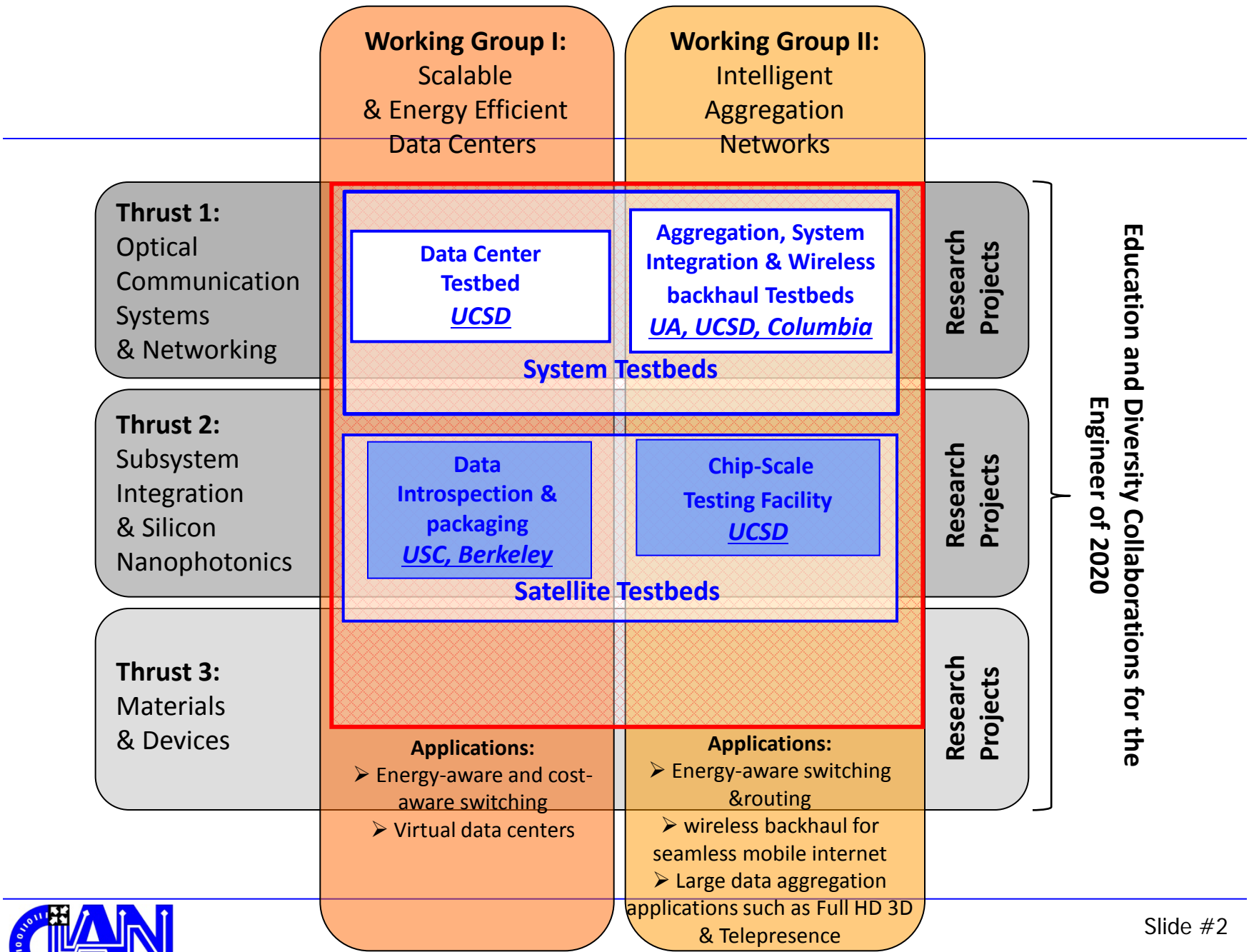


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# WG1 DATACENTER TESTBED AND CHIP-SCALE TESTING FACILITY

George Porter and Maziar Nezhad





Education and Diversity Collaborations for the Engineer of 2020



# Testbeds in action:

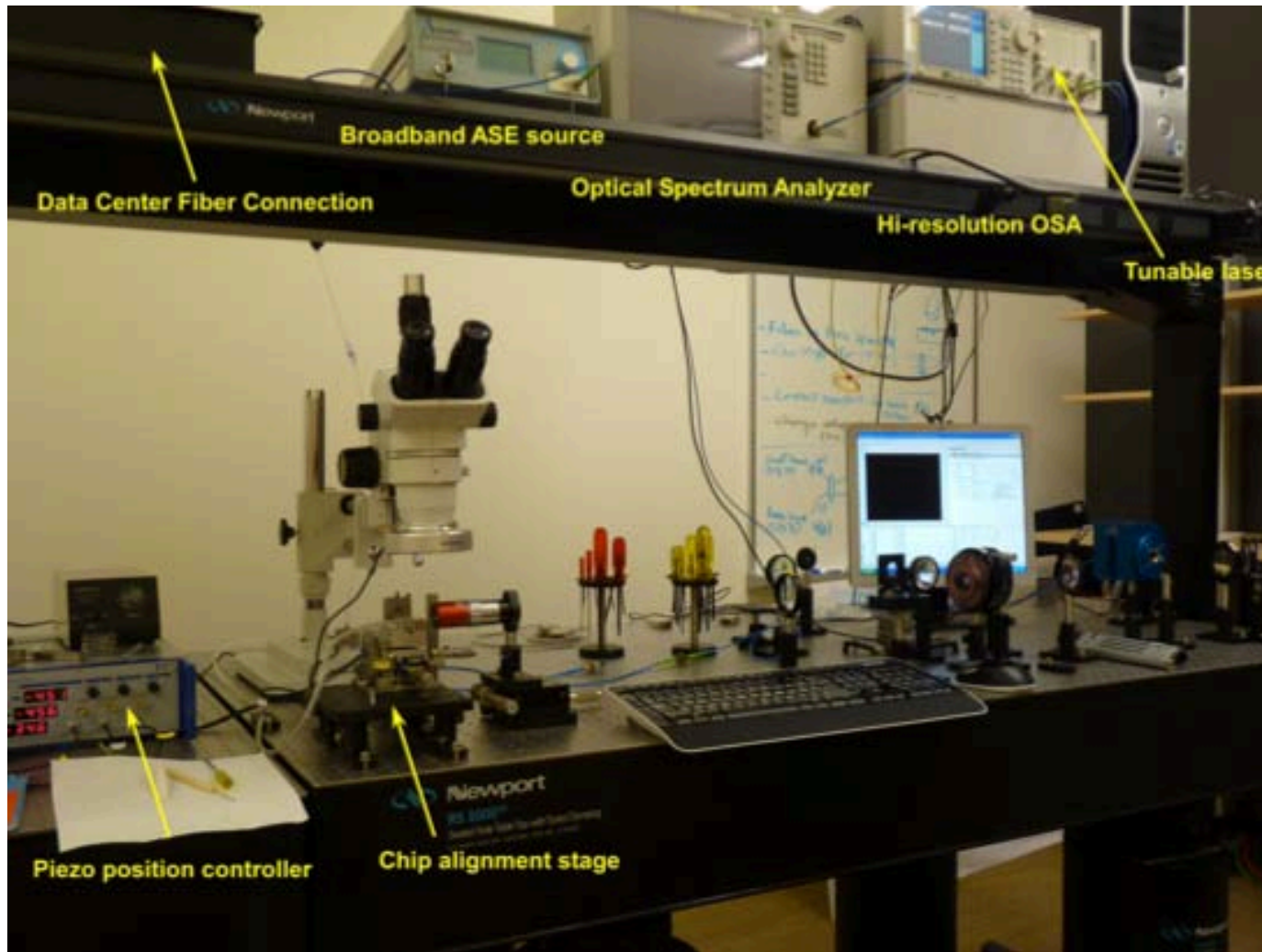
## Testing out a new fast switch

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- Consider the following scenario:
  - New, fast MEMS switch developed from Norwood, new wavelength device from Chang-Hasnain, or industrial hardware from industry members
- ❖ Micro-evaluation at the optical layer
  - How does it perform purely as an optical device?
- ❖ Comparison against commodity devices
  - How much better can we do with CIAN-developed technology?
- ❖ Macro-evaluation with datacenter traffic
  - How do real applications perform with the switch?



# UCSD Chip-Scale Testing Facility



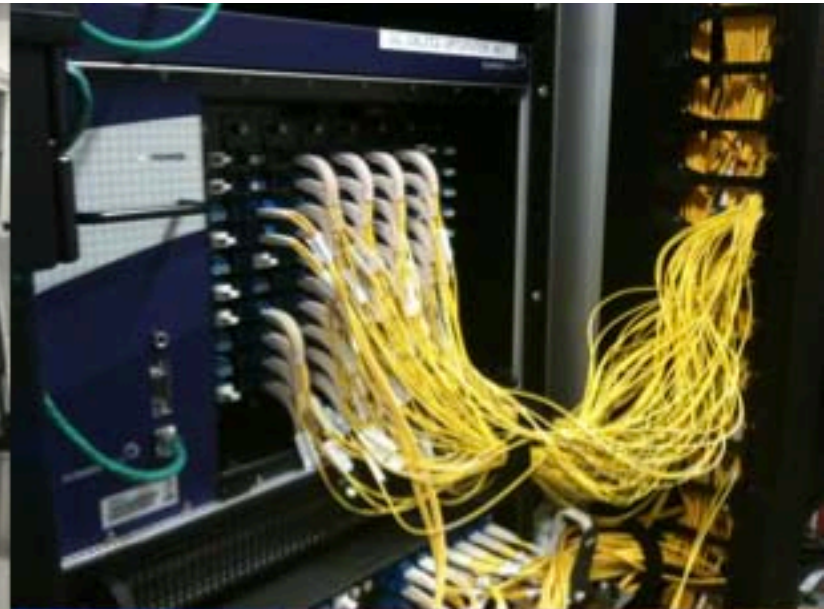
# UCSD Chip-Scale Testing Facility

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- 67 GHz Lightwave component analyzer (Agilent N4373C)
- 13 GHz realtime oscilloscope (Agilent Infiniium)
- Tunable laser , 100fm resolution (Agilent 81600B)
- Hi-resolution (8fm) optical spectrum analyzer (Agilent 83453B)
- Grating based Optical Spectrum Analyzer
- Simulation and design software (COMSOL & RSoft)
- Simulation server (donated by SUN micro systems), 128 GB memory, 8 CPU cores.



# How devices get inserted into the Datacenter testbed



# Evaluating against realistic datacenter traffic

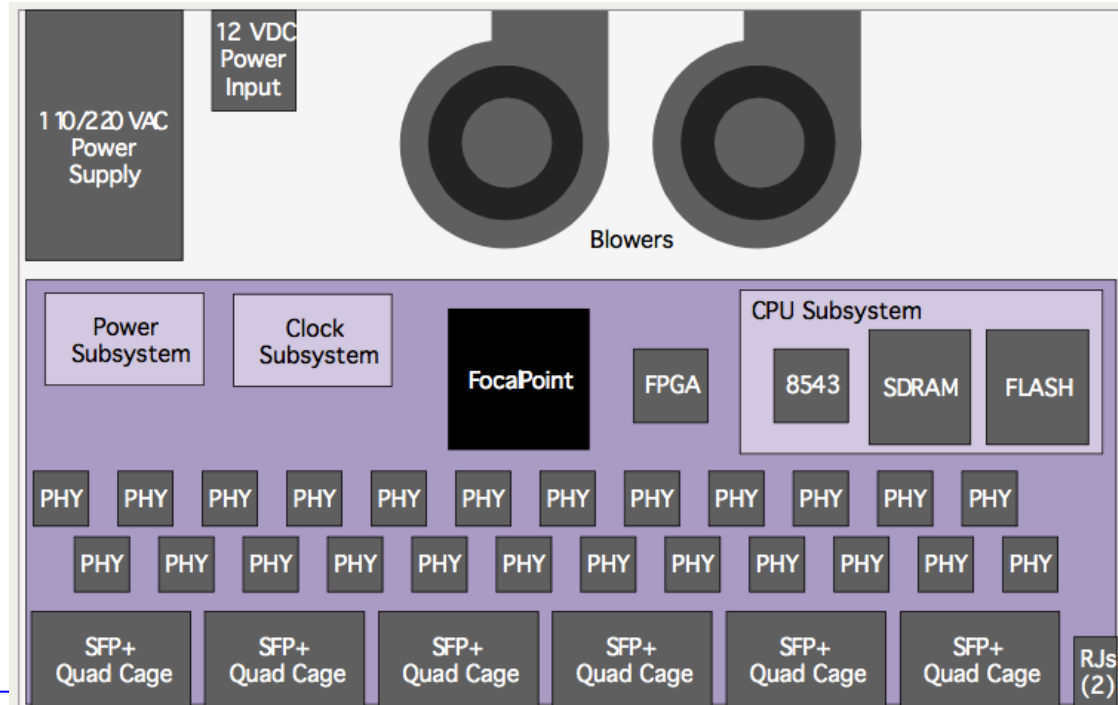
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- CIAN WG1 Datacenter testbed:
  - Servers (70)
  - Storage (0.6 PB)
  - 2x 10Gbps SFP+ copper links from each server
  - 3x Fulcrum Monaco programmable switch fabrics
  - 2x 52 port Cisco electrical packet switches
  - 2x 48 port Quanta switches
  - 4-wavelength cWDM (1270,1290,1310,1330nm)

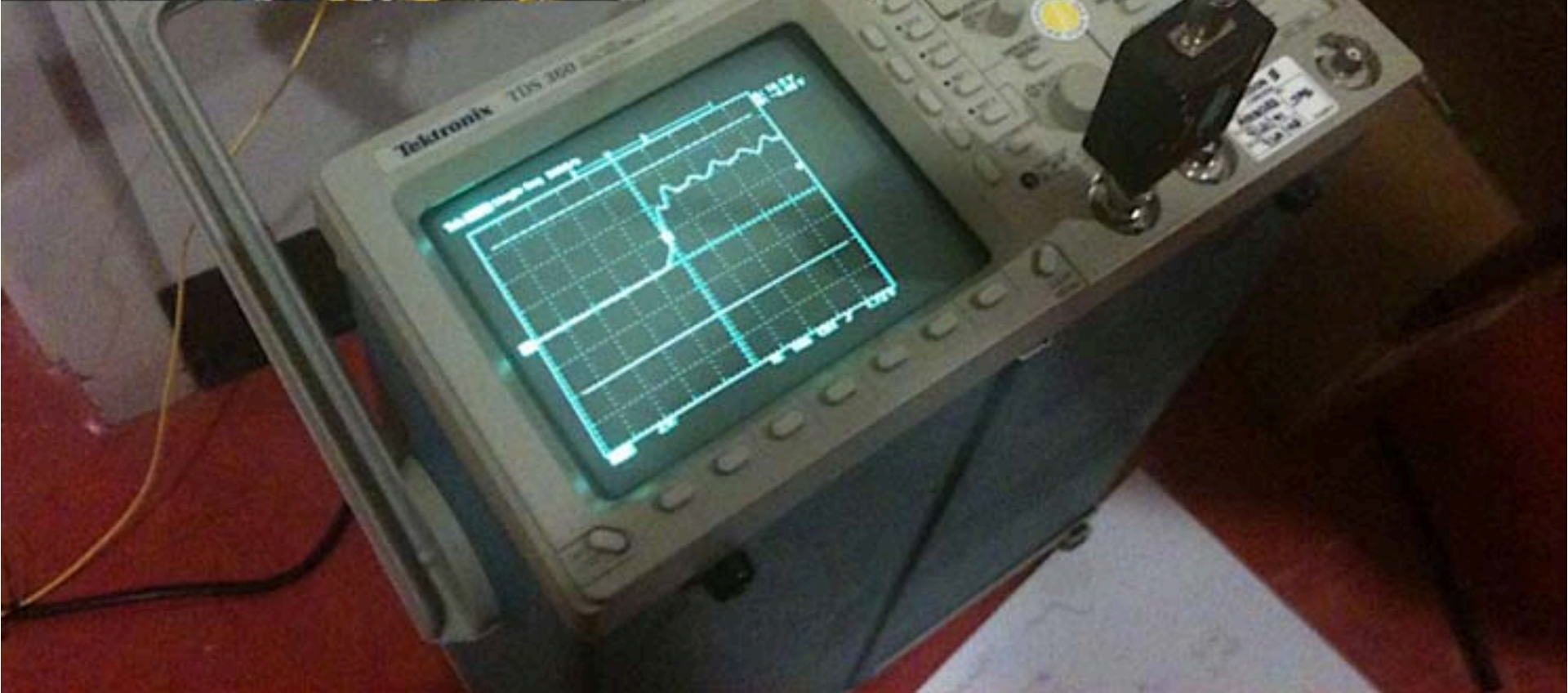


# Fulcrum 'Monaco' Switch

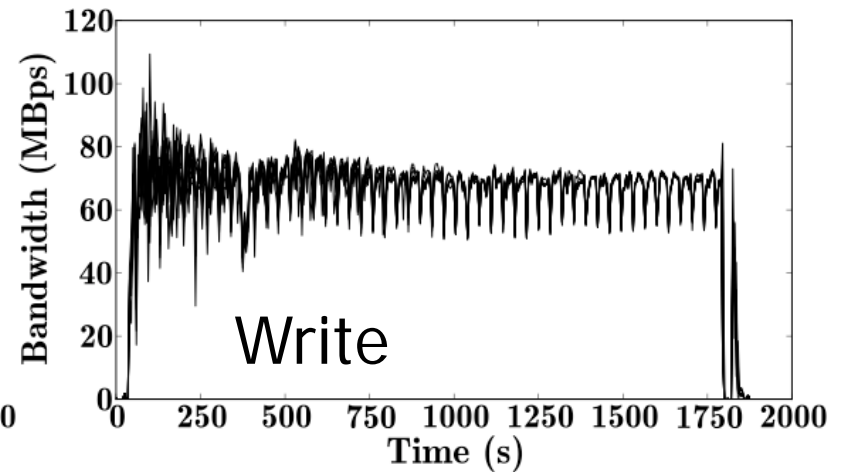
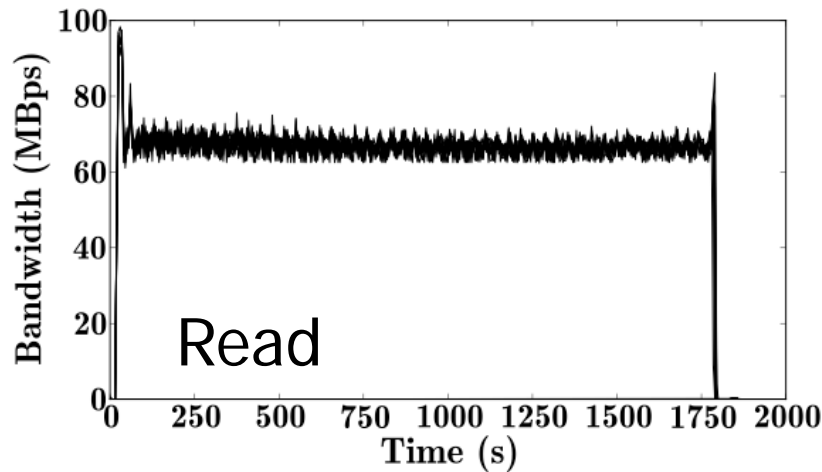
- 24 SFP+ interfaces
- Programmable Freescale 8543 control processor
- Altera EP3C80F484C Cyclone-III series FPGA
- Embedded Linux 2.6



# Evaluating Switching Speed



# Case study: Cisco and TritonSort



- Industrial collaboration: Efficient sorting with Cisco
- All-to-all rate of  $\sim 6$  Gbps to 48 nodes in units of 16KB needed to break world record
- Equivalent optical switching speed: **21.33 $\mu$ s**
- Informs Multi-stage topologies and future hybrid switching architectures

# Replacing COTS with CIAN technology

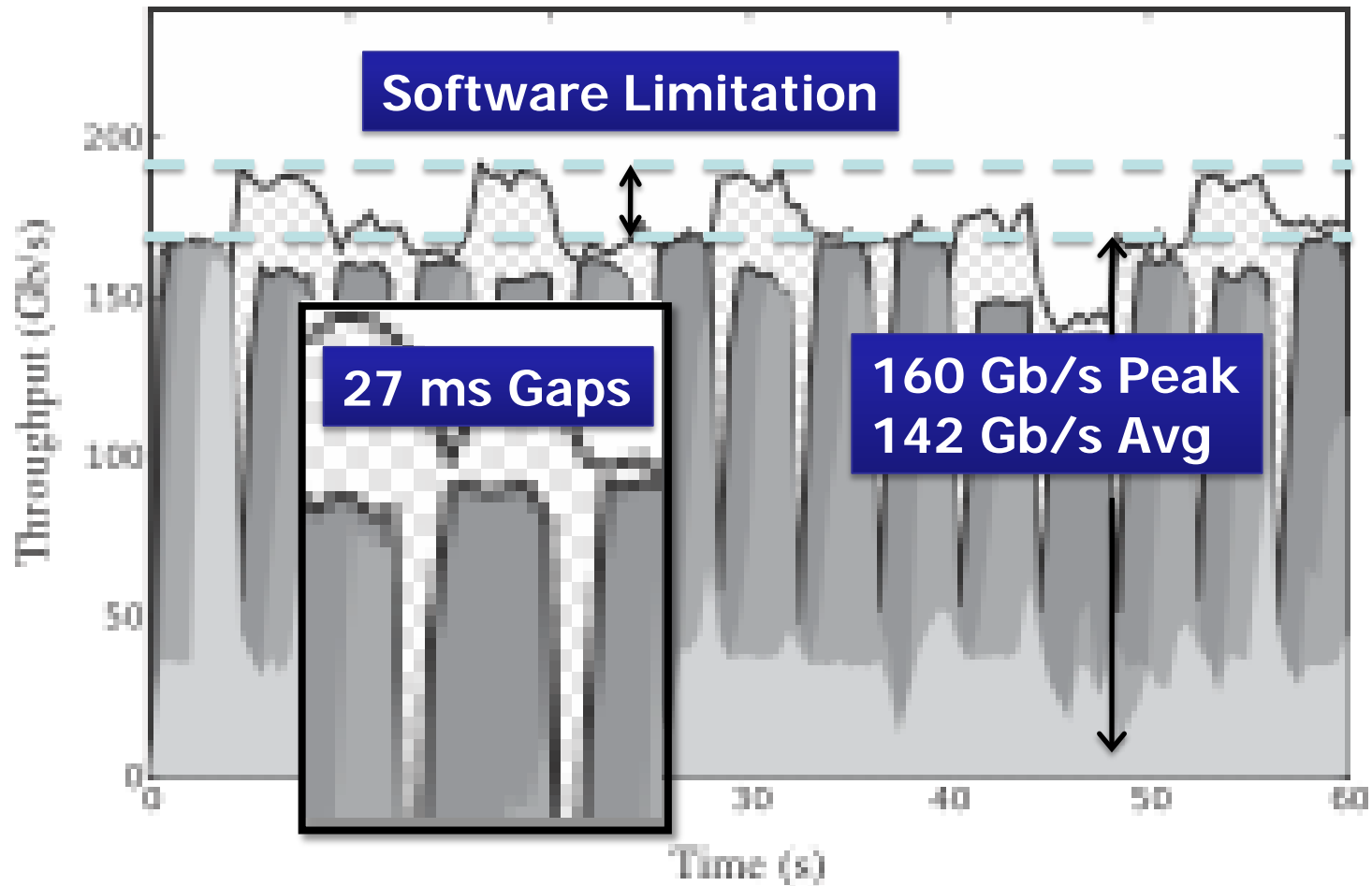
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- The new device, unpackaged, resides in the chip-scale testing facility
  - Ideal given the needs of things like external lasers, bench equipment, and stable isolation tables
- Optical fiber bundle is now in place to rack in datacenter testbed on 1<sup>st</sup> floor
- Those fibers will interface with the electrical packet switches via the Glimmerglass MEMS switch
- In software, we can splice new device in or out of the datapath within tens of milliseconds



# Example Evaluation: Helios [SIGCOMM 2010]

## Glimmerglass MEMS vs. Cisco Electrical



# Discussion

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- Thank you

