NOVARTIS

Distributed Desktop Grid, PC Refresh Help Novartis Enhance Innovation

SOLUTION SUMMARY

Challenge	A rising star in the pharmaceutical industry, Novartis AG is committed to bringing more innovative medicines to market faster. With drug discovery increasingly dependent on computing resources, Novartis wanted a cost-effective way to expand its R&D compute power.
Solution	Novartis has linked 2,700 of its researchers' PCs in a high-performance grid that delivers an extra 5+ teraflops of compute power and enables scientists to enlarge the scope of their research, examine bigger datasets with greater precision, and target new classes of problems. This year, Novartis is upgrading its 65,000 corporate PCs, standardizing its client environment, and expanding the grid's potential power. Novartis is also applying the grid to mainstream business problems.
Business value	Novartis' US $400,000 investment in grid technologies has generated savings of $2M and produced affordable computing resources that will help the company accelerate the development of life-saving new drugs. Novartis expects its PC standardization to save it an estimated $200M in total cost of ownership (TCO) over three years. The new PCs can be added to the grid, further enhancing Novartis' return on its PC investments.
Desktop PCs	Standardizing on Hewlett-Packard (HP) PCs based on fast Intel® Pentium® 4 processors and Microsoft* Windows* XP
Grid management	United Devices* Grid MP Enterprise* running on HP* ProLiant* server with dual Intel® Xeon™ processors

Business Challenge

CANCER BREAKTHROUGH

When Swiss pharmaceutical leader Novartis AG introduced Gleevec*/Glivec* in 2001, it electrified the pharmaceutical industry. Not only did the drug offer hope to sufferers of several rare and life-threatening cancers, it also validated three decades of cancer research efforts. Gleevec is the result of molecular targeting. In contrast to traditional chemotherapy, which can be so harsh the patient dies of its side-effects, Gleevec targets specific abnormalities in cancer cells, killing the cancer and leaving healthy cells undamaged. Gleevec's success, in the words of one of its developers, Dr. Brian Druker, "tells us in a very dramatic fashion that we're on the right path to beating cancer."[1]

Now Novartis is investing heavily to make its drug development process even more innovative, efficient, and reproducible—and a grid linking thousands of distributed Intel® Pentium® 4 processor-based PCs and managed by an Intel® Xeon™ processor-based server is playing a key role.

"Grid computing will explode on a global level. It will drive the future of computing."

Peter Sany
Chief Information Officer
Novartis AG

MISSION: FASTER DRUG DESIGN, BETTER DRUGS

Based in Basel, Switzerland, Novartis was formed in 1996 by the merger of Ciba-Geigy and Sandoz. With more than 77,000 employees worldwide, the $19 billion company ranks #22

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Research Division
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on the Fortune Global 500 list and experienced double-digit sales growth the past two years. Its core businesses include pharmaceuticals, generics, consumer health, eye care, and animal health.

Novartis already brings prescription medicines to market faster than the industry norm, and in the last two years has had more drugs approved in key markets than any of its competitors.[2] Seeking to further enhance its industry-leading development efforts, the company has added 1,000 researchers, raised its R&D budget to $2.8 billion, and is opening a new, multi-million dollar research headquarters in Cambridge, Mass. Novartis is also making grid computing a strategic part of its five-year plan for adding R&D computational resources, and is looking to utilize the grid for mainstream business computing challenges as well.

NEW TARGETS

"The decoding of the human genome has transformed drug discovery and molecular targeting," explains Novartis CIO Peter Sany. "Before the genome was decoded, we had 300 druggable targets. Now we have 30,000, and we're just starting to learn about them—what their actions are, what molecules they may bind with. There are tremendous opportunities to develop very precise drugs that actually cure diseases instead of just treating symptoms, but there is a huge amount of work to be done."

Computing power is increasingly essential to drug development. Much as automotive engineers use computer-based crash test simulations to avoid expensive real-life tests, pharmaceutical researchers rely on *in silico* experiments—conducted in the computer—to explore drug actions, speed the development cycle, and reduce the need for expensive, robotics-controlled physical experiments. "The drug discovery process is absolutely dependent on high-performance computing (HPC), and the dependence is accelerating," says Manuel Peitsch, head of informatics and knowledge management for Novartis' research division. "The more we go forward, the less computer-independent drug discovery we will do."

That's what got Sany and Peitsch interested in grid computing. Grids take advantage of existing computing resources, delivering additional performance at a fraction of the cost of purchasing, deploying, and managing new systems. "If you look at the desktop PCs in a typical corporation, probably 90 percent of computing cycles are unused," says Peitsch. "Just by capturing unused cycles on the PCs we've already got, we've created a 5 teraflops supercomputer. We've avoided the expenses of buying an HPC system, building another computer center, and taking on the people to support it. We invested roughly $400,000 in grid software licensing and figure we've saved at least $2M based on the 2700 seats we have currently. We expect to realize more savings of this nature in the future as our grid expands."

Business Solution

FROM PILOT TO 5 TERAFLOPS WITHIN WEEKS

Novartis began its entry into grid computing in 2001, surveying available solutions to find a software platform that would provide superior security and scalability, broad application support, and easy integration with its existing systems management tools and user interfaces. The Novartis team worked with Austin, Texas-based United Devices to deploy a 50-PC pilot. United Devices offers a comprehensive grid software platform, the Grid MP Enterprise* platform, as well as substantial in-house expertise to assist companies with their grid deployments. Intel® Capital, which invests in companies that have promising technologies relevant to Intel's strategic direction, is an investor in United Devices.

The Novartis pilot exceeded expectations. The 50 desktops were grid-enabled and collaborating in less than a day, and within a week had provided 3.18 years of additional aggregate processing time. Novartis quickly deployed the United Devices agent to another 570 desktops, and currently has 2,700 PCs on its grid.

United Devices' Grid MP Enterprise makes it easy for companies to derive added business value from their PCs and other distributed computing resources. A client agent runs on the grid nodes, which can be networked PCs, clusters, individual servers, or even occasionally-connected notebooks. Control software, running on an Intel Xeon processor-based server, manages the workflow, assigning tasks to the nodes and assembling the results. The Grid MP platform ensures that the grid application has no impact on the user. "If the user so much as moves the mouse, the grid application backs off and waits," says Sri Mandyam, United Devices' director of product marketing. "All data files are compressed and encrypted, so even if users find them, they can't get into them."

The Grid MP Enterprise grid services interface is based on industry standards and supports over 20 programming languages, making it easy to move applications onto the grid. The Grid MP platform offers multi-layer security, with 168-bit triple DES encryption for all data stored on disk and transmitted over the network, robust user and resource authentication mechanisms, and digital signature checks to prevent tampering. Network impact at Novartis has been minimal, with continuous load testing

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on a 620-machine test grid showing that bandwidth usage increased 2.4 percent or less.

The solution is highly scalable: Small deployments run on a single control server, while larger ones can divide the central workload among multiple 2-way and 4-way Intel Xeon processor-based application servers and database servers running behind a networked load balancer. In fact, some 2 million people around the world are part of the www.intel.com/cure grid, a philanthropic program Intel and United Devices created that lets people donate unused cycles on their home PCs to medical research. All 2 million PCs run under a single instance of the Grid MP platform on one set of Intel®-based servers.

REDUCING COST, GAINING A ROBUST BACKBONE

Scalability is critical for Novartis. The company is upgrading all its business desktops to PCs based on fast Intel® Pentium® 4 processors, and Sany says the company plans to eventually grid-enable all those machines. Moreover, having a well-controlled client environment is essential to the success of the grid. "I wouldn't risk putting non-standard PC configurations on the grid," Sany says. "It would be too easy to repeatedly crash the user's system. PCs are too essential to our business and to our users' productivity for us to let that happen."

Although it wasn't planned that way, Novartis has, in effect, been running a controlled experiment in the value of a standardized PC environment. Five years ago, Novartis' pharmaceuticals division, which represents about half the company, moved to standardized configurations based on Microsoft* Windows NT* 4.0. That standardization saved the division $120M over three years, according to Sany.

"Simplifying our configurations and images allows us to standardize our processes and leverage our purchasing power," says Sany. "It produces efficiency gains and provides an extremely robust backbone for the company. What's interesting is that the parts of the company that hadn't standardized felt they had lower TCO and greater agility, but our studies proved it was the other way around."

Now, Novartis is driving toward a global standard based on a new Microsoft* Windows* XP-based application layer it calls the Enterprise Next-Generation Infrastructure Environment or Engine. "We wanted to move away from Windows NT to Windows XP, and a lot of the old PCs weren't strong enough to support our new Engine application layer," says Peitsch. "Through PC life cycle management, we can get everyone to the same level of performance. We can bring the company to the state of the art while reducing total cost of ownership."

By the end of the year, Novartis expects to have a single desktop, two notebook configurations, and a single software image. The IT organization is eliminating some 7,500 applications, most of which were duplicate versions and variants or multiple applications performing the same function. The software image will be preinstalled, reducing deployment time and costs.

Sany says the simplification and upgrade will generate enormous TCO savings through enhanced security and consistency and increased control of the environment. "For example, help desks are generally responsible for one-third of a company's client TCO," he says. "We expect to go from tens of help desks around the world to two or three."

Overall, Sany expects to see savings of approximately 1,000 Swiss Francs (CHF) per year for the PCs that were already standardized on Microsoft Windows NT, and about 2500 CHF per year per PC for systems that were previously unstandardized—which could add up to an estimated $200M over three years.

The upgrade also expands the grid's potential power. "The Intel Pentium 4 processor in the new machines is more powerful than the chip in the old machines, so that gives us more power for the user and for the grid," says Sany. "And of course we'll have thousands more PCs that we can look at adding to the grid." Novartis' vision is to link its servers and clusters to the grid as well, forming a unified and transparent computing continuum.

HAVING AN IMPACT: R&D AND BEYOND

While the prospect of thousands more systems on the grid is exciting, Novartis is already experiencing big benefits from its 2,700-node grid.

"All of a sudden, you can do things you couldn't do before—and do them economically," says Sany. "We have projects we calculated would take six years on a single supercomputer. Today, the runtime is 12 hours. Before, you wouldn't bother starting such a process. Now, it's completely practical and affordable."

Given the complexity of biological systems and processes, changes of this magnitude are just what the doctor ordered. "Drug discovery is a lengthy and complex process, with lots of feedback loops," says Peitsch. "Because of the grid, researchers don't have to make such difficult trade-offs between computational time and precision. They can compute on much larger data sets, with more degrees of precision, and get results in a reasonable time. We can look at biological systems and combinations of genes rather than just individual genes and compounds. As a company,

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Nor is the grid limited to scientific problems. On the business side of the house, Novartis teams are using the grid for advanced data mining.

Executives at both Novartis and United Devices say they expect grid computing to experience explosive growth and to transform the way companies do computing. "Grids allow companies to ride up Moore's Law," says Piush Patel, United Devices' director of business development. "Every time you go through a client refresh cycle, you get a more powerful supercomputer. When you aggregate all that power, you have an opportunity to cut years out of the drug discovery process, or to have a similar impact in fields ranging from reservoir simulation in oil and gas exploration to satellite image analysis in the world of defense and intelligence."

Sany points out that there's still work to be done. "We need standards, and ultimately we expect those standards to be driven right down to the chip level," he says. "But I'm convinced grid computing will explode on a global level. It will drive the future of computing."

More Information
www.intel.com/eBusiness
www.novartis.com
www.ud.com

LESSONS LEARNED

- **Recognize grids as the next wave of distributed computing.** By enabling companies to make more efficient, cost-effective use of their computing resources, grid computing offers value for virtually any enterprise. Start planning how your business can take advantage of grid technologies.
- **Apply standards.** To maximize access to grid resources, deploy PCs and servers based on open, standards-based Intel® architecture. Look for emerging grid standards such as the open-source Globus Toolkit and the Open Grid Services Architecture, and choose solutions like United Devices' Grid MP Enterprise* that are built on industry-standard interfaces.
- **Simplify your client environment.** Standardizing and upgrading its PC configurations and images enables Novartis to streamline its IT processes worldwide. The result: hundreds of millions of dollars in cost savings, a powerful computing backbone for the enterprise, and more performance for the grid.
- **Don't neglect the human element.** Individuals have feelings of ownership about their PCs, and departments may have concerns about resource sharing. Novartis executives say they've succeeded by recognizing the issues, moving respectfully, and promoting the value of the grid. "Once people started seeing the advantages, they were happy to join in," says Peitsch.

Solution provided by United Devices

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[1] Interview with Dr. Brian Druker on www.healthtalk.com/client/toc/research/cml/09.html

[2] See www.novartis.com/about_novartis/en/product_pipeline.shtml

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