

User's Perspective for Ten Gigabit Ethernet

Michael Bennett

Lawrence Berkeley National Lab

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Background



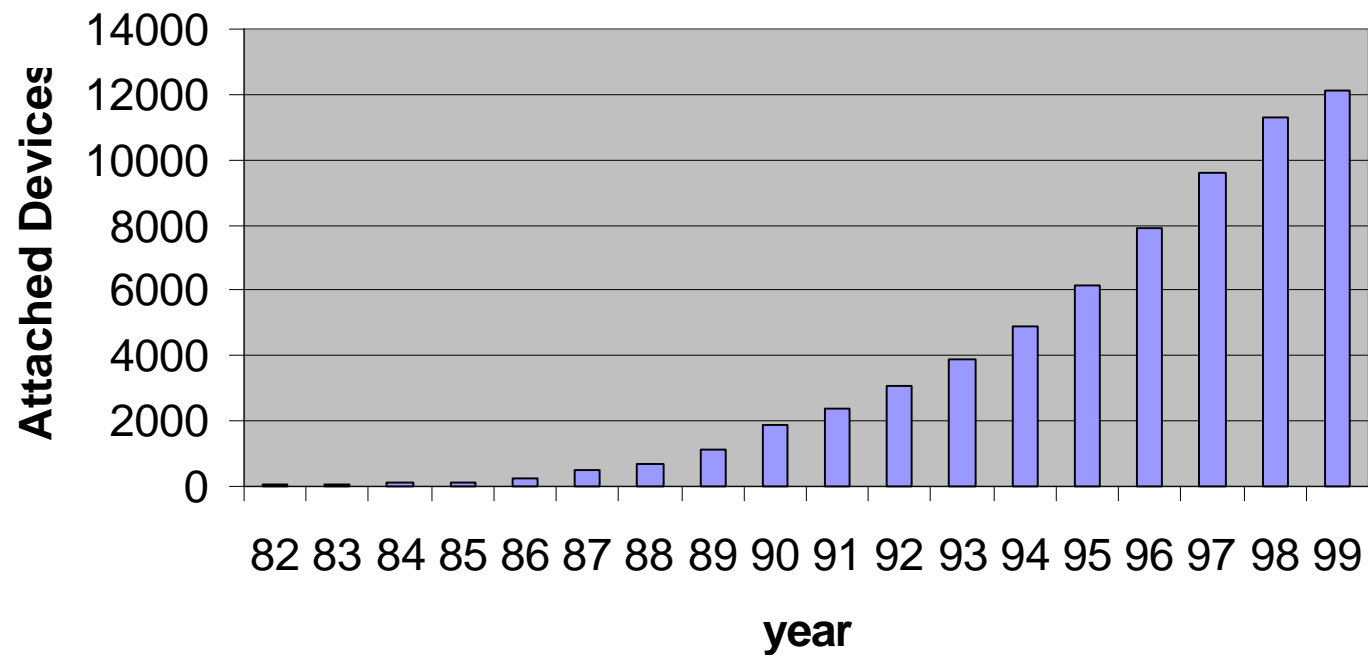
- **About LBNL**

- **Leading edge research in the biological, physical, materials, chemical, energy, and computing sciences.**
- **Unique user facilities include the Advanced Light Source, Joint Genome Institute, and the National Energy Research Scientific Computing Center.**

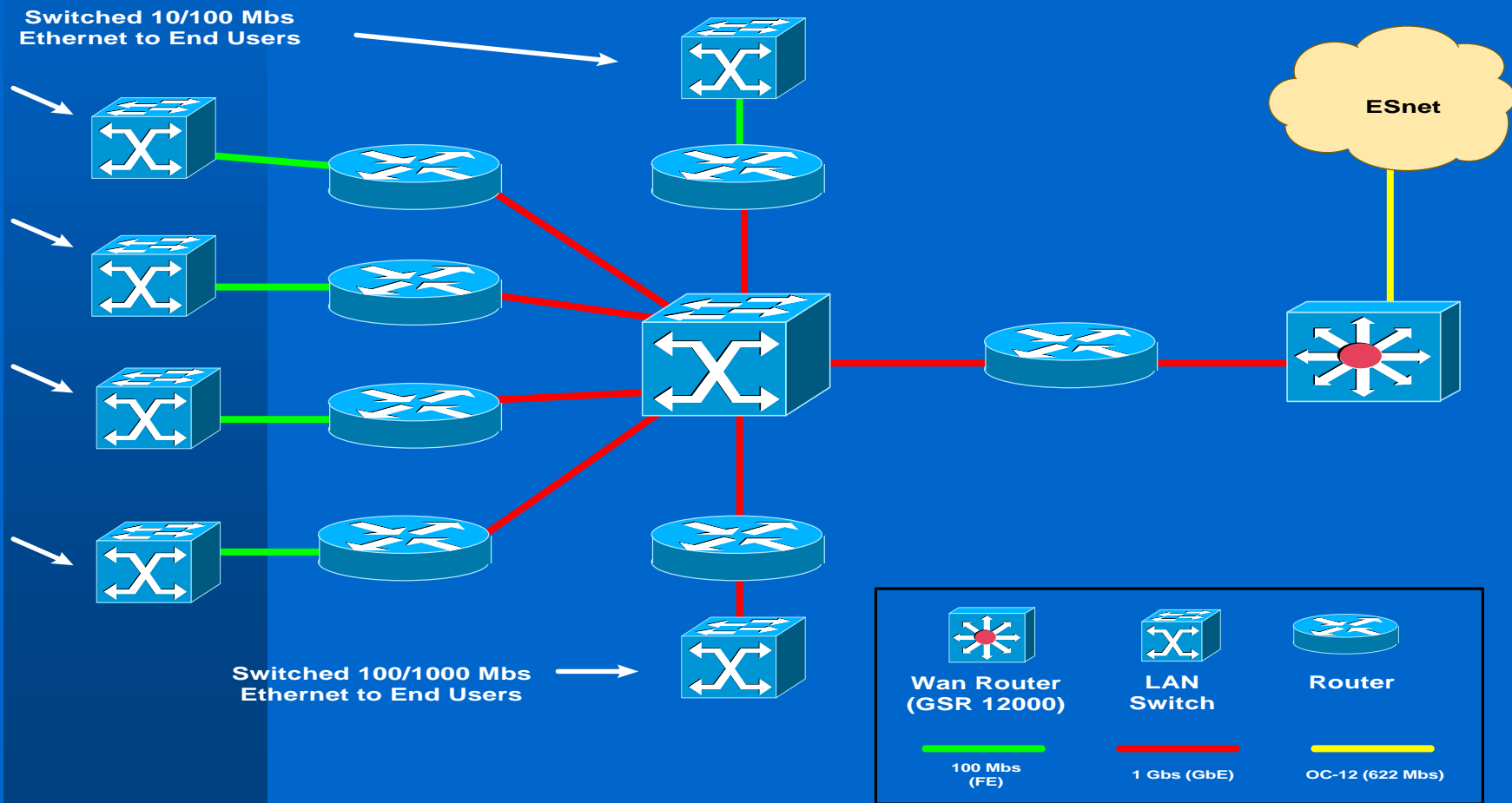
Growth at LBNL



Systems Attached to LBLnet



LBLnet Architecture



Our Bandwidth Needs



- **Research Traffic Increased by a factor of 400 between 1990 - 1998**
- **Next 5-year growth is projected to be by a factor of 1000.**
 - **This means providing multi-gigabit networking by 2000**
 - **We should be testing 10 GbE in 2000.**

Our Bandwidth Needs (cont.)



The accelerated-track requirements have been defined by a working group defining "cross cutting technologies" for the proposed multi-agency Information Technology for the Twenty-First Century," or IT².

Fundamental end-to-end performance levels for the two requirement sets are as follows:

FY	2000	2001	2002	2003	2004
Fast-Track	OC48	2xOC48	OC192	2xOC192	OC768
Acc-Track	OC192	4xOC192	16xOC192	16xOC768	25xOC768

Fast-track performance levels are based on a reasonable projection of requirements based on current growth rates. A number of DOE major projects, programs, and initiatives have projections for cumulative performance levels that are represented by the accelerated-track performance levels. Actual requirements will likely fall between these two extremes, depending upon turn-up schedules and funding for these new activities.

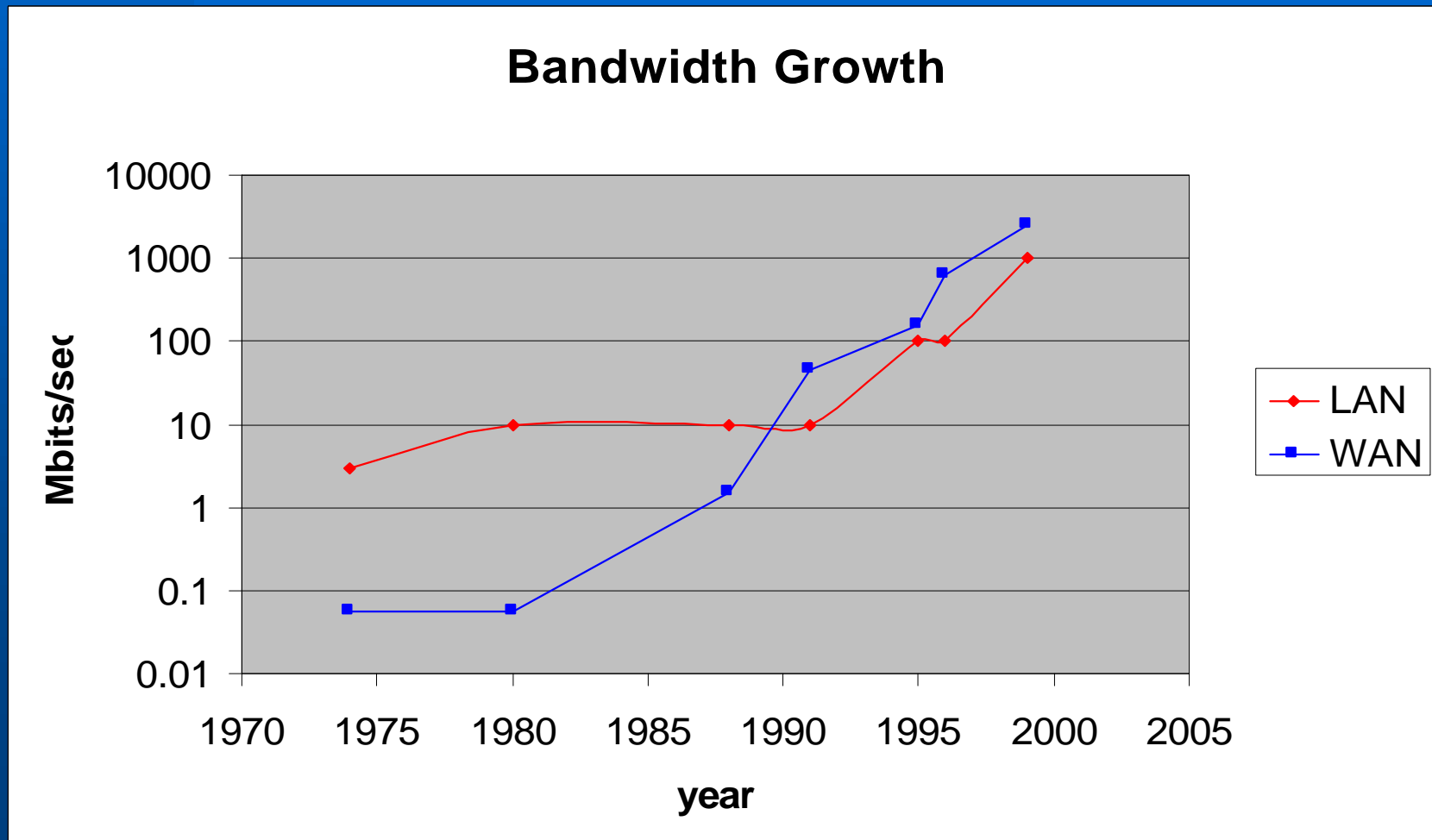
Our Bandwidth Needs (cont.)



Type of Interaction	# Simult.	Bandwidth
Computations	1 -- 3	100 Gb/s to 1 Tb/s
Real-time Steering	2 -- 10	10 Gb/s
Remote Visualization	2 -- 10	10 Gb/s
Remote I/O	2 -- 3	30 Gb/s to 600 Gb/s
Navigation	5 -- 20	1 Gb/s to 5 Gb/s
Collaboration	30 -- 60	100 Mb/s to 1 Gb/s
Instruments	10 -- 20	80 Mb/s to 5 Gb/s

- ★ Computation: 1%-10% of bisection bandwidth; steering: 4 screens x 160 frame rate x 4Kx4K pixels x 32; remote I/O: 600 TB in 55 hours; navigation: $128^3 \times 8 = 16\text{MB} \times 30 \Rightarrow 500\text{MB} \Rightarrow 5\text{Gb}$; collaboration: 9-video, stereo audio; instruments: per beamline; with 20-100 channels $\Rightarrow 100\text{Gb/s}$.

We Need to Catch Up



The Infrastructure



- **LBNL Campus fibre distribution:**
- **47 Buildings connected via fibre.**
- **3134 fibres total:**
 - 2% 100 u (legacy stuff)
 - 81.5% 62.5 u multi-mode
 - 16.5% 8 u single-mode
 - almost none run to the desktop

What fibre do we use

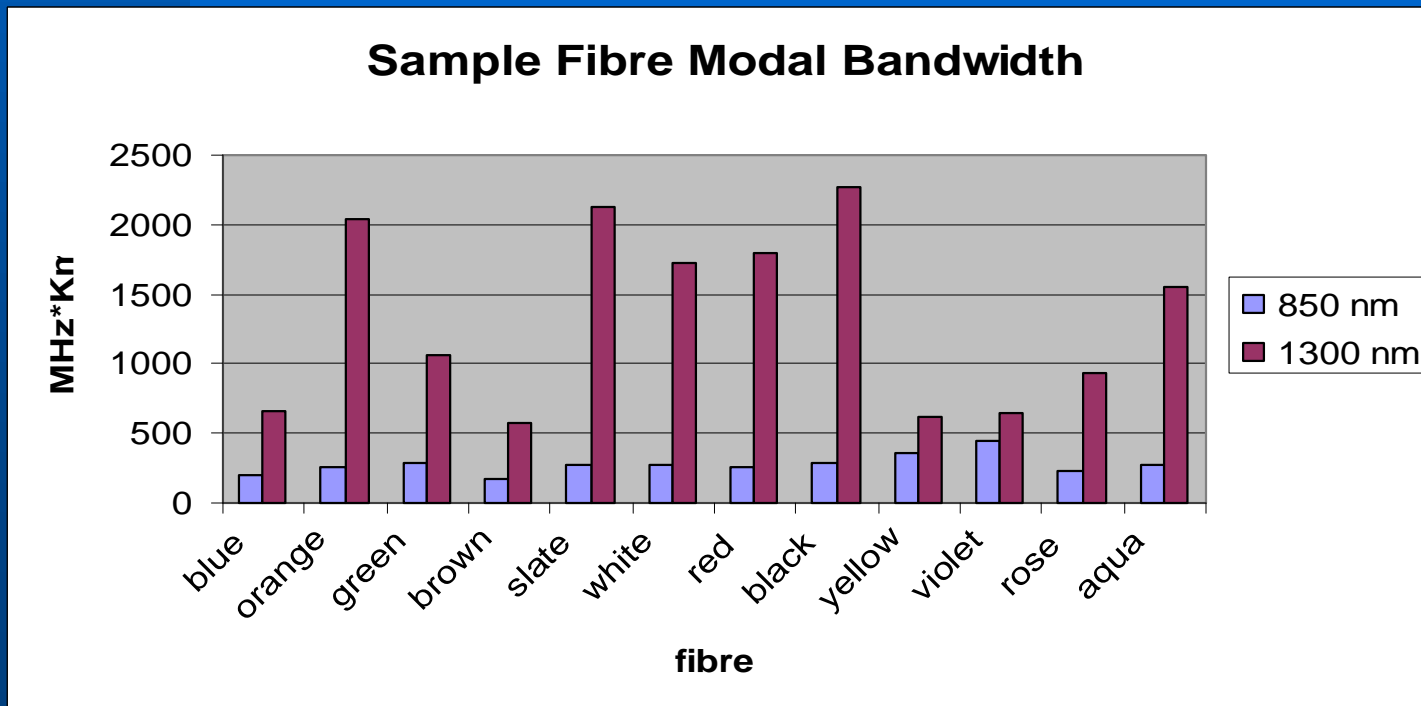


- <10% of LBNL's MMF will reach inter-building at <500M - thus will use SMF
- Intra-building fibre is the realm of MMF for us, and we have almost none to the desktop
- Therefore it doesn't matter to us if we pull new MMF

New fibre specification is OK



- New 62.5 u fibres test better than 160/500 Mhz*Km spec:



So, for MMF

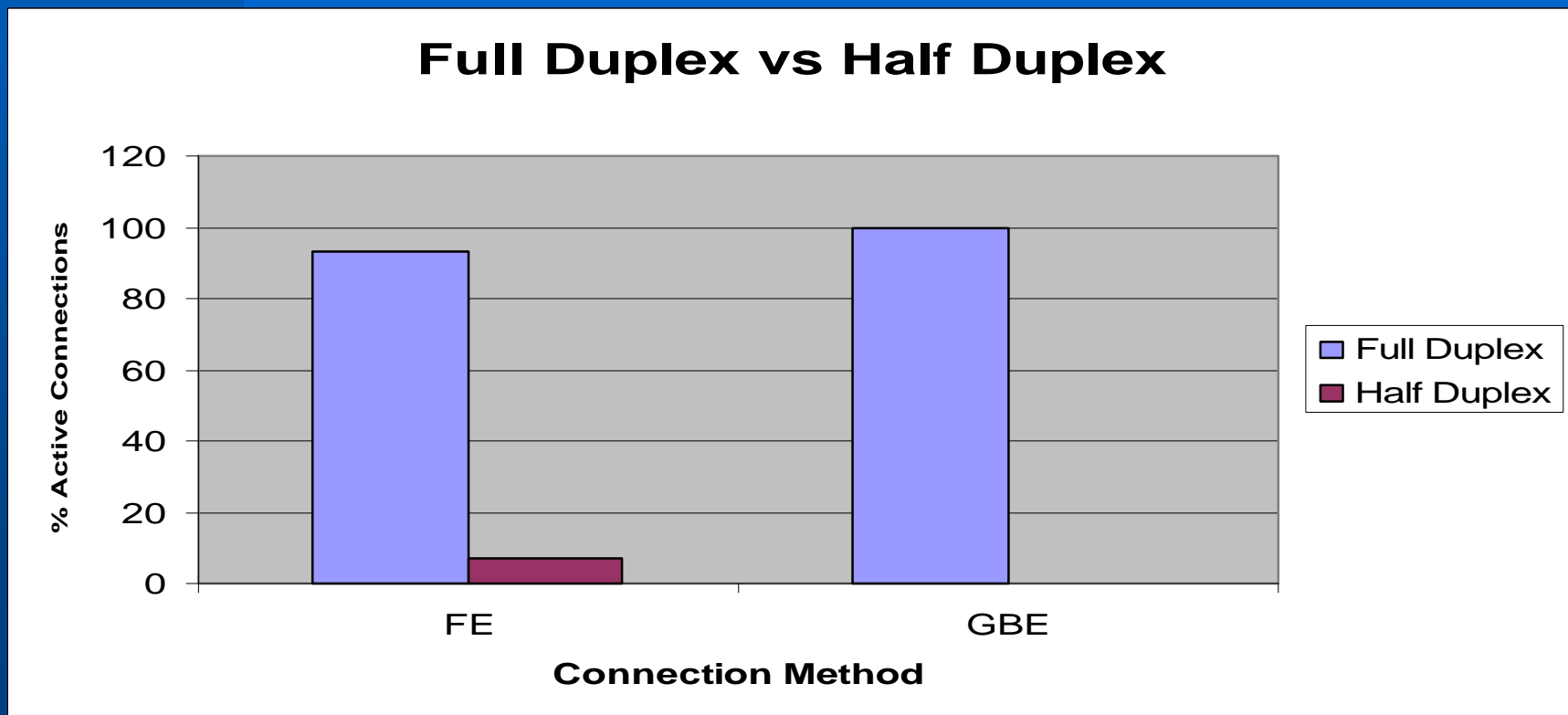


- Don't get hung up on old, badly specified MMF
 - ... plan on using the good stuff
- This will keep costs and complexity down

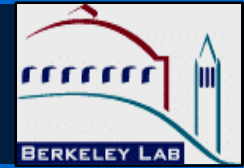
No need to do CSMA/CD



- A Sample of active connections:



No Jumbo Frames Please



- We have hundreds of pieces of equipment that become obsolete if frames > 1518 Bytes become standard.
- There is hardware today that can provide the throughput.
- Even if you decide it is a good idea, this is probably not the place for it.

Keep the primary emphasis on LAN



- **Use of readily available components and high volume means low cost**
 - Newer better technology is good as long as it doesn't delay the time to standard too long
- **Focus on the 10GbE for LANs as a first priority, work on MAN/WAN stuff second**

Other Issues



- **Very important to stay on track**
 - avoid “connector wars”
 - avoid 10 GbE on copper delays for basic standard (just like GbE)
 - and restating, avoid MAN/WAN efforts delaying basic LAN effort
- **That is, structure these efforts so timely and appropriate results occur**

Summary



- The need for 10 GbE is here
- Its OK to require new MMF fiber
- Full Duplex is fine, forget CSMA/CD
- No need for frames > 1518 Bytes
- Stay on track with a low cost LAN solution to start with
- Thank you!