



Flash Memory Summit



Many-Channel DMA for Virtualized Enterprise Storage SoCs

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Driving Factors

- Exponential traffic growth in data centers
- More connected devices virtualization expanding
- Convergence of Network, Compute, Storage on chip

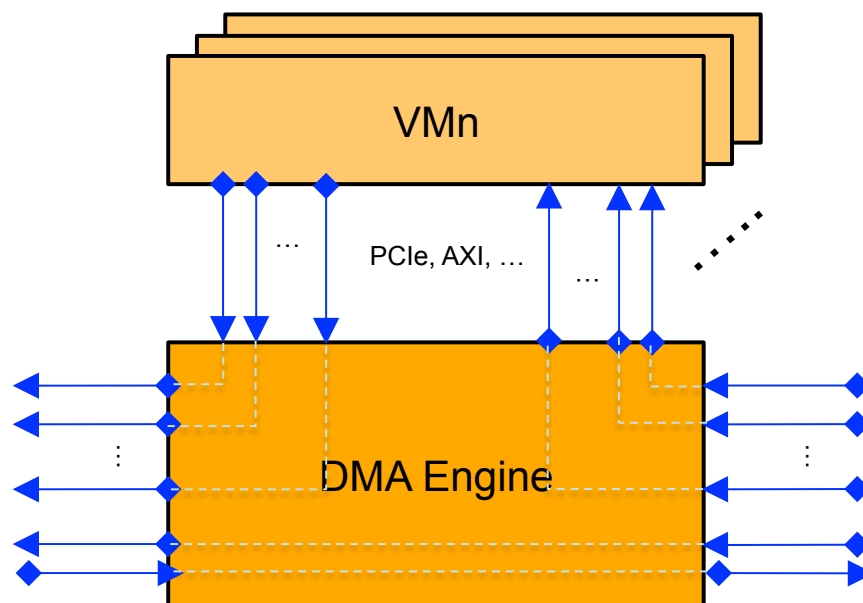


1000s of VMs competing for the same hardware



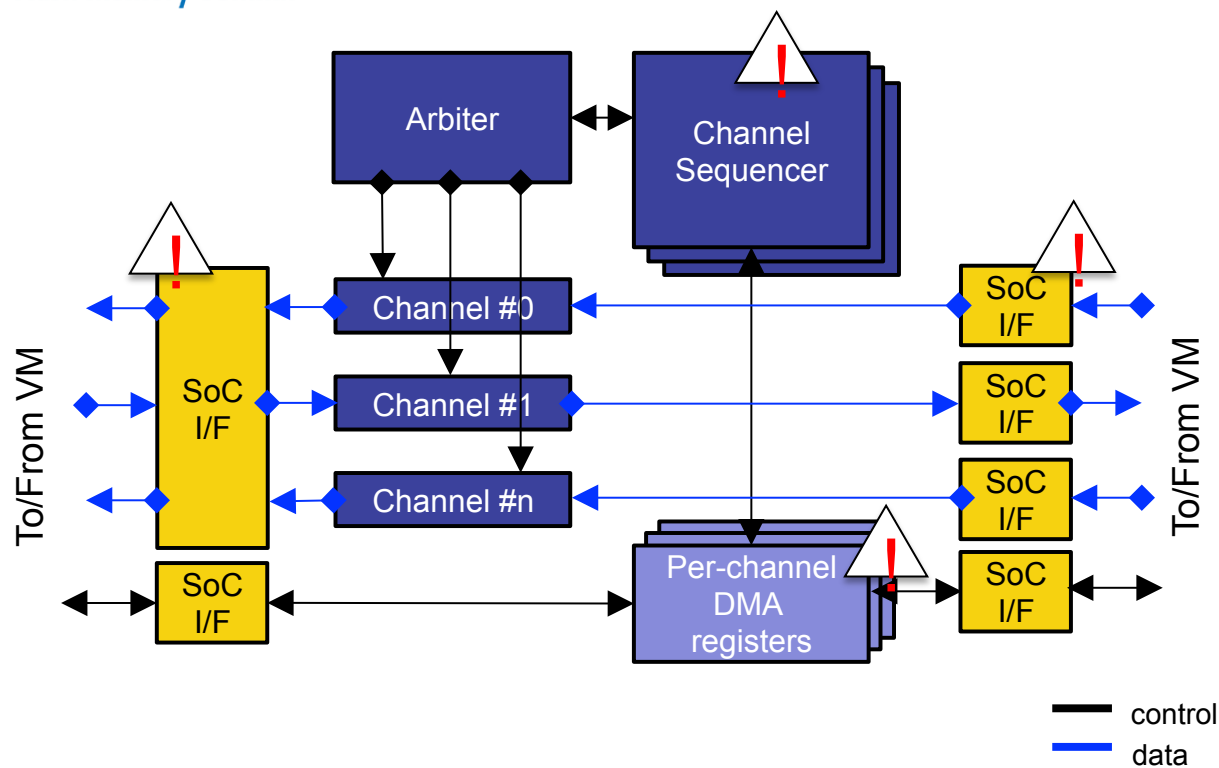
VMs Need Efficient Data Movers

- **Flexibility:** Many channels, any source-dest
- **Serviceability:** Fair bandwidth sharing, non-blocking
- **Reliability:** Isolation, data protection





Traditional DMA Limitations

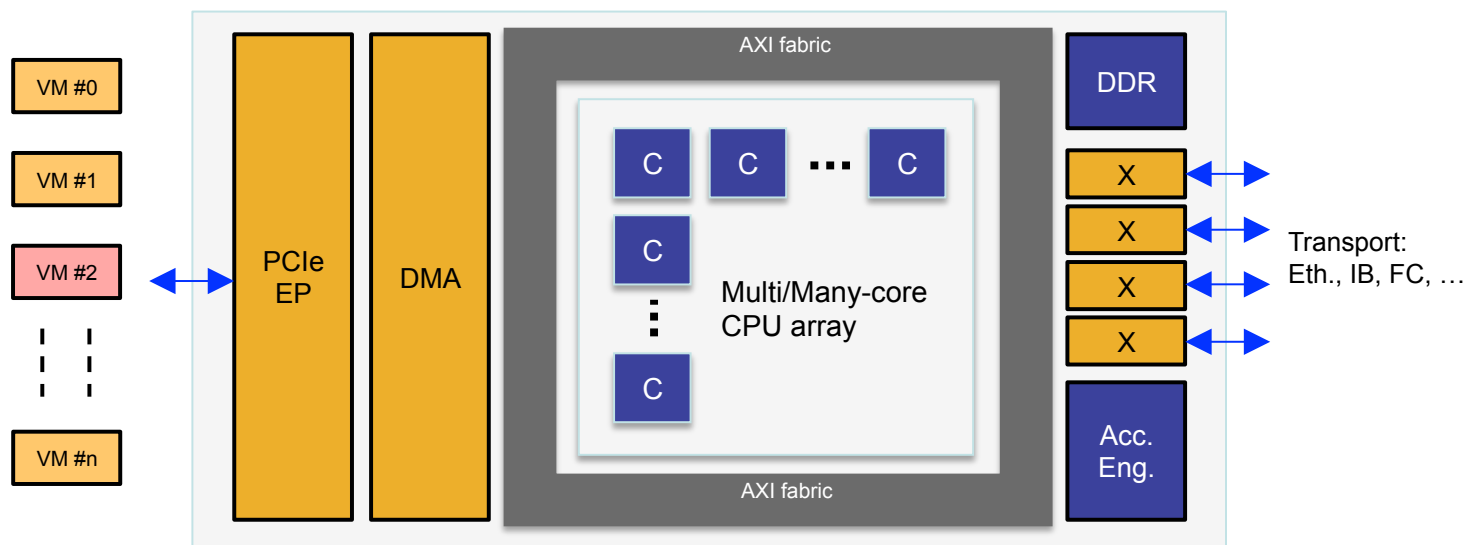


- High register count
- Channel blocking
- No VM id & isolation
- No data protection



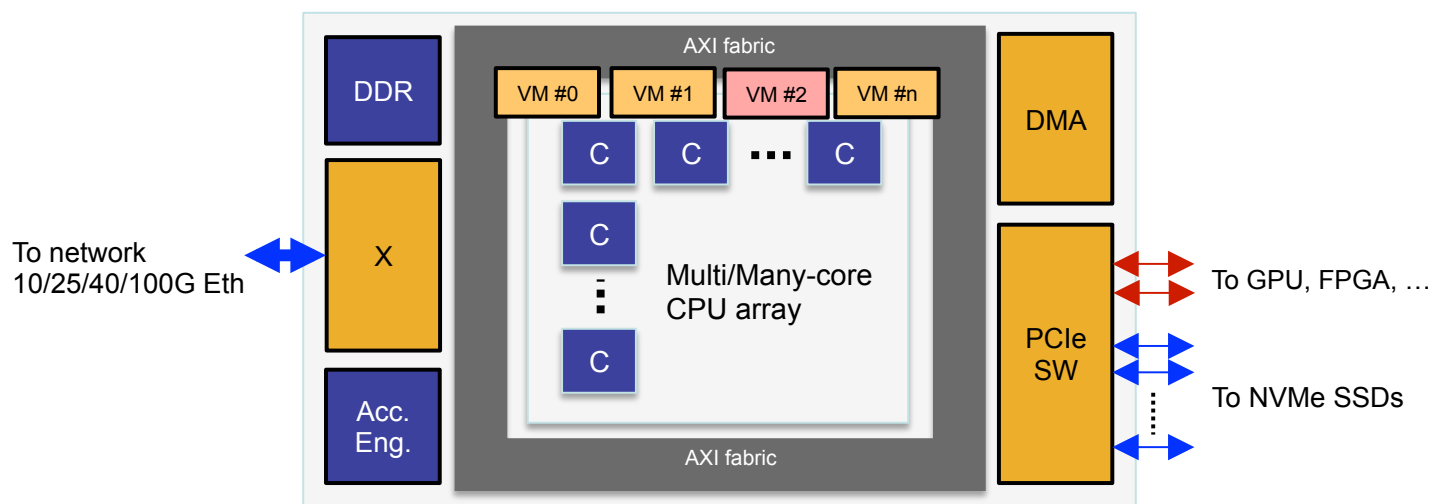
SoC Architecture (1)

- Data Center SoCs for Network & Storage offload: Flow processors, Smart NICs, Storage controllers



SoC Architecture (2)

- Data Center SoCs for Network & Storage offload: NVMe Host controllers



Virtualized DMA Requirements

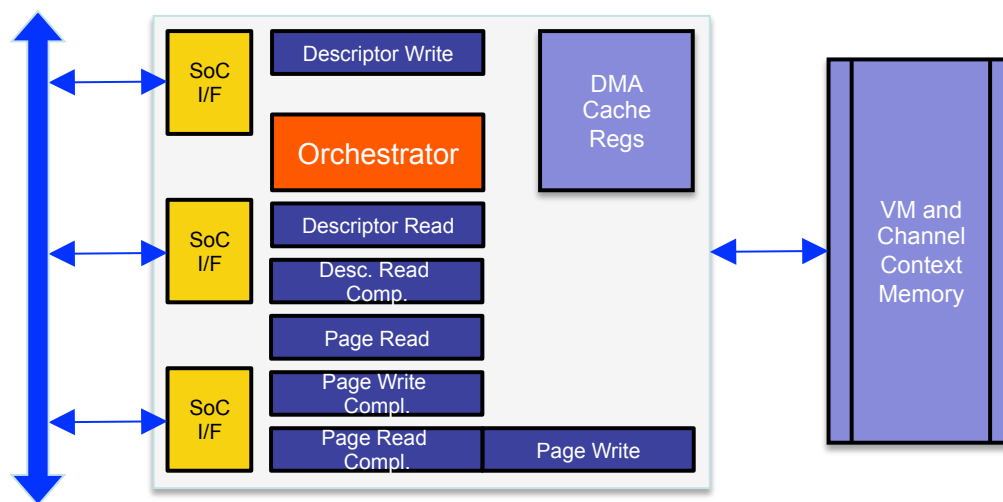


- **Performance & Scalability**
 - High throughput esp. small packets
 - 32+ DMA channels per VM
- **QoS**
 - Non-blocking operations
 - VM and channel priority
- **Security**
 - VM isolation, data path protection



vDMA IP Architecture

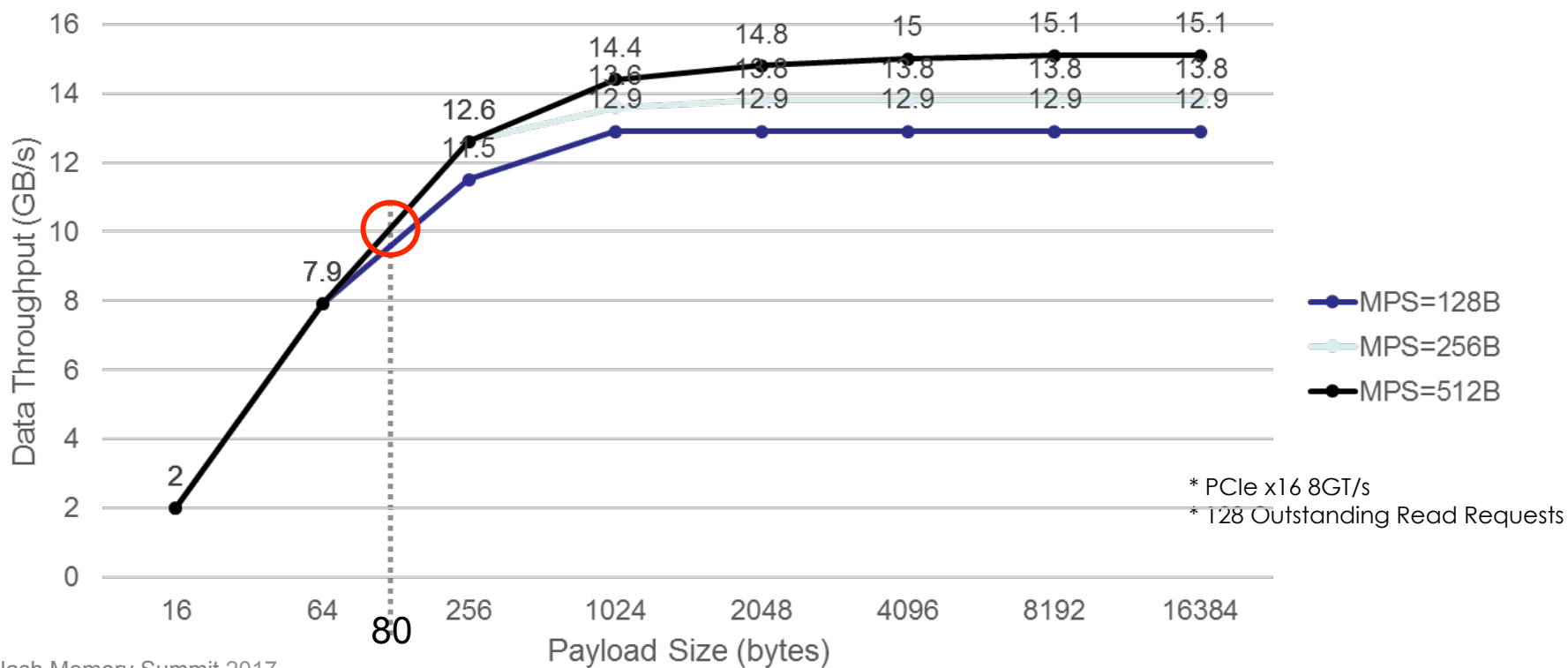
- Concurrent DMA tasks
- External Context memory
- Cache registers





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vDMA IP Performance

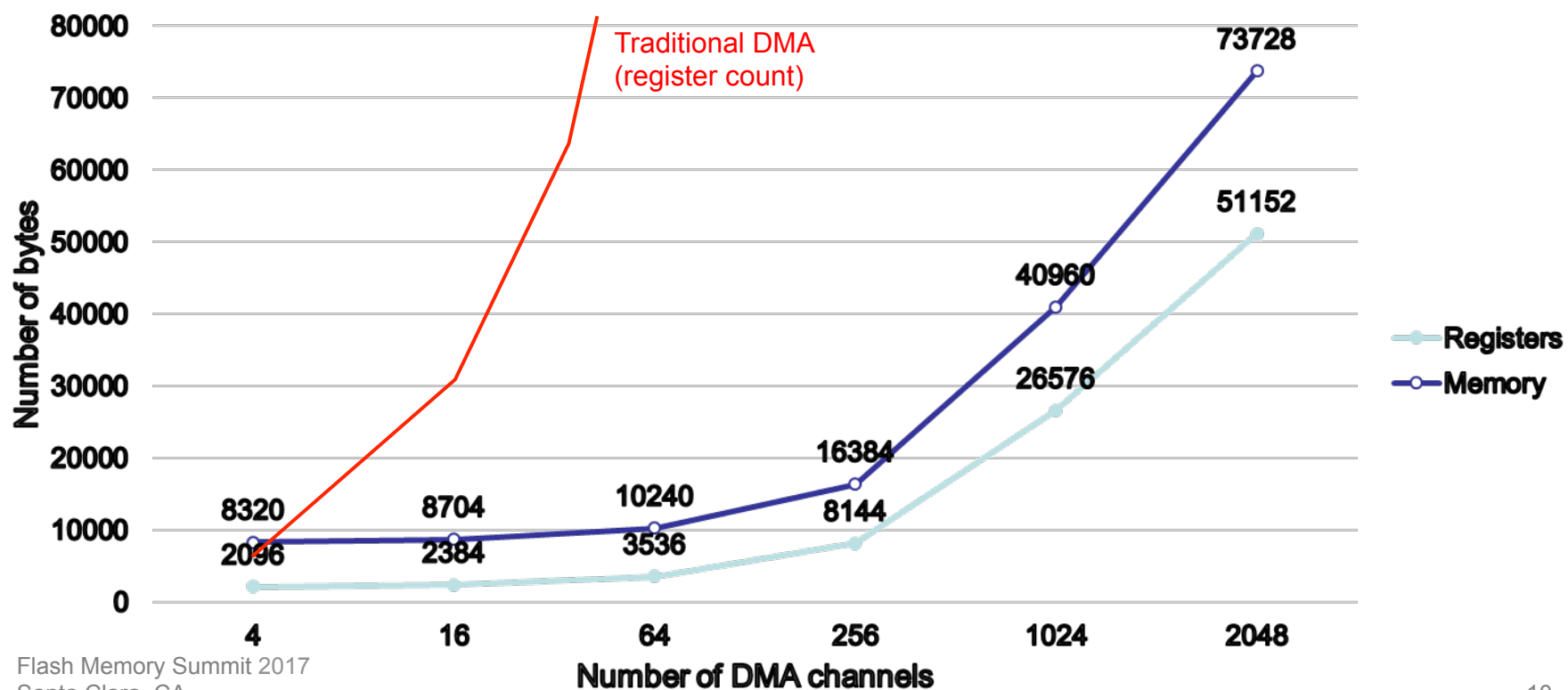


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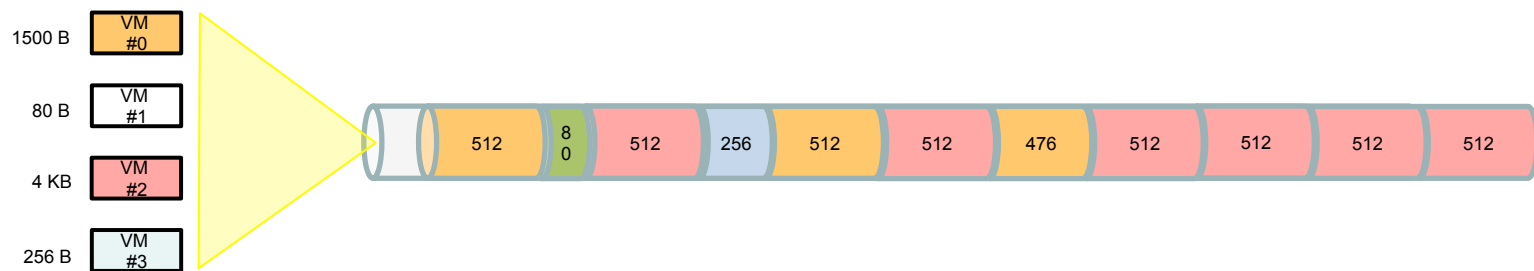
vDMA IP Resources



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Implementation Details (1)

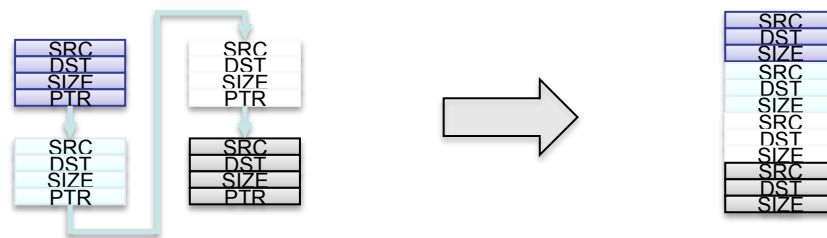
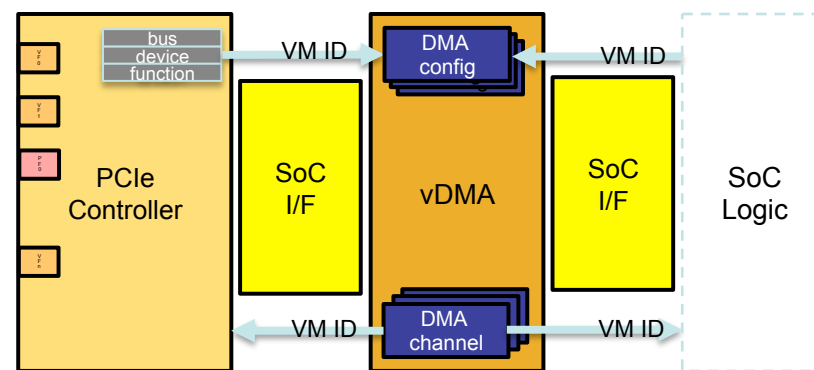
- Blocking due to buffers/data not available, VM crash
 - Sideband signaling
- Fair arbitration
 - Round-robin, fixed packet size, configurable





Implementation Details (2)

- VM isolation
 - Sideband signaling
- Performance optimization
 - Increase # of Outstanding Requests (read)
 - Propose contiguous DMA descriptors API





vDMA IP Summary

- Many-channel DMA IP Core targeted at Data Center SoCs
 - Standalone-SoC version: AXI-AXI
 - PCIe-SoC version: PCIe-AXI
- Available for ASIC & FPGA
- 2048 DMA channels
- 512 VMs
- 256-bit data path: PCIe 8GT/s x8 and 16GT/s x4



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Thank You!

- Come see our vDMA demo Booth #826
- Questions: info@plda.com
- Visit us online: <http://www.plda.com>
- Tel: (408) 273-4528