AMD

AMD 64 Opteron™

Solaris 10 Developer Meeting

インサイド AMD Opteron™

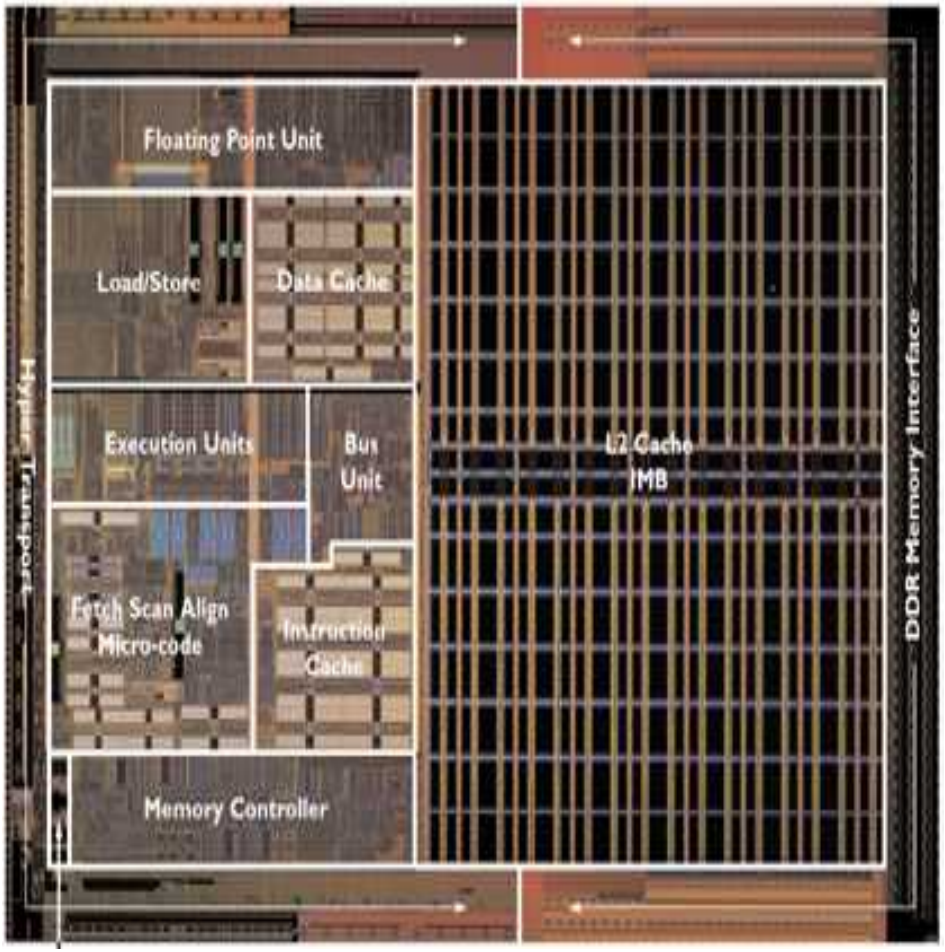
Dec 16th 2004

於) 東京コンファレンスセンター

AMD Athlon™64 プロセッサ
主要な3つの革新

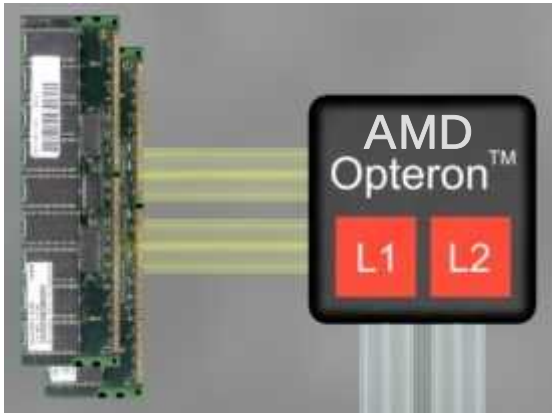
- **AMD64 テクノロジ**
  - X86の32ビット環境を拡張した64ビット・テクノロジ。
  - マイグレーションの為の追加投資が不要。
- **統合メモリ・コントローラ**
  - ノース・ブリッジ・チップ上のメモリ・コントローラをCPU上に統合。
  - メモリ・インターフェイスに起因するボトルネックを解消。
- **HyperTransport™ インターフェイス**
  - ボード上のチップ間通信に画期的性能向上をもたらす。
  - インターフェイス性能に起因するボトルネックを解消。

AMD Opteron™



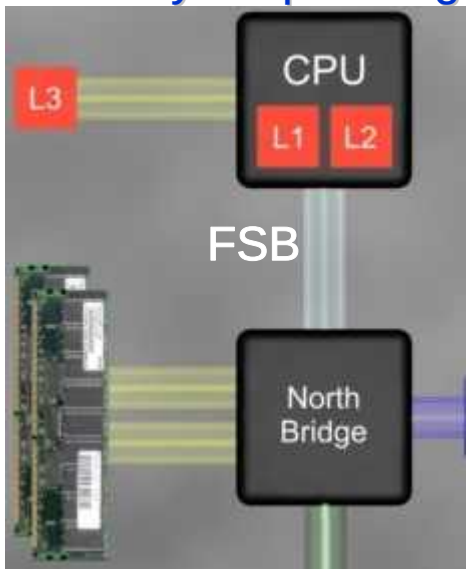
統合メモリ･コントローラ

1,000's of MHz
& Always Increasing



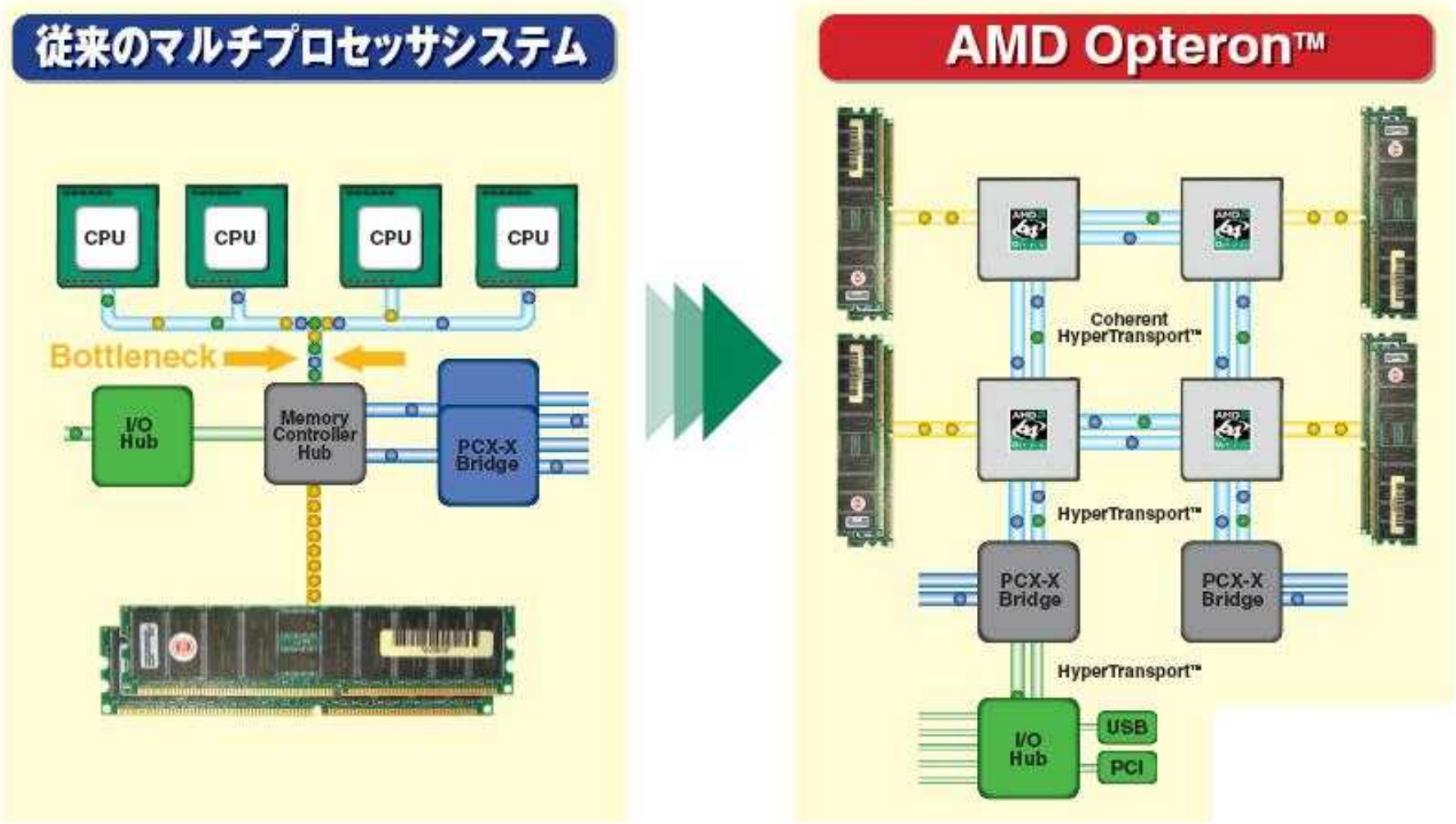
- AMDの統合メモリ･コントローラはCPUコア周波数で動作しています
  - CPUの動作周波数向上に従ってOpteron™のメモリコントローラの応答性能が向上します
  - それぞれのCPUは専用の帯域を持っています
  - CPUを増やす事で、帯域幅が拡張されます

100's of MHz
& Slowly Improving



- Itanium, Pentium® 4, & Xeon
  - メモリのパフォーマンスはFSB周波数に依存します
  - 追加したCPUは帯域幅を共有するため、問題はより深刻となります

HyperTransport™が従来システムのボトルネックを解消



AMD64 Server and Workstation Processor Positioning

The AMD Opteron™ processor 800 Series

- Industry-leading performance and price/performance in the x86 four-way server market
- Customer friendly migration to 64-bit computing

The AMD Opteron processor 200 Series

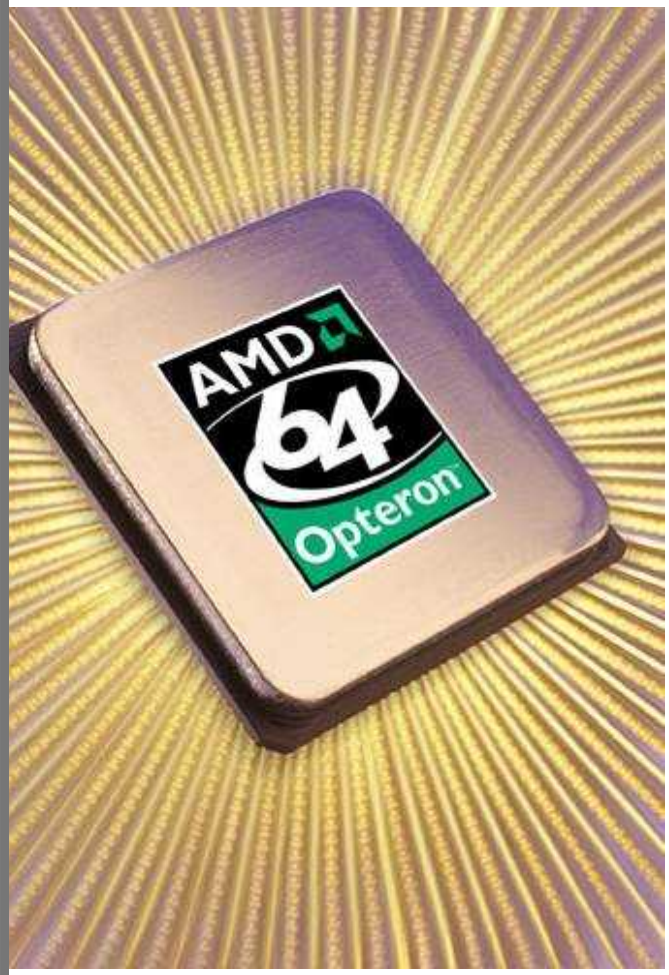
- Enable the world's highest-performing x86 processor for 2P servers

The AMD Opteron processor 100 Series

- Designed to provide powerful 32-bit performance with 64-bit capabilities for demanding workstation applications

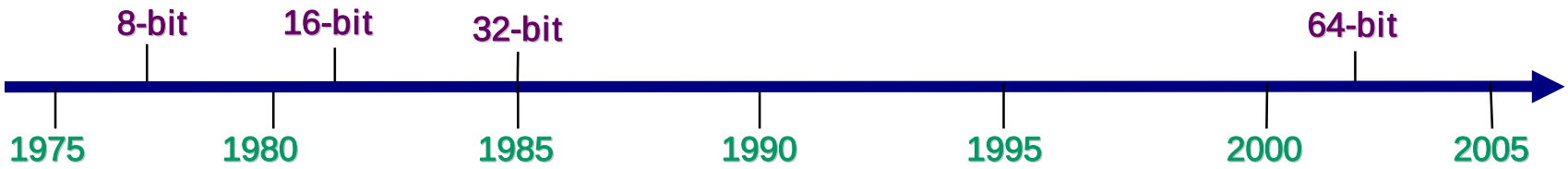
Low-power models AMD Opteron processor HE (55W) and AMD Opteron processor EE (30W) for servers and workstations

- Well-suited for blade servers, storage servers, custom workstations and servers, telecom switches, and network appliances



AMD64 with Direct Connect Architecture

AMD64の64ビット拡張はx86アーキテクチャの正常進化です



AMD64 with Direct Connect Architecture eliminates the real challenges and bottlenecks of system architecture

- Memory is connected directly to the CPU
  - Optimizing memory performance
- I/O is directly connected to the CPU
  - Balance throughput and enables expandable I/O
- CPUs are connected directly to CPUs
  - More Linear Symmetrical Multiprocessing
- CPUs are connected to CPUs on same die
  - Even greater reduced latencies between processors

Increasing memory address space without addressing the bottlenecks of a front-side bus adds little value!


AMD
AMD64 & EM64t

AMD64 Datasheet Plagiarism
cut & paste examples

Not all instructions require a REX prefix. The prefix is necessary only if an instruction references on of the extended registers or uses a 64-bit operand. If a REX prefix is used when it has no meaning it is ignored.

The AMD x86-64 Architecture Programmers Overview, 24108C-January 2001

Not all instructions require a REX prefix. The prefix is necessary only if an instruction references on of the extended registers or uses a 64-bit operand. If a REX prefix is used when it has no meaning it is ignored.

64-Bit Extension Technology Software Developer's Guide, Volume 1 of 2 – February 2004

Immediately after activating long mode, the system-descriptor-table registers (GDTR, LDTR, IDTR, TR) continue to reference legacy descriptor tables. The tales reference by the descriptors all reside in the lower 4GBytes…….

The AMD x86-64 Architecture Programmers Overview, 24108C-January 2001

Immediately after activating IA-32e mode, the system-descriptor-table registers (GDTR, LDTR, IDTR, TR) continue to reference legacy descriptor tables. The tables referenced by the descriptors all reside in the lower 4GBytes…….

64-Bit Extension Technology Software Developer's Guide, Volume 1 of 2 – February 2004

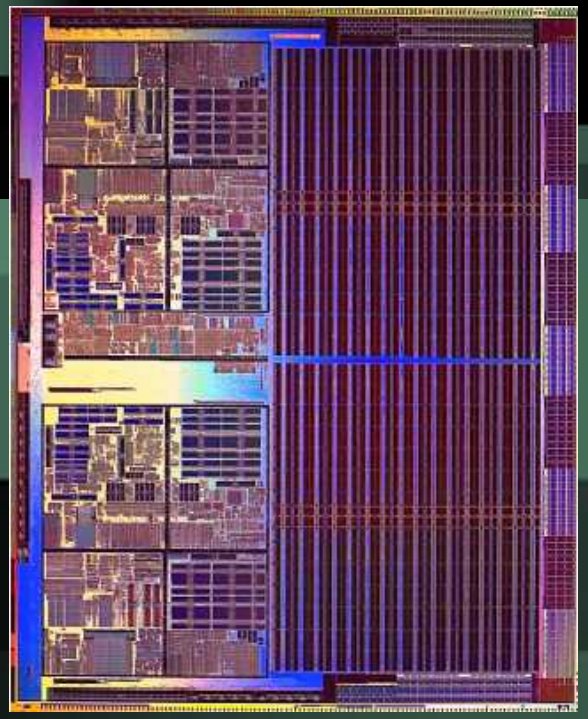
Another example that EM64T is an AMD64 clone

AMD64 Sets The Standard
known differences to EM64T

Differences	AMD64	EM64T	Details
NX (no execute pages)	✓		AMD64 family of processors all have the NX bit, Windows SP2 & AMD64 based systems provide "Enhanced Virus Protection" EM64T based don't. EM64T is more compatible with viruses then AMD64!
Fast-fxsave/fxrstore	✓		Feature to speeds up task switches in Win64 (requested by Microsoft). Only leveraged by OS, doesn't appear in application code. OS will test CPUID to enable feature
Near branch with 16-bit prefix	16-bit Branch	32-bit Branch	Intel read our 1999 AMD64 Docs and implemented a 32-bit branch vs. 16-bit branch. No one is going to use 16-bit branches when running in 64-bit mode.
CMPXCHG16B		✓	Very minor performance enhancement. Only leveraged by OS, doesn't appear in application code. OS will test CPUID to enable feature. (we'll be adding this to a future rev of our processor)
PUSH imm64	SIGN Extend	Zero Extend	Intel confirmed "Typo". Should be "SIGN Extend"
Fast system calls SYSCALL/SYSRET	✓	✓	Win64 uses SYSCALL/SYSRET for fast 64-bit calls for both IA32-e and AMD64.
Fast system calls SYSENTER/SYSEDIT		✓	Win64 does not use these two instructions.
SSE3 / Hyperthreading		✓	Hyperthreading requires major software work to show advantages and can actually hurt performance for non-hyperthreading apps. Hence, why Tier 1's always offer under there "Customize It" section of their web ordering the option to "enable" or "disable" the feature.
CDQE, CMPSQ, LODSQ, MOVSQ	✓	✓	Intel claims these are "New" 64-bit instructions. We've had them from the get go.

ACE's Hardware referenced these differences (http://www.aceshardware.com/#80000460)

Bottom line = AMD64 & EM64T are compatible



AMD

AMD PowerNow! technology with Optimized Power Management (OPM)

AMD PowerNow!™ TECHNOLOGY

AMD

- Proven AMD technology
  - Introduced in June 2000 with mobile K6-2+ and K6-III+ processors
    - AMD was the first to introduce dynamic (multiple operating states) power management solution
- Lowers power consumption without compromising performance

Delivers performance on demand minimizing power when full CPU performance is not necessary

- PowerNow! Technology enables CPU to
  - Run at multiple performance states (frequency & voltage combinations)
  - Switch among multiple performance states dynamically (controlled by software), without having to reset CPU or change FSB frequency
- In actual systems, CPU can be controlled by software to change performance states dynamically, based on CPU utilization
- Planned support for Microsoft and Linux operating systems

All AMD Opteron™ processors support AMD PowerNow! technology
(revision CG, E and above)

PowerNow! Technology
Customer Benefits

Investment Protection

✓Less strain on cooling systems particularly in high-density server farms / datacenters

Lower Cost of Ownership

✓Reduces average and idle processor power

✓Performance on demand, to conserve power

Helps IT manage the high cost of power & cooling!

Lower Acoustics

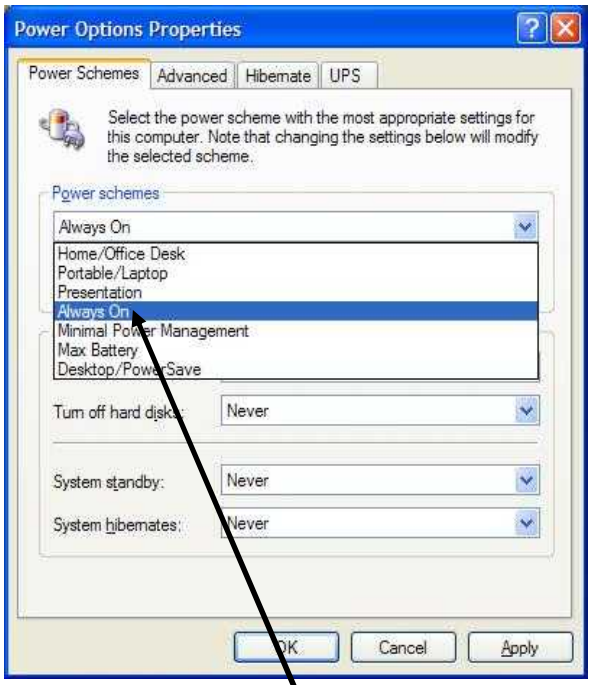
✓Low noise work environment by throttling system fans

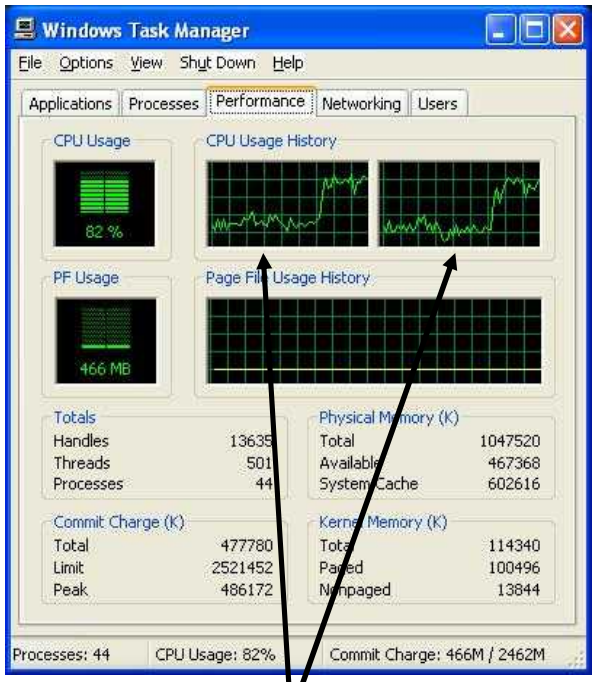
✓Quiet Workstations for confined work environments

Enables a reduced stress environment!

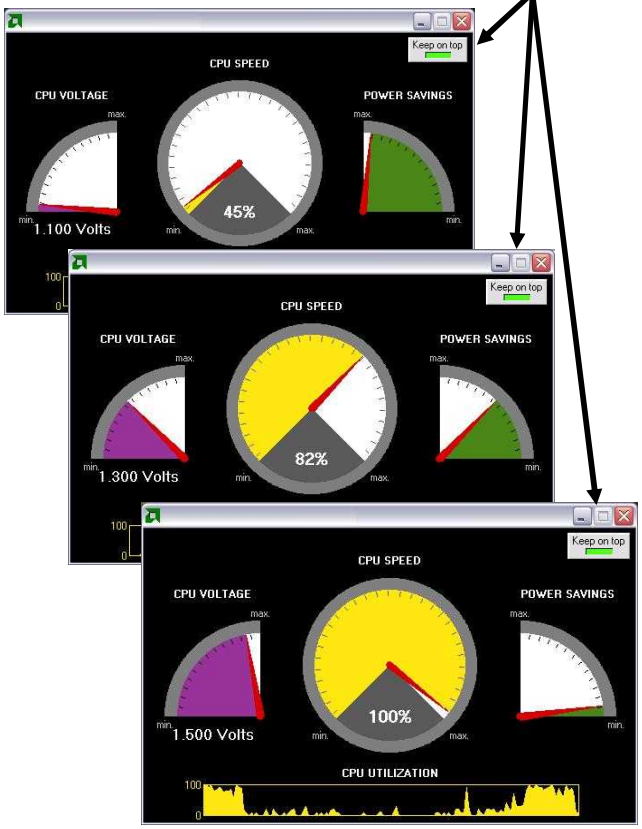
AMD PowerNow!™ TECHNOLOGY

AMD



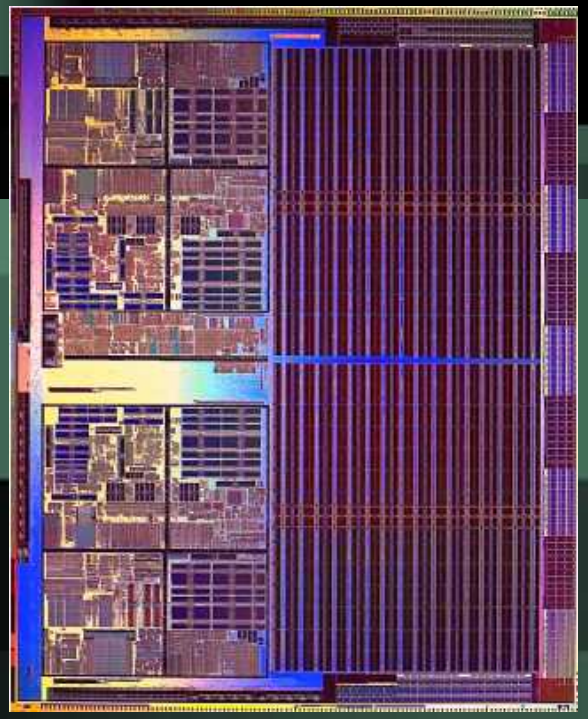


As workload demands decrease, CPU frequency and voltage automatically drop contributing to power savings.



Can be simply enabled or disabled from within the operating system.

CPUs are controlled by software to change performance states dynamically, based on CPU utilization.

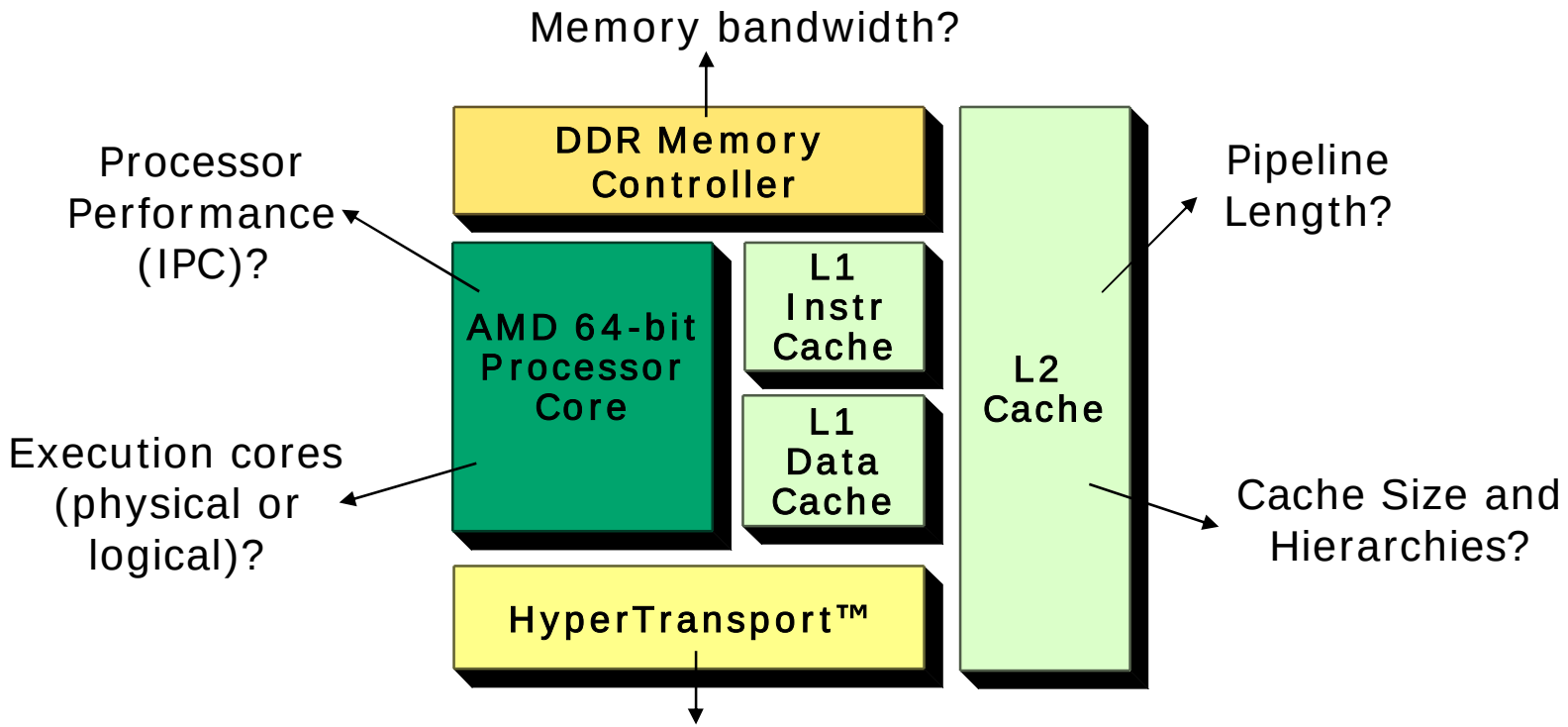


AMD

Opteron™ Dual-core

革新 …

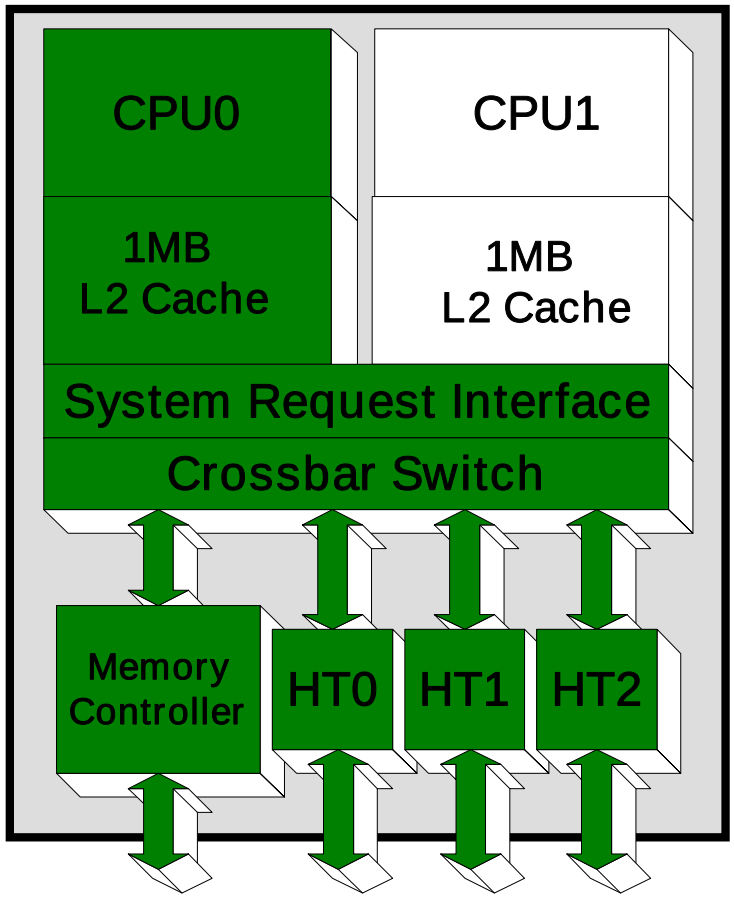
今日のコンピューティングにおけるサイズ、エネルギー消費、パフォーマンスに対するニーズは半導体メーカへ製品設計に新しい革新をもたらす事を求めます。



Dual core processor technology allows AMD to continue to offer a competitive performance roadmap while meeting the system architecture demands of our customers

AMD Opteron™ Processor Dual-Core Implementation

- The AMD Opteron™ processor was designed from the start to add a second core
- The CPU cores leverage the same SRI, HyperTransport™ technology and memory controller
- 940-pin socket compatibility with 90nm single core processors
- Rev E BIOS update to enable Dual-Core in existing systems



Power Infrastructure Requirements Dual-Core vs. Single-Core

- AMD Opteron™ dual-core processors will have same power infrastructure as 90nm single-core products through 2006:
  - Maximum Wattage is 95W
  - Maximum Current is 80A
  - Maximum Tcase is 68C
- Ease of Migration to Dual-Core Processors
  - OEMs/SBs will be able to easily incorporate dual-core products into their existing AMD Opteron processor-based designs
  - End-users can upgrade their existing 95W-based systems with dual-core processors
- Higher Performance Per Watt
  - Customers will experience the performance advantages of dual-core processors in the same thermal envelope as single-core

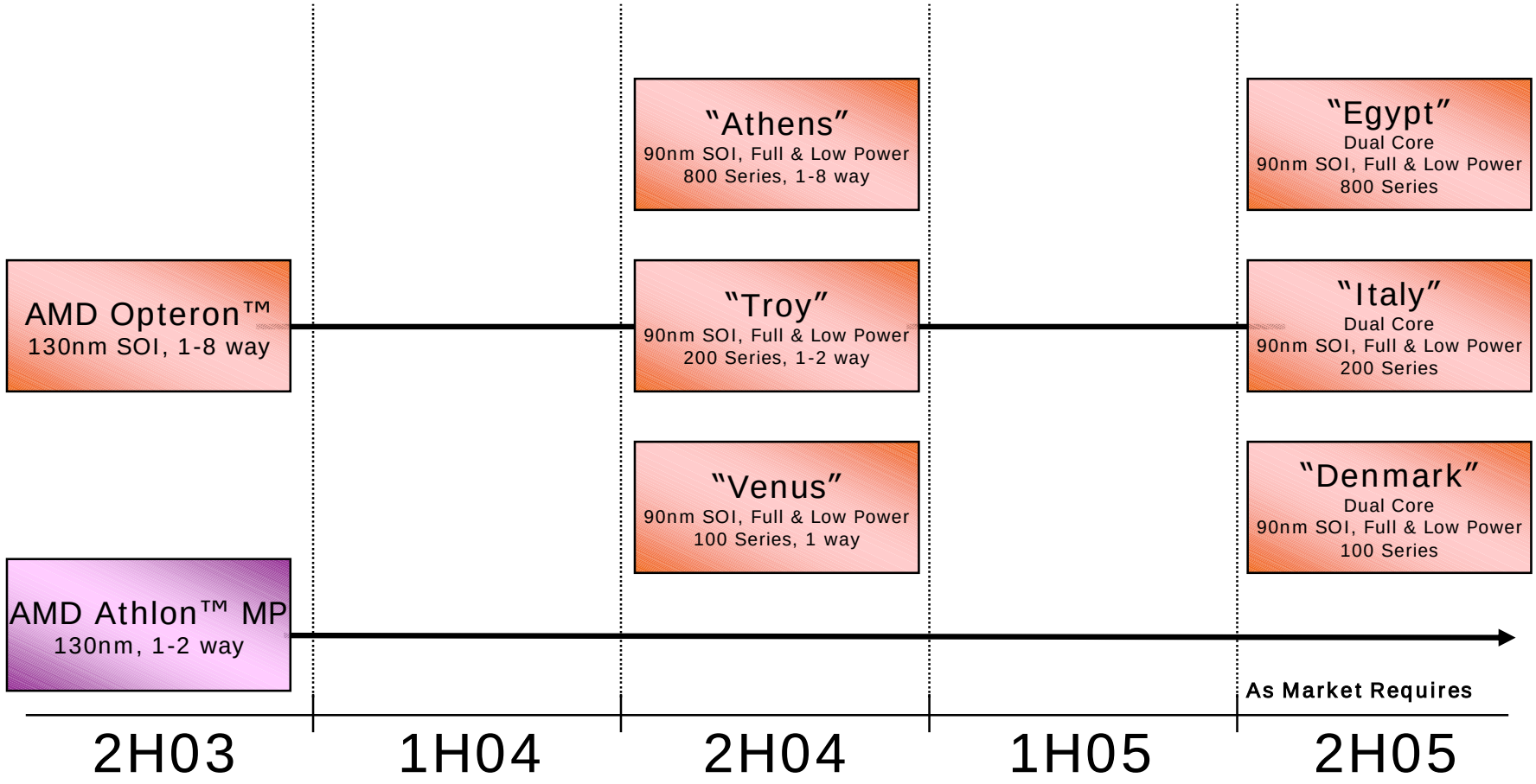
Value Proposition

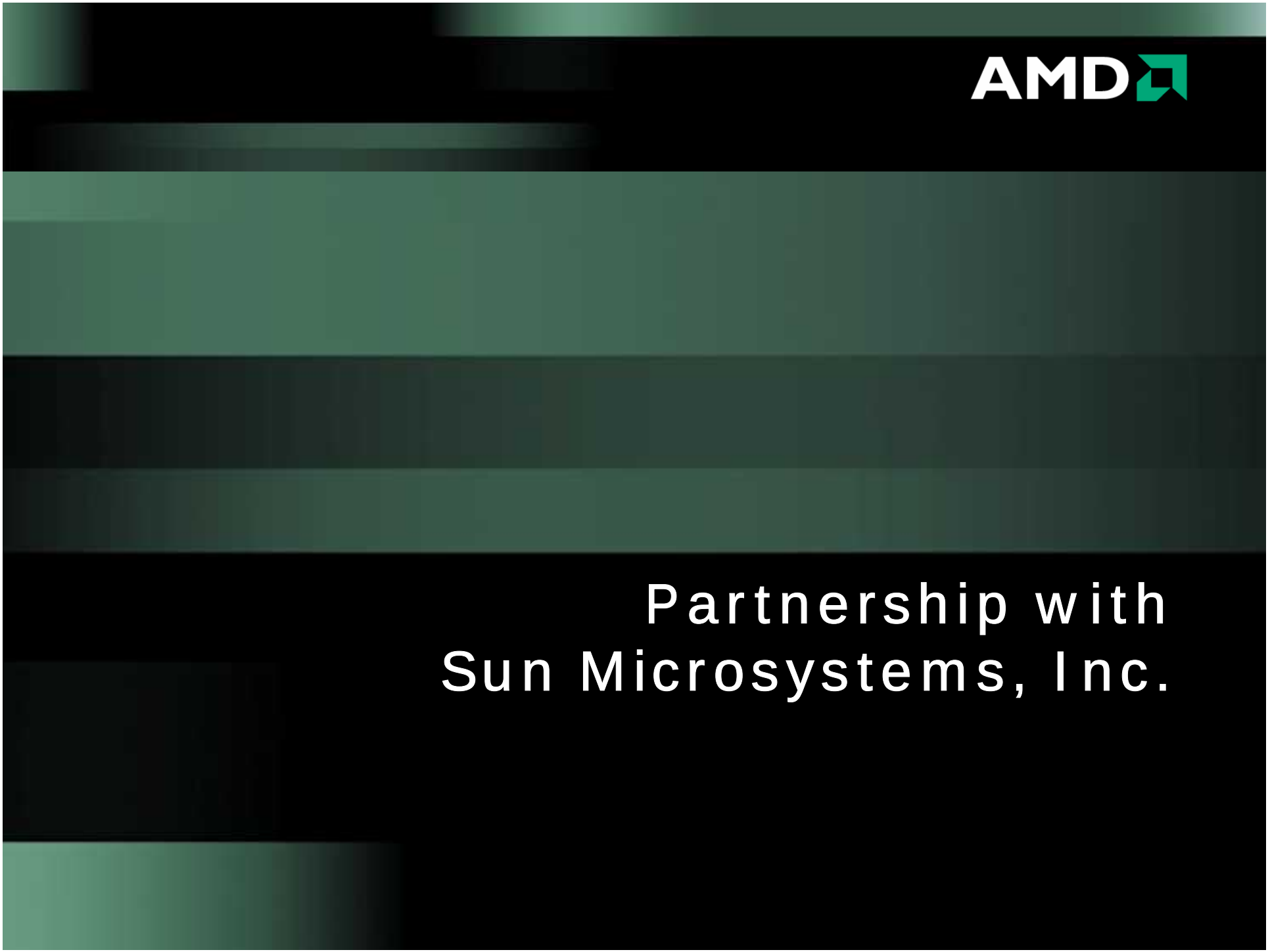
Why AMD Opteron™ processors?

- Direct Connect Architecture provides industry-leading performance
  - Best performance per watt architecture in the market
  - Best 2-socket and 4-socket server architecture for x86 computing (see www.amd.com/opteronperformance for more details)
- Cost-effective 940 socket infrastructure
  - One architecture for one enterprise
  - Development platform, production environment all share the same images
- Best Performing 32-bit platform
  - Investment protection for best price/performance 64-bit platform

The AMD Opteron™ processor brings a very compelling value proposition to the server and workstation market

AMD Server Workstation Processor Roadmap




AMD
Partnership with
Sun Microsystems, Inc.

—Launch of Solaris 10 Operating System Marks Anniversary—

SUNNYVALE, CALIF.—Nov. 17, 2004— AMD (NYSE: AMD) today celebrated the one-year anniversary of the strategic alliance with Sun Microsystems, Inc. As part of the alliance, AMD also announced support for the Solaris 10 Operating System (OS) introduced on Monday, Nov. 15.

2003年11月17日に発表されたサーバ分野での戦略提携 ～提携の概要～

AMD

- Sunは2004年中にAMD Opteron™プロセッサを搭載したSun Fireサーバ（2ウェイおよび4ウェイ）を投入
- SunとAMDは協力してSolaris OSとJava Enterprise SystemのOpteron™への最適化および64ビット・モードへの対応を行い、エンタープライズ分野への普及を図る
- Opteron™プロセッサをベースとした4ウェイ以上のスケーラブルな製品ポートフォリオを展開。HyperTransport™テクノロジの実装でも協力。
- 両社は共同でSolaris向けにアプリケーションを開発、移植を行なうISV支援プログラムを展開
- その他

Trademark Attribution

AMD, the AMD Arrow logo and combinations thereof are trademarks of Advanced Micro Devices, Inc. Other product names used in this presentation are for identification purposes only and may be trademarks of their respective companies.