

Intel Wide Dynamic Execution

Tech Talk: Intel Wide Dynamic Execution (a key new feature in the Core Microarchitecture) makes it possible to deliver more instructions per clock cycle to improve execution time and energy efficiency. Each execution core in a new Core 2 Duo processor is wider, allowing each core to fetch, dispatch, execute, and return up to four full instructions simultaneously. To put this into perspective, the previous Intel Mobile and NetBurst microarchitectures could handle a maximum of three instructions as a time.

- **Consumer tutorial:**
 - Most of us still think the power of a PC's brain chip is measured solely by how fast it can go. And for many years that was a legitimate gauge.
 - Today, the name of the game in brain chip performance has to do with how many things can be done with each stroke of the engine.
 - The new Intel Core 2 Duo processors dramatically boost how much work can be done with each stroke of your brain chip's engine.
 - Each of the two brains (execution cores) in a single Core 2 Duo processor can simultaneously process four instructions at once. That's a big deal, as past Intel processor designs could do only 3 instructions simultaneously. (see question below)
 - Everything your PC does ultimately breaks down into instructions – from keeping your PC's operating system on top of all the action (Windows XP, for example) to everything you see displayed, hear pumping out of your PC's speakers, you name it!
 - The more work your microprocessor can accomplish with one clock cycle (times 2 with twin brains) means less thumb twiddling for you. Your PC can keep up with your multi-tasking lifestyle.
 - Think of what it will be like to have a processor with two powerful brains inside that each can do four things at once with each stroke of the multi- gigahertz engine!

- Simple Sound bites for Consumer Press/Media:
 - **Highway analogy:**
 - What happens when a 3-lane highway can't handle a growing community's traffic? If you can, you add a lane. That's just what a Core 2 Duo processor does. It has two information processing highways (processing cores or brains) each with 4 traffic lanes to significantly boost traffic flow.
 - **Ferry Boat Analogy:**
 - Think of the wide ferry boats that shuttle automobiles across a river. An old-school single brain Intel microprocessor would be a ferry with 3-lanes wide. And an Intel pre-Core 2 Duo dual-core processor would be like having two 3-lane ferry boats side-by-side.
 - Let's imagine that each stroke (clock cycle) of the processor represents a trip across the river.
 - For each crossing, the mono-brain ferry can gather and deliver 3 cars, and the pre Core 2 Duo twin-brain double ferry team delivers 6 cars at a time.
 - What if your double-ferry boat team had an additional lane for each vessel? You can deliver 8 cars in one trip!
 - Now imagine that your 4-lane each, double-ferry team can cross the river at nearly 3 billion trips per second. That's a lot of cars. Your new Core 2 Duo twin-brain microprocessor can do just that with instructions that make all your computer fun and work come to life.
 - **PP&J in a Bag Analogy:**
 - Let's say it's time to make your two kids PP&J sandwiches for lunch

- You know you need bread, jam, peanut butter and a plastic baggie (4 elements).
- Now let's imagine there's a band conductor in the kitchen counting time for you. Each down stroke of the baton is like a "clock cycle" or engine stroke for a microprocessor. And in this analogy, you'll perform your actions based on each down stroke of the baton.
- If you were a previous generation Intel mono-brain processor, you could grab and act on 3 of the 4 items needed for one sandwich simultaneously as the baton comes down, but you'd not be able to complete the single sandwich until the next down stroke of the conductor's baton.
- Now let's imagine you are a super cool Core 2 Duo sandwich making parent with two hungry kids ready to head off to school with their bag lunches.
- With each down stroke of the conductor's baton your twin brains could fetch and act on all four of the ingredients for the sandwich simultaneously. Hey, you could make two PP&J sandwiches at one stroke of the conductor's baton!
- When you consider the billions of things your PC's brain has to deal with in the blink of an eye, you can see why being able to do 4 things at once x 2 boosts performance to a new level.

Intel Intelligent Power Capability

Tech Talk: Intel Intelligent Power Capability includes features that further reduce power consumption. For example Intel core microarchitecture uses advanced power gating to take advantage of the microarchitecture's ultra fine grained logic control. This feature intelligently turns on only the individual logic subsystems that are currently required. And the finer granularity helps to minimize subsystems that require power. Intel intelligent power capability optimizes energy usage delivering more performance per watt for desktop PCs, laptops and servers.

- *Consumer analogy: Think of a Core 2 Duo processor as being like a house with lots of rooms with lights in each room. The rooms in this case represent the individual logic subsystems (the internal working parts of the processor). Doesn't it drive you nuts when your kids leave lights or TV on in a room that's not occupied? Do you find yourself turning off lights as you move around your home to save energy? Intel Intelligent Power Capability does just that – it intelligently turns on only the parts needed at a given time to optimize energy usage.*
- *Consumer analogy: An Intel Core 2 Duo processor has built-in energy smarts. One of the two processing brains can rest, on-the-fly, in response to how much work needs to be accomplished at any given moment. It's an idea that works great in some cars, such as V-8 or V-6 engines that can shut off pistons and go into 4-piston mode when cruising on a flat highway.*
- *Saving Energy is great, how else will this benefit me?*
 1. Every energy reduction or efficiency innovation in the Core 2 Duo processors (desktop or laptop) makes it possible for designers to make your next desktop or laptop smaller and quieter.
 2. If you can reduce the number and size of fans in a desktop, for example, you don't have to settle for a large "tower" style case for your next PC.
 3. Smaller, quieter and lower temperature desktop PCs also means greater freedom to place a system anywhere in your home.

4. Desktop PCs made with Core 2 Duo processors consumer up to 40% less power than PCs made with pre-Core 2 Duo dual-core Intel processors!

Intel Advanced Smart Cache

Tech Talk: Intel Advanced Smart Cache. The shared L2 cache is dynamically allocated to each processor core based on workload. This efficient, dual-core optimized implementation increases the probability that each core can access data from fast L2 cache, significantly reducing latency to frequently used data and improving performance.

- **Consumer Tutorial:**
 - A modern PC has lots of ways to store the information. All forms of information storage on a PC is technically called “memory.”
 - The hard disk and active memory (RAM) are forms of “memory.”
 - There are two other forms of memory that play a critical role in a PC’s overall performance that most consumers have never heard of – L1 and L2 “cache” memory.
 - L1 (level 1) memory is a small amount of memory built right into the body of your PC’s microprocessor. It holds instructions and data so that it can be instantly available for the microprocessor to act on.
 - L2 (Level 2) memory is sometimes built into the body of the microprocessor, or may be a set of memory chips closely linked to the microprocessor.
 - Both L1 and L2 memory is called “cache” (sounds like “cash”) – a place to hold a small amount of immediately accessible data.
 - When you run a program, or play a music file or view a photo file, information is read from your hard disk with some data loaded into the PC’s active memory (RAM) and some immediately needed information is loaded in the L2 and L1 cache memory.
 - The bigger and more efficient your PC’s RAM and L1 and L2 cache memory the better overall performance will be.
 - Intel’s new Core 2 Duo processors embody some important advancements in L2 cache
 - The twin brains in a Core 2 Duo processor cleverly share a single L2 Cache that can be from 2 megabytes to 4 megabytes in size
 - Most twin brain (dual-core) processors have separate, smaller L2 caches fixed exclusive to one brain.
 - What’s cool about the Intel Advanced Smart Cache approach is that cache storage space can be allocated on-the-fly to the twin brain that needs it the most at any given moment. If one of the twin brains is resting, or operating on a small task, all, or nearly all, of the L2 Cache can be allocated to the brain doing the heavy lifting.
 - Having a single, smartly allocated cache that’s shared between the twin brains also helps save energy.
- **Consumer Analogy**
 - **Pizza Shop:**
 - Let’s imagine your local pizza shop has two cooks, each with a separate counter to build their pizzas
 - If Chef A gets a large order of 10 pizzas to build, and Chef B is only being asked at the moment to make 2 pizzas, Chef A will have to make due with the space available on his work counter.

- What if Chef A and B shared a magic pizza making counter? One that could magically identify which chef has the biggest need for the most working space?
 - That's just what Intel Advanced Smart Cache does
 - The work counter represents the L2 cache inside the Core 2 Duo processor. It has the smarts to automatically allocate overall space to the Chef (core processor) that needs the most help at any given time.
 - With this scheme our Chefs (the twin brains in a Core 2 Duo processor) can crank out more Pizzas eliminating idle working space and time.
- Auto Repair Shop:
 - Imagine your PC is a car you've brought to the auto shop for work
 - You have two jobs you'd like worked on at the same time – a tune up and a transmission rebuild.
 - Each job represents a computer intensive application like playing a video game or recording digital video
 - To get the job done in the least amount of time the shop will have two mechanics working on your car at one time (each representing one of the two brains in your new Core 2 Duo microprocessor)
 - The two mechanics share a magic tool tray parked right against the car (the "tray" represents the L2 cache built into the Core 2 Duo processor, and the tools symbolize program instructions)
 - When both mechanics have an equal amount of work happening at the same time, the magic tool tray allocates an equal amount of tray space to hold the tools needed to get the job done.
 - If the Transmission mechanic takes a break, the magic tray can automatically give the Tune up mechanic a larger portion of the tray space giving him/her access to more tools, more quickly.
 - If each mechanic had a separate tool tray ½ the size of the magic shared tray it would be less efficient, and it would take longer to get your car out of the shop.

Intel Smart Memory Access

Tech Talk: Intel Smart Memory Access includes an important new capability called memory disambiguation, which increases the efficiency of out-of-order processing by providing the execution cores with the built-in intelligently to speculatively load data for instructions that are about to execute BEFORE all previous store instructions are executed.

- Consumer Analogy
 - Imagine you are a custom suit tailor
 - As you stand behind the counter of your store you see before you a line up of customers
 - Let's imagine that in your shop you normally deal with each customer one at a time in single file.
 - But what if you could intelligently guess what the 3rd customer in line wants, and you could move up his work to the front of the line without negatively impacting your service to customers 1 and 2 before him?
 - That's what Intel Smart Memory Access can do to smartly manage out-of-order processing to gain overall net performance gains.
 - Intel Smart Memory Access reminds me of Wayne Gretzky's great lines: "A good hockey player plays where the puck is. A great hockey player plays where the puck is going to be."

Intel Advanced Digital Media Boost

Tech Talk: The Intel Advanced Digital Media Boost is a feature that significantly improves performance when executing Streaming SIMD Extension (SSE) instructions. 128-bit SIMD integer arithmetic and 128-bit SIMD double-precision floating-point operations reduce the overall number of instructions required to execute a particular program task, and as a result can contribute to an overall performance increase. They accelerate a broad range of applications, including video, speech and image, photo processing, encryption, financial, engineering and scientific applications.

- Consumer Tutorial:
 - Some of the most demanding this you can ask a PC to do for you include:
 - Digital video editing and formatting
 - Speech recognition
 - Editing and applying special effects to high-resolution photos
 - Recording and editing multi-track music
 - Design engineering
 - Scientific applications
 - The digital media instructions to make all the magic happen are big and complex, with each instruction having to deal with multiple bits of data.
 - Pre Core 2 Duo dual-core processors had twin-brains that had to break these complex instructions in half. And it took a single processor heart beat (clock cycle) to execute each half.
 - With Intel Advanced Digital Media Boost each of the twin brains in a Core 2 Duo processor can execute one of these big bad boy digital media instructions with a single heart beat.
 - With twin brains each sporting Advanced Digital Media Boost your multimedia gets a real shot in the arm.

It's all about "Wait Reduction" and Doing More with Dual-Core!

- You'll be able to do get more out of one PC than ever before*:
 - **Imagine you are upstairs in your master bedroom.**
 - You have a nice TV with a special adapter box designed to communicate with, and grab videos, photos and music stored on your downstairs Intel Viiv technology-based entertainment PC.
 - Using the adapter's remote control you request a high definition video store on the downstairs system be played back in the master bed room TV.
 - You begin to enjoy the video with no concern about if the downstairs system is being used by another family. You're not concerned because the downstairs Viiv system has Core 2 Duo power to spare
 - Unbeknownst to you, your wife is downstairs is using the Viiv system to run Adobe Photoshop Elements. She's opening and editing photos and burning a DVD photo album.
 - And get this, in the background, this same downstairs Viiv system is running a Virus scan!
 - Photo fun for the wife in foreground, virus scanning to keep the PC healthy, and digital movie fun delivery for you upstairs – all at the same time!

**Note: Based on demos for launch provided by George*

- **Add additional examples from Mike Rabieh (in progress)**