In its latest networking buy, Intel reaches for Cray's high-performance interconnects

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Intel has gone networking crazy. The chipmaker recently agreed to acquire Cray's interconnect hardware assets – some might say its crown jewels – for $140m in cash. For Intel, which apparently approached Cray, the deal makes considerable sense, and comes hot on the heels of a series of networking transactions it's been putting together over the past few years. For Cray, the deal is driven by the fact that a major trend in the HPC industry is toward tighter integration between components, and sooner or later some or all of the interconnect logic will migrate to the processor – something that Cray cannot do, but Intel can. The two are talking in terms of a 'broadening relationship,' and the M&A agreement includes rights for Cray to continue using the transferred assets in its future products.

Acquirer:
Intel

Target:
Cray (interconnect assets and IP)

Subsector:
High-performance computing

Deal value:
$140m in cash

Date announced:
April 24, 2012

Closing date, expected:
By the end of June 2012

Advisers:
None

Deal details

Cray has signed a definitive agreement with Intel to sell its interconnect hardware development and related intellectual property, including 34 patents and up to 74 employees based in Chippewa Falls, Wisconsin (where Cray currently employs about 225 engineers). It will receive $140m in cash at closing, which, because no regulatory approval is required, is anticipated to happen relatively quickly, and certainly before the end of the current quarter, assuming the usual closing conditions are met. The cash, likely to be reduced to $130m after applicable taxes, will add $3.50 per share in value. Cray retains certain rights to use the transferred assets and IP within Cray products, and has also secured the rights to use unspecified 'important differentiating features' of certain future Intel

products. Along with a stronger balance sheet, Cray says the lower headcount will result in cost savings in the future, though it expects these savings to be relatively modest in 2012. According to SEC filings, neither side used an outside financial adviser.

Target profile

Cray may be a legend in the supercomputer industry, but it's a very different company today than it was when founded as Cray Research in the 1970s (see here for the complex family tree). Cray Research was responsible for building a series of groundbreaking supercomputers – the Cray-1, Cray-XMP, YMP and C90 – before being sold first to SGI in 1996 (for $740m) and then to Tera Computing in 2000 for just $21.5m in cash and stock, after which Tera promptly renamed itself Cray. In February 2004, the company acquired systems startup (and AMD Opteron partner) OctigaBay Systems for $115m, strengthening its existing relationship with AMD. Over the years, Cray has been heavily funded by the US Defense Advanced Research Projects Agency, but it's been able to commercialize the results.

Having accrued losses from 2006-2009, Cray posted profits for both 2010 and 2011. For 2011, Cray reported revenue of $236m (down from $319 million in 2010), with net income of $14m (against $15m). Gross margins were up to 40% (from 34% in 2010), and operating expenses were flat at $93m. But with individual product sales often measured in tens of millions of dollars or more, revenue is inevitably lumpy, and Cray has for years been looking at ways to expand into lower-end, higher-volume offerings. To that end, earlier this year Cray set up a new division called YarcData that is focused on delivering solutions to the 'big data' analytics market. (Yes, Yarc is Cray spelled backwards!)

Acquirer profile

Intel has always kept its eye on the HPC space and often used it as a proving ground for developing technologies that would later hit the mainstream markets. The company founded Intel Scientific Computers in 1984 and built several of its own supercomputer systems over the years, including ASCI Red for Sandia National Laboratories in 1997, which for the next three years was rated the faster supercomputer in the world. However, the focus of this current deal is as much about networking as it is about HPC, and should be seen in the context of Intel's recent M&A activity in networking. Recent acquisitions include Ethernet switching chipmaker Fulcrum Microsystems in July 2011 for an estimated $175m and QLogic's InfiniBand assets in January for $125m.

Technology

Cray has always highlighted three technology differentiators: its interconnect, system software (OS, scalability technology, compilers and programming tools), and power and cooling packaging technologies inside the rack. The company still believes that the interconnect is a differentiator, but has seen the industry trend where the hardware components of interconnect are increasingly being integrated with other chipsets on the node – with AMD's reach for SeaMicro the most obvious recent example (see below). Cray feels that it won't be able to compete on hardware development as this integration process gathers momentum. System software that optimizes these integrated interconnects will be the crucial element in the future, Cray says, and it will continue to work in that area, optimizing for its own interconnects and for those built by others.

Deal rationale

In the world of high-performance computing, Gigabit Ethernet and InfiniBand now own almost 90% of the market – a massive change from a decade ago, when proprietary interconnects were dominant. And both of these technologies are becoming increasingly important in mainstream enterprise computing as well. Intel has these bases covered. In contrast, Cray's interconnects are used in just a small number of systems (though they are all very, very large).

So what does Intel gain from Cray? The two latest interconnect technologies in use or under development at Cray are Gemini and Aries. Gemini is a 3-D torus interconnect used in architectures capable of scaling beyond one million processor cores, including the Cray XE6 (using AMD Opteron processors with eight processors per blade) and the Cray XK6 (using four Opteron CPUs and four NVIDIA GPUs per blade). Aries, effectively a superset of Gemini, is the interconnect that Cray will use in its forthcoming Cascades supercomputer, which, significantly, will offer a choice of either AMD or Intel processors. Some of the interconnect team that Intel has obtained will stay on during a transition period to help complete Cascades, which is due for release in the first half of 2013.

Cray notes that the product roadmap for Cascades remains unchanged through 2016. The interconnect for the generation of systems after that will be jointly developed with Intel. Moving the future development of interconnect technologies to Intel will allow Cray to focus on its other key areas of differentiation, which are the software that drives the interconnect, scalable system software, the Cray programming environment, and the packaging, power and cooling aspects of high end, multi-megawatt supercomputers.

The essential point is that, whereas Gemini was tightly hooked into AMD technology because of its

use of HyperTransport, Aries connects using the PCI Express 3.0 bus, meaning that Cray can choose between AMD or Intel (although only Intel currently has a PCI 3.0 controller on-chip). Before this deal, that seemed like a good strategy for Cray, which has been affected by delays in AMD's chip roadmap in recent years. But will Intel now seek to integrate Aries with its own QuickPath chip-to-chip interconnects? Something along those lines seems to be implied by the 'differentiating technologies' Cray is apparently committed to take from Intel in the future. However, Cray says it will continue to have relationships with AMD and NVIDIA.

For Intel, the closer integration of interconnect technology with its other silicon assets is clearly the driving force for this transaction. It may have been spurred to act in part by AMD's recent pickup of startup SeaMicro, a company Intel had been working closely with. SeaMicro's core asset was a 3-D torus interconnect embedded in identical server building-block nodes that together made up a 1.2TB data fabric – along the lines of the supercomputing fabric that IBM used for its Blue Gene supercomputers, but optimized for Internet workloads. SeaMicro was using Intel's Atom CPU on the nodes, but its technology was designed to be CPU-independent. AMD is working on versions hooked up to its own large-, medium- and small-core CPUs, but may also use it to connect hybrid systems, including (potentially) ARM cores in the future. Intel sees this as a threat, and may want to pitch its new Cray technology as a countermeasure.

Another area of potential future collaboration between the two is likely to focus on Intel's forthcoming Many Integrated Core architecture (aka Knights Corner), which will be aimed at the HPC sector. Knights Corner is expected to be launched later this year.

Competitive landscape

Viewed simplistically, Intel's competition in high-end HPC interconnects is predominantly InfiniBand, a technology for which it is a major player via its acquisition of QLogic's InfiniBand assets. The QLogic division's only direct competition for InfiniBand technology is Mellanox, which has a larger share of the market than QLogic, but must now be wondering what Intel/QLogic/Cray will do next. While the InfiniBand part of QLogic is now 100% owned by Intel, Mellanox has its own major IT supporter in the shape of Oracle, with its purchase of just over 10% of the company. Oracle says it has no plans to try to buy the rest of Mellanox, but sees the latter's technology as being of great importance to its Exadata and Exalogic products.

The alternative networks at the high end of the HPC space include a number of proprietary options: the 5D torus interconnect used by IBM in its BlueGene/Q, the 6D mesh/torus called Tofu used in Fujitsu's K Computer (the fastest computer on the planet for now), the interconnect used in China's

Tianhe-1A, and SGI's cache-coherent NUMAlink. Old-timer Myricom has now all but disappeared from the HPC sector and sells interconnects that support mainstream 10-Gigabit Ethernet applications with demanding latency or throughput requirements.

New kids on the block pushing interconnect technologies into HPC systems include Gnodal and EXTOLL. Gnodal, whose legacy can be traced back to Intel, Meiko and now-defunct Quadrics, builds high-density, low-latency 10GigE and 40GigE switches, and is a partner in the European Commission (EC)-funded Mont Blanc project, which is designing an Exascale system that uses up to 30 times less energy than current systems. EXTOLL is a recent spinoff of Heidelberg University in Germany, and participates in the EC-funded DEEP project, in which it is further developing its switchless architecture.