

# COTSWORKS™

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## **High Speed Miniature Interconnects: 2.5G to 10Gbps and Beyond**

**Presented by Ken Applebaum,  
Director, COTSWORKS**

**AdvancedTCA Summit 2009**



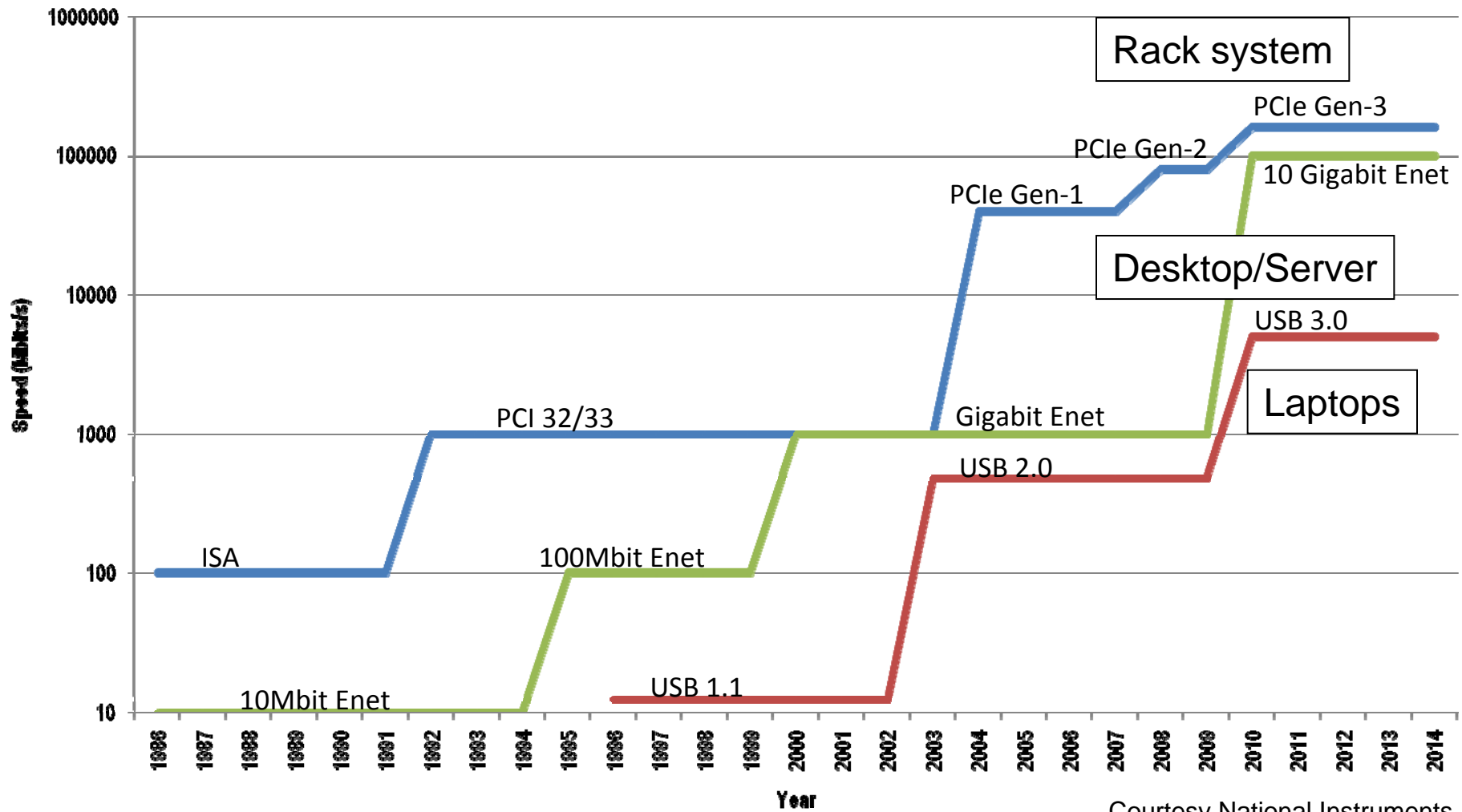
Rugged Fiber Optic Components  
For Harsh Environments



# Today's High Speed Interconnects

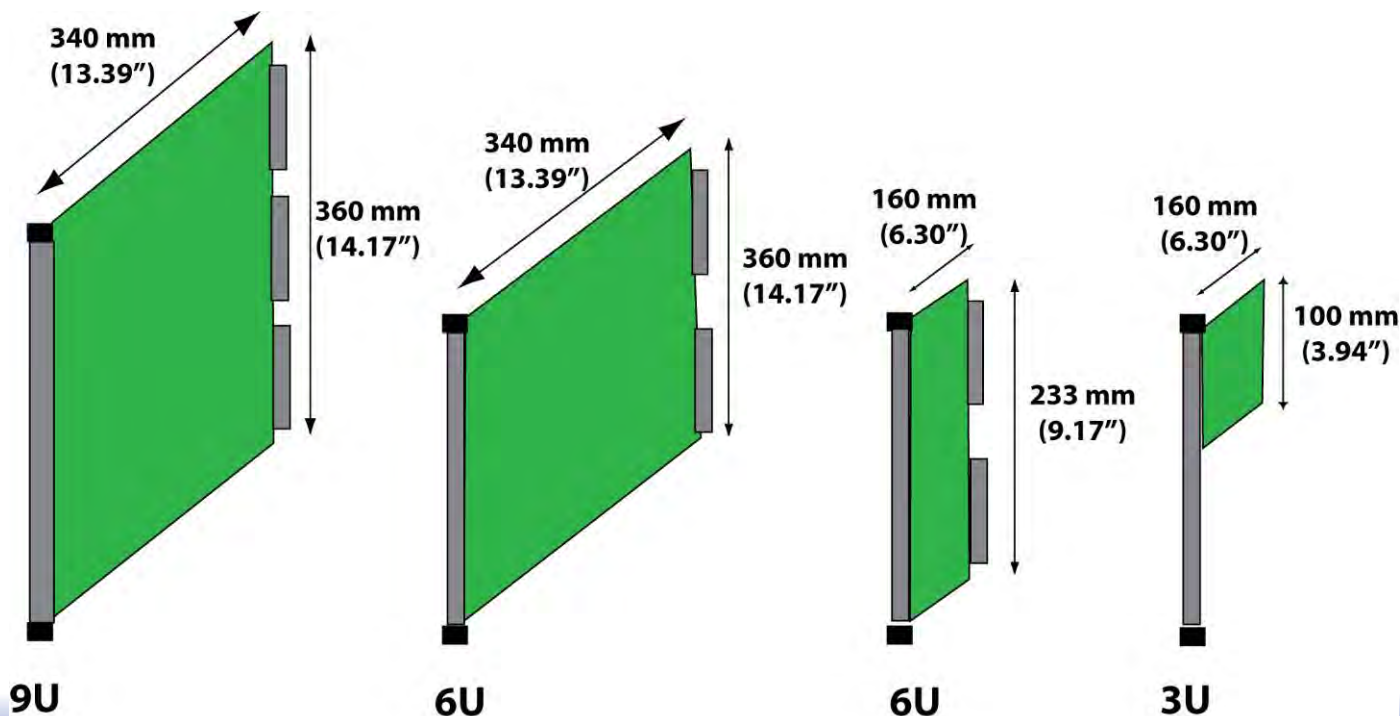
- I/O is outpacing backplane throughput
  - Move beyond 1Gbps Ethernet, to 10, 40+
  - Looking to 8, 16Gbps Fibre Channel
  - Needs Infiniband latency with more open architecture
- Front side I/O needs to use optics in order to provide greater than 1Gbps but means front bus communication or more complex installs
- Backplane must move to optics to keep up
- Size, heat, packaging issues need to be addressed

# Bus Throughput Timeline



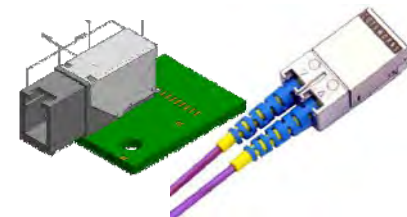
# VPX Form Factors

- Rack mount boards with copper backplane I/O need optics for increased throughput
- Transceiver size prevents effective I/O, HxWxL: 0.4"x0.5"x2.25" could use 30% of space!



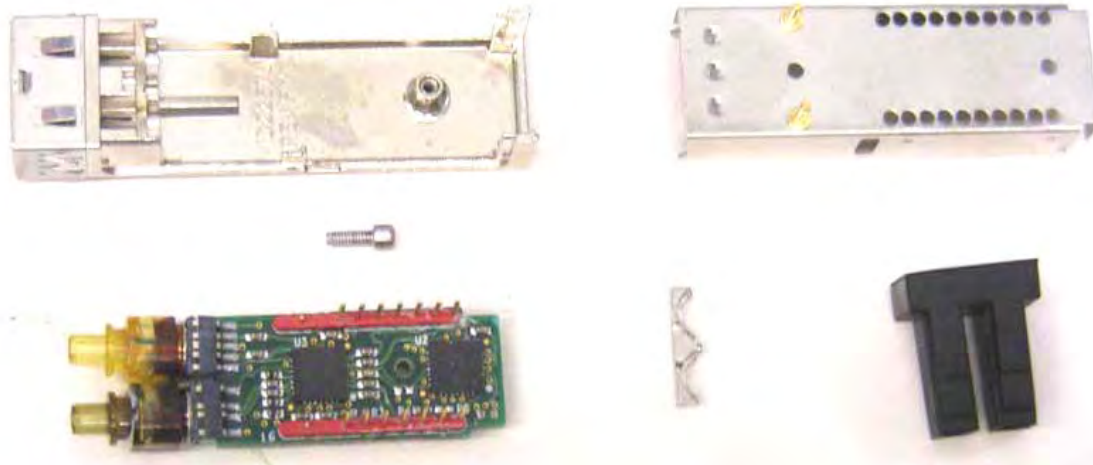
# Single Channel Optical Transceivers

- Small form factor modules run up to 8Gbps
  - SFP, pluggable
  - SFF, thru-hole mount
- XENPAK/XFP/SFP+ run 10Gbps, pluggable
- CFP/CXP run 40Gbps and higher
- Non-standard form factors
  - RJ, chip scale, sugarcube



# Transceiver Explained

- Typical transceiver has a TOSA and ROSA or Transmitter and Receiver in sealed package and with an LC connector welded/epoxied on
- Laser and receiver each have driver chips
- Signal coming into transceiver is digital high speed copper



# The Drive To Multi-Channel

- Datacomm
  - Need is for high density to link processors in supercomputing
  - They can also be lower cost than separate SFPs
- Military
  - They provide a way to put digital high-speed communication in a package that was once small amounts of analog
  - They also can be embedded in a connector saving board space and fiber cable routing in an LRU
- *Embedded Communication is always short links*
  - Almost always Multimode fiber
  - SX spec using 850nm VCSELs
  - 1-4 or 10Gbps speeds at Ethernet, Fibre Channel, XAUI protocol

# Existing Datacomm Multi-Channel

- Thinner active cables replace copper and at higher speed
- MSA parts use MTP cabling making higher density possible
- BGA connectors reduce board space requirement
- Very cost effective producing good gross profit and growth
- Cost below \$25/transceiver
- Cable breaks...part breaks making failures expensive
- Fixed lengths with no repeater options
- Only works in very controlled environments: no shock, vibration or temp. swings
- Arrays available only in 4 or 12 channel count fixing speed increases to a specific multiple



**Active cable**



**SNAP 12**

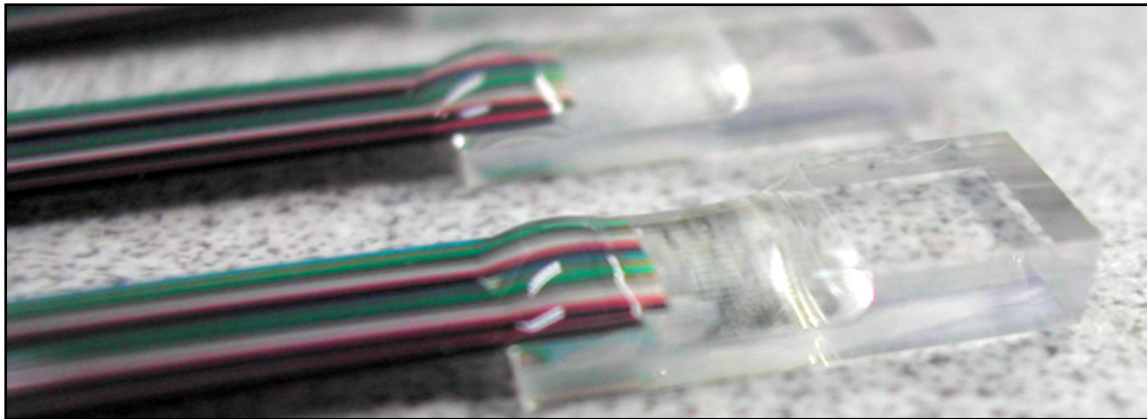


**SNAP 12**

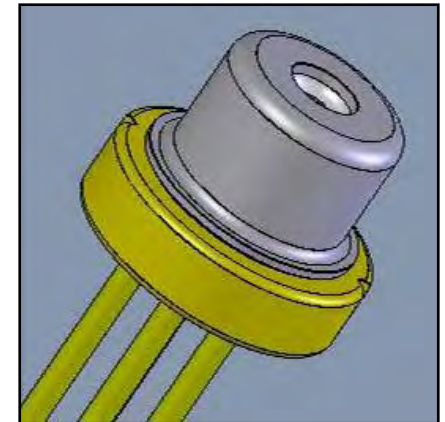
Images courtesy Emcore

# Without TOSA: Fiber Bonding

- 62.5um fibers are bonded directly to semiconductor lasers (sometimes 5um wide)
- Epoxy is applied and UV cured with a tri-axial alignment procedure
- If the last fiber bond in an array fails, the whole part is scrapped
- To reduce cost, assembly is done overseas and specifications are relaxed or ignored as long as **fixed** link works
- This technology is not new, but automating it is being automated
- Glass end is not polished to same specs as fiber cables



Vs.



# Embedded I/O: VITA 66

- Backplane optical connector options
  - MTP offers 4, 8, 12 fibers with pin alignment
  - ARINC 801 or LuxCis™ is rugged, multi-source 1.25mm termini with spring lock
  - Expanded Beam uses ball lens for fiber connectivity in outdoor environments

- *User choice of module on backplane*
- *Multi-channel transceiver on board with pigtails – see COTSWORKS for more information*

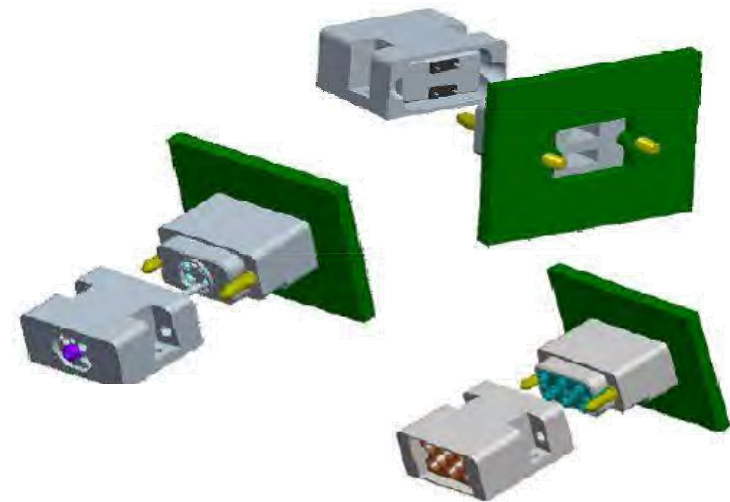
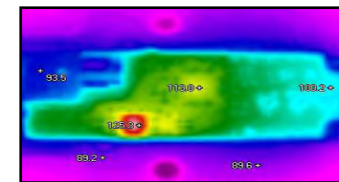


Image courtesy Tyco Electronics

# Problems Facing Optics In Embedded

- Design engineering knowledge: laser types, link budgets, electrical interfaces
- Mechanicals: fiber cable layout including jacketing, bend radius, installation
- Environmental: laser operating temperature, pluggability, heat management
- Test: multi-channel with automation to test links under stress for mission critical use
- Service: Fiber inspection, cleaning, test
- Communications: active optics companies need to participate in VITA, ATCA



# About COTSWORKS

## ***Our Mission:***

*Enable a new generation of fiber optic products for high-speed communication and smart structures in harsh environments*

- Use highest quality Commercial Off The Shelf fiber optic parts from Tele/Datacomm and make them work at Mil/Aero, Industrial, and custom specifications
- Help engineers design *new* or upgrade *existing* systems from copper or analog or unmonitored systems to digital, fiber optic based, high speed, intelligent ones

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