Next Generation Technology from Intel

Intel® Pentium® 4 Processor

The Intel® Pentium® 4 Processor Platform

- **Intel's highest performance processor for desktop PCs**
  - Targeted at consumer enthusiasts and business power users at introduction
- **All new IA-32 micro-architecture designed to deliver leadership performance**
- **Performance for the visual Internet**

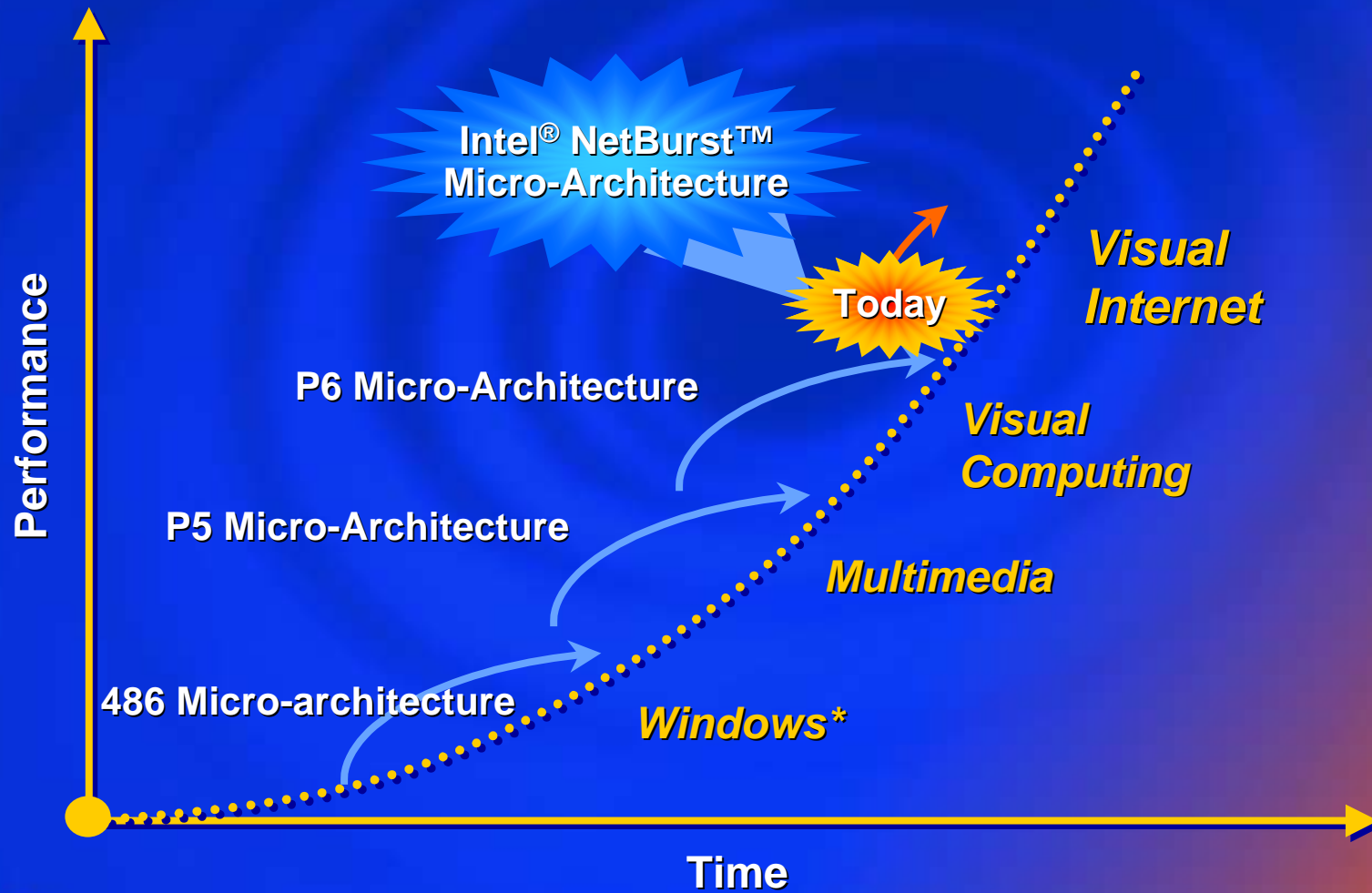*Designed for Where the Internet Is Going*

Intel® Pentium® 4 Processor Design Goals

- **Deliver world class, end user appreciable performance across both existing and emerging applications and usage models**
  - Internet, imaging, streaming video, speech, 3D and multimedia
  - Multi-tasking user environments
- **Deliver performance headroom and scalability for the future**
  - Base micro-architecture must deliver both performance and frequency scalability well into the future

Micro-architecture that will Drive Performance Leadership for the Next Several Years

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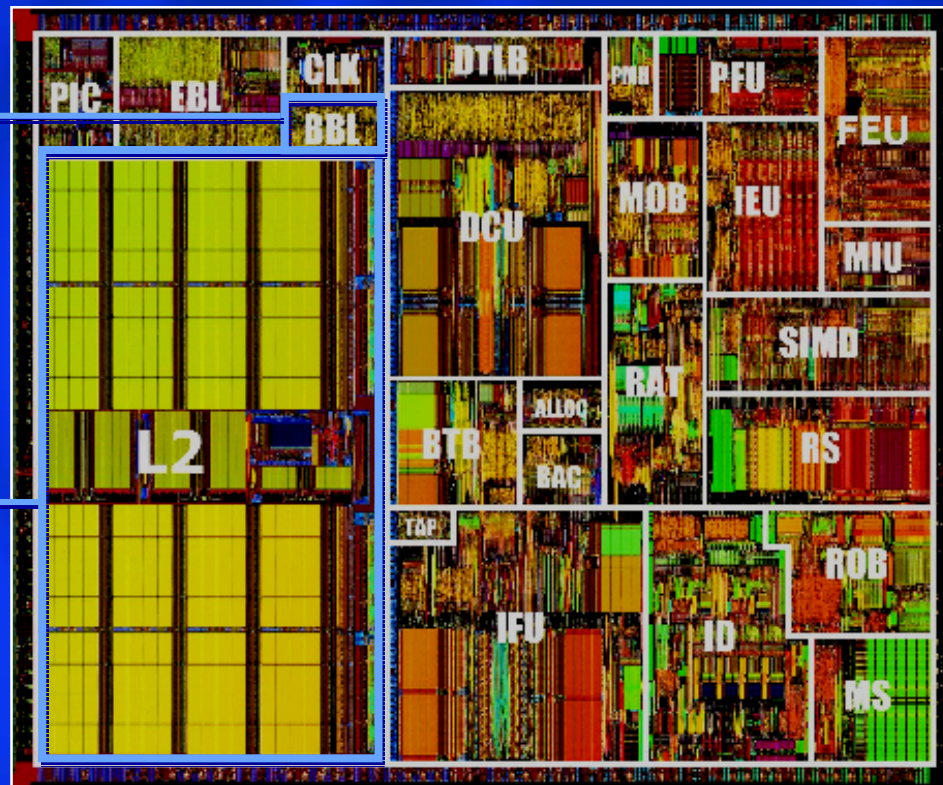pentium 4

Introducing the Foundation for the Intel® Pentium® 4 Processor

Performance (vertical axis)

Time (horizontal axis)

Intel® NetBurst™ Micro-Architecture

Today

P6 Micro-Architecture

P5 Micro-Architecture

486 Micro-architecture

Visual Internet

Visual Computing

Multimedia

Windows*

The Intel® Pentium® 4 Processor Intel® NetBurst™ Micro-Architecture

42 million transistors

400 MHz System Bus

Advanced Dynamic Execution

Rapid Execution Engine

Advanced Transfer Cache

Hyper Pipelined Technology

Streaming SIMD Extensions 2

Execution Trace Cache

Enhanced Floating Point / Multi-Media

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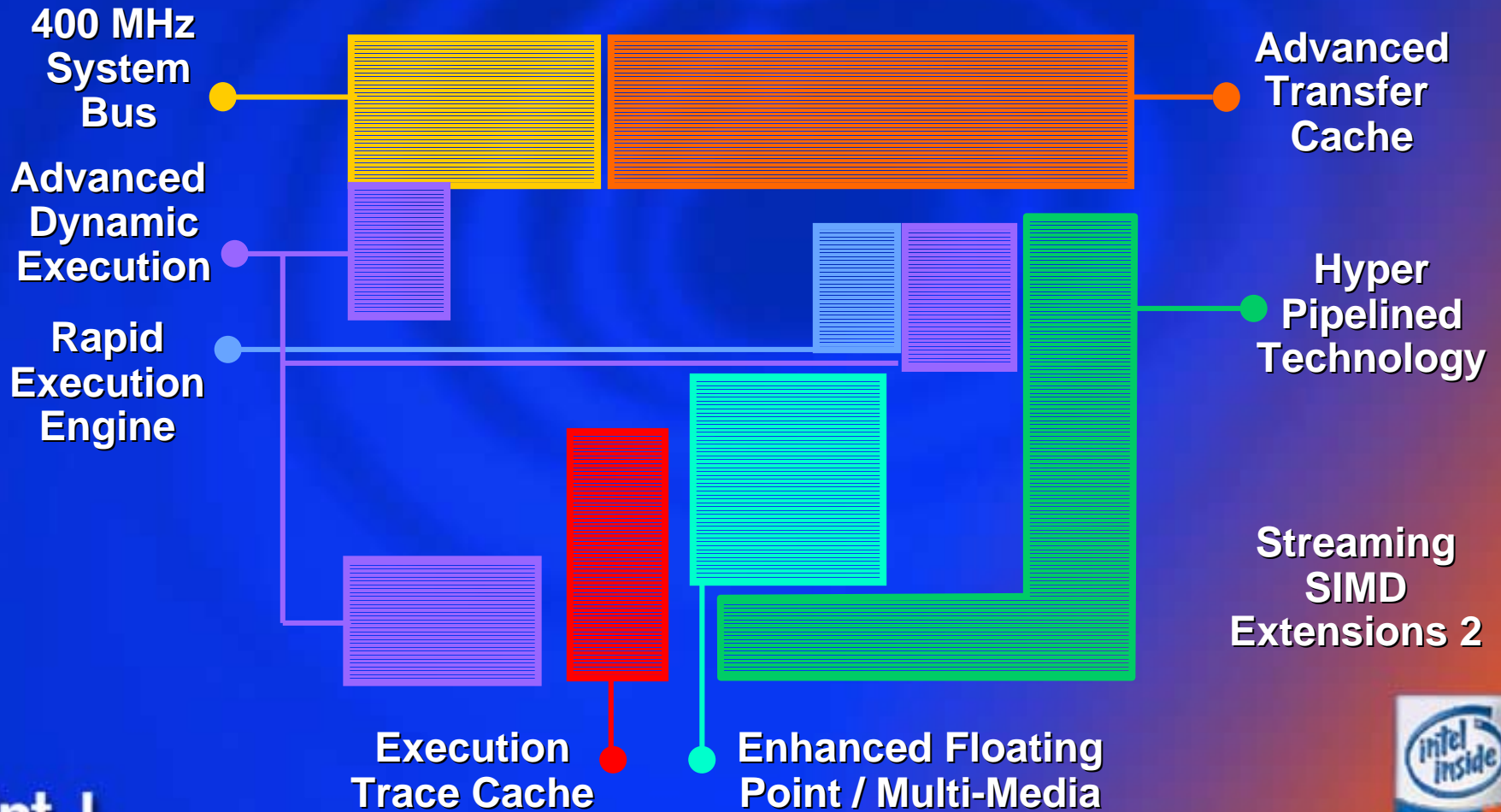
Rapid Execution Engine

- **Arithmetic Logic Units (ALUs) run at twice the core frequency**
  - **Executes certain instructions in 1/2 core clock tick**
  - **Results in higher execution throughput and reduced latency of execution**

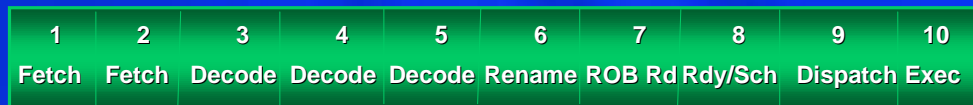*Integer Instructions Executing at*   **2X core frequency**

Hyper Pipelined Technology

- **Intel® Pentium® 4 processor doubles the pipeline depth to 20 stages**
- **Significantly increases processor performance and frequency capability**

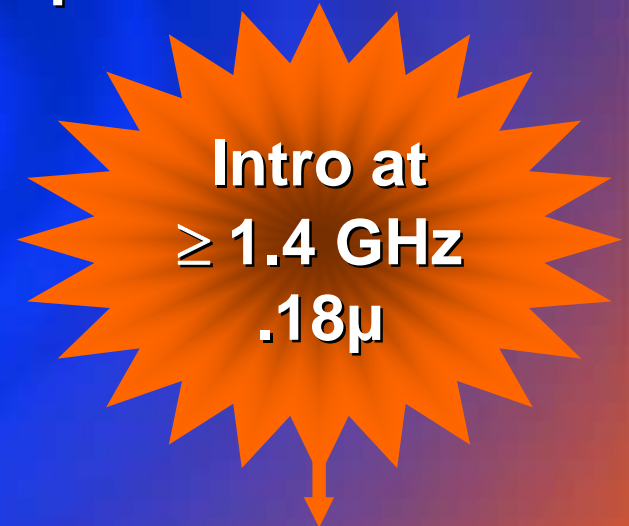| 1 Prefetch	2 Decode	3 Decode	4 Exec	5 Wrtbck

233MHz

P5 Micro-Architecture

1 Fetch	2 Fetch	3 Decode	4 Decode	5 Decode	6 Rename	7 ROB Rd	8 Rdy/Sch	9 Dispatch	10 Exec

1 GHz Today

P6 Micro-Architecture

Intro at ≥ 1.4 GHz .18µ

1 TC Nxt IP	2	3 TC Fetch	4	5 Drive	6 Alloc	7 Rename	8	9 Que	10 Sch	11 Sch	12 Sch	13 Disp	14 Disp	15 RF	16 RF	17 Ex	18 Flgs	19 Br Ck	20 Drive

Intel® NetBurst™ Micro-Architecture

Advanced Dynamic Execution

- **Very deep, out-of-order speculative execution engine**
  - **Keeps the Execution units executing instructions**
    - **Up to 126 instructions in flight - 3x P6**
    - **Up to 48 loads and 24 stores in pipeline – 2x P6**
- **Enhanced branch prediction capability**
  - **Keeps the processor executing to the correct program flow**
  - **Reduces the mis-prediction penalty associated with deeper pipelines**
    - **Advanced branch prediction algorithm**
    - **4K entry branch target array - 8x P6**

Keeps the Correct Instructions Executing

Revolutionary New Cache Subsystem

- **Advanced Level 1 Execution Trace Cache**
  - **Caches decoded instructions (~12K micro-ops)**
    - **Removes decoder latency from main execution loop**
  - **Caches the path of program execution flow**
    - **Integrates taken branches into single line**
    - **Makes more efficient use of cache memory**
- **Level 2 Advanced Transfer Cache – Full Speed , 256 KB**
  - **Delivers ~45 GB/sec data throughput(@1.4GHz)**
  - **Bandwidth / performance increases with core frequency**

Optimizes Data Transfer to the Core

Streaming SIMD Extension 2 (SSE2)

- **SSE2 Extends MMX™ and SSE technology with the addition of 144 new instructions**
  - **128-bit SIMD integer arithmetic**
  - **128-bit SIMD double precision floating point**
  - **Cache and memory management operations**

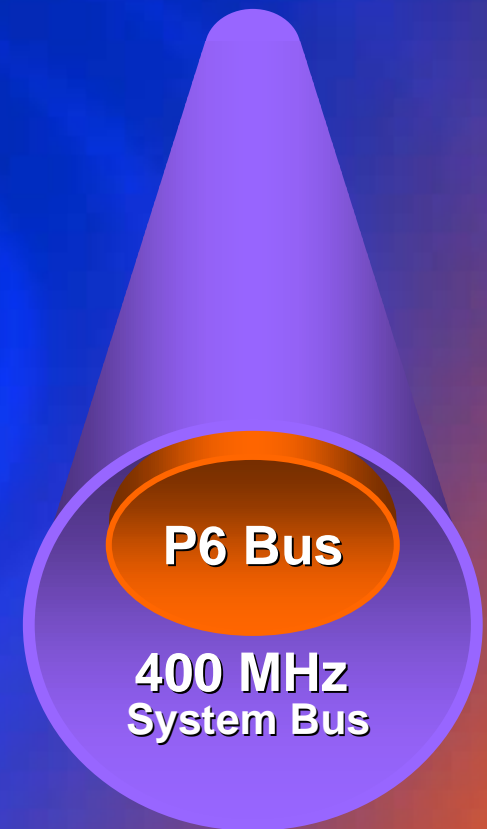*Delivers Performance Increases Across Broad Range of Applications*

400 MHz System Bus

- **3.2 GB/sec data transfer rate**
  - 3x bandwidth of Pentium® III processor system bus
  - 400 MHz quad pumped off 100MHz clock
- **Split-transaction, deeply pipelined**
- **128-byte lines with 64-byte accesses (32-byte lines on P6)**
  - Makes better use of the system bus bandwidth

P6 Bus

400 MHz System Bus

Highest Bandwidth Desktop Bus – 3.2 GB/sec

Intel® Pentium® 4 Processor
Intel® NetBurst™ Micro-architecture Summary

- **Foundation for next generation Intel IA-32 processors**
  - Hyper pipelined for industry leading performance scalability
- **Exceptional performance advantages from architectural innovations**
  - Hyper Pipeline Technology
  - Rapid Execution Engine
  - 400 MHz System bus
  - Execution Trace Cache

Intel's Next Generation Micro-architecture

Beyond the Silicon…
Intel® Pentium® 4 Processor Usage Models

Consumer Usage Model Categories

- **Enhanced streaming media**
- **Real-time video encoding**
- **Video/photo editing**
- **3D visualization**
- **Video-as-input**
- **HDTV SW decode**
- **Speech recognition**
- **Voice over IP**

Excels where users need and recognize performance most

Business Usage Model Categories

- **e-Business**
- **Knowledge Management**
- **Data Mining/Visualization**
- **Communications**
- **Telephony**
- **Security**

Intel® Pentium® 4 Processor
Summary

- **Next Generation NetBurst™ micro-architecture**
- **Designed for the visual internet**
- **Headroom for the future**

Designed for where the Internet is going