

“The Rambus® Industry” Technology Overview

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Rambus Inc.
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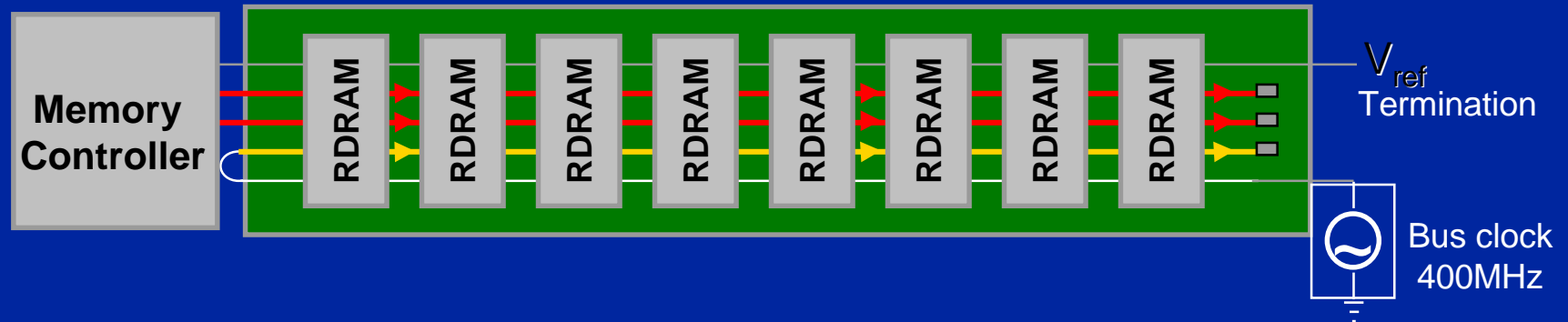


Direct Rambus™ Technology

- **Breakthrough high-bandwidth technology**
 - 800MHz Rambus memory provides headroom to optimize future architectures
 - Highly efficient pipelined protocol eliminates control and data conflicts
 - Design extends on proven Rambus technology
- **1.5 Gbytes of sustained performance per Channel**
 - Provides 2-3X the bandwidth of PC100 SDRAM
 - 1.6Gb/sec peak bandwidth
- **Total System Solution**
 - Comprehensive Specifications for RDRAM, Controller (RAC), Module (RIMM), Connector, Clock Generator (DRCG)
 - Narrow system bus lowers pin counts and cost



Signaling: 800 Mbits/sec Per Pin



■ Uniform impedance transmission line

- Identical signal topology, Equal trace loading
- Precision design using standard PCB materials

■ Precision clocking

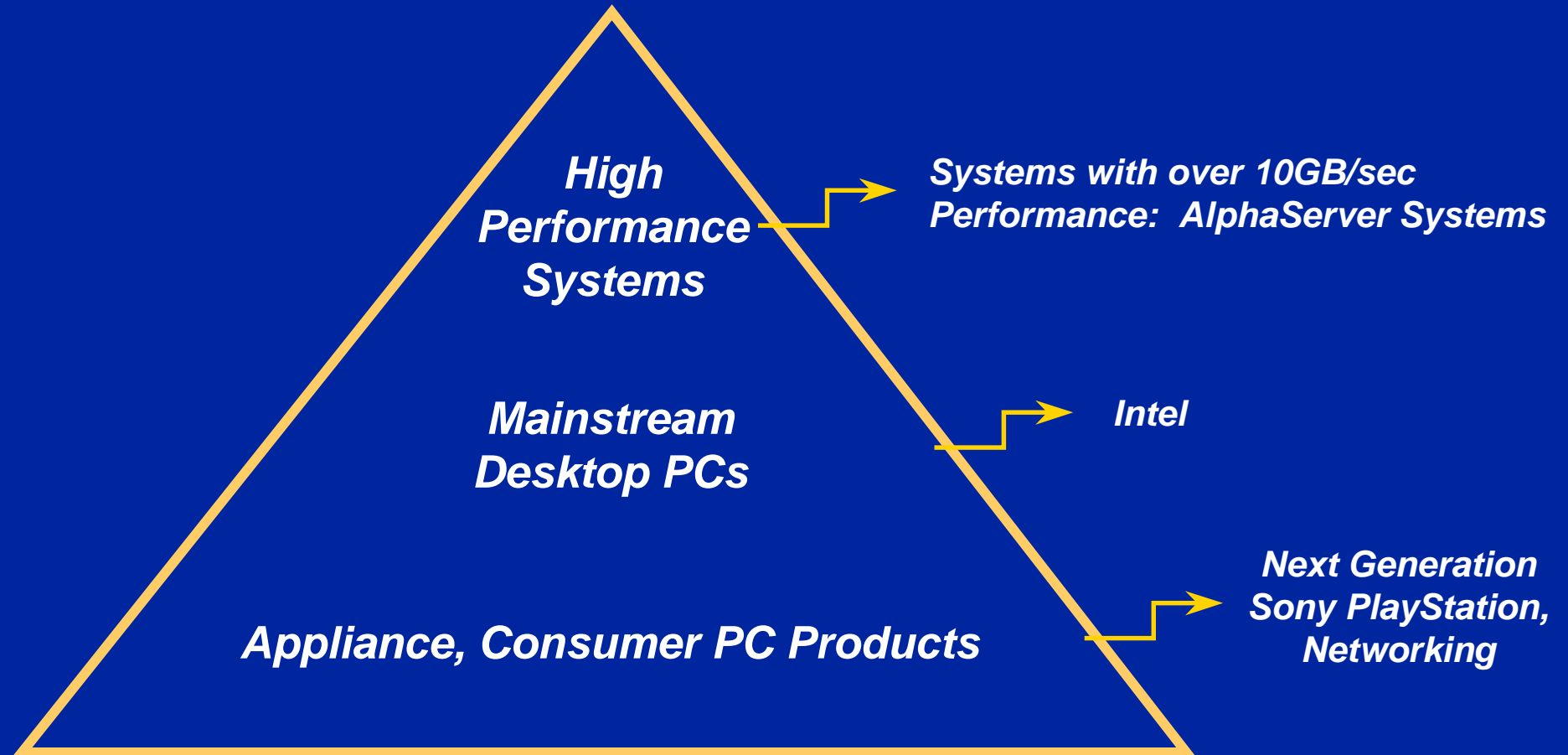
- Clock and data travel together
- Active timing compensation in I/O circuits

■ 800-MHz Channel

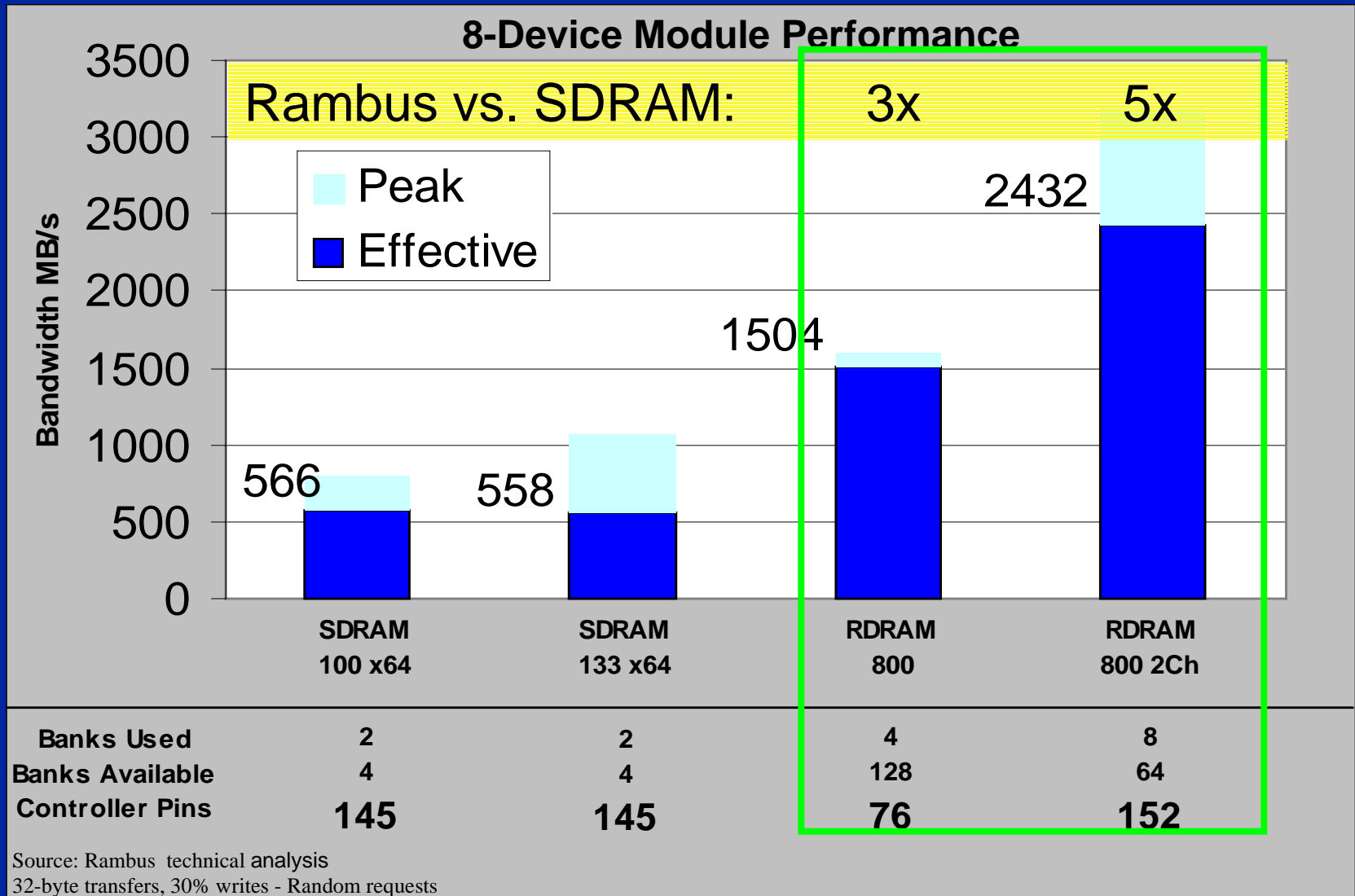
- Uses Rambus Signaling Level (RSL)
- 2.5 Volt supply, 1.8V V_{term} , 1-32 RDRAMs per Channel



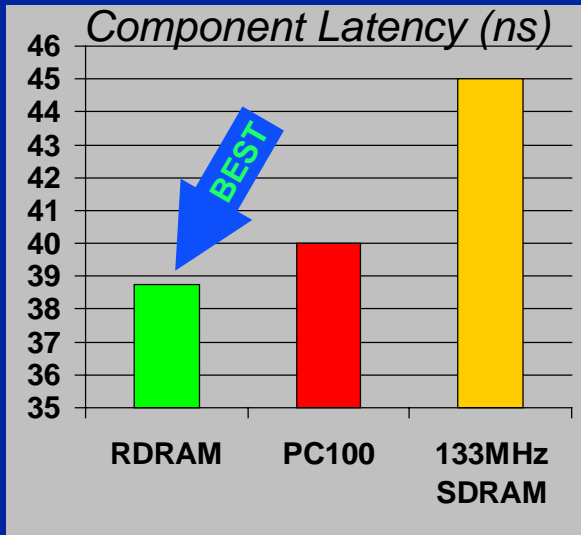
Headroom for Broad Range of Systems



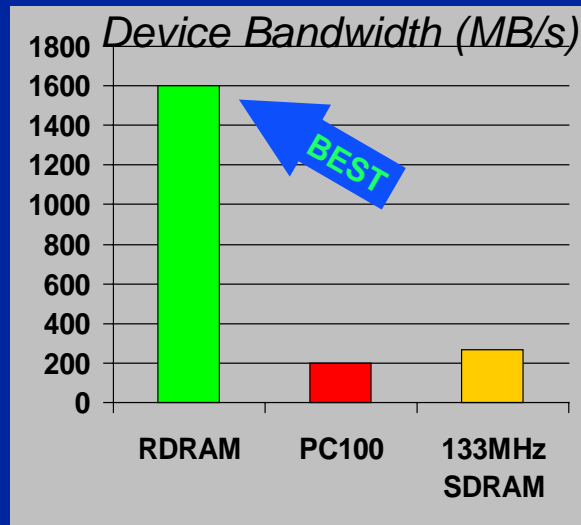
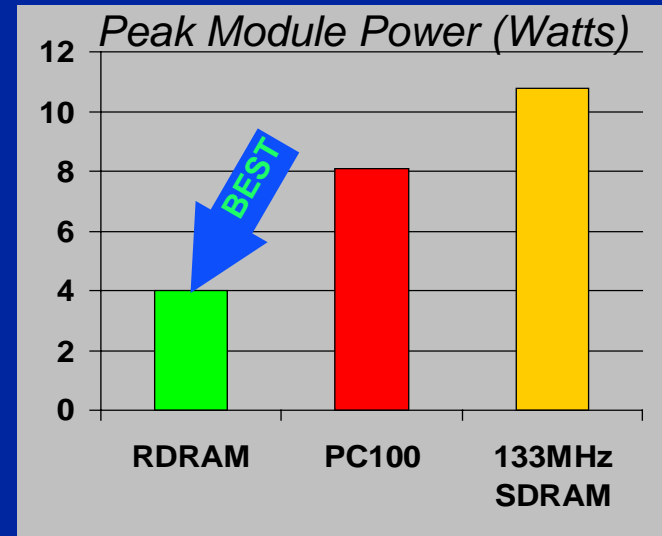
Effective Memory Bandwidth



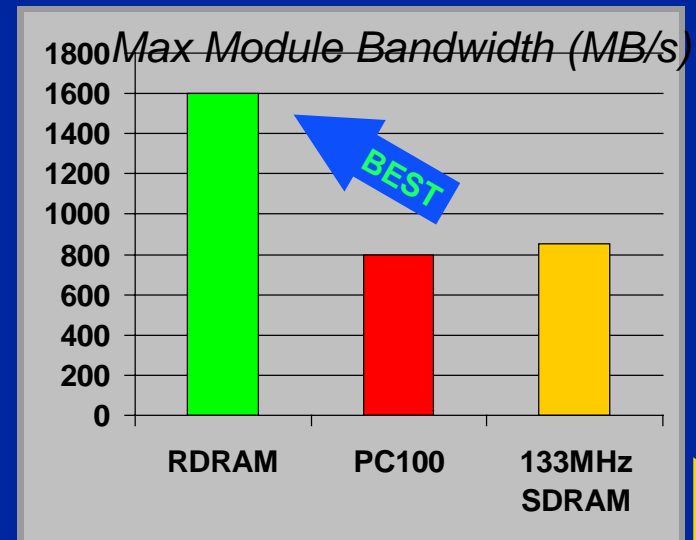
Why Rambus is in Your Future...



Lower is Better

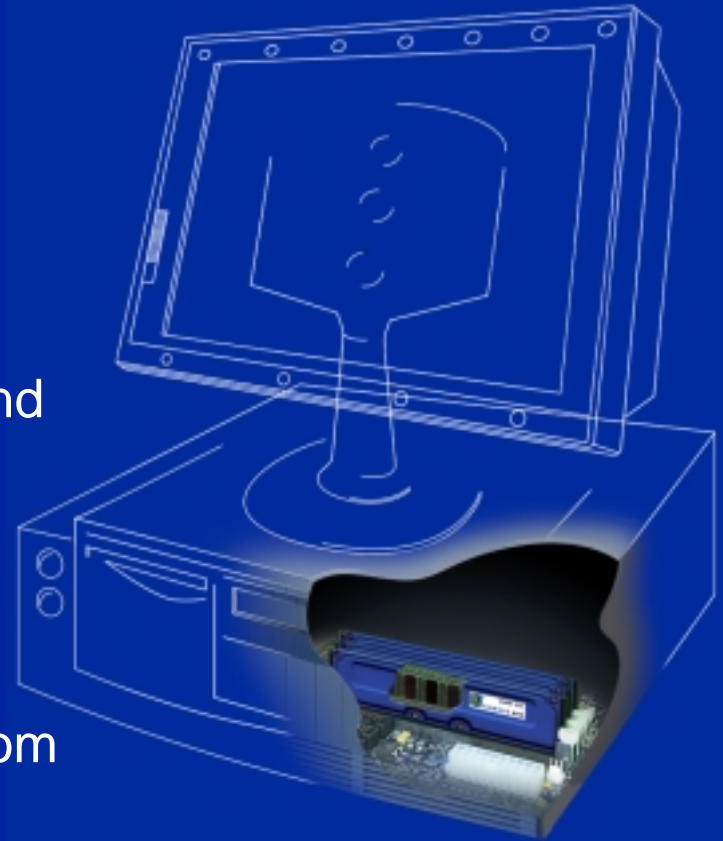


Higher is Better



Headroom for the Desktop

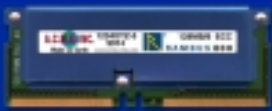
- **Rambus provides the headroom to fully experience Streaming SIMD**
 - 3D graphics
 - Surround sound
 - Real-Time MPEG-II video encoding and decoding
- **Rambus has the headroom to optimize future architectures**
 - Streaming SIMD - potentially 6GB/s from a 500 MHz processor
 - Integrated processors combining multiple GB/s graphics cores with high performance CPUs



Rambus Mobile Memory System



- **For Mobile PCs**
 - Mobile PCs hold SO-RIMM modules
- **Fits within profile of SO-DIMM memory**
 - Meets Intel's Thin & Light specs
- **Availability: 2000**



Twice the performance, less power than PC100 SDRAM memory



Rambus for Consumer Products

■ Sony PlayStation2

- 2 Rambus Channels provide 3.2GB/sec
- 32MB Rambus memory (2x128M RDRAMs)
- 66 Million polygons/sec vs. 8M for 3-D PC

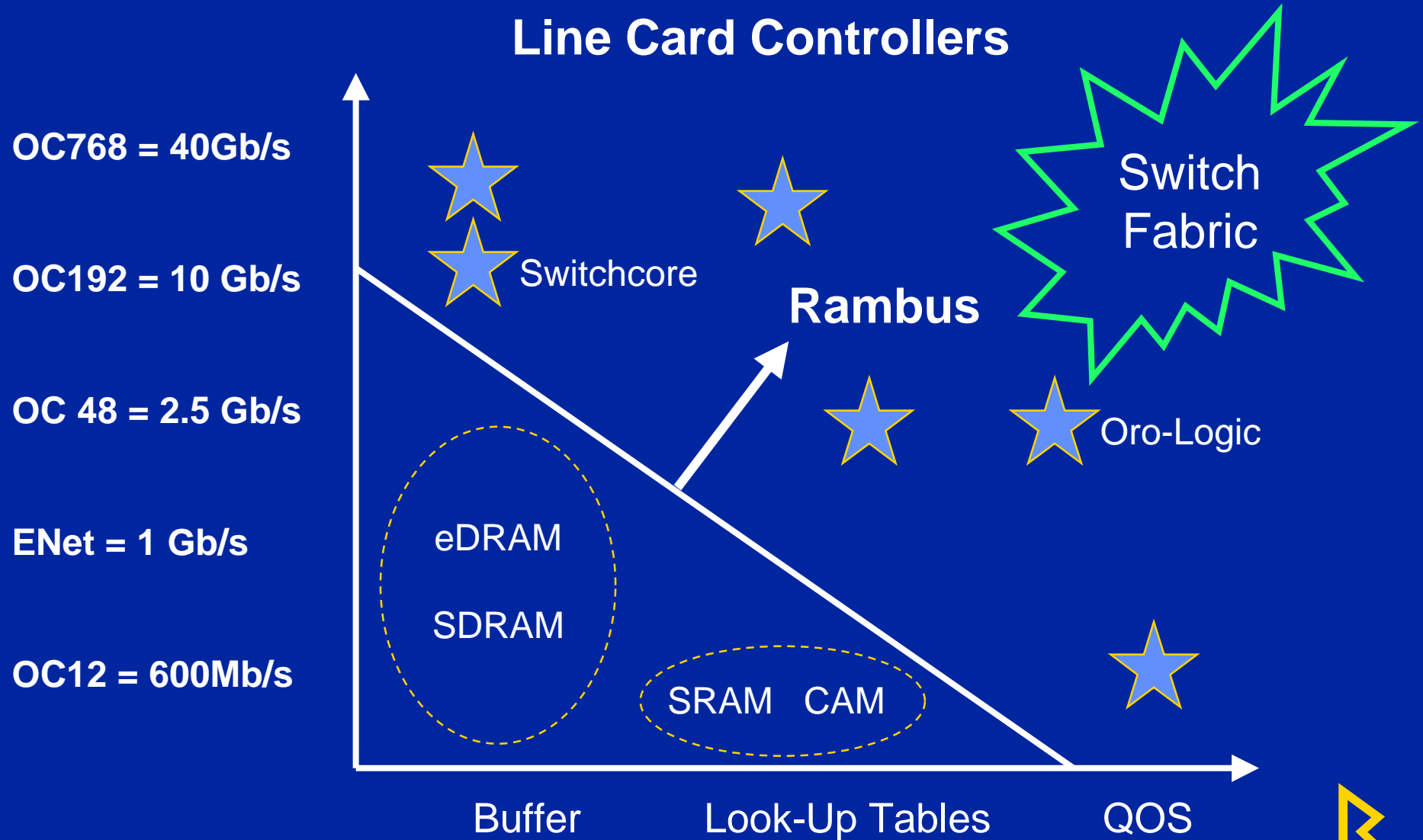
■ New I/O, graphics, and processing capabilities emerging in desktop

■ Access to digital content requires >1GB of sustained bandwidth

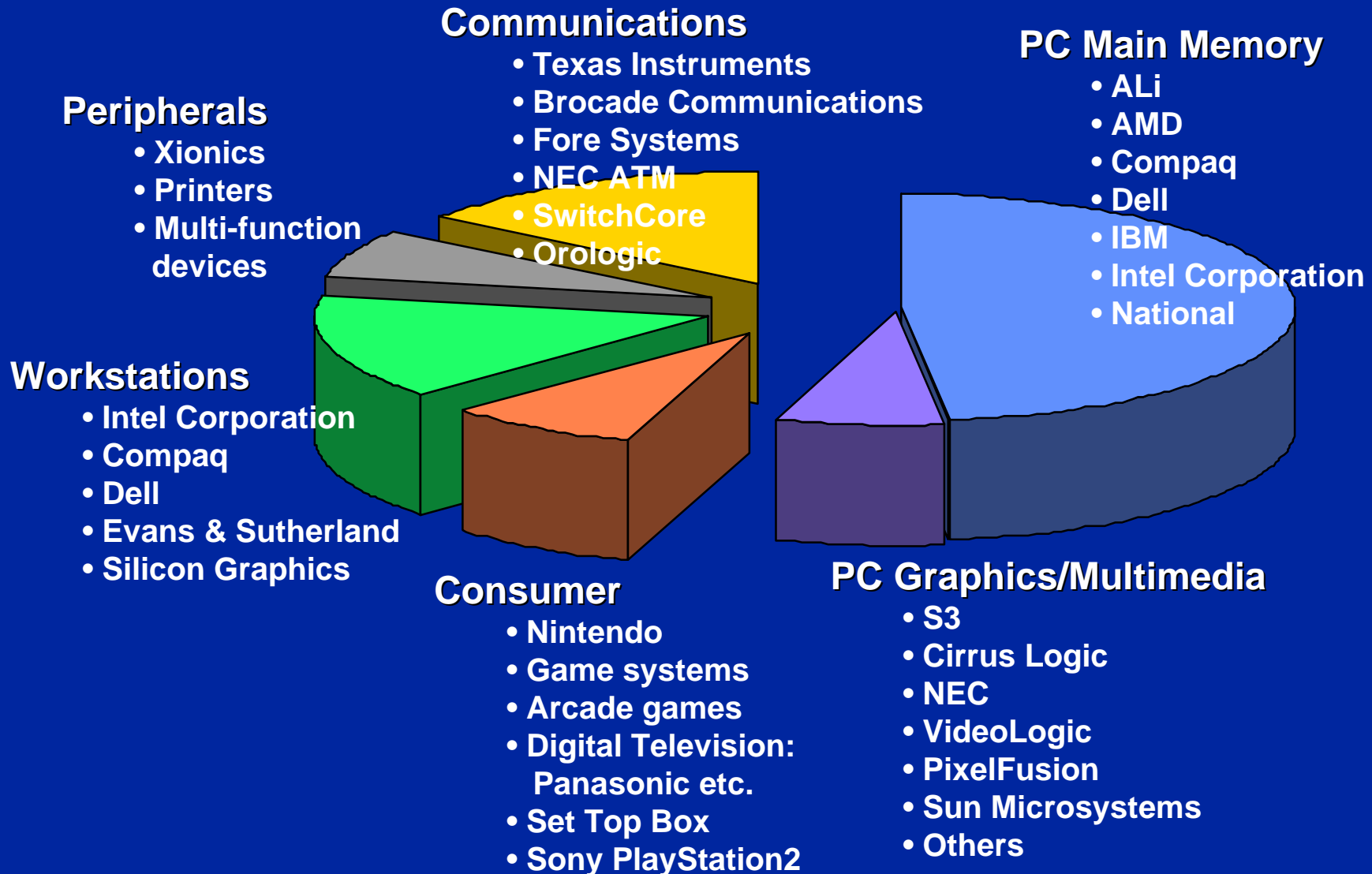
■ Internet experience requires memory bandwidth provided by RDRAMs



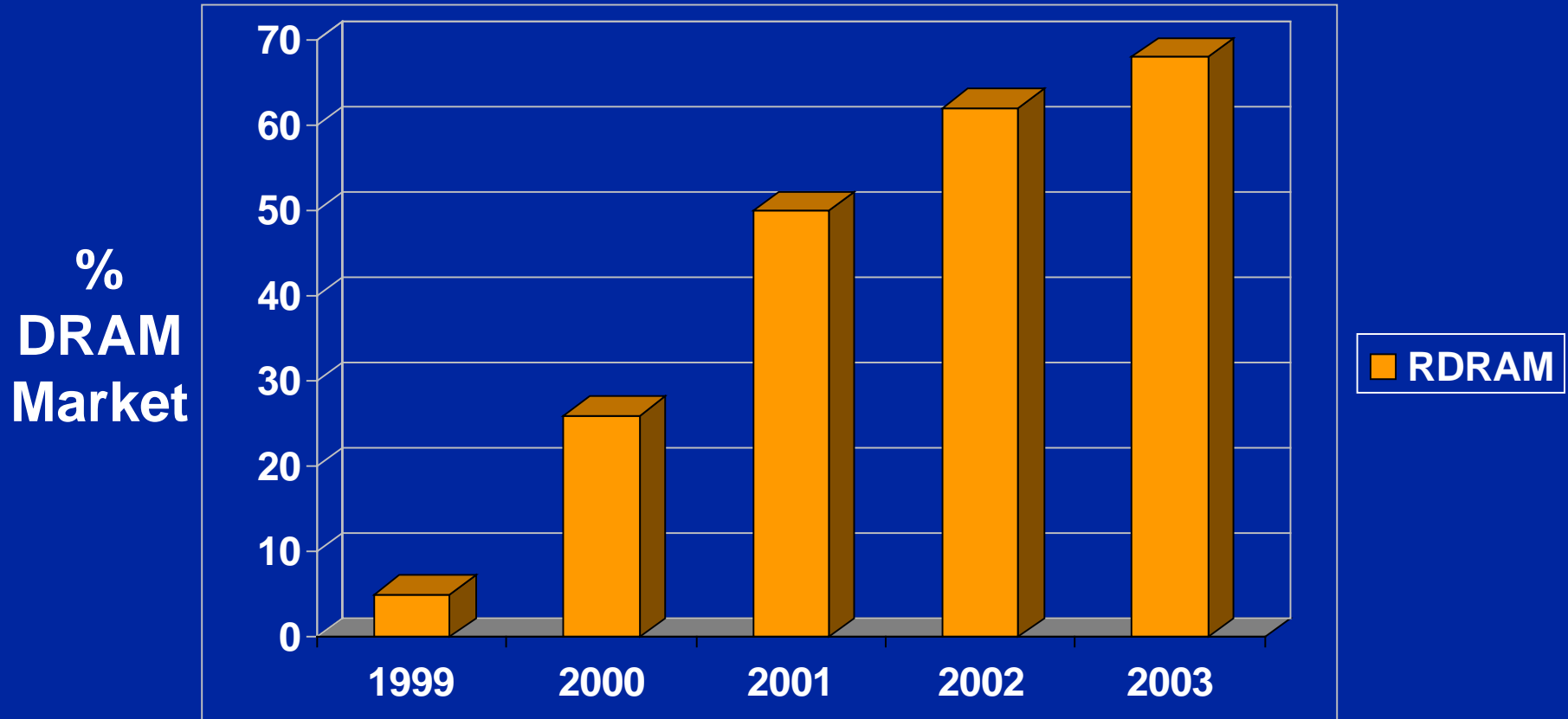
Networking Design Wins Accelerating



Announced Design Wins by Market



Rambus Marketshare Projection



Source: DataQuest 7/99



What Does Rambus Mean?

To Consumers:

MORE PERFORMANCE!

- **Memory Hungry Applications**

- Gaming, Graphics Processing, Numerical/Array Processing, Table Look Up

- **Better Resiliency under Multitasking Loads**

- Background Processes: Virus Checkers, Backup Programs, Remote Administration/Monitoring
- Streaming Content: Data being downloaded in the background, processed in foreground



What Does Rambus Mean?

To OEMs and System Designers:

LOWER COST, HIGHER PERFORMANCE!

■ Reduction in System Cost

- Highly efficient, low latency memory system can mitigate need for large cache and high performance I/O subsystems
- Reduced pincount interface with increased bandwidth allows higher integration
 - Fewer high frequency pins to optimize

■ Higher Performance

- Replicate Rambus Channels to increase overall memory capacity and bandwidth



Rambus Technology Opportunities

- High bandwidth memory enables new applications in all market segments
- Designing with Rambus Technology
 - *Comprehensive system design*
 - RDRAM, Controllers, Clocks, Modules, Connectors
 - *High-speed logic design*
 - Microprocessor speeds for your applications
 - *Transmission Line Optimization*
 - Impedance, Propagation Delay, Attenuation, Cross-talk Noise
 - *High-signal integrity board layouts*
 - High bandwidth enabled on standard PCB technology



Rambus/Tektronix Partnership

- Tektronix is a key Rambus Development Partner
- Precision Measurement Tools
 - Used during design and evaluation
 - *Signal integrity/ module transmission line design*
 - *Rambus Component AC/Jitter Characterization*
 - Tektronix TDS 694C, 11801, CSA 803
 - *High-speed logic design*
 - Tektronix TLA 714
- Production Tools
 - Tektronix 11801 TDR is approved equipment for PCB production test



More Information

- More information on Rambus Technology is available at:

www.rambus.com/developer

- Also, on Intel's web site at:

developer.intel.com/design/chipsets/memory/r dram

- On Tektronix web site at:

www.tektronix.com/rambus



The Rambus® Industry

System performance unbounded by memory speed, allows:

- Higher performance
- Expanded capabilities
- New applications
- New markets



The High Bandwidth Memory Solution

