CHAPTER IV: AMD TECHNOLOGY: ENABLING A BETTER WORLD

AMD technology is being used to help address some of the world’s most pressing challenges. In addition to designing technology products, we also work with customers and partners to design world-class systems, develop or optimize applications, and provide features to meet user needs. From helping scientists advance research in healthcare and climate change, to optimizing clean energy technologies, to creating “green” data centers powering cloud computing, AMD employees and the technology we produce are helping to make the world a better place.

AMD and the Cloud

Building on our long history of innovation, AMD is focused on radically changing the data center and accelerating the expansion of cloud computing and the capabilities and benefits it provides. We are launching technologies that dramatically reduce energy consumption and space requirements while enabling highly specialized workload optimizations that are transforming the capabilities, design and economics of the cloud. Our energy efficient technologies are also helping our customers – and their customers – reduce the environmental impact associated with computing operations and data management.

Walking the Talk: AMD’s Private Cloud

AMD’s private cloud is one of the largest internal cloud computing infrastructures in the world. It is used by our engineers around the world to design future generations of AMD processor solutions. Optimized for both performance and power management, this network consists of tens of thousands of AMD CPUs with more than four petabytes of storage. With an operation of this size, energy efficiency and power management are essential for performance management, lowering energy costs and managing our carbon footprint.

In addition to using servers equipped with AMD’s energy efficient processors, we designed a heavily virtualized computing environment. Virtualization increases the utilization of each physical server, which increases efficiency while reducing the overall number of physical servers needed to meet compute requirements. Fewer servers means our data centers use less power and generate less heat that in turn reduces the energy needed for cooling.

AMD’s commitment to data center efficiency and sustainability goes well beyond reducing energy consumption. We are also committed to using renewable energy when available and feasible. For example, AMD’s newest data center, located in Alpharetta, Georgia, was awarded a LEED (Leadership in Energy and Environmental Design) Commercial Interiors certification from the U.S. Green Building Council (USGBC), and was powered by 100 percent renewable wind energy in 2012.

This data center is just one example of AMD’s overall strategy to make our own IT operations as efficient as possible, and use our current state-of-the-art, high-performance and high-efficiency technologies to design new generations of technologies. In short, we’re using today’s cloud technologies to advance tomorrow’s cloud technologies.
Greening Datacenters and the Cloud

Datacenters are the foundation of the digital economy and cloud computing services that enable smartphone applications and other online services are driving unprecedented demand for digital content and computing capacity. While the cloud enables a range of new and efficient services, concerns have been raised about the environmental impacts of generating the energy needed to run datacenters.

According to a study by Stanford Professor Jonathan Koomey, worldwide electricity consumption for datacenters grew by approximately 56 percent between 2005 and 2010 and now represents about 2.5 percent of total electricity use in the U.S.¹

The rising demand for electricity to power the cloud, coupled with environmental concerns is driving the imperative to design the most energy efficient computing technology. In our continuing efforts to innovate low power, environmentally efficient solutions, AMD has teamed up with Clarkson University, the New York State Energy Research and Development Authority (NYSERDA), HP and other organizations to research effective ways to power data centers from renewable energy sources.

Developed by AMD’s External Research Office, the project is in its second year. The goal is to build a distributed computing network by co-locating renewable, yet dynamic, energy sources such as wind and solar with containerized data centers such as HP’s Performance Optimized Datacenter (POD), driven by AMD Opteron microprocessors.

Since solar and wind sources are intermittent, the project is testing the feasibility of using a fiber optic network to transfer work load to the POD datacenters where alternative energy is actively being generated. This model can create considerable cost efficiencies by replacing expensive electrical transmission lines to transport electricity with less expensive fiber optic lines to transport data. Renewable energy sources obviously provide environmental benefits by reducing the carbon emissions associated with traditional energy generation. We’re excited about the potential of this and our other projects that are helping to make computing more cost efficient while protecting the environment.

“So called “green computing” is important to AMD because it is not only more environmentally sustainable, but it is also more efficient from a computing perspective and cost-effective from a business perspective. Now that is good business.”

— Alan Lee, Corporate Vice President for Advanced Research and Advanced Technology

Making Cloud Computing More Environmentally Sustainable

German cloud services company Intergenia is a leading provider of web hosting and server solutions across Europe and the United States. With more than two million active websites, a proprietary backbone and competitive pricing, Intergenia is one of the leading companies in dedicated hosting worldwide. They are also dedicated to operating “green” data centers that are highly energy efficient and offer their customers cost savings and an environmentally responsible alternative to many other data center operations.

“By running the datadock, Europe’s greenest data center, we meet both our and our customer’s ecological concerns. The datadock’s fantastic Power Usage Efficiency (PUE) value of 1.21 is also supported by using energy-efficient processors such as AMD Opteron processors.”

—According to Intergenia founder and president, Thomas Strohe

Datadock is also committed to using 100 percent green electricity, state-of-the-art power saving transformers and cooling devices. Together, these technologies reduce power consumption by 25 percent compared to an average data center. Those savings are directly proportional to reductions in GHG emissions from electricity generation.

Read the Intergenia case study on AMD’s Customer Experiences website.

Advancing Healthcare

Early Detection and Treatment of Breast Cancer with Advanced Medical Imaging

High-resolution imaging and detection technologies enable more precise, swift and timely diagnoses of life-threatening diseases, limit the number of invasive and unnecessary medical procedures and support preventive care. Medical imaging technology company, Barco, has relied exclusively on AMD FirePro™ workstation graphics cards for more than a decade to power their high resolution diagnostic displays.

Over the years, AMD and Barco have worked together to address such issues as extending the life of older technology, redesigning existing graphic cards and enabling new cutting edge features. The latest advance in mammography technology, Breast Tomosynthesis, offers multi-frame 3D views of the breast. It provides clearer, more accurate views, and allows physicians to more effectively pinpoint the size, shape and location of any abnormalities. Barco introduced the first 5-megapixel display for Breast Tomosynthesis, powered by AMD FirePro™ workstation graphics.

In addition to high-image quality, multi-monitor configurations can also help medical professionals work more efficiently by allowing them to quickly view more information at once and in greater detail. AMD’s Eyefinity multi-display technology enables one workstation graphics card to be able to power up to six displays. The most common configuration for Barco customers is three displays, powered by one ATI FirePro™ V5800 workstation graphics card.

View the video on AMD and Barco (http://youtu.be/OpeHZAyvpec).

Health Management in Nigeria

Third-world conditions can make delivering electronic health care services particularly challenging. In Nigeria, the network and server access needed to manage health records and communications was limited throughout the healthcare system due to a lack of consistently reliable electricity. eHealth Nigeria, an NGO dedicated to providing universally available and sustainable Health Management Information Systems met this challenge by designing a small, yet fully functional data center with its own dedicated power source – a combination of gasoline- and diesel-powered generators. eHealth Nigeria is also utilizing innovative open source technologies to create systems and applications that are well-suited
for the patchwork of IT networks and infrastructure in Nigeria. Read more about eHealth’s work in Nigeria on AMD’s Customer Experiences website.

**Speeding Up DNA Replication**

Once reserved for research, DNA analysis is quickly becoming an essential tool for medical professionals to accurately diagnose and analyze treatment options for their patients. The time and resources needed to replicate and analyze DNA, however, continues to present a challenge to its widespread availability and affordability. Recently, BJS Biotechnologies turned to AMD to help them build their xxpress® DNA replication machine. Using AMD embedded processor technology, xxpress® incorporates an innovative design with a powerful graphical user interface that reduces setup time and the time required to replicate DNA from days or hours to as little as 10 minutes. This greatly improves the efficiency and reduces the costs for DNA testing. This breakthrough can allow patients to be diagnosed and prescribed treatment in a single visit, help assess and improve ongoing treatments for chronic or serious disease, or even help save lives in emergencies.

Read more about DNA replication on AMD’s Customer Experiences website.

**Understanding Climate Change Using the World’s Most Powerful Supercomputer**

**Titan Supercomputer**: The Titan supercomputer at the U.S. Department of Energy’s Oak Ridge National Laboratory is the world’s fastest supercomputer (Top 500, November 2012), operating at nearly eighteen petaflops (one petaflop equals one quadrillion operations per second) with a peak theoretical performance level of approximately 27 petaflops. This massively parallel supercomputer is the world’s most powerful computer available to academic researchers, helping to usher in a new era of research on highly complex systems and materials.¹ Titan is produced by supercomputing powerhouse Cray, Inc., and uses more than 299,000 AMD Opteron processor cores, as well as other processing solutions.

Researchers are using Titan to develop highly complex weather simulation models to predict and understand the effects of climate change on our environment. Using these models, researchers can forecast climate-related changes and their impact on coastal flooding, food-crop production, biodiversity and many other impacts. With this information, they can work toward identifying the most efficient and effective ways to both combat and adapt to climate change. Read more about Titan on the Oak Ridge National Laboratory site: [http://www.olcf.ornl.gov/titan/](http://www.olcf.ornl.gov/titan/).

**SHARCNET**: Powered by AMD Opteron™, SHARCNET (Shared Hierarchical Academic Research Computing Network) is another supercomputer engaged in climate change research. SHARCNET is a network of high-performance computers and software, in essence a “cluster of clusters” operated by a consortium of Canadian universities, colleges and research institutes. As a shared computing resource for universities and laboratories, the network is designed to meet a number of research priorities, as well as serve as a means to attract and retain talented students, researchers and other collaborators.

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In addition to climate change modeling and prevention scenarios, SHARCNET’s models and simulations are addressing a number of other promising research areas, including environmentally friendly vehicles and understanding how highly infectious diseases are spread to evaluate containment and prevention options. Read more about SHARCNET on AMD’s Customer Experiences website.

**Improving Weather Forecasts to Prevent Disasters in Brazil**

In Brazil, the Center for Weather Prediction and Climate Studies of the National Institute for Space Research (CPTEC/INPE) is one of the largest centers for space and climate research in the world. The center’s job is to make weather forecasts for Brazil and the rest of the world, helping citizens and public authorities plan for and respond to weather- and climate-related events.

The Cray XE6 “Tupa” supercomputer, the largest supercomputer in Latin America, relies on AMD Opteron™ processors to help CPTEC/INPE improve their research and operations. Because of the immense processing power and scalability provided by the AMD Opteron™ processors, Tupa allows users to simulate the complex scenarios characteristic of climate research. This allows for faster computation and astrophysical modeling, which improves the accuracy of weather forecasts. This in turn allows scientists and researchers to enhance their predictive models and help anticipate and prepare for potential natural disasters. Using their AMD powered supercomputer, CPTEC/INPE can deliver more accurate predictions that result in safer communities.

**Increasing the Efficiency of Wind Energy Generation**

In a 100-megawatt wind farm, a drop in output of even a few percentage points can result in the loss of energy for utilities and their customers, as well as hundreds of thousands of dollars in lost revenue for the wind farm. A supercomputer built by Nor-Tech, featuring AMD Opteron™ processors is helping engineers design more efficient turbines by better understanding the effect of wake turbulence on the efficiency of wind turbines.

The AMD Opteron™ processor-powered Nor-Tech supercomputer cluster is specifically tailored to compute fluid dynamics for wind turbines. This allows wind farms to adjust turbine placement and positioning to minimize the inefficiencies associated with wake turbulence, thereby bringing the farm closer to its maximum power output. The complicated fluid dynamics computer programs run exceptionally well on AMD Opteron™ processors because of the unique design architecture, making the Nor-Tech cluster an ideal tool for optimizing its wind turbine performance. Building on this success, there are plans to use this supercomputer for similar renewable energy projects, including a Department of Energy (DOE)-funded project to generate wind power for New York City.

Read more about Nor-Tech on AMD’s Customer Experiences website.