ANANDTECH

ABOUT   ADVERTISING   BENCH   FORUMS   GALLERIES   PODCAST

PC COMPONENTS ▼   SMARTPHONES & TABLETS ▼   NOTEBOOKS & DESKTOPS ▼   CLOUD/DATACENTER & IT ▼

TRENDING TOPICS   SMARTPHONES   GPUS   HTC   HTC ONE   ANDROID   SNAPDRAGON 600   TABLETS

Like 29k   Follow 20.6K followers

Home > CPUs

Intel's Sandy Bridge Architecture Exposed

62 Comments

by Anand Lal Shimpi on September 14, 2010 4:10 AM EST

Posted in   CPUs   Intel   Sandy Bridge

+ Add A Comment

A Physical Register File

Just like AMD announced in its Bobcat and Bulldozer architectures, in Sandy Bridge Intel moves to a physical register file. In Core 2 and Nehalem, every micro-op had a copy of every operand that it needed. This meant the out-of-order execution hardware (scheduler/reorder buffer/associated queues) had to be much larger as it needed to accommodate the micro-ops as well as their associated data. Back in the Core Duo days that was 80-bits of data. When Intel implemented SSE, the burden grew to 128-bits. With AVX however we now have potentially 256-bit operands associated with each instruction, and the amount that the scheduling/reordering hardware would have to grow to support the AVX execution hardware Intel wanted to enable was too much.

Buy the Intel CLP0555 Core i7-2600K

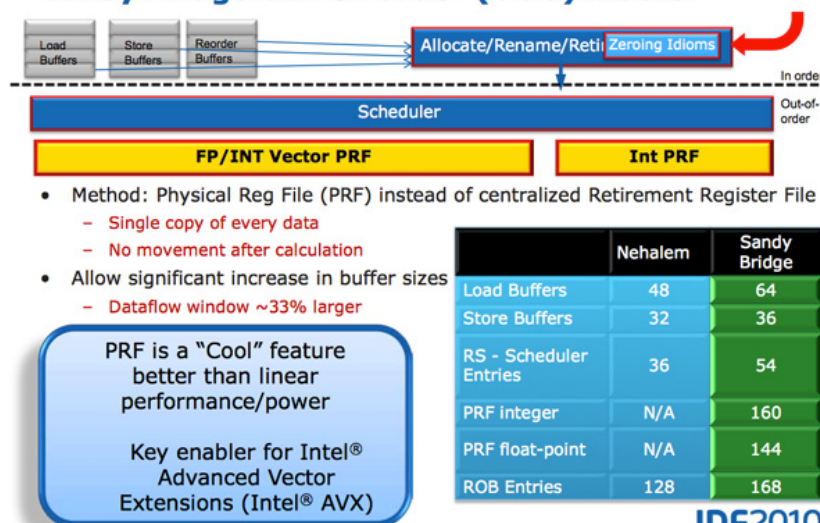A physical register file stores micro-op operands in the register file; as the micro-op travels down the OoO engine it only carries pointers to its operands and not the data itself. This significantly reduces the power of the out of order execution hardware (moving large amounts of data around a chip eats tons of power), it also reduces die area further down the pipe. The die savings are translated into a larger out of order window.

PIPELINE STORIES   + SUBMIT NEWS

LenovoEMC's LifeLine OS 4.0 Brings Enterprise Features to SMB NAS Devices

OpenCL Support Coming To Adobe Premiere Pro for Windows

Best Budget Laptops, April 2013

Facebook Announces Home, and HTC First

The AnandTech Podcast: Episode 18

A Comment on PC Gaming Battery Life

A Visual Guide to the iPhone 5 on T-Mobile

Unreal Engine 4 Infiltrator Demo from GDC [video]

AMD Teases Official Radeon HD 7990

AMD Announces "Radeon Sky" Family of Server-Cloud Video Cards

Best Budget Ultrabook, March 2013

HandBrake to Get QuickSync Support

The die area savings are key as they enable one of Sandy Bridge's major innovations: AVX performance.

The AVX instructions support 256-bit operands, which as you can guess can eat up quite a bit of die area. The move to a physical register file enabled Intel to increase OoO buffers to properly feed a higher throughput floating point engine. Intel clearly believes in AVX as it extended all of its SIMD units to 256-bit wide. The extension is done at minimal die expense. Nehalem has three execution ports and three stacks of execution units:
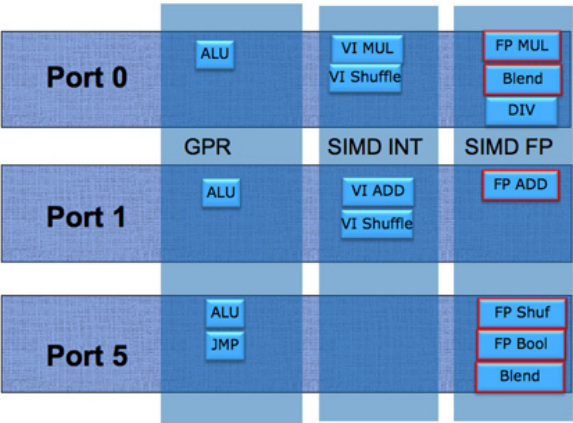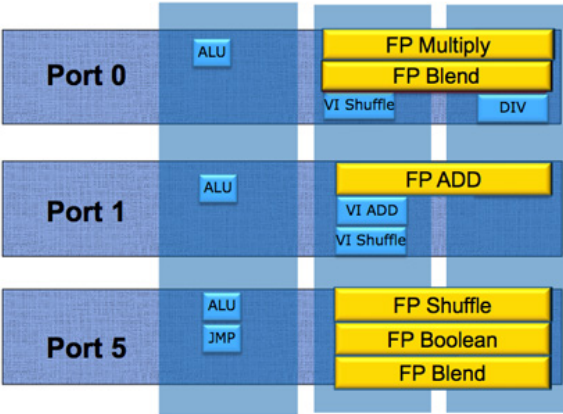

Sandy Bridge allows 256-bit AVX instructions to borrow 128-bits of the integer SIMD datapath. This minimizes the impact of AVX on the execution die area while enabling twice the FP throughput, you get two 256-bit AVX operations per clock (+ one 256-bit AVX load).

Granted you can't mix 256-bit AVX and 128-bit integer SSE ops, however remember SNB now has larger buffers to help extract more ILP.

The upper 128-bits of the execution hardware and paths are power gated. Standard 128-bit SSE operations will not incur an additional power penalty as a result of Intel's 256-bit expansion.

AMD sees AVX support in a different light than Intel. Bulldozer features two 128-bit SSE paths that can be combined for 256-bit AVX operations. Compared to an 8-core Bulldozer a 4-core Sandy Bridge has twice the 256-bit AVX throughput. Whether or not this is an issue going forward really depends on how well AVX is used in applications.

The improvements to Sandy Bridge's FP performance increase the demands on the load/store units. In Nehalem/Westmere you had three LS ports: load, store address and store data.

FACEBOOK   Like 29k

In SNB, the load and store address ports are now symmetric so each port can service a load or store address. This doubles the load bandwidth which is important as Intel doubled the peak floating point performance in Sandy Bridge.
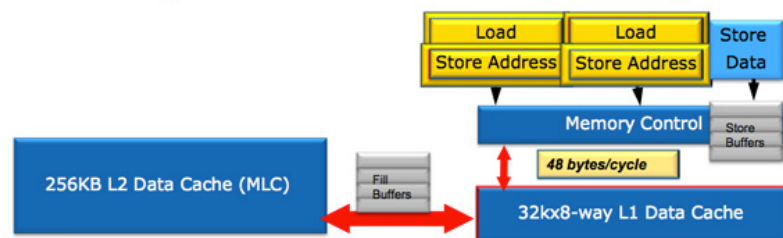
There are some integer execution improvements in Sandy Bridge, although they are more limited. Add with carry (ADC) instruction throughput is doubled, while large scale multiplies (64 * 64) see a ~25% speedup.

TWEETS

anandshimpi: @rf I've played with it for a while, Surface Pro seems to make it not all that interesting though - it doesn't offer more than SPro.

anandshimpi: @tnofuentes will toss something in with the other package this week ;)

anandshimpi: Back to killing SSDs

anandshimpi: Management at many of the big OEMs were very motivated to make costs back asap on investing in these new designs, hence stupid pricing

anandshimpi: The pricing for everyone was too high at launch, we are getting closer to where things should have been.

IanCutress: @DTheSleepless Every time you use 'utilize', put use in + read it back. It makes what you are saying simpler to understand and always works

IanCutress: Since when was 'noise emissions' a phrase? It's just 'noise'. Just like utilise should just be 'use'. Idle corporate speak BS :rolleyes:

IanCutress: @haydenoscar ~£100 since I noticed it again

IanCutress: @jeffkibuule @chrisheinonen The only question is when. Until that point, I'm making a small pile of cash.

IanCutress: $174 / BTC. If you invested back at $50, you are in the money.

jarredwalton: I liked a @YouTube video http://t.co/t0b0sKNcVk Torment: Tides of Numenera Sagus Cliffs screen shot Unity

THE FRONT END	THE RING BUS & SYSTEM AGENT

PHYSICAL REGISTER FILE & EXECUTION IMPROVEMENTS	⌃ ⌄

Curtir   215 pessoas curtiram isso. Seja o primeiro entre seus amigos.

PRINT THIS ARTICLE

62 Comments

POST A COMMENT

View All Comments

beginner99 - Tuesday, September 14, 2010 - link
AMD's been taking about fusion forever but I can't get rid of the feeling that this Intel implementation will be much more "fused" than the AMD one will be. AMD barley has CPU turbo so adding a comined cpu/gpu turbo at once, maybe they can pull it off but experience makes me doubt that very much.

BTW, if it takes like 3mm^2 for a super fast video encoder I ask my self, why wasn't this done before?

REPLY

duploxxx - Tuesday, September 14, 2010 - link
first or not, doesn't really matter.

who says AMD need's GPU turbo? If Liano really is a 400SP GPU it will knock any Intel GPU with or without turbo.

If we see the first results of Anadtech review which seems to be a GT2 part it doesn't have a chance at all.

core i5 is really castrated due to lack of HT, This is exactly where liano will fight against, with a bit less cpu power.

REPLY

B3an - Tuesday, September 14, 2010 - link
Even if AMD's GPU in Liano is faster, intels GPU is finally decent and good enough for most people, but more importantly more people will care about CPU performance because most users dont play games and this GPU can more than easily handle HD video. And i'm sure SB will be faster than anything AMD has. Then throw in the AVX and i'd say Intel clearly have a better option for the vast majority of people, it just comes down to price now.

REPLY

B3an - Tuesday, September 14, 2010 - link
Sorry, didnt mean AVX, i meant the hardware accelerated video encoding.

REPLY

bitcrazed - Tuesday, September 14, 2010 - link
But it's not just about raw power - it's about power per dollar.

If you've got $500 to spend on a mobo and CPU, where do you spend it? On a slower Intel platform or on a faster AMD platform?

If AMD get their pricing right, they could turn this into a no-brainer decision, greatly increasing their sales.

REPLY

duploxxx - Tuesday, September 14, 2010 - link
now here comes the issue with the real fanboys:

"And i'm sure SB will be faster than anything AMD has."

It's exactly price where AMD has the better option. It's people " known brand name" that keeps them at buying the same thing without knowledge... yeah lets buy a Pentium.

REPLY

takeulo - Wednesday, September 15, 2010 - link
hahahahah yeah i agree AMD is the better option at all if i have the high budget i'll go for Insane i mean Intel but since im only "poor" and i cant afford it so i'll stick to AMD and my money worth it

sorry for my bad english XD

REPLY

MySchizoBuddy - Monday, December 20, 2010 - link
how do you know Intel GPU has reached good enough state (do you have benchmarks to support

---

test.

nerdtalker: @jeffkibuule @richardlai yeah they are, it's called total idiocy

nerdtalker: @richardlai it's laughably bad

nerdtalker: @Frankiezzy I have that bug too

nerdtalker: @robertprejs I love that android gives raw nmea messages

nerdtalker: @TheJasonTsay so basically mental masturbation

Follow @ANANDTECH

your hypothesis). they have been trying to reach this state for as long as i can remember.

your good enough state might be very different that somebodies else's good enough state.

REPLY

bindesh - Tuesday, September 20, 2011 - link
Your all doubts will be cleared after watching this video, and related once.

http://www.youtube.com/watch?v=XqBk0uHrxII&fea...

I am having 3 AMDs and 1 Intel, Believe me with the price of AMD CPUs, i can only get a celeron in Intel. Which cannot run NFS SHIFT. Or TIme Shift. But other hand, with AMD athlon, i have completed Devil May Cry 4 with decent speed. And the laptop costs 24K, Toshiba C650, psg xxxxx18 model. It has 360 GB SSD, ATI 4200HD.

Can you get such price and performance with Intel?

Best part is that i am running it with 800MHz cpu speed, with performance much much greater than 55K intel dual core laptop of my friend.

REPLY

vlado08 - Tuesday, September 14, 2010 - link
Still no word ont the 23.976 FPS play back?

REPLY

LINKS

Home
About
Forums
RSS
Pipeline News
Bench
Galleries
DailyTech

TOPICS

CPUs
Motherboards
SSD/HDD
GPUs
Mobile
IT/Datacenter
Smartphones
Memory
Cases/Cooling/PSU(s)

Displays
Mac
Systems
Cloud
Trade Shows
Guides

FOLLOW

Facebook

Twitter

RSS

The Most Trusted in Tech Since 1997

About   Advertising   Terms, Privacy