AMD Opteron™ Processor for MP Server Systems

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Agenda

AMD

- AMD Opteron™ processor overview

- Contrast to existing MP system topology

- Glueless MP system topology

AMD Opteron™ Processor Technology Overview

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- **Processor Core Overview**
  - Support for AMD's 64-bit technology
  - 12-stage int, 17-stage fp pipelines
  - Enhanced TLB structures
  - TLB flush filter
  - Enhanced branch prediction
  - Large L2 cache (up to 1MB)
  - ECC protection

- **Memory Controller Overview**
  - Dual-channel DDR memory
  - PC2700, PC2100, or PC1600 DDR memory support
  - Registered or Unbuffered DIMMs
  - ECC and Chip Kill
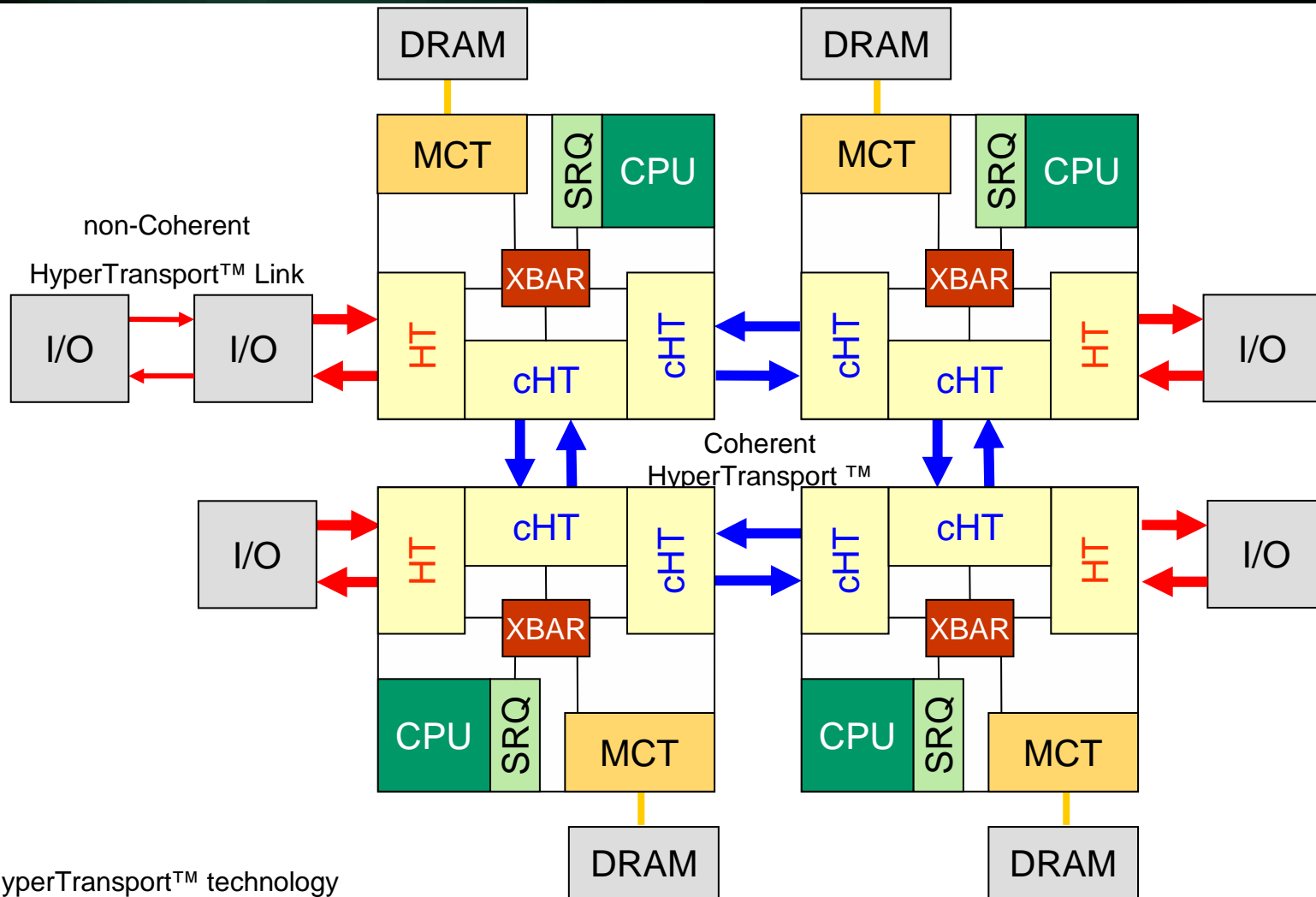 - High bandwidth (up to 5.3GB/s)

- **HyperTransport™ Technology Overview**
  - One, two, or three links
  - 2, 4, 8, 16, or 32-bits full duplex
  - Up to 6.4 GB/s bandwidth per link
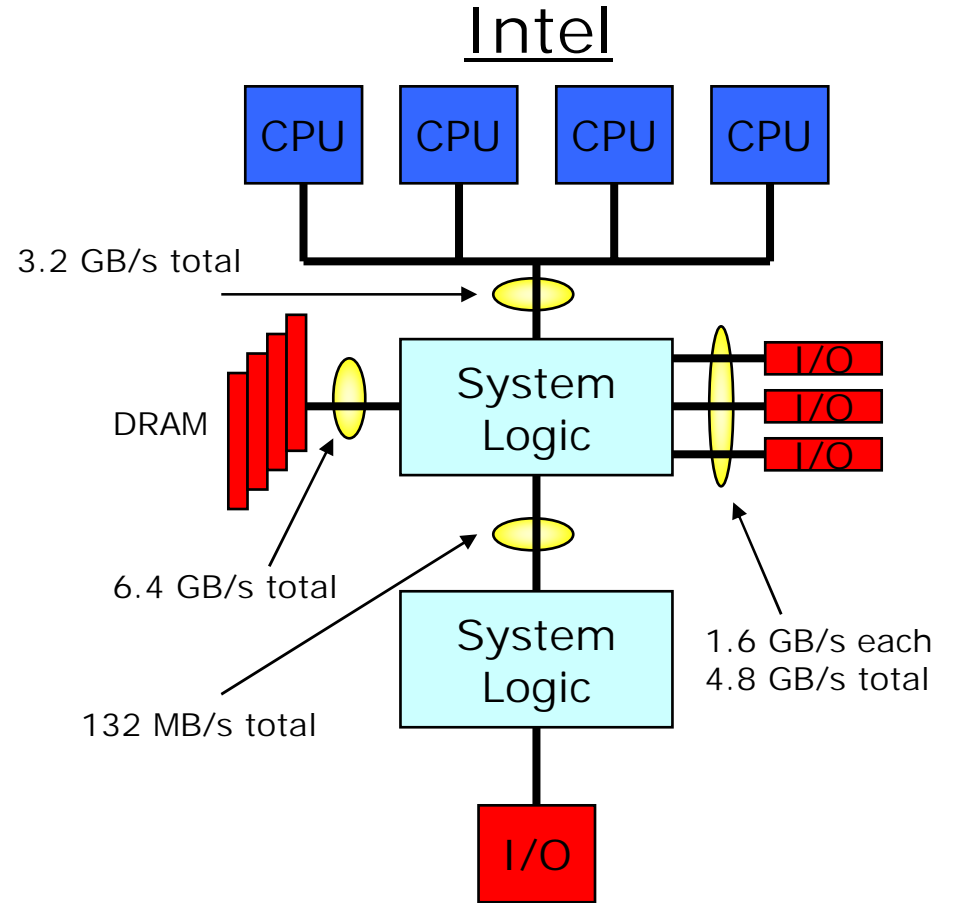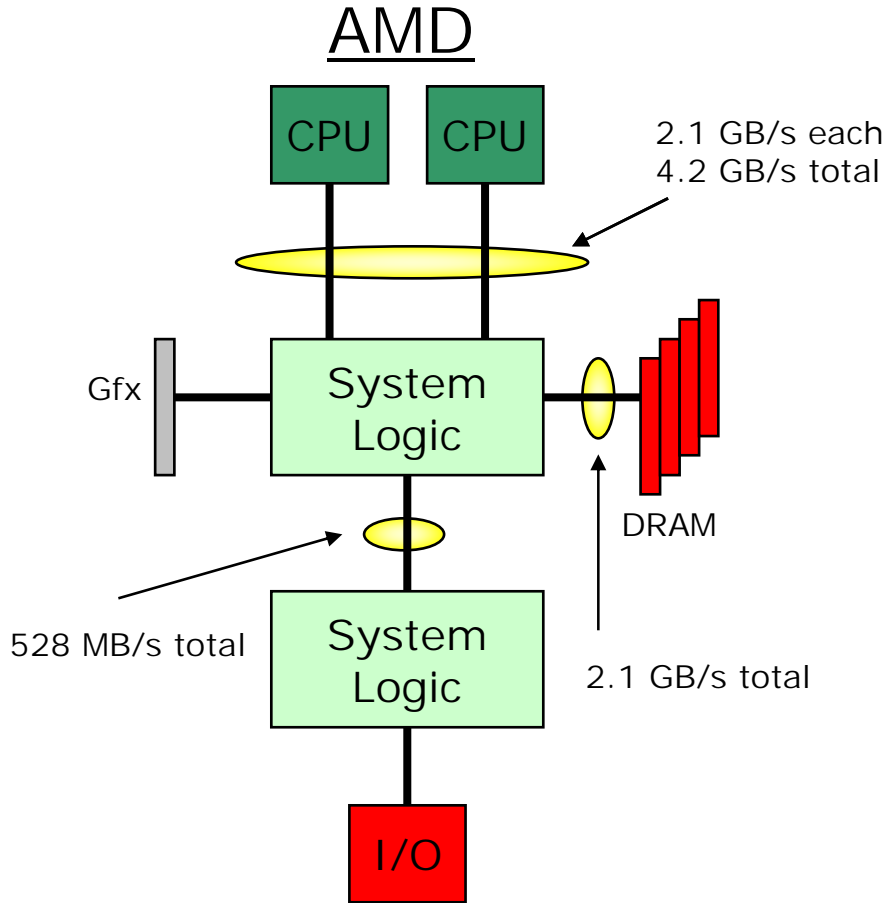 - 19.2 GB/s aggregate bandwidth
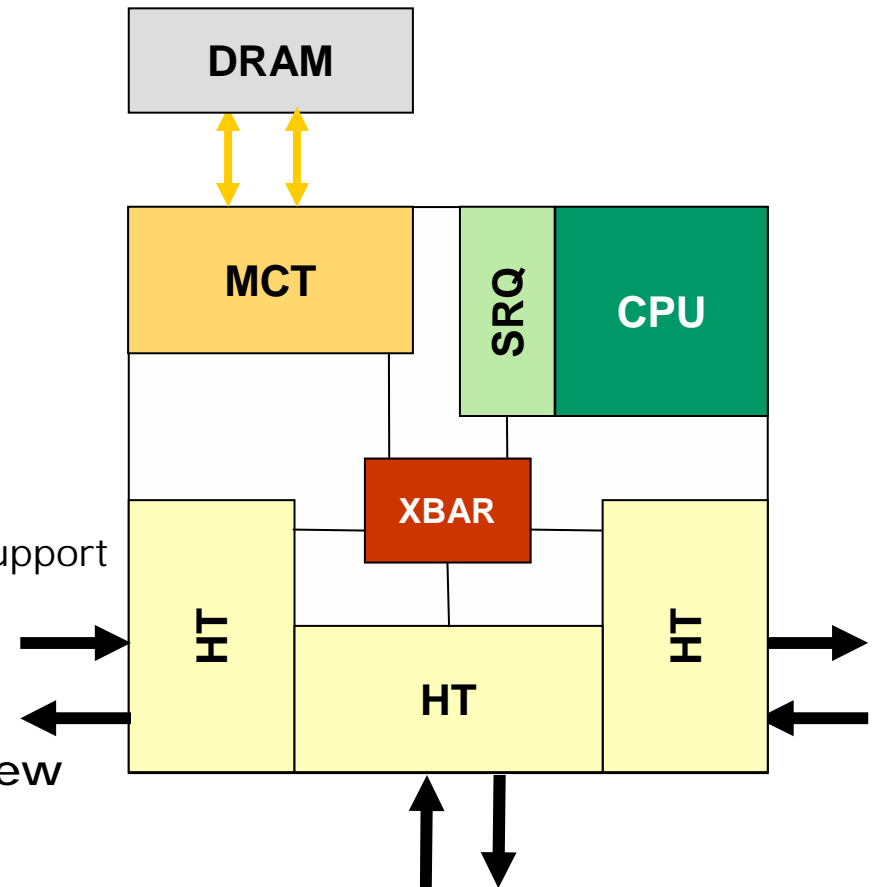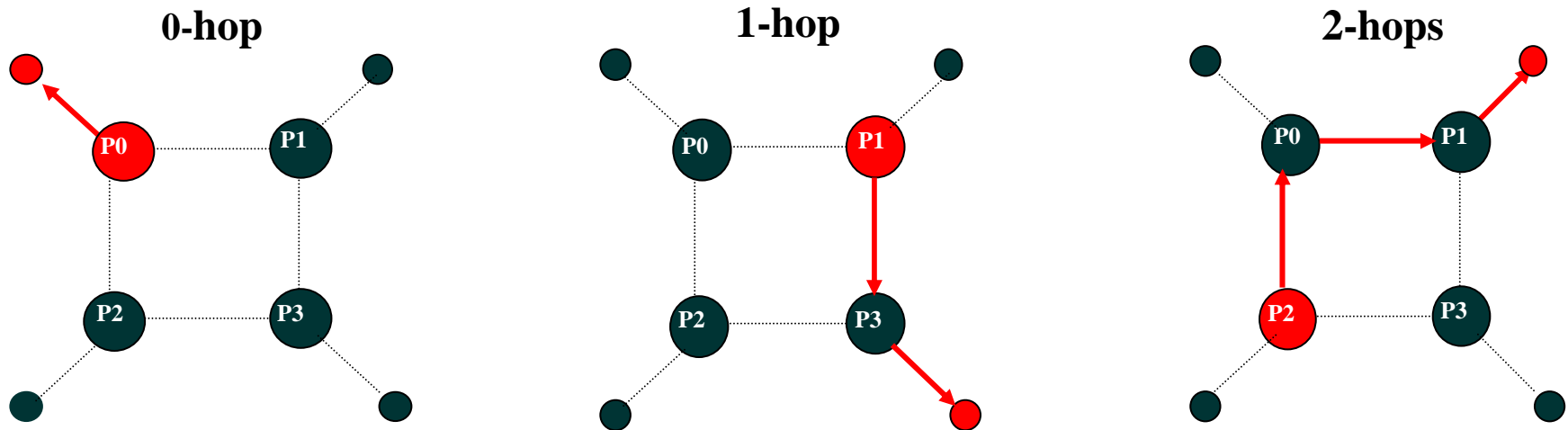

HT = HyperTransport™ technology

AMD Opteron™ Processor Glueless MP System Overview

Existing MP System Topology

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CPU   CPU

2.1 GB/s each
4.2 GB/s total

Gfx — System Logic — DRAM

DRAM

528 MB/s total

System Logic

2.1 GB/s total

I/O

Intel

CPU   CPU   CPU   CPU

3.2 GB/s total

DRAM — System Logic — I/O I/O I/O

6.4 GB/s total

132 MB/s total

System Logic

1.6 GB/s each
4.8 GB/s total

I/O

Local vs. Remote Memory Access

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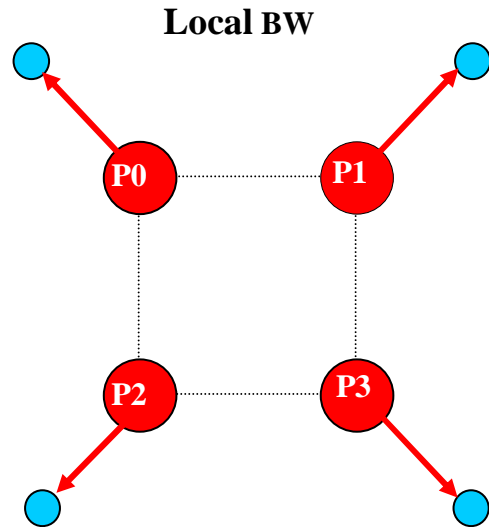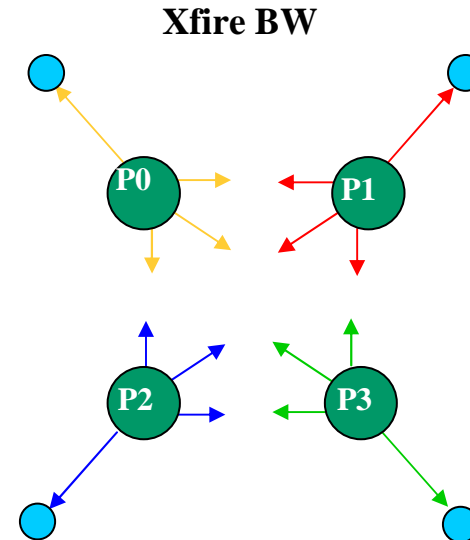| 0-hop	1-hop	2-hops

- 0 Hop: Local Memory Access
- 1 Hop: Remote 1 Memory Access
- 2 Hop: Remote 2 Memory Access
- Diameter: maximum hop count between any pair of nodes
- Average distance: average hop count between nodes

Local vs. Crossfire Memory Bandwidth
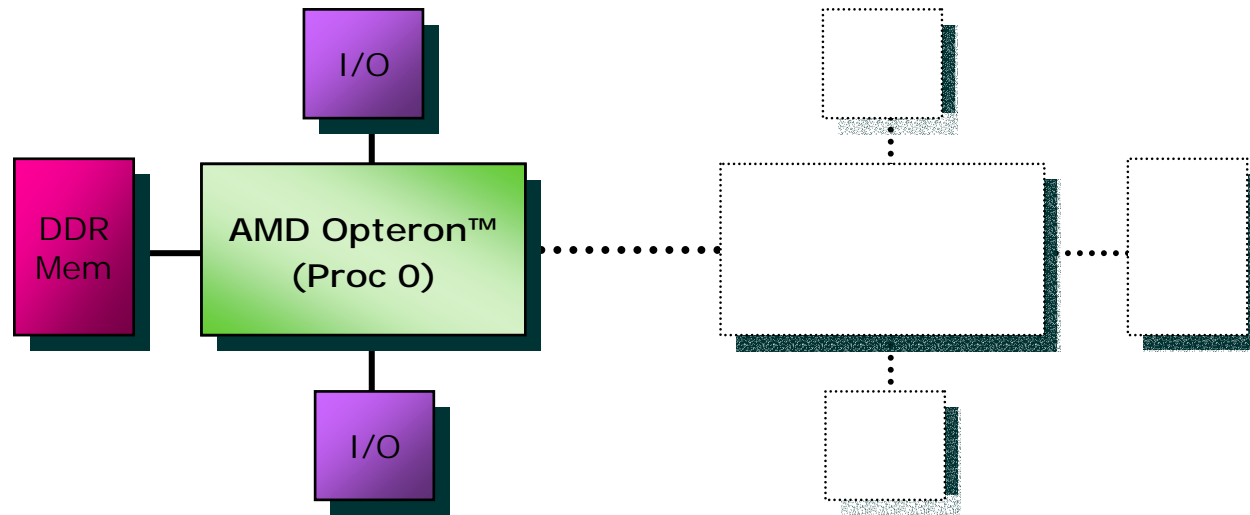
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Local BW

Xfire BW

- Local memory access bandwidth
  - Each processor reads data from its own local memory

- Xfire memory access bandwidth
  - All processors read data from memory at all nodes

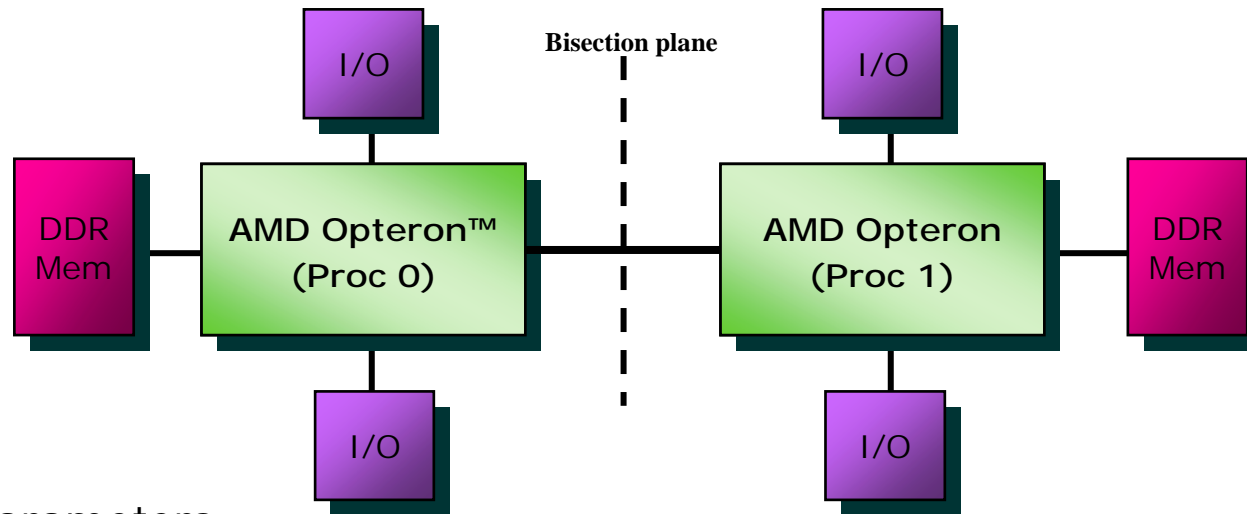# Single Processor Population

System Parameters:

- 8 DIMMs (up to 16 GB using 256Mb DRAM)

- 2 HyperTransport™ links available for I/O

- Processor-to-Memory Read Bandwidth = 5.3 GB/s

- I/O Bandwidth = 6.4 GB/s (per link)

SPEC® CPU 2000

AMD

- **System Configurations**
  - AMD Opteron™ processor operating at 2.0GHz
  - Registered PC2700 DDR memory

- **SPECint® 2000:**
  - Estimated base score = 1202

- **SPECfp® 2000:**
 - Estimated base score = 1170

Dual Processor System Topology

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Bisection plane

```
         [I/O]                      [I/O]
           |                          |
[DDR   ]--[ AMD Opteron™ ]--------[ AMD Opteron ]--[DDR   ]
[Mem   ]  [ (Proc 0)     ]        [ (Proc 1)    ]  [Mem   ]
           |                          |
         [I/O]                      [I/O]
```

System Parameters:

- 16 DIMMs (up to 32 GB using 256Mb DRAM)

- 4 HyperTransport™ links available for I/O

- Bisection-bandwidth = 6.4GB/s

- Diameter = 1, Avg distance=0.5

- Local Memory Read Bandwidth = 10.67 GB/s
  – Local Bandwidth/processor = 5.3 GB/s

- Xfire Memory Read Bandwidth = 7.06 GB/s
  – Xfire Bandwidth/processor = 3.53 GB/s

Quad Processor System Topology

![AMD]
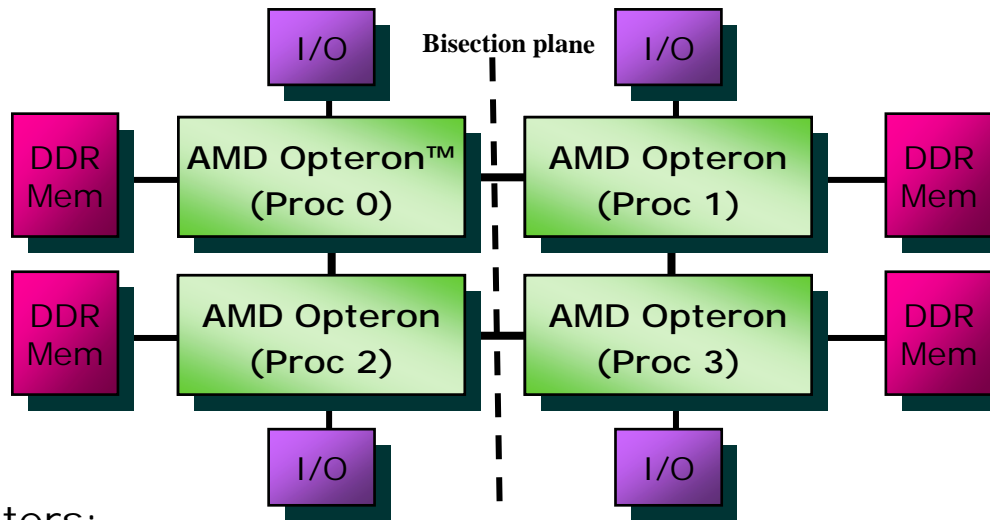
System Parameters:

- 32 DIMMs (up to 64 GB using 256Mb DRAM)

- 4 HyperTransport™ links available for I/O

- Bisection-bandwidth = 12.8GB/s

- Diameter = 2, Avg distance = 1

- Local Memory Read Bandwidth = 15.59 GB/s
  - Local Bandwidth/processor = 3.9 GB/s

- Xfire Memory Read Bandwidth = 11.23 GB/s
  - Xfire Bandwidth/processor = 2.8 GB/s

MP System Scalability
Memory Bandwidth

Memory Bandwidth Scalability

Summary

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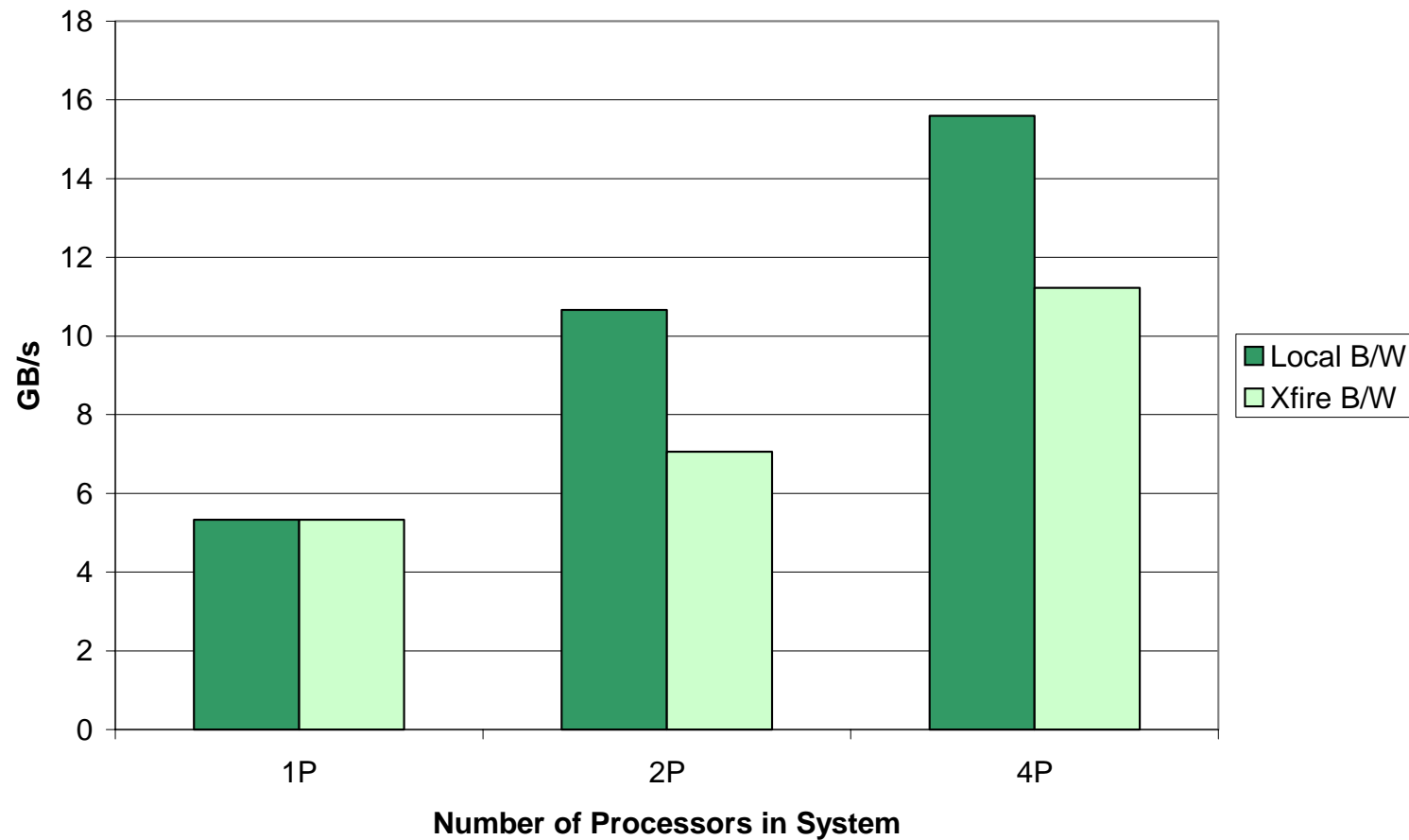
- **The AMD Opteron™ processor is designed to provide industry leading performance for enterprise class servers**
  - 32-bit performance leadership substantiated by delivering on AMD's promise of nearly doubling x86-based SPEC® CPU performance from a year ago
  - Simultaneous 32 and 64-bit performance

- **AMD Opteron "plumbing" is designed to provide exceptional MP scalability**
  - Performance advantage grows versus competitive platforms
  - Memory capacity and bandwidth scales
  - I/O capacity and bandwidth increases

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