Intel Server Products and Technology Overview

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Agenda

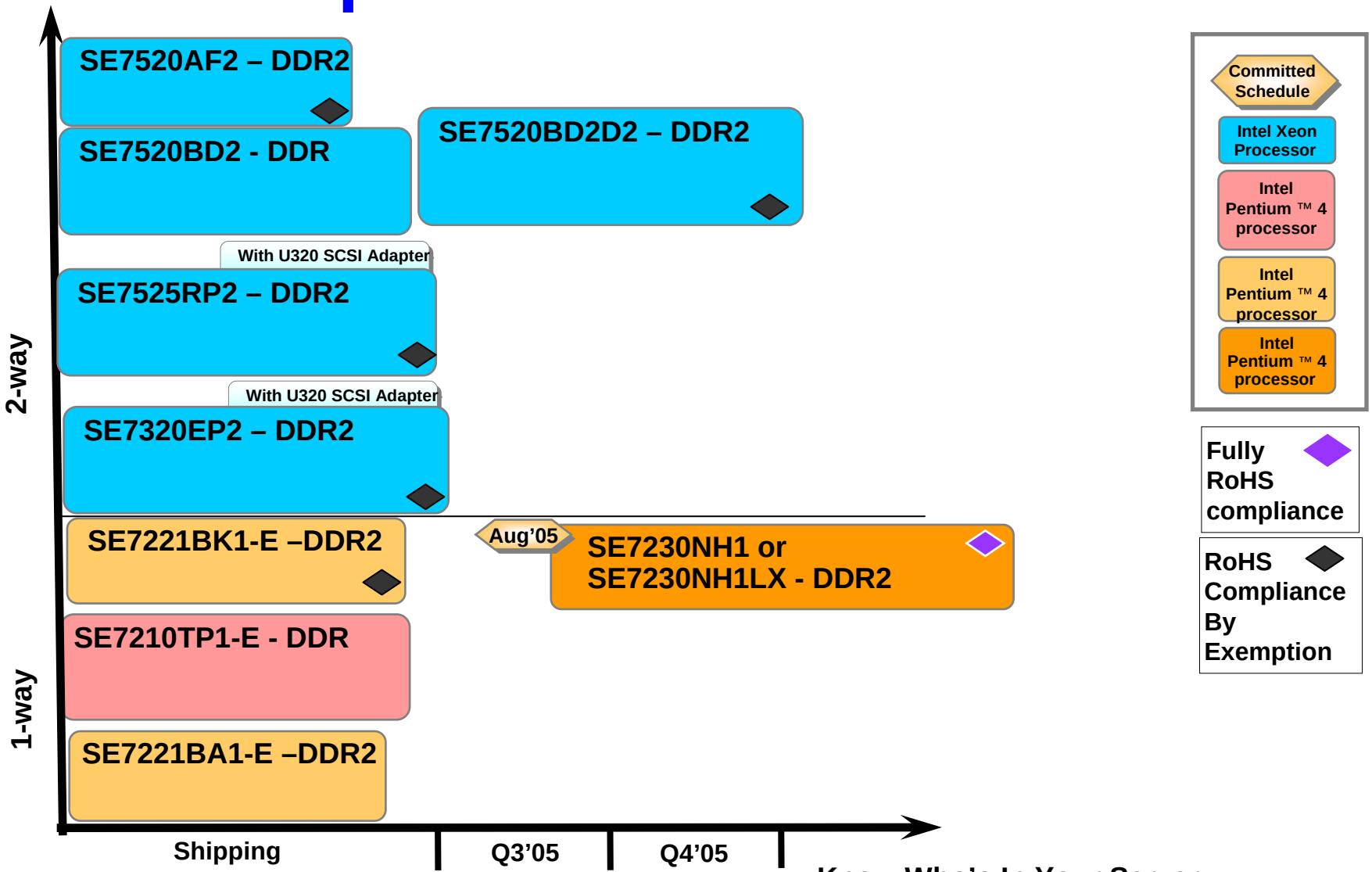
- **2005 Intel Server Product Overview**
  - UP/DP Pedestal Product Roadmap
  - UP/DP Rack Product Roadmap
  - Chassis Product Roadmap
- **2006 Server Technology Trends**
  - DDR2 -> FBDIMM Transition
  - SCSI -> SAS Transition
- **Wrap Up / Q&A**

2005 Server Technologies

- **Processors:** 64-bit Intel® Xeon™ processor cores
- **Networking:** TCP Offload (TOE)
- **Storage:** SATA, 10K – 15K SCSI, 3.5” drives
- **Environmental:** Power management (DBS)
- **Management Technology:** Tiered management, OOB tools
- **Memory:** DDR2
- **I/O:** PCIe

DDR2 top to bottom, PCIe and flexible management = High performance, Reliable Server Systems

EPSD UP/DP Pedestal Optimized Roadmap



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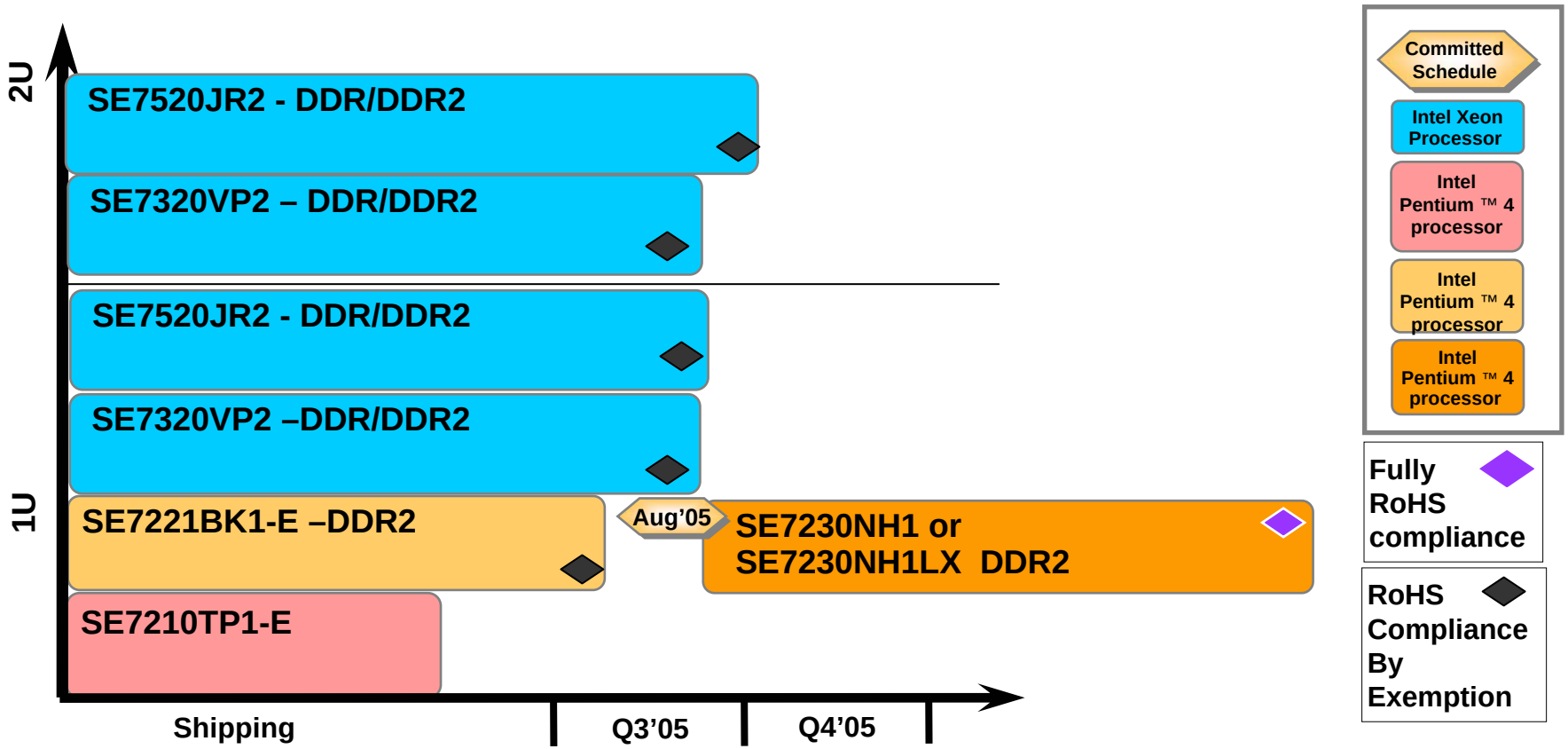
EPSD UP/DP Rack Optimized Roadmap



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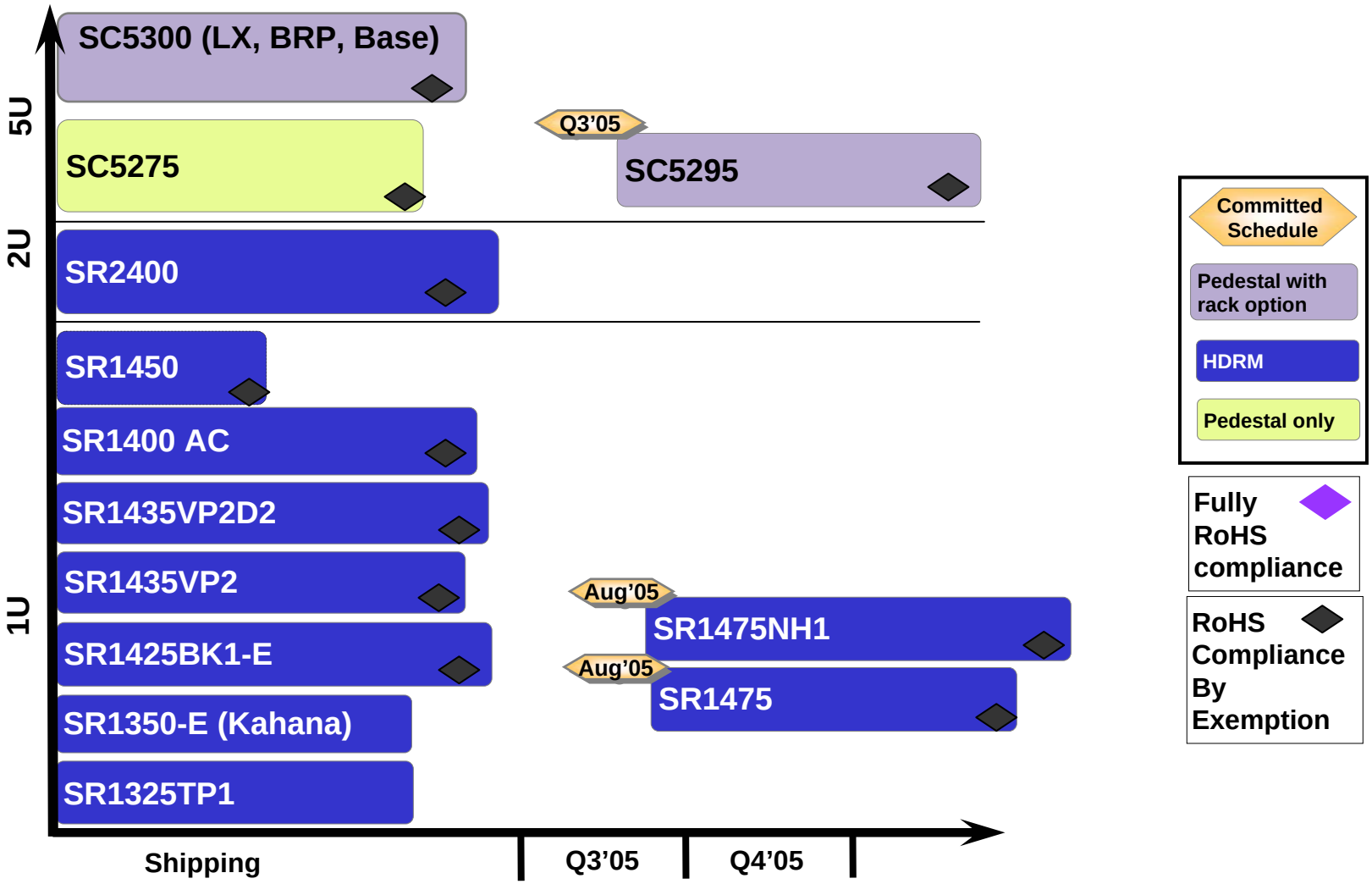
EPSD Chassis Roadmap



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2006 Server Technology Inflections and Trends

- **Processors: Dual 64-bit Intel® Xeon™ processor cores**
- **Networking: IO Acceleration / TCP Offload**
- **Storage: SAS transition, Enterprise 2.5” drive transition**
- **Environmental: Lead free/ROHS, Power supply efficiency, Power management (DBS), Low power processors**
- **Management Technology: BMC integration, ASMI, Virtualization**
- **Memory: New FB DIMMs, higher capacity boards, more granularity**
- **I/O: More PCIe**

Look for major platform performance increases coming in 2006!

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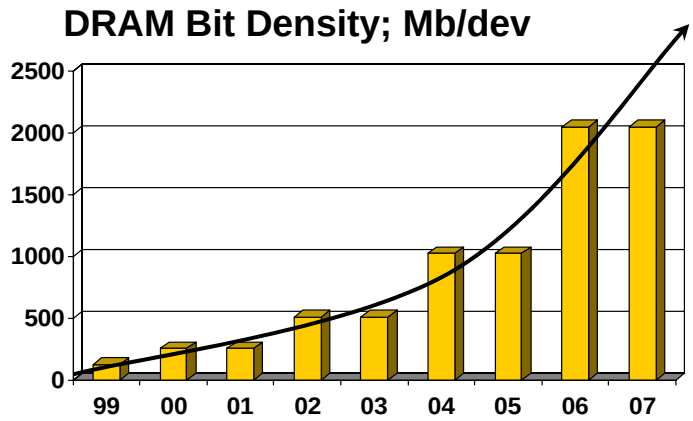
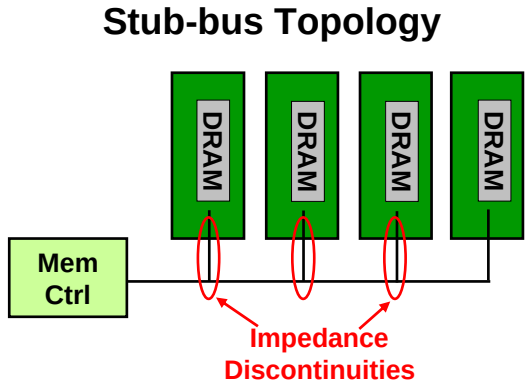
Why move to FBDIMM?

The Problem

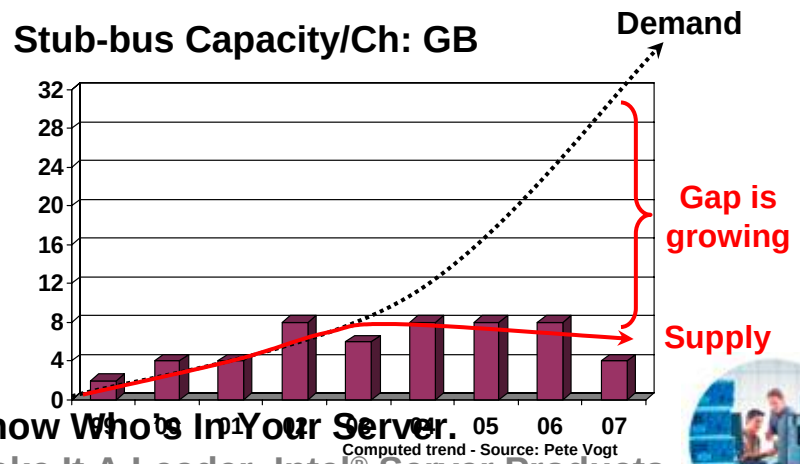
Memory hungry apps driving memory bus data rates and DRAM bit densities up



"Stub-bus" architecture causing signal and data integrity concerns at higher data rates driving down number of devices per channel



<u>Result</u>: Server memory capacity has hit a ceiling



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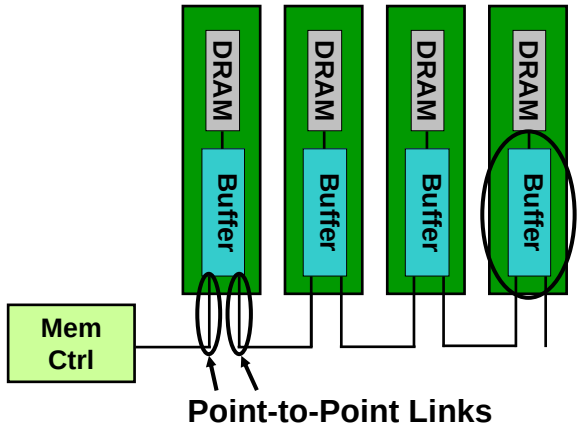
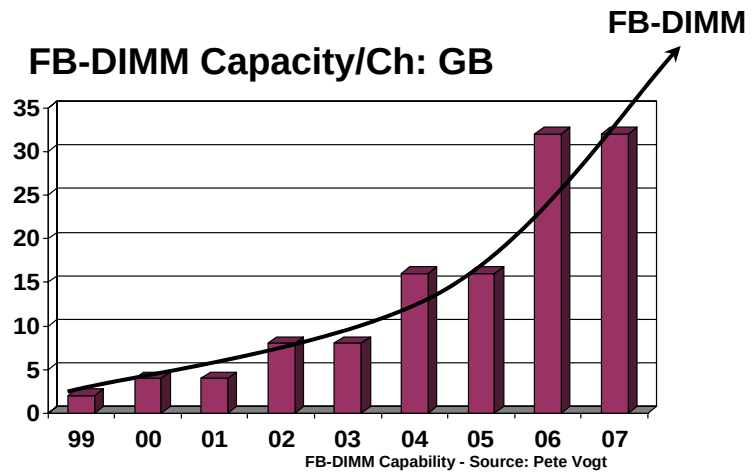
The Solution: FB DIMM

FB-DIMM buffers the DRAM data pins from the channel and uses point-to-point links to eliminate the stub bus

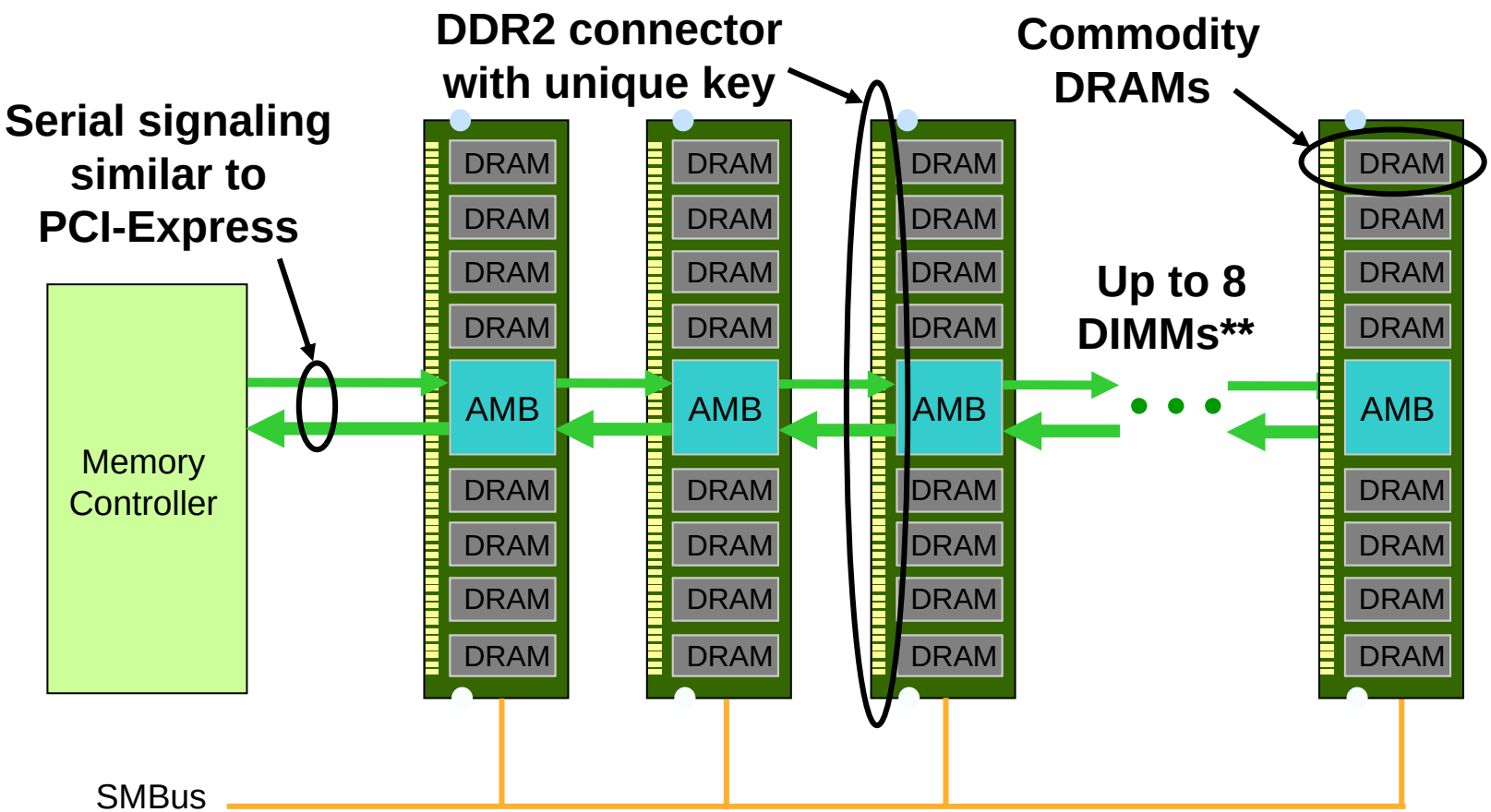
FB-DIMM capacity scales throughout DDR2 & DDR3 generations



FB-DIMM eliminates the "Stubs" & Meets the Capacity Demand



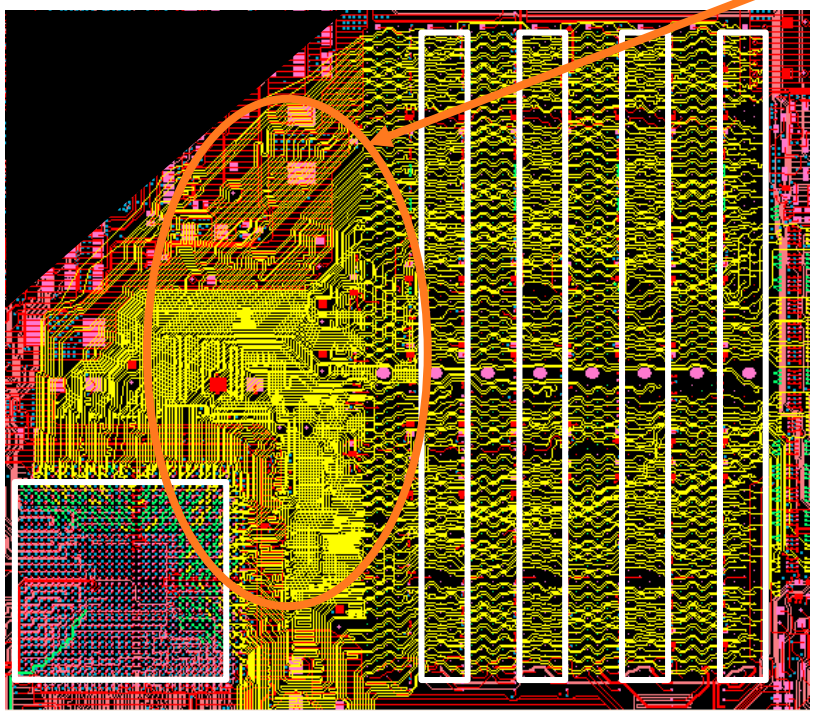
FB-DIMM Solution Details



** FBD spec supports up to 8 DIMMs per channel, however initial Intel chipsets will only address 4 DIMMs.

Routing Comparison

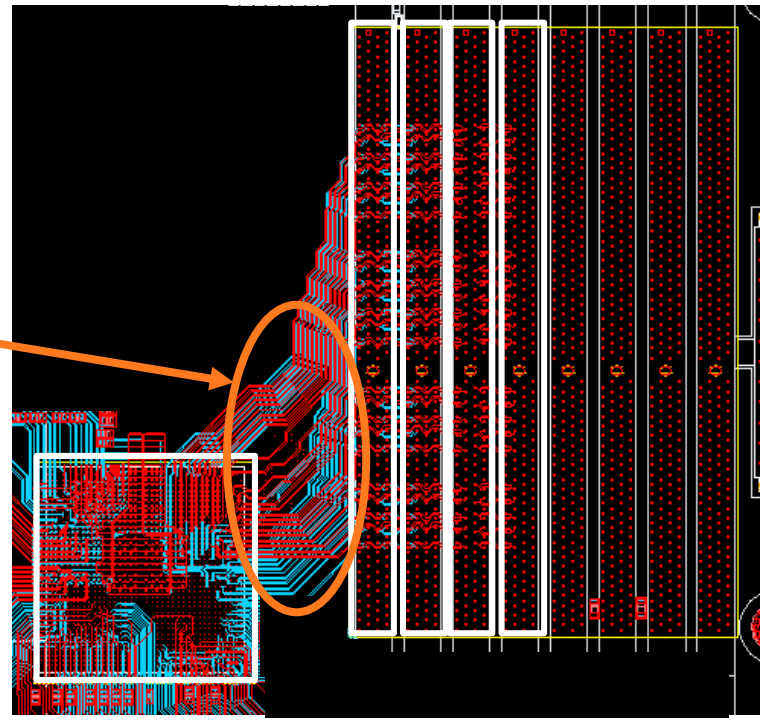
Direct DDR2 Registered DIMMs:
1 Channel, 2 Routing Layers with 3rd layer required for power



Serpentine routing is complicated and uses up a lot of board area

Fewer signals and no trace length matching minimizes board area

FB-DIMMs:
2 Channels, 2 Routing Layers (*includes* power delivery)



FB-DIMM: Fewer Layers, Less Routing Area

Source: Intel Enterprise Architecture Group

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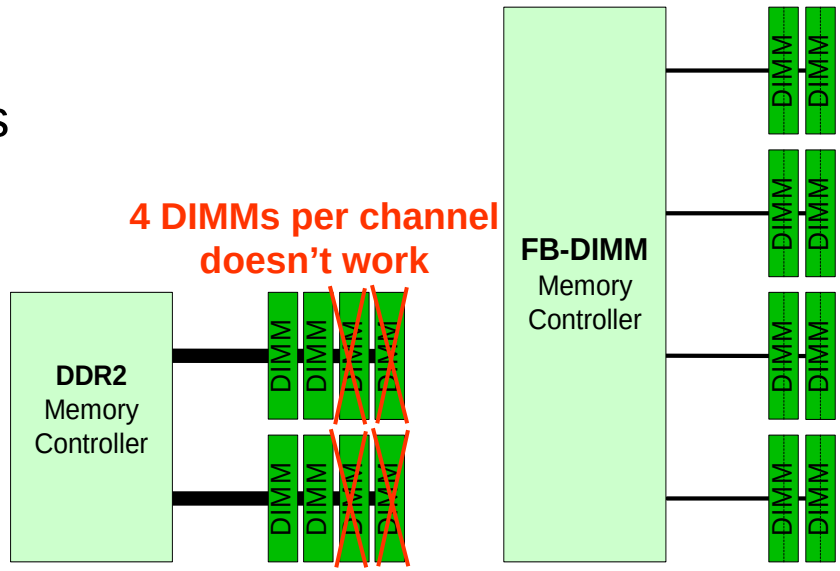
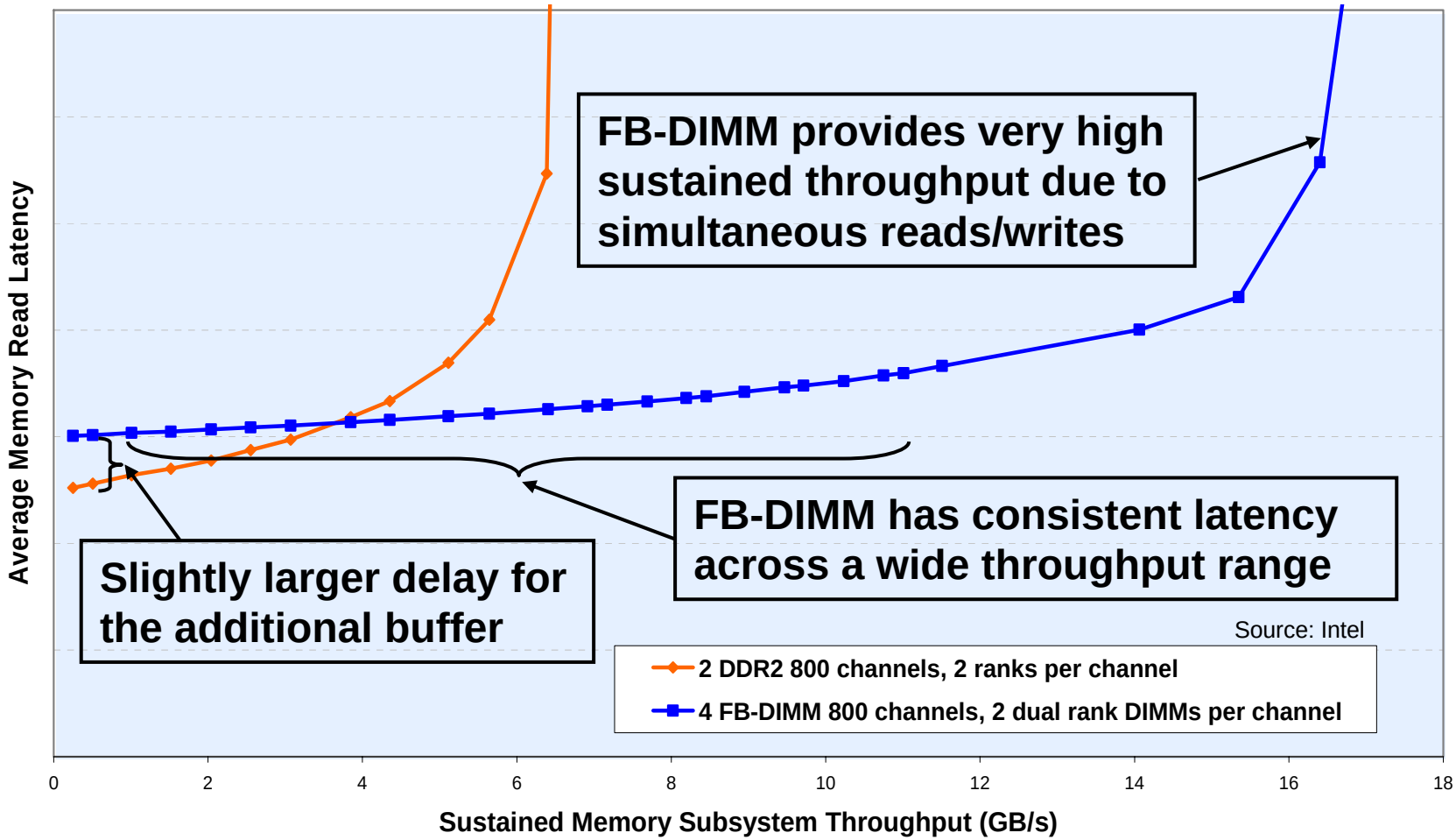
DDR2 vs. FBD Config Comparison

- **4x capacity**
  - 8GB vs. 32GB
- **~2.5x throughput**
  - ~6.5GB/s vs. ~16.5GB/s
- **Lower pin count**
  - ~480 vs. ~280



FB-DIMM Provides 4x the Capacity in standard configuration

DDR2 vs. FBD Config Comparison



What to expect in the SCSI to SAS transition

The Problem

- **Parallel architecture can no longer reliably keep up with data rate increases.**
- **Cost of deploying multiple HBAs to support SCSI 16 device limit**
- **Rising need for flexible solution to support either Online or Nearline storage**

Current Parallel SCSI architecture has hit a ceiling

The Solution: Serial Attached SCSI

SAS is the next generation of SCSI

- Same SCSI protocol for data transfer
- Serial instead of Parallel interconnect
  - Same cabling/connectors/physical interface as SATA
- Point to point architecture
  - Unlike shared bus of SCSI (15 drives maximum per channel)
  - Ports can be linked together – 'Wide' ports for larger throughput to Expanders
  - 300MB/s per port initially, moving to 600MB/s and more in future
- SATA Tunneling Protocol provides compatibility with SATA devices
  - Allows lower cost drives/devices to be used in the SAS environment

Expanders provide greater performance and flexibility

SAS vs. SCSI

Benefits of SAS

- Transparent application migration from SCSI->SAS
- Reliability is equivalent using SAS or SCSI drives
- SATA drives can be used in SAS environment
- SAS drives are dual ported, providing full redundancy to drives, if desired

Transition to SAS from SCSI

- SAS industry launching Q1’05, and will be widely available by ’06
- EPSD is a technology leader, and SAS is the next technology
- SCSI will continue to exist as commodity for several years - ~2010

SAS vs. SATA

Benefits of SAS

- SAS architecture supports enterprise environments by design
  - Protocol supports larger drive configurations
  - SAS drives are designed for higher performance and reliability (MTBF)
  - SAS drives are dual ported, providing full redundancy to drives

Benefits of SATA

- SATA integrated into current and future generation chipsets
- SATA technology has 1.5year head start on SAS
  - SATA is now stable, and infrastructure is established
  - Low risk of unexpected technology or interoperability issues
- SW and HW RAID greatly reduces reliability gap

SAS Architecture

Expander Overview

Expanders allow access to multiple targets

- Non-blocking switch architecture – basically a simple FC switch
- Allows any number of incoming SAS controller ports to connect to a large number of SAS or SATA targets
- Aggregate throughput from multiple targets
  - Provides the functionality to fully utilize the available bandwidth/IOPS of the connection

Two types of Expanders: Edge and Fan-Out

- Edge: Direct and Subtractive Routing only
  - Supports direct devices and ONE other Expander connected (subtractive)
  - Primary inside the box need
- Fan-Out: Direct, Subtractive, and Table Routing
  - Supports direct devices and up to 128 other Expanders (routing to the necessary connected Expander via the internal routing table)
  - Tables can be smaller than max of 128 – this is the common implementation today
  - Primarily large port count/external box usage

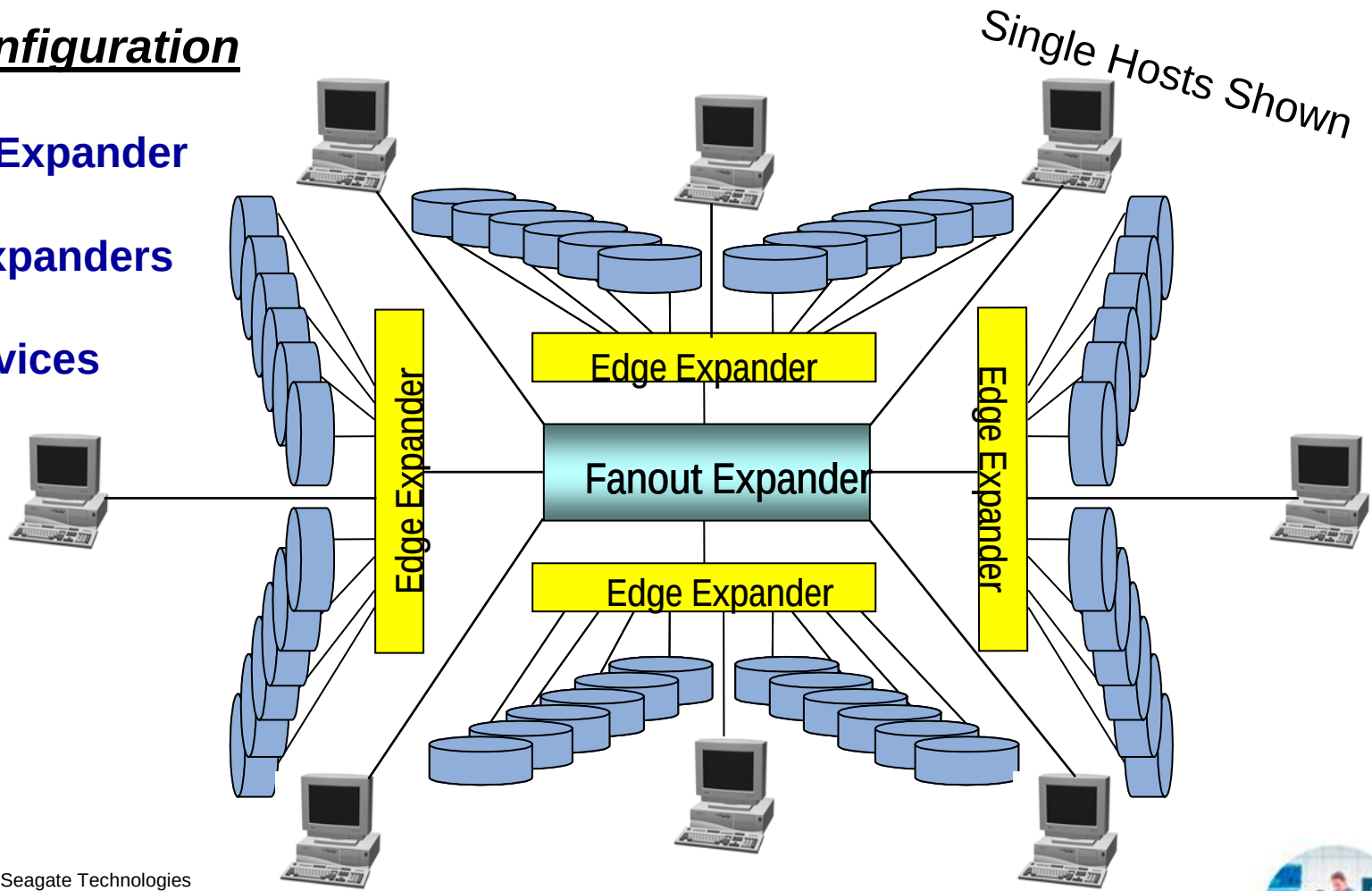
Maximizing Connectivity

Maximum Configuration

1 **Fanout Expander**

128 **Edge Expanders**

16,384 **SAS Devices**



Source: Seagate Technologies

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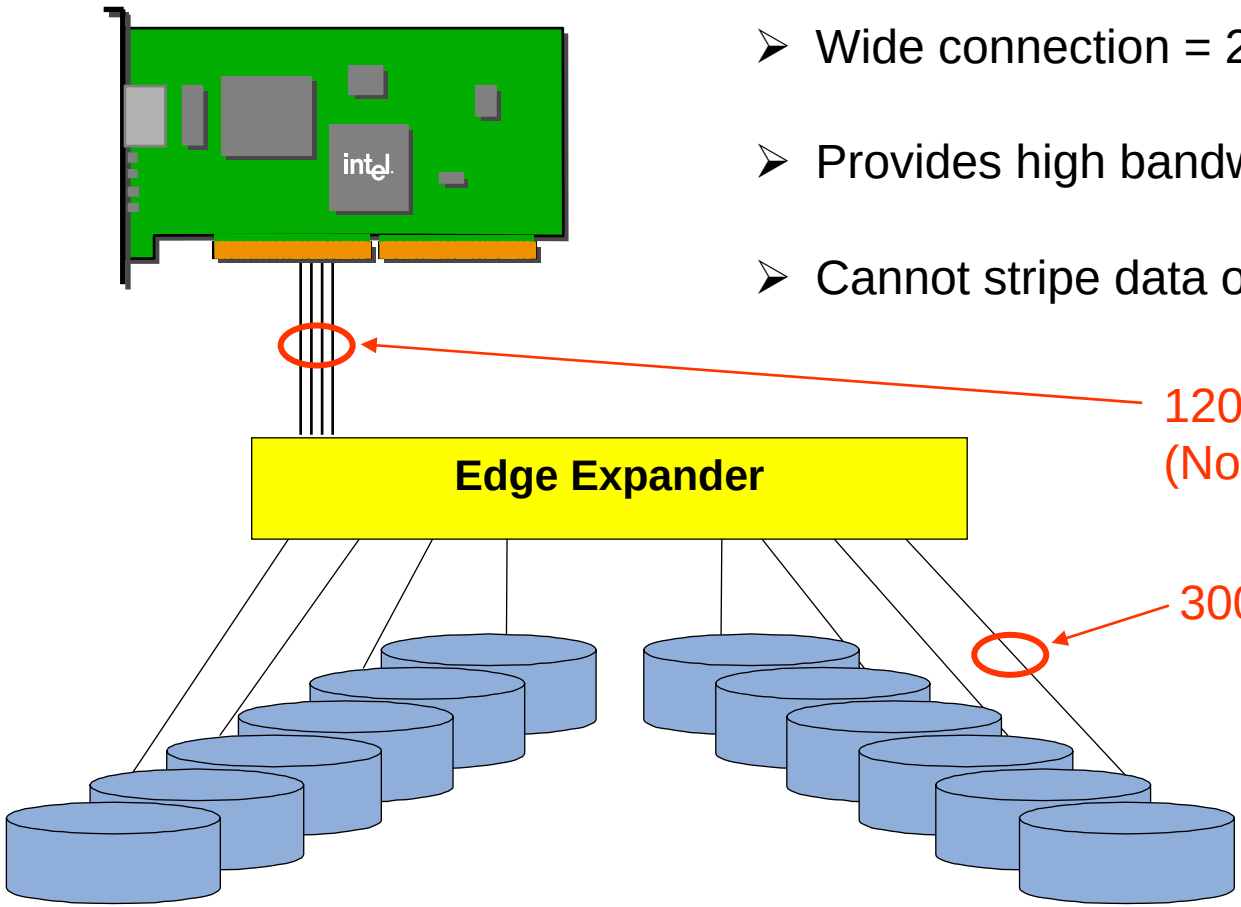
Using a “Wide” Connection



- Wide connection = 2 or more single connections
- Provides high bandwidth path for Host
- Cannot stripe data on a wide link

Source: Seagate Technologies

SAS vs. SATA connectors

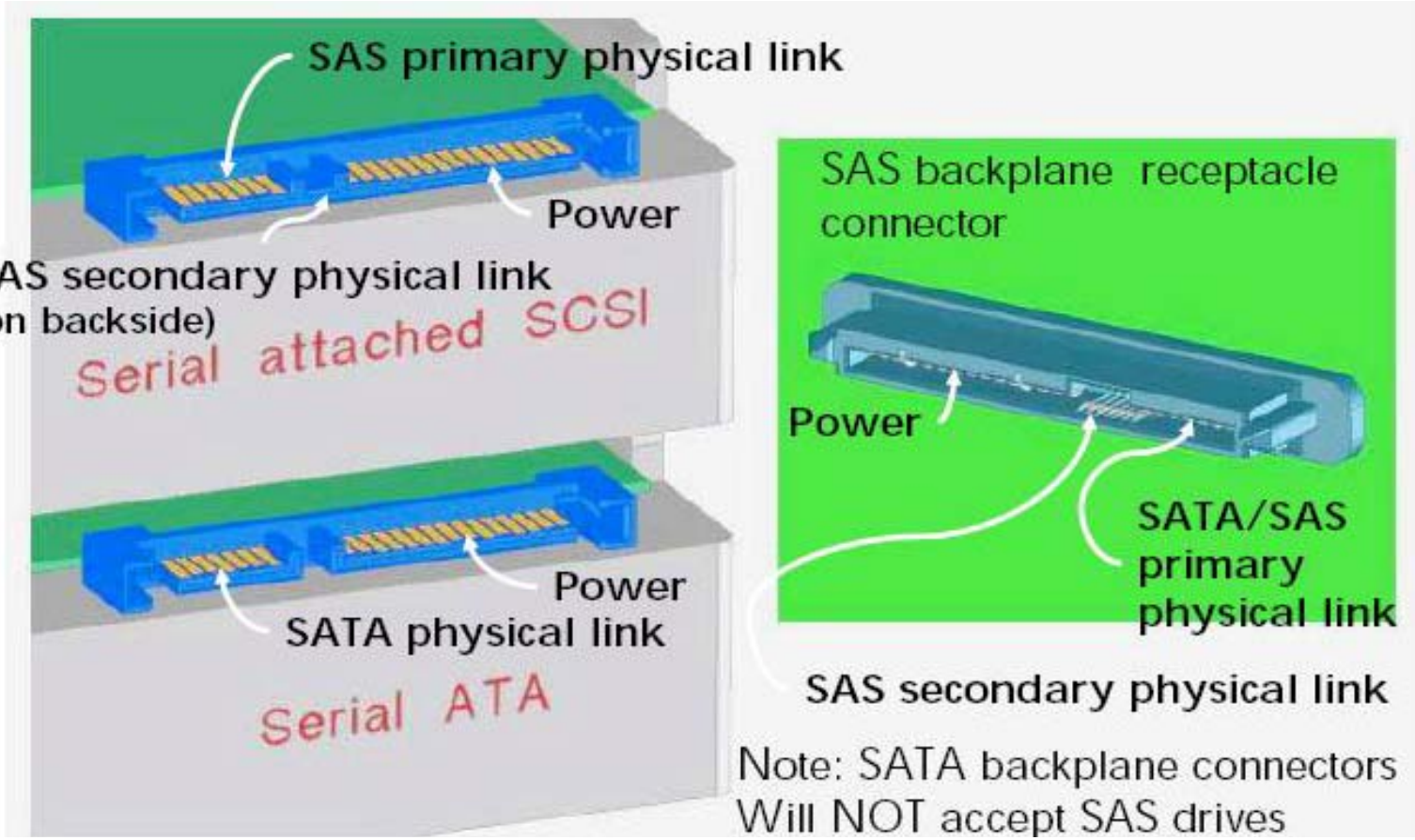
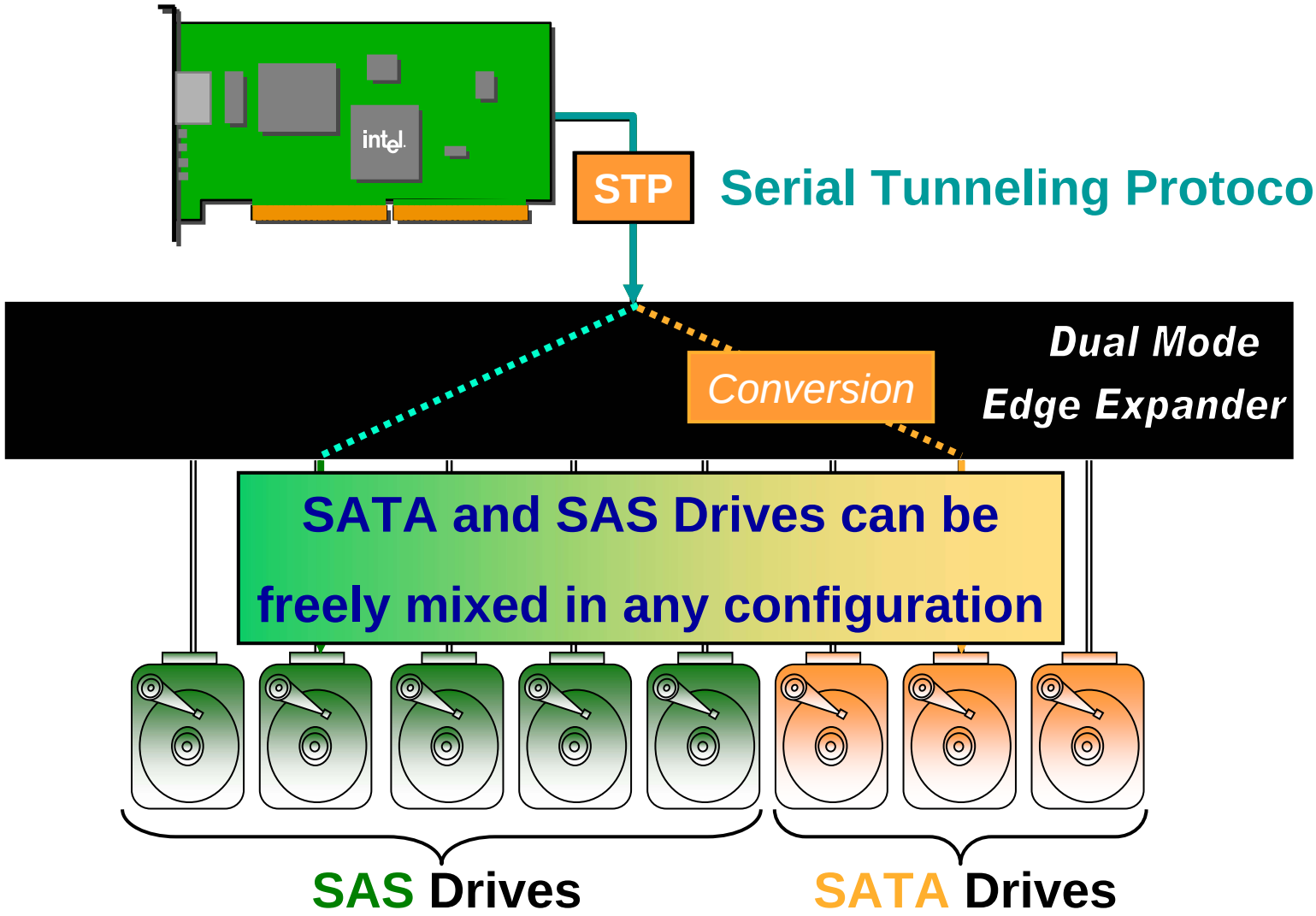


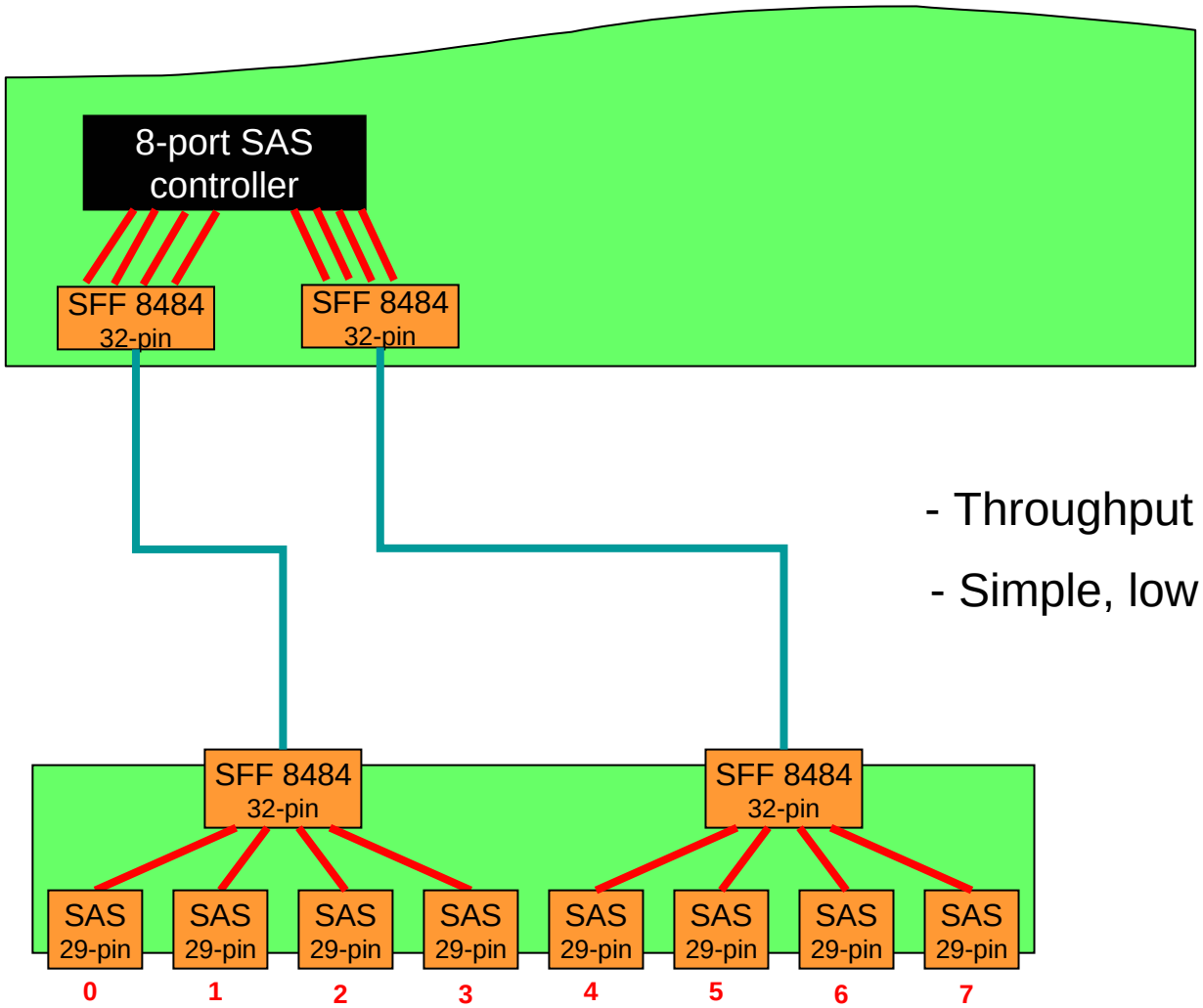
Diagram courtesy of HP
www.scsita.org/aboutscsi/ sas/tutorials/SAS_Physical_layer.pdf

Expanders Extend SAS & SATA Topology



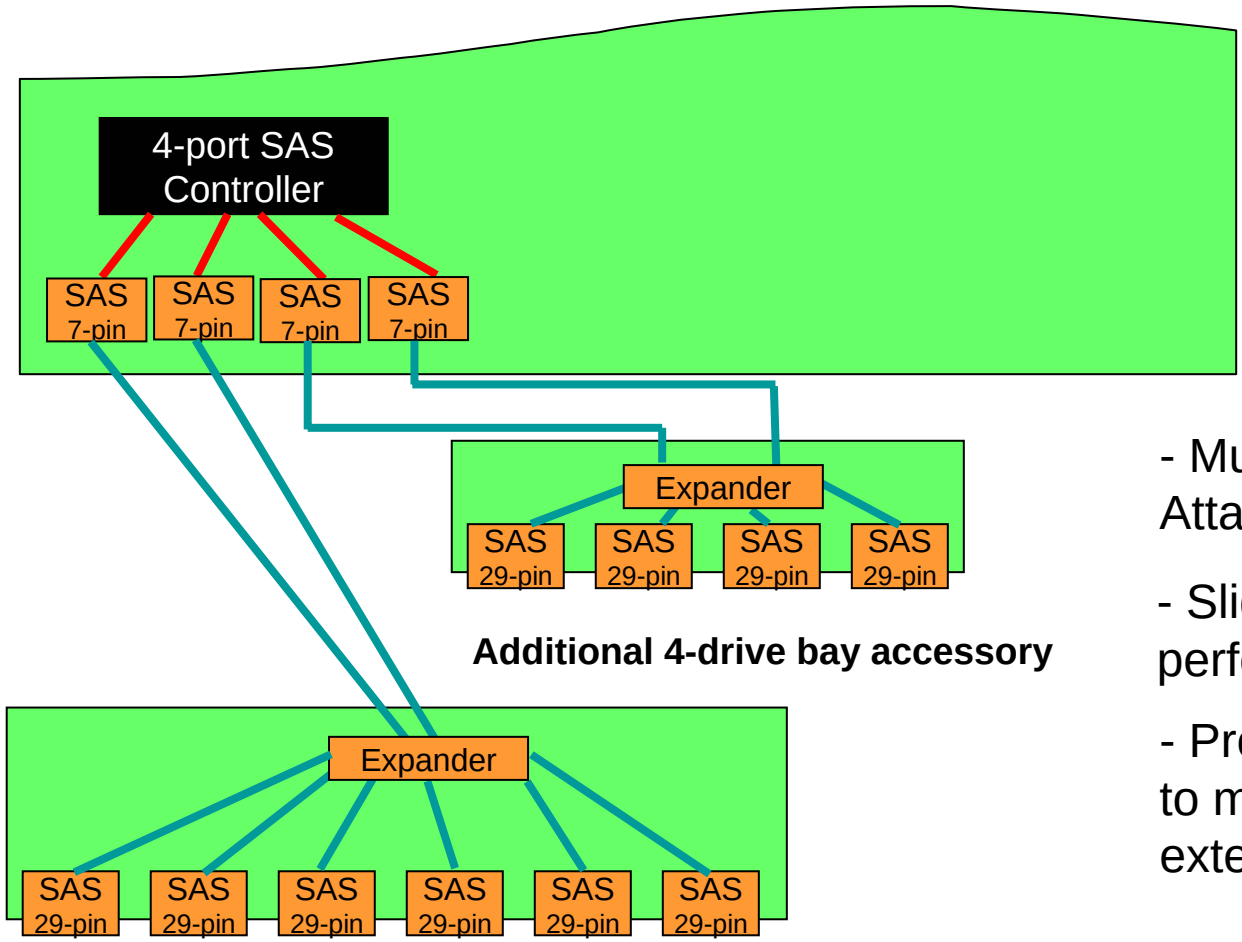
Source: Seagate Technologies

Usage Model - Direct Connect



- Throughput and IOPS are Drive limited
- Simple, low cost implementation

Usage Model – w/Expanders



- Much more efficient than Direct Attach model

- Slightly higher cost, but major performance improvement

- Provides capability to connect to many more drives, including external attach (if desired)

Wrap-Up

- **Intel's 2005 server product line up provides a solution for all your customer needs.**
- **FBDIMM technology solves the server memory capacity problem created by the stub-bus architecture of today and allows for a high speed server memory architecture for next generation products.**
- **SAS is the next generation SCSI solution for servers requiring high capacity and performance disk subsystems in 2006 and beyond.**

Watch for these technologies in 2006 Intel server products!

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Thank You!

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For More information on the products mentioned in this presentation visit:

http://developer.intel.com/products/server/motherbd

Backup

Enclosure Management

Enclosure management in configurations where one SAS port is mapped to one hard drive.

- SGPIO
  - Fault, rebuild & locate indication
  - Does not provide drive event notification to BMC
  - Limited ability to add new features
- SAF-TE & SES2
  - Fault, rebuild & locate indication
  - Provides drive event notification to BMC
  - Able to implement new features

Enclosure management in configurations with expanders

- SES2
  - Fault, rebuild & locate indication
  - Provides drive event notification to BMC
  - Able to implement new features