R22

Optimize xSeries System Performance With DDR2-400 Memory

Mike Hyland & Jim Elliott

IBM @server xSeries Technical Conference

Aug. 9 - 13, 2004

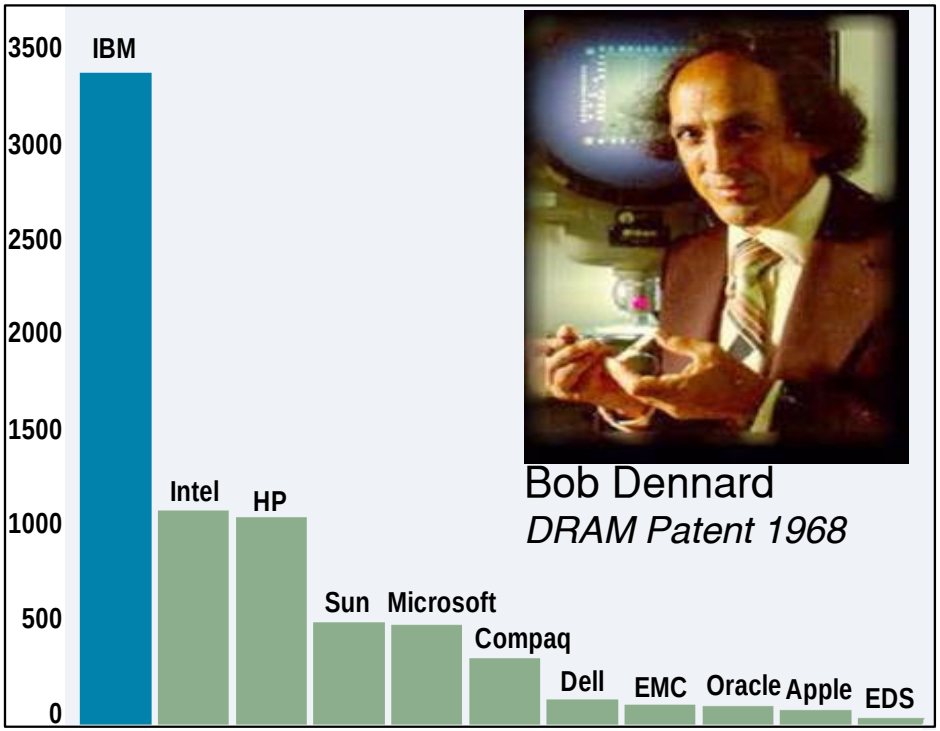
Chicago, IL

RETURN TO INDEX

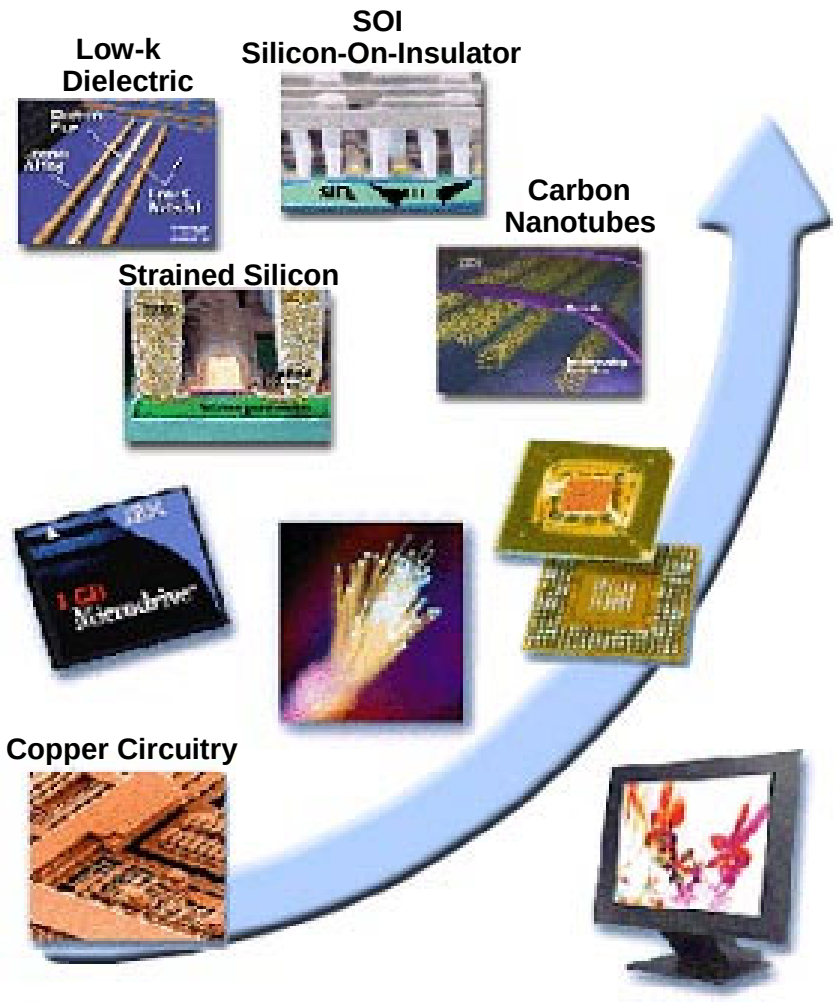
DDR2 Memory Transition Agenda

- IBM Today
- Invest in Innovation
- Technology Transition
- System Benefits
- Performance Benefits
- Industry Readiness Statement
- xSeries Memory Portfolio
- Why IBM Memory ?
- Summary

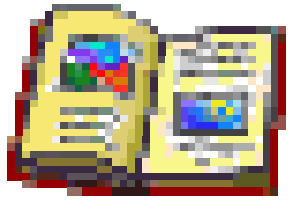
Investment in Innovation



For the 10th consecutive year, IBM led the IT industry with 3,288 patents



System Group Strategy & MI Customer Survey ---Microsoft Window's Users --Key Findings：



- Server capacity purchases will be up in 2004
- Centralized IT department purchases gaining control over 2004 purchases
- The top workload implemented are the **high volume workloads** :
  Networking, Security and File and Print
- The top **growing workload** planned by customers are:
  Web Serving, Decision Support and Scientific / Engineering applications
- The **top migration battlegrounds** are :
  OLTP, Application Development, Scientific/Engineering and CRM

What is Intel® Extended Memory 64 Technology?

- **Translation:**
  - --Additional memory addressing capability
  - --Native compatible with existing IA-32 Software
- **Primary Benefits:**
  - --Ability to execute large "memory" applications (>4GB / Process Virtual Memory)
- **Time Table:**
  - 3Q'04 Intel shipping 32/64b Xeons for Servers
  - 4Q'04 Microsoft plans to ship 64b Windows OS
  - 2Q'05 MS SQL Server expected to ship w/64b capabilities

...ts to support ...arting in mid '04

DDR2-400 Memory Transition Talk On The Street……

- DDR2 DP Servers & Memory Options In Summer 2004
- New DDR2 Memory DIMM Packaging
- Servers Will Precede Desktops In DDR2 Memory Transition…
- All Memory Suppliers Transitioning to DDR2 This Year ?

DDR2 Transition not a matter of if but When and Where???

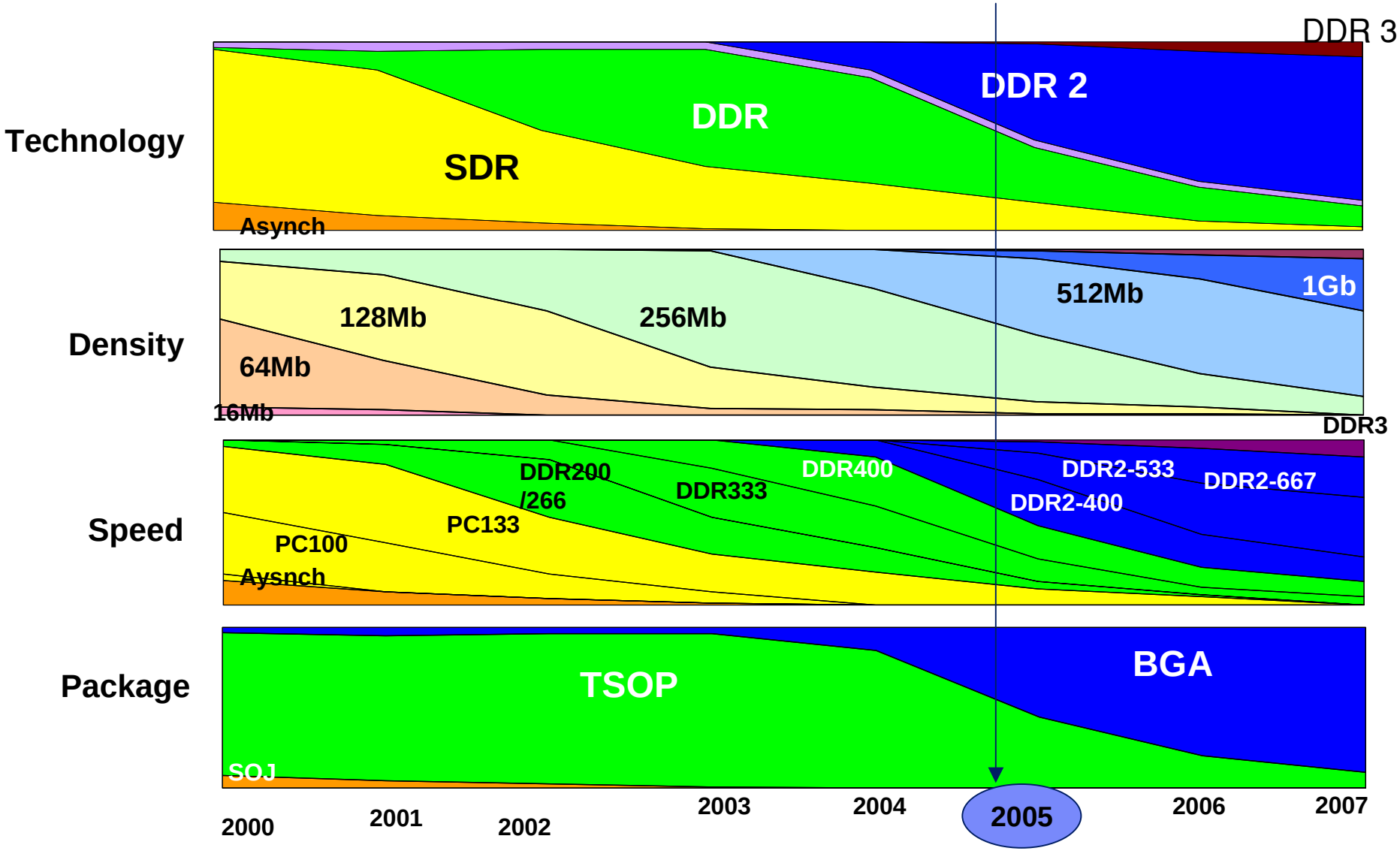
DDR2 Benefits Over DDR1 Memory

- Higher Peak Bandwidth /Transfer Rate For Increased Performance…. 20% Higher Peak Bandwidth Over DDR333
- Lower Power Consumption & Better Thermals…. 1.8v Operation & 50% Power Reduction over DDR1
- Up To Four DIMMs Per Channel Compared to Three DIMMs With DDR
- Unique FBGA DIMM Package Required For High Frequency Will Be Introduced With The Announcement Of DDR2 Memory Modules:
  - -Smaller Size
  - -Thinner Height
  - -Higher Performance
  - -Higher Reliability
  - -Better Signal Integrity
  - -JEDEC Compliant

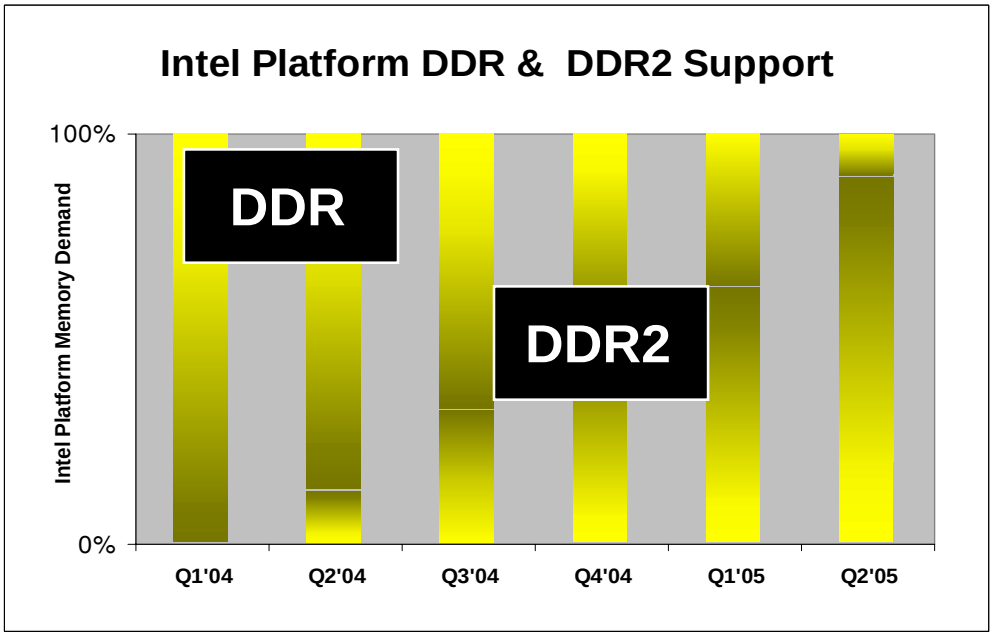
Bottom Line:

Operational Enhancements To Increase Memory Performance, Efficiency & Timing Margins For High Performance Computing

Staying in the DRAM "Sweet Spot"



Intel's 2004 Chipsets Support both DDR and DDR2



Transition will be driven by price and availability of DDR2

xSeries 306

Grantsdale/Alderwood

xSeries 336

Lindenhurst/Tumwater

Alviso

Flexible DDR2 transition expected across all new IA platforms

Platform Adoption of DDR2

Performance PCs and Workstations

Z Pro

Higher Volume

Mid-Range Servers

xSeries 255

xSeries 455

High-End Server [FBDIMM]

Reducing premiums

Entry-Level Servers

xSeries 306

Mainstream Desktop & Notebooks

Value Desktops & Notebooks

X40 G Series

1H04 **2H04** **1H05** **2H05**

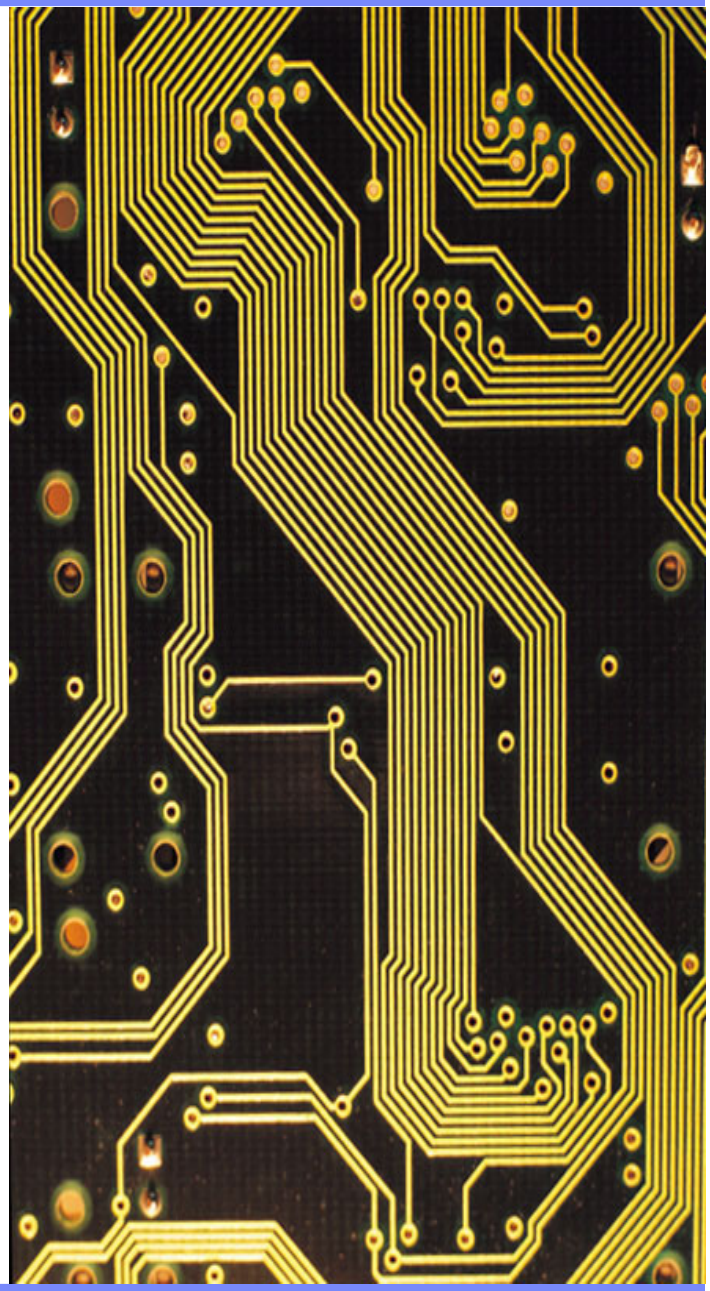
DDR2 Naming Conventions & Bandwidth

	Speed	Name	Transfer Rate
DDR2-400	400MHz	PC2-3200	3.2GB
DDR2-533	533MHz (Year 2005)	PC2-4300	4.3GB
DDR2-667	667MHz (Year 2006)	PC2-5300	5.3GB

DDR2- 400 Not Backward Compatible:

-- Voltage

- Chip Technology
- Incompatible Pin Configurations
- Different ***Key*** Than DDR to Prevent Insertion Into Incompatible Memory Sockets



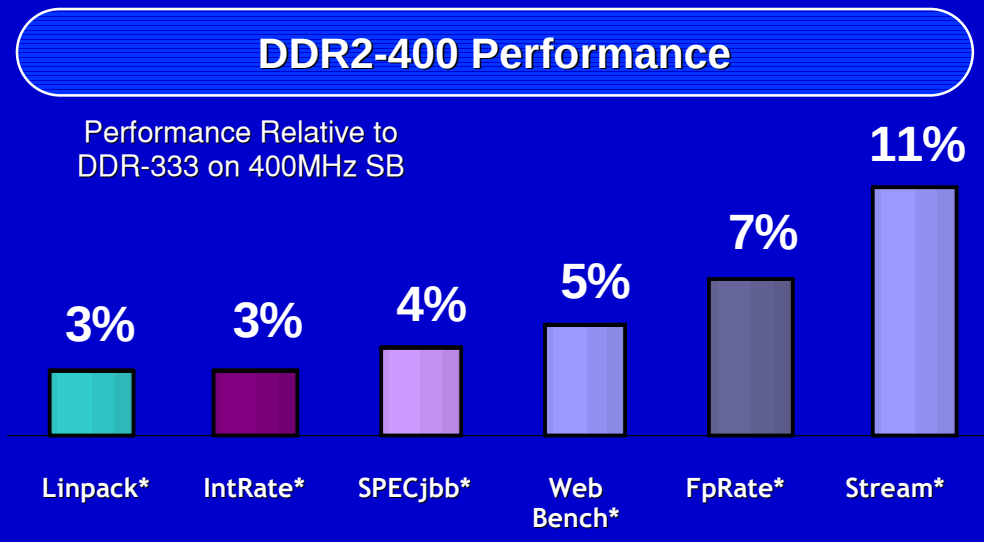
DDR2 Advantages Over DDR

Features	DDR	DDR2	DDR2 Advantages
Voltage	2.5Volts	1.8Volts	Low Power Consumption
Speeds (MHz)	200,266,333,400	400,533,667	Speed Limit Raised Above 400MHz
Chip Package	TSOP & BGA	FBGA	Higher Speed and Improved Electrical /Thermal Performance
On Die Termination	Signal Terminated on Planar	In Every Chip	Improved Signal Quality & Integrity
Pin Configuration	184 Pins Registered	240 Pins	To Prevent Insertion Into a Incompatible Socket
Densities	128MB -1Gb	256Mb – 4Gb	Enable Large Capacity Memory Subsystems
Internal Banks	4	4 & 8	Better Performance and Throughput

DDR2-400 Performance

DDR2-400 vs. DDR333

- New FSB plus DDR2-400 Advantages
  - 50% higher bus frequency lowers latency
- DDR2-400 demonstrating performance gains with tuning
  - Up to 11% benefit



	Linpack*	IntRate*	SPECjbb*	Web Bench*	FpRate*	Stream*
Memory	2 GB	2 GB	2 GB	2 GB	2 GB	2 GB
Metric	Gflop	Base	Ops/s	Req/s	Base	Score
Other	1Kx1K	8.0 ICC	BEA	ISAPI	8.0 ICC	Triad

Source: Intel Corporation (Apr 04)
Early Measurements on Pre-production Hardware.
Results may vary by platform or by other hardware or software configuration variations

DDR2-400 delivers performance benefits for memory intensive workloads

Industry Ready for

20040128

SAMSUNG Electronics Ramps Up DDR2 For Next Generation PCs and Servers

Larger Image

Seoul Korea - January 28 , 200 4 : SAMSUNG Electronics Co., Ltd. , the world leader in advanced semiconductor memory technology, announced today that its advanced DDR2 memory solutions are ready to meet the needs of a new generation of high performance PCs and servers. SAMSUNG's DDR2 solutions include 1Gb/512Mb/256Mb densities in 400/533/667Megabits per second (Mbps) performance and nineteen DDR2 based module combinations.

SAMSUNG has passed Intel system validation for twelve of its 512Mb and 256Mb DDR2 components, the largest volume in the industry. Based on its full line up of quality components, SAMSUNG provides a broad availability of module configurations including a high density 2GByte Registered-DIMM utilizing SAMSUNG's unique module design technology mounting thirty-six 512Mb monolithic devices in two rows on each face of the PCB and the industry's highest performance 1Gbyte Unbuffered-DIMM made up of sixteen 512Mb DDR2-667 components.

SAMSUNG is
facilities and s
technologies t

gy Group

Micron Technology, Inc., First to Validate All Three Densities of DDR2 Components With Intel

Validation of 1Gb DDR2 components solidifies Micron's leadership position in DDR2

Contact Info

Boise, February 3, 2004 -- Micron Technology, Inc., today announced it is the first supplier to validate the one gigabit (Gb) DDR2 component and first to validate all densities of DDR2 components, including 256Mb and 512Mb, with Intel. Validation and production availability of all three densities provides the foundation for multiple module solutions for notebook, desktop, and server computing products.

"Micron's 1Gb DDR2 is the first to pass Intel's component validation, which makes Micron first to validate all three densities," said Pete MacWilliams, Intel Senior Fellow. "Micron's leadership position in DDR2 validation and production availability is key to enabling Intel's platforms and our customer's products in 2004 and beyond."

"Micron already announced volume production of DDR2 devices and modules," said Terry Lee, Executive Director of Advanced Technology and Strategic Marketing for Micron's Computing and Consumer Group. "Intel Platform validation of 1Gb DDR2 components solidifies our leadership position, allowing us to provide the highest density DDR2 products available to our server customers. This gives Micron the broadest DDR2 product offering available today for meeting the memory requirements of notebook, desktop, and server computing products."

Micron Technology, Inc., is one of the world's leading providers of advanced semiconductor solutions. Through its worldwide operations, Micron manufactures and markets DRAMs, Flash memory, CMOS image sensors, other semiconductor components and memory modules for use in leading-edge computing, consumer, networking, and mobile products. Micron's common stock is traded on the New York Stock Exchange (NYSE) under the MU symbol. To learn more about Micron Technology, Inc., visit its Web site at www.micron.com.

t Infin

Japan Elpida To Mass-Produce Advanced DRAM For Intel MPU

DOWJONES

05-08-03 11:40 PM EST

TOKYO -(Dow Jones)- Elpida Memory Inc. is ready to begin mass production this summer of high-speed next-generation dynamic random access memory chips for Intel Corp.'s (INTC) new microprocessing unit set, a company official said Friday.

The Japanese DRAM maker said it was recently confirmed that Elpida's next- generation DRAM chip, called "DDR (double-data-rate) 2," works well with Intel's new MPU set for use in high-performance personal computers and servers.

e next generation of High-Performance main memory from
Offering greater bandwidth and density in a smaller package at
power consumption

DDR2 Advantages and Supply

Benefits of DDR2

Power savings

- 40% less than DDR333
- 30% less than DDR266

Flexibility

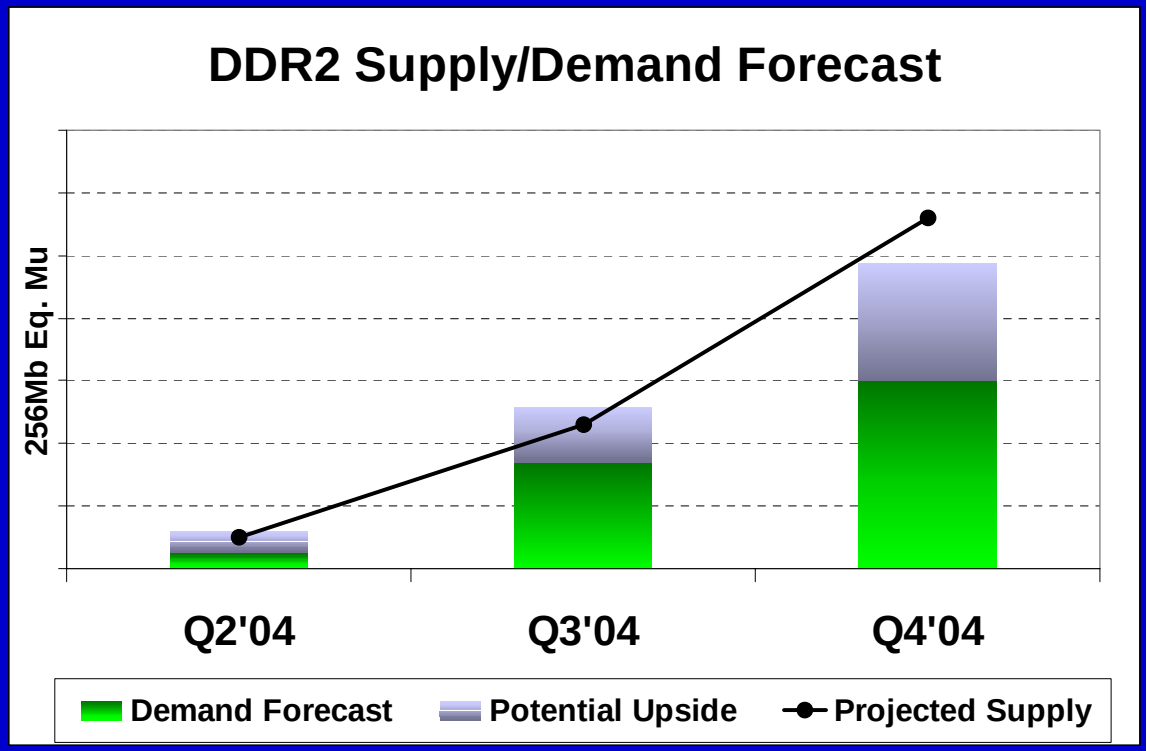
- Up to 4 DIMMs/channel at 400 MHz
- Smaller board form factors (with ODT†)

Performance (vs. DDR333)

- 9-11% increase in sustainable memory BW (STREAM)
- Up to 7% improvement of SPECfp_rate2000 and server benchmarks

Availability

- Healthy supply at launch to meet customer requirements



Successful Memory Transition

Half the Launch Premiums of DDR Intro (50% vs. 100%)
Twice as Many Suppliers and Parts Available at Launch

†ODT: on die termination

DDR2 Price Parity With DDR1

	3Q'04	4Q'04	1Q'05	2Q'05	3Q'05
IDF Seminar	1.35	1.15	1.1	1.05	July Parity
Gartner Report	1.20	1.10	1.10		1.0

April DDR2 Parity

DDR2 Price Premiums In 2004

- Capacity Limitations
- Infrastructure Cost
- Lower Production Yields

Minimal Premiums In 2005

- Larger Vendor Base
- Available Capacity
- Significant Market Adoption

Typically Premiums Persist for the First 6 Quarters of New Technology

xSeries Readiness

Engineering and Technical

- JEDEC Design Participation
- Internal DRAM Qualifications
- System Tuning and Refinements
- Performance /Technical Benchmarking
- Production Ramps
- Supplier Negotiations
- Price Negotiations

Sales, Marketing & Operations

- T3 Training & Surveys
- Customer Education
- Product Announce and Launch Plans
- Product Forecasts
- Price Projections
- DDR1 / DDR2 Transition Planning

IBM eServer Industry-

Enterprise Scale Up Servers
2-way to 16-way SMP

DDR2 Supported
1st Half 2005


xSeries 445


xSeries 455

Scale Out Rack Optimized Servers
Uni to 4-way SMP

DDR2 Supported


xSeries 382


xSeries 365


xSeries 336


xSeries 343
NEBs Solution


xSeries 346

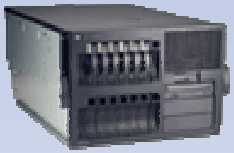

xSeries 306

Distributed Tower Servers
Uni to 4-way SMP


xSeries 206


xSeries 225


xSeries 235

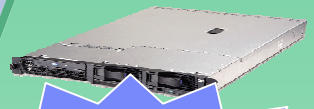

xSeries 255

DDR2 Supported
1st Half 2005

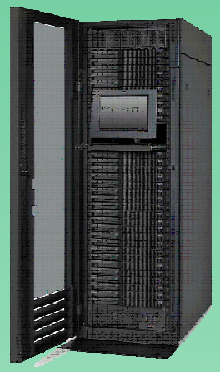
Enterprise Scale Out Offerings
...s, scalable clustering

DDR2 Supported


eServer BladeCenter



DDR2 Supported
1st Half 2005


1350 Linux Cluster

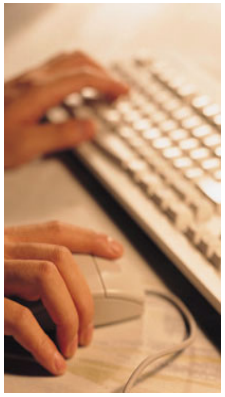
IntelliStation Workstations
Uni to 2-way SMP 2D - 3D Graphics


A Pro

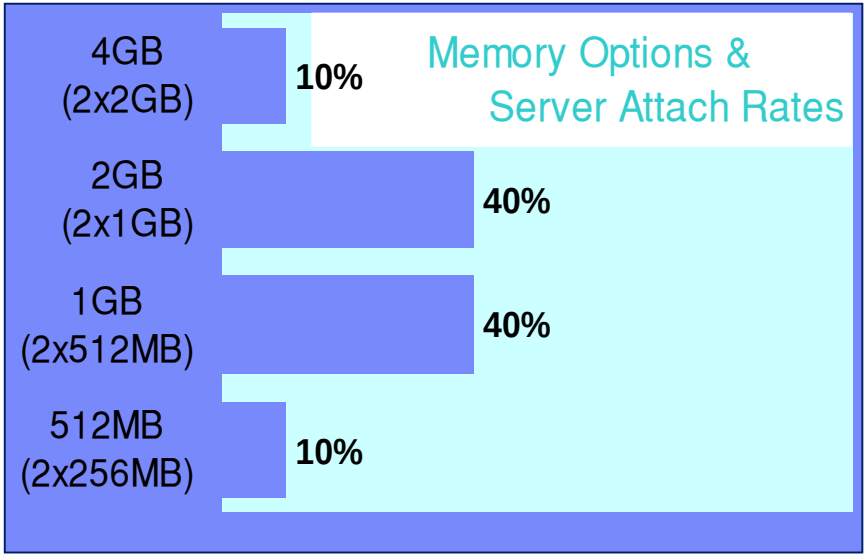

M Pro


Z Pro

xSeries DDR2 Memory Options



- xSeries DP Servers Are Two Way Interleaved Servers -- Memory Upgrades Have To Be Installed in Pairs
- xSeries DDR2 Memory Options Will Be Offered In Kits of Two (2) Memory DIMMs
- This Change Will Result In A
- Customer / Business Partner Convenience + Environmental Savings
- The 2GB & 4GB memory are Chipkill enabled options
- Current DDR1 Memory Options supported Through December 2005



IBM Memory

Compatibility tested and tuned for optimized xSeries server performance & throughput

- **Tested to ensure signal clarity & electrical guard band tolerances are being met**
- **Single customer source for IBM system and options – One stop shop for responsibility & accountability**
- **Options automatically assumes the IBM System Warranty**
- **Seamless IBM service & support in 150 countries**
- **24 hour Help Center telephone support**

Promise of Value

- **IBM Memory options are integrated into the IBM Director Systems Management to ensure correct Light Path Diagnostic responses and performance feedback analysis for optimum system uptime performance**
- **End of marketing dates published to ensure technology transitions are properly panned ---- Options Continuation Program instituted to ensure continuous support of IBM options after the xSeries withdrawal date**

IBM Memory Supplier Relationships

ELPIDA
The Power of Focus

SAMSUNG

Micron

Infineon technologies

Infineon technologies

hynix

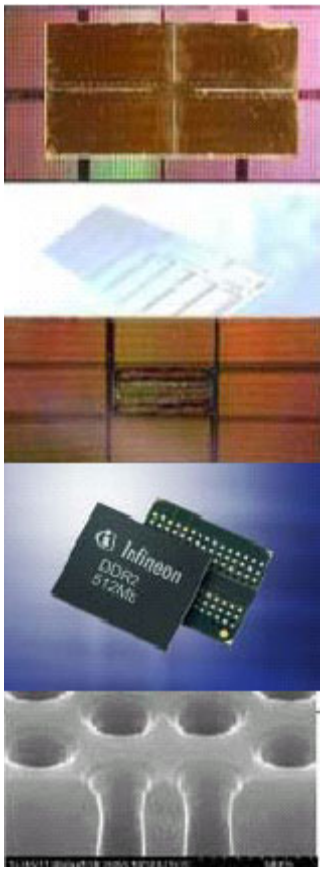
Kingston TECHNOLOGY

Kingston Relationship
WW Distribution of IBM Memory
Fountain Valley / Dublin /Taiwan

3M Authentication Labels

- Protecting our customers loyalty
- xSeries Brand equity protection
- Avoids tampering or diverting options to unauthorized distribution channels
- Ease of verification
- Labels utilized to ensure IBM's quality is delivered with all our IBM memory & hard file options
- Covert security feature –IBM Logo visible when viewed under a focused light

Summary …..Technology that Excels…



- DRAM Industry is quickly adopting DDR2 for advanced system designs

-High speed with lower power consumption

-Interface improvements such as ODT simplifies board design and saves product cost

-Major DRAM suppliers are all announcing DDR2 readiness

- Industry standard module Gerbers developed in JEDEC

Information in this presentation concerning non-IBM products was obtained from the suppliers of these products, published announcement material or other publicly available sources. IBM has not tested these products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Prices do not include tax or shipping and are subject to change without notice. Starting price may not include a hard drive, operating system or other features. Price may include applicable discounts. Reseller prices may vary. Unless otherwise specified, pricing information is current as of original publication of this document.

MB, GB, and TB = 1,000,000, 1,000,000,000 and 1,000,000,000,000 bytes, respectively, when referring to storage capacity. Accessible capacity is less; up to 3GB is used in service partition. Actual storage capacity will vary based upon many factors and may be less than stated. Some numbers given for storage capacities give capacity in native mode followed by capacity using data compression technology.

Maximum internal hard disk and memory capacities may require the replacement of any standard hard drives and/or memory and the population of all hard disk bays and memory slots with the largest currently supported drives available. When referring to variable speed CD-ROMs, CD-Rs, CD-RWs and DVDs, actual playback speed will vary and is often less than the maximum possible.

Footnotes

Visit *www.ibm.com/pc/safecomputing* periodically for the latest information on safe and effective computing.
Warranty Information: For a copy of applicable product warranties, write to: Warranty Information, P.O. Box 12195, RTP, NC 27709, Attn: Dept. JDJA/B203. IBM makes no representation or warranty regarding third-party products or services including those designated as ServerProven or ClusterProven.

Telephone support may be subject to additional charges. For onsite labor, IBM will attempt to diagnose and resolve the problem remotely before sending a technician.

All offers subject to availability. IBM reserves the right to alter product offerings and specifications at any time without notice. IBM is not responsible for photographic or typographic errors.

This publication was developed for products and services offered in the United States. IBM may not offer the products, services or features discussed in this document in other countries. Information is subject to change without notice. Consult your local IBM representative for information on offerings available in your area.

All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only. Contact your local IBM office or IBM authorized reseller for the full text of a specific Statement of General Direction.

The examples given in this paper are hypothetical examples of how a customer can use the products described herein and examples of potential cost or efficiency savings are not based on any actual case study. There is no guarantee of comparable results. Many factors determine the sizing requirements and performance of a systems architecture. IBM assumes no liability for the methodology used for determining the configurations recommended in this document nor for the results it provides. Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements quoted in this presentation may have been made on development-level systems. There is no guarantee these measurements will be the same on generally-available systems. Some measurements quoted in this presentation may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

Chipkill Technology--

Lines of Defense Against System Downtime

- **ECC**- Ability to correct single bit memory errors

- **Chipkill-** (RAID-M)
  Ability to correct up to four bit memory errors for single, or multiple memory chips
  No server performance degradation over single-bit error correction
  - -Chipkill is a memory DIMM + memory controller based enablement
  - -Chipkill uses redundant bit recovery technology
  - -Chipkill is transparent to the user application

- **Memory Intense Applications**-
  - -OLTP Databases: BEA, Oracle, MS SQL, IBM DB2
  - -Extended ERP: Baan, Peoplesoft, SAP, i2
  - -Business Intelligence: SAS, IBM Knowledge

Bottom Line:
Greater the Base Memory= Greater Opportunity for a Memory Failure

RETURN TO INDEX