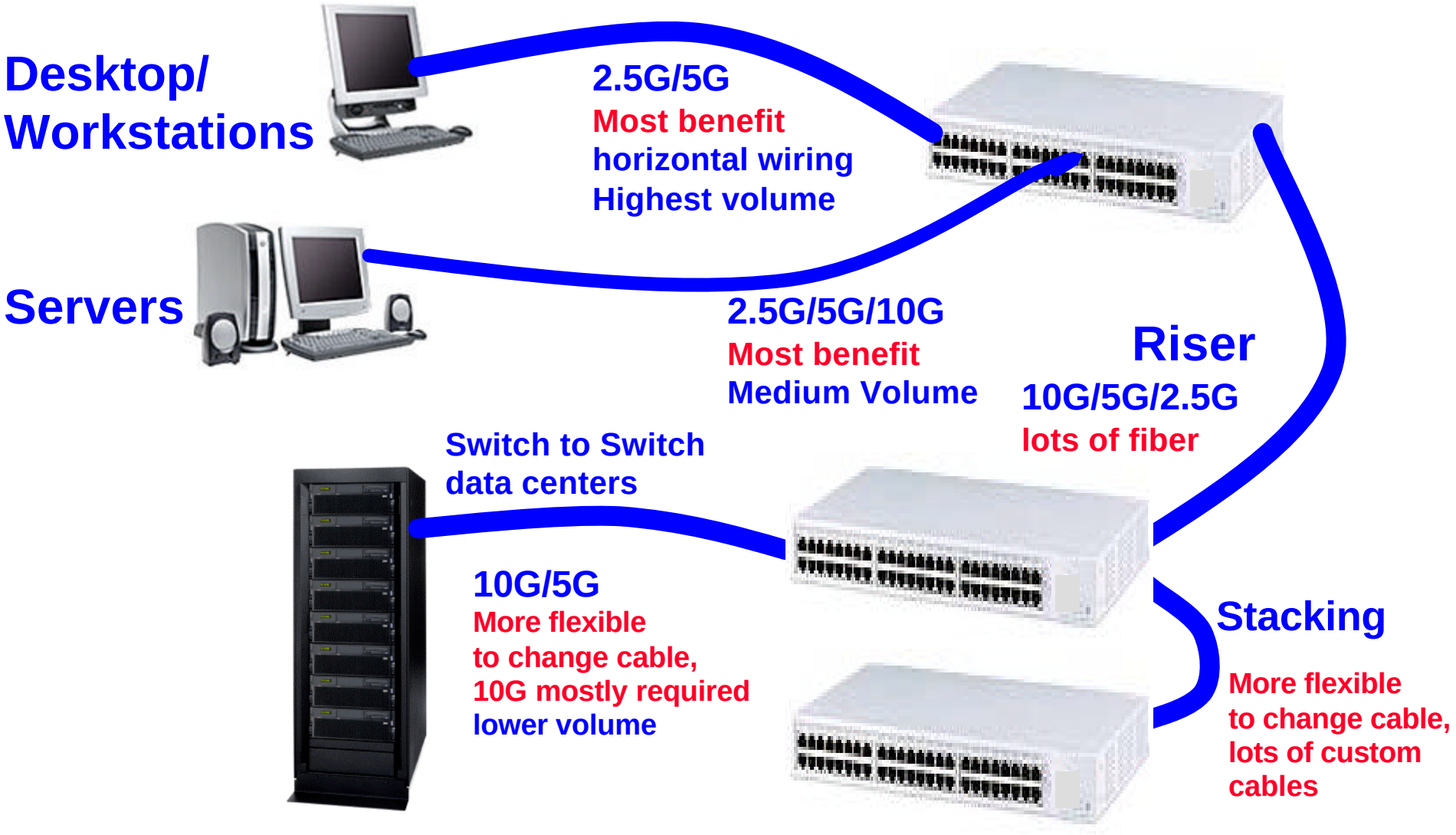
- **Multi Rate PHY provides speed upgrade over 1000Base-T on installed base and future installations and supports 2.5Gbps, 5Gbps and 10Gbps**

- **Multi Rate PHY implements a mechanism for negotiating down the link speed on links that don’t support higher speed**

Goals for Multi Rate PHY

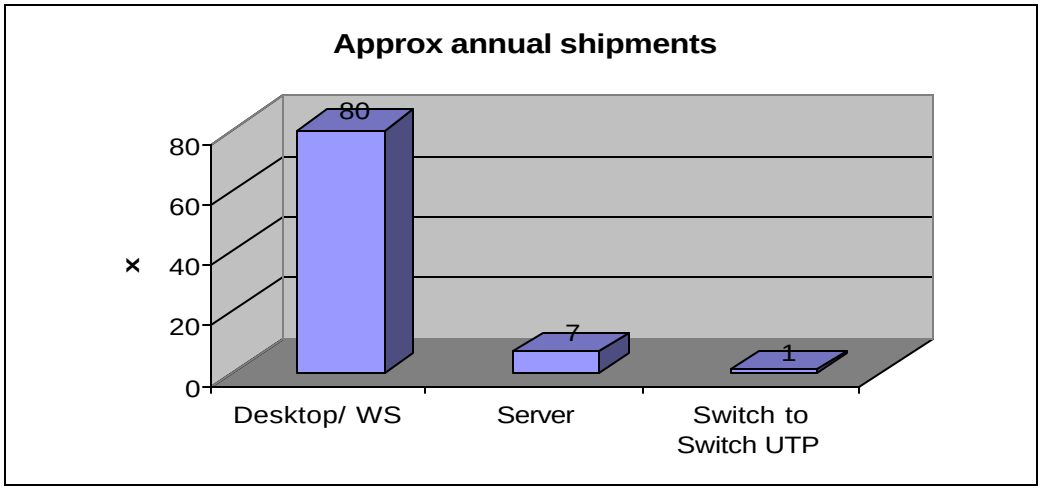
- **Multi-Rate PHY supports multiple data rates appropriate for its attached media**
  - Multi Rate PHY performs continuous signal integrity analysis on the channel to determine speed capability by an enhanced auto negotiation method
- **Multi-Rate PHY supports the following speeds:**
  - 10G, 5G, 2.5G
  - 1G,100Mbps, and 10Mbps will be supported as a matter of practicality
- **Multi-Rate PHY shall guarantee operation at:**
  - 2.5Gb/s on 100m Cat5e or better
  - 5Gb/s on 100m Cat6 or better. Nominal ANEXT improvement maybe required
  - 10G to operate over a distance and media type suitable for the rate.
- **Multi Rate PHY chooses the highest speed on the media after completion of Enhanced Auto Negotiation. Forced speed mode will be supported.**

Which Users Benefit from Multi-Rate PHY



Possible Deployment Scenario

Desktops	**1000BT penetrating now**	→	**2.5G**	→	**5G**	
Servers	**1000BT LOM is standard now**	→	**2.5G**	→	**5G**	→ **10G**
Switch to Switch links	**Mostly 1G few 10G**	→	**10G, 5G for cost sensitive apps**			



Which Users Benefit From Multi Rate PHY

- **All users benefit from having flexibility provided by Multi Rate PHY:**
  - **Flexibility in choosing appropriate copper media required for the application and preserving media investment**
  - **Data center switch to switch applications get the 10G on copper**
  - **Multi-Rate PHY addresses a bigger market than 10G only solution which drives down the cost of Multi-Rate PHY**
  - **Users could achieve 10G by Trunking 4x2.5G or 2x5G on 100m UTP with no bundling or installation restriction**
  - **Flexibility in optimizing cost to offer 2.5G and 5G products for applications like servers, desktops, and storage.**
  - **2.5G will be required for desktops much sooner than 10G is required**
  - **Multi rate capability expands the total Ethernet market**

Multi Rate PHY Complements 10Gbps Ethernet

- **Multi Rate PHY can address a large segment of the market that 10GBase-T can not address**
  - ie Horizontal UTP cables
- **Users with UTP cables that are inadequate for 10G data rate can still achieve 5G or 2.5G**
  - Without Multi rate PHY, the only other option is 1G if 10G does not work
  - Example: 10G may work at 70m, but it may fail at 71m. The next speed option should be 5G not all the way down to 1G
- **Multi Rate PHY provides a future proof path allowing Network equipment and computers to fully utilize the media capability**

Economic Feasibility

- **Negligible incremental cost to support 5G and 2.5G as part of a 10G PHY device**
  - 2.5G and 5G is essentially free as part of a 10G PHY
- **Manufacturing cost of a Multi Rate PHY will be lower since it can reach high volume addressing a large market**
- **Preserves installed base**
- **Cost can be optimized to address desktop market and server market**
- **Approximately 1.5x silicon cost increase over 1000Base-T to support 2.5Gbps**

Review of 5 Criteria

- **Broad Market Potential:**
  - Multi Rate PHY supports installed base 100m Cat5, Cat5e, Cat6 and better horizontal cabling
- **Compatibility with IEEE std 802.3**
  - Minimal Change to MAC may be necessary to either enhance rate control or specify new rates for MAC and XGMII
- **Distinct Identity**
  - Greater than 1G
  - Maximizes use of cable capability
  - Support ISO 11801 links

Review of 5 Criteria

- **Technical Feasibility**
  - Preliminary technical feasibility has been shown for 5G and 2.5G
- **Economic Feasibility**
  - Negligible cost impact to add 5G and 2.5G capability to a 10Gbase-T PHY
  - 2.5G cost optimized devices will have comparable cost to 1G

Conclusion

- **We need a standard that addresses installed base for speeds higher than 1Gbps**
- **Multi speed PHY is the only solution that can achieve broadest market potential by supporting higher speed data rate on existing and future installations**
- **Addressing broad market is important. Addressing just data centers will not create a high volume market**
- **Ask IEEE to include multi rate PHY as part of 10GBase-T study group**
- **Provide standardized mechanism for resolving speed and cable quality on a given ISO 11801 channel**

Proposal

Recommend to include lower speeds in 10GBASE-T and define 10GBASE-T as:

XGBASE-T for rates $1 < X \leq 10$ gigabits per second.

With these objectives:

A XGBASE-T PHY shall operate at $1 < X \leq 10$ gigabits per second at the following rates and media type if capable:

1. A minimum of 2.5 Gb/s over an ISO Class D or better 100 meter channel and with an alien crosstalk requirement to be specified.

2. A minimum of 5.0 Gb/s over an ISO Class E or better 100 meter channel and with an alien crosstalk requirement to be specified.

3. For greater than 5.0 Gb/s to operate over a distance and media type suitable for the rate.

A XGBASE-T PHY shall be capable of all rates below its maximum rate.