ROOM FOR RENT:
No pets, but servers welcome
Colorado datacenters are a great place to park your data

By Stace Johnson

It is September 3, 2009. Jeffrey Barnes, a mid-sized business owner in Galveston, has just finished boarding up his house and is preparing to head inland. The winds are already gusting, and the rain falls in sheets as he merges slowly onto the northbound lanes of an already packed Interstate 45. He knows his office will bear the brunt of Hurricane Nicholas, but he's not worried. He and his employees have their laptops and IP phones, and all of his company's data is a thousand miles away, safely housed in a datacenter on the edge of the Rocky Mountains.

This storm scenario is fictitious, but for businesses in areas prone to natural disasters, it foretells a very real possibility. Many small and mid-sized companies went out of business in the wake of Hurricane Katrina in 2005 because they were not prepared for disaster. As a result, companies on the coasts and in earthquake areas are taking a close look at their disaster recovery plans. A common thread is beginning to appear: Move inland.

Data is location agnostic. Today, as long as customers can access their data reliably, it can be located anywhere. The Rocky Mountain region – and Colorado's Front Range in particular – is becoming known as an ideal location for datacenter operations, and that reputation is reflected in the growth of local datacenter providers. Despite the slow economy, datacenter companies like FORTRUST and ViaWest are posting record gains, while similar vendors in other locations are posting only modest gains, or even losses.

WHY COLORADO

Colorado is attractive to datacenter companies for many reasons. The generally mild climate along the Front Range is an important factor. Although we do get the occasional big snow storm or strong wind, we are not prone to hurricanes, large tornadoes, volcanoes, or earthquakes. In addition, real estate and power costs in Colorado are relatively inexpensive compared to coastal cities, and the Denver metro area boasts a strong Internet connectivity infrastructure by virtue of its central location between the coasts and large amount of fiber optic cross-connects.

MORE THAN JUST A COMPUTER ROOM

Although datacenters contain computers, a true datacenter is much more than just a glorified computer room. In its "High-Performance Data Centers" research project, the Lawrence Berkeley National Labs defines a datacenter as a "facility that contains concentrated equipment to perform one or more of the following functions: Store, manage, process, and exchange digital data and information."

The definition goes on to say that datacenters provide data processing services, including Web hosting, Internet and/or intranet access, telecommunications, and various other information technology services.

To provide these services reliably, datacenters must have a very strong infrastructure.

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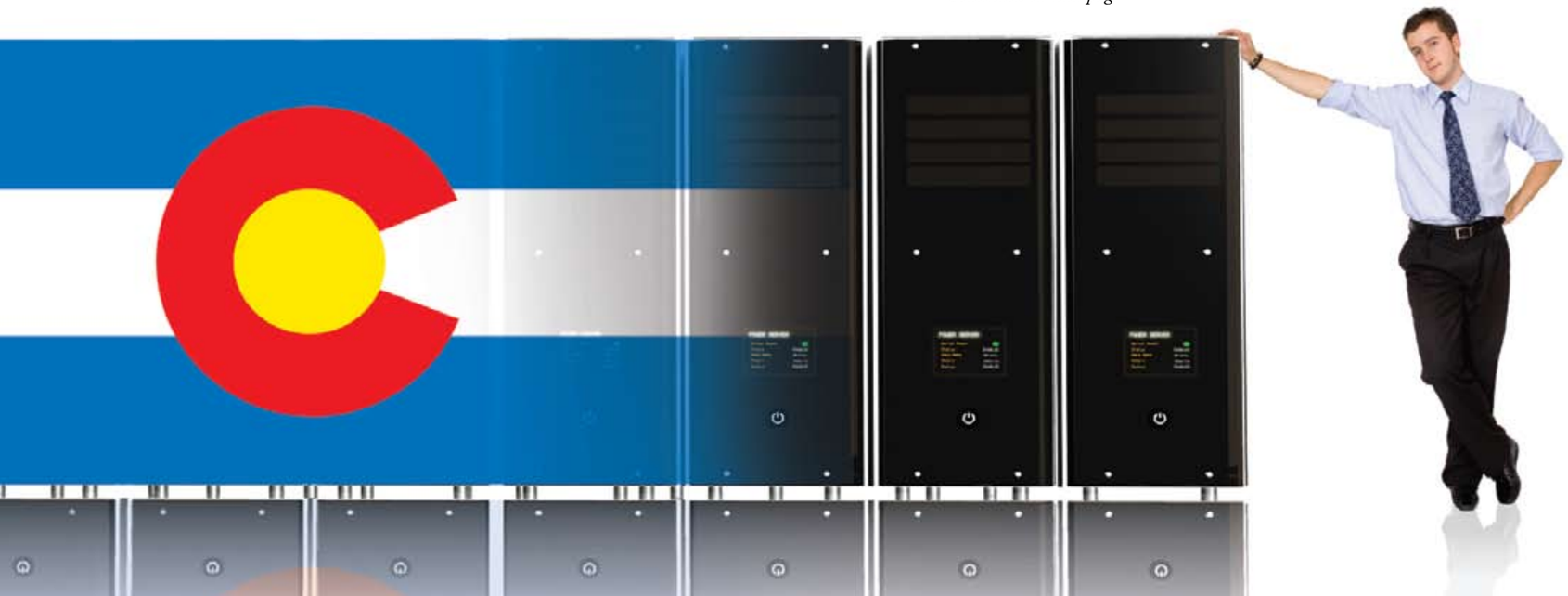

Companies trust datacenters with their most valuable assets. So quality datacenters must be able to guarantee high availability of data and uptime, multiple layers of security, clean uninterrupted power, and sufficient cooling for the computers and communications equipment held within their walls.

Dana Steele is the information technology manager at Hyder Construction, Inc., a Denver general contractor. As a client of FORTRUST, one of the state's largest datacenter firms, Steele says that the datacenter's high availability has significantly changed the way his company does business.

"Any user within Hyder can access our production systems," Steele explains. "Connectivity to our corporate office could take a hit or connection loss, and only those users would be affected. All remote locations and users would not be affected. Corporate users could then go work from home as if they were sitting at their desks in the office."

Datacenters meet the demands of high availability by making sure they have multiple high-speed data lines to several different Tier I carriers on the Internet backbone. In the event that one carrier suffers an outage, data will automatically route through other carriers. Because ViaWest, another large Denver datacenter, has multiple datacenter locations, they take this redundancy a step further by directly connecting each datacenter to at least two of their other locations.

Data is a precious commodity, and if a company is to trust an external datacenter with its bits and bytes, multiple layers of security and authentication are a must. At the same time, customers need to have access to their equipment housed at the datacenter, which presents an interesting dilemma.

A typical datacenter will have a specific 24-hour access door for customer use. Getting in that door usually requires a magnetic card or proximity badge. Then the customer must pass a second layer of security, often involving biometric authentication, visual physical confirmation, random code entry, or some combination thereof. From that point, the customer may have to go through yet another secure door with a different set of authentication methods before he can gain entry to the datacenter floor.

Upon entering the floor, customers are often required to check in at the Network Operations Center (NOC) or security center, both of which are staffed around the clock, all year long. Datacenter employees will already have notification of the customer's entrance, and will have seen the customer on surveillance cameras every step of the way. After passing all the security checkpoints, the customer finally has access to his company's cabinet, cage, or vault that contains his equipment.

At that point, he must still provide an access key of some kind, whether a physical key, a combination, or a code, to get to his equipment. Clearly, security is taken very seriously in a world-class datacenter, and customers can rest assured that their data and equipment are safe from the outside world.

To achieve the goal of uninterrupted power, datacenters utilize large Uninterruptible Power Supplies (UPS) and multiple backup generators, as well as bringing in lines from at least two different power substations. When possible, datacenters will bring in power from two different power companies for further security.

Computers require adequate cooling, and when hundreds or thousands of computers, switches, and routers occupy the same space, cooling is even more critical. To that end, many datacenters utilize elaborate cooling systems that feed chilled water to Computer Room Air Conditioners (CRACs), which then pump cold air under the 36-inch raised flooring and through perforated floor tiles to cool the equipment. The floor tiles can be moved around easily to accommodate changing rack configurations. FORTRUST ensures the safety and continued operation of its CRAC units by mounting them on earthquake-proof shock absorbers, even though Denver is not at high risk for earthquakes.

In November of 2008, Red Rocks Data Center completed installation of an Air-Side Economizer, which draws in cool mountain air to reduce dependency on CRAC units. In addition to saving money, this reduces the datacenter's carbon footprint, a difficult task at best.

DATACENTER SERVICES

Initially, datacenters were created primarily to provide reliable Web hosting and co-location services, the so-called "space-power-access" paradigm. Over time, customer expectations have changed. More datacenters are now beginning to provide a variety of managed services, as well.

"About a year ago," says FORTRUST General Manager Rob McClary, "customers started asking for managed services, like systems monitoring and management, reporting, backup and storage, and managed security." To meet customer demand, FORTRUST has partnered with Colorado businesses to provide those services.

Several factors are driving this customer demand, including the increase in Software as a Service (SaaS) applications. [See story in the November-December issue of Rocky Mountain TechLine.] As SaaS expands beyond its current foothold in Customer Relations Management (CRM), datacenters are finding they have to increase their hardware and infrastructure capacity, as well as increase customer service staff.

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The Sarbanes-Oxley (SOX) and Health Insurance Portability and Accountability Act (HIPAA) regulations have also increased demand because they require companies to meet stringent requirements for information storage, retention, and accessibility. Often, this creates a financial and staffing burden on small and mid-sized companies. Allowing a datacenter to manage those requirements is a fast and inexpensive route to compliance when compared with expansion of a company's existing hardware and staffing, especially in a weak economy.

DATACENTERS AND THE ECONOMY

In general, the datacenter business model does well in poor economic conditions. It is a one-to-many model, in which the datacenter provides a consistent service to many different customers.

Although the cost of building and maintaining a datacenter is very high (FORTRUST has spent more than $100 million upgrading its facilities in recent years), the monthly cost to customers is still more affordable than the capital outlay required to build and staff an in-house private datacenter. Steve Prather, ViaWest's Senior Vice President of Sales Engineering and Operations, provides some hypothetical numbers.

"Depending on the situation, building a private datacenter will cost $1,200 to $1,300 per square foot," he says. "By the time you take into account the infrastructure costs, even a small datacenter can run $200,000."

Compared to a hypothetical monthly cost of $3,000 for datacenter services, says Prather, it would take several years to justify the capital costs of building a private datacenter, and that's assuming no more money is spent on the infrastructure in that time, which is unlikely.

Colorado datacenters appear to be ahead of the curve financially, when compared with datacenters in other parts of the country. According to Prather, ViaWest's same-center revenue is increasing by 50 percent annually, with approximately $100 million in total revenues in 2008. And a FORTRUST press release from December declares a 115 percent annual growth rate last year, with an 83 percent increase in the company's customer base.

By comparison, Andover, Massachusetts-based NaviSite, with numerous locations domestically and abroad, posted only a 10 percent gain in the first quarter of its 2009 fiscal year, which ended October 31, 2008. Houston-based INX saw revenues beginning to decline in the third quarter of 2008, citing worries over the economy and delayed capital expenditures by enterprise customers.

IDC, an East Coast technology research company, indicates that the datacenter industry grew by 19 percent in 2006 and will continue to grow 15 percent a year through 2011. According to the numbers posted by FORTRUST and ViaWest, the two Colorado firms beat those projections handily. The statistics confirm the growing popularity of the Front Range for datacenter location, and the industry is taking notice.

Microsoft opened a private datacenter in Boulder in 2008 to support its Virtual Earth project. In June 2008, IBM opened a new 70,000 square foot datacenter at its Boulder facility. January saw the opening of Honda America's 60,000+ square foot datacenter in Longmont, which receives power from the Platte River Power Authority at a significantly reduced rate than that charged by Xcel Energy. After a year of red tape and budget shortfalls, the National Center for Atmospheric Research received approval from the National Science Foundation to begin initial design work on a proposed supercomputer, which will be housed in a 20,000 square foot private datacenter on a 24 acre campus in Cheyenne, Wyoming. Though some of these are private datacenters, their presence validates the Rocky Mountain region as a prime location for datacenters.

PROS AND CONS

The benefits of commercial datacenters, from guaranteed uptime to lower costs, are clear. But nothing is perfect. The commercial data center concept does raise some issues.

The primary concern voiced by customers who are new to external datacenters is the limited access to their equipment. If a customer decides to co-locate equipment in a datacenter and then needs to access that equipment for configuration, repairs, or replacement, the extra time necessary to drive to the datacenter and pass through all the security checkpoints can be bothersome, to put it mildly. However, with modern remote access tools, technical services provided by the datacenters and availability of hot spares, the disadvantages can be minimized.

The change in mindset necessary to shift from in-house equipment to an external datacenter requires trust on the part of the customer. As FORTRUST's Rob McClary puts it, "The relationship is based on trust; the customer has to have confidence that the datacenter can provide the services needed and the security to protect customer data and equipment." It's up to the datacenter to meet or exceed those needs and build that trust.

Mick Garrett is CTO of I-Cubed, a satellite imagery and aerial photography company in Fort Collins. As a FORTRUST customer, he says, "A well managed datacenter gives us and our customers great peace of mind. We have some very large, high-profile customers."

Colorado Datacenters

DATACENTER CHALLENGES

Both FORTRUST's McClary and ViaWest's Prather agree that the most pressing challenge for the datacenter industry today is coping with the capacity needed to accommodate the growing number of servers.

"The challenge is keeping up with denser loads of current server technology," McClary says. "Modern datacenters need to have sufficient power and cooling capacity to grow with changes in technology."

According to Prather, "Footprint is the single largest change over the last few years. A modern rack of equipment requires 18,000 watts of power versus 3,000 watts a few years ago. A datacenter has to be able to grow in cooling and power capacity to keep up with the needs of the equipment."

Considering the trend toward packing more and more processing capability into smaller and smaller packages, accommodating bigger footprints seems counterintuitive. Advertisements about current server efficiency are ubiquitous. So wouldn't the servers of the future require less power to run?

The problem, McClary points out, is density. A modern blade server chassis with eight blades and a shared Storage Area Network (SAN) can equal or exceed the processing and storage capability of an entire rack of older servers. However, depending on configuration, that blade chassis only takes up a few units of a standard 42-unit rack, and when a customer is paying for an entire cabinet, it makes financial sense to fill that cabinet with as many servers as possible. Once a rack becomes more than half full of dense server equipment, McClary says, the amount of heat generated by the servers – and the amount of power required to run them – is greater than an entire 42U rack full of 1U servers, and the cooling capacity required for that rack increases proportionately.

Even though an eight-blade server chassis may very well be more energy efficient than eight 1U servers, when blades are densely stacked, the cooling and power costs outweigh the savings from the hardware's energy efficiency. As a result, the perception of green technology presented by manufacturers, while accurate in terms of individual systems, no longer applies in datacenters filled with those systems. The machines are efficient, but their efficiencies don't scale well.

Keeping a datacenter running efficiently is a challenge in any circumstances. A Lawrence Berkeley National Labs study a few years ago found numerous inefficiencies in California datacenters.

In some cases, the space beneath the raised floor had become so cluttered with cables and conduits that airflow was interrupted, preventing proper cooling of the computer systems. In others, vent panels in the raised floor were not placed for optimum airflow or were blocked by equipment.

Some CRAC units were inadequate for the spaces they were meant to cool, while others put out too much cooling. Some CRAC units were found to be humidifying server rooms, while others were dehumidifying the same spaces, and when the HVAC compressors were on, they only worked at one speed.

Finally, none of the datacenters evaluated made use of natural temperature stratification – the principle of hot air rising and cool air descending – to efficiently route air through the cooling system return ducts.

THE GREENING OF DATACENTERS

Datacenters, like many other large manufacturers and companies, are under pressure to increase energy efficiency and reduce their carbon footprints. Companies are addressing those concerns as new technology becomes available. All of the Rocky Mountain datacenters we interviewed are taking steps to become greener. Perhaps the most ambitious is the Red Rocks Data Center.

In addition to implementing the free cooling/ambient air system that takes advantage of naturally cool mountain air, they hope to be completely off the grid by the end of 2009, utilizing solar panels, fuel cells, and wind technology to provide all the power to their datacenter. In addition, their long-range goal is to convert all servers to DC power, which is 20 percent more

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efficient than AC power. The DC power would be fed by the alternative energy technologies.

FORTRUST already utilizes water cooling in its datacenter, increasing its temperature efficiency. In addition, it routes all power and networking cables from the ceiling down to the cabinets, rather than running them through the floor, to ensure clean airflow to the systems. In addition, FORTRUST has a -48 volt DC power plant on site to provide for the direct current needs of their customers.

ViaWest has embraced green initiatives at all of their locations. In addition to utilizing wind power, ViaWest uses a combination of efficient water-cooled chilling systems and CRAC units, free cooling/ambient air solutions, aisle management and ducted air return, thermal analysis, an aggressive recycling program, high-efficiency lighting, and server virtualization to drastically reduce energy costs at its locations.

The Honda America datacenter in Longmont claims green status, as well. It is the first Silver Certified datacenter in the United States, using the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) criteria. Among other things, Honda utilizes a highly reflective roof, dual-paned windows with low-emissivity glass, recycled construction materials, and energy-efficient light fixtures with motion sensors to achieve the Silver Certification.

IBM's new datacenter, part of the company's Project Big Green, is hailed as their greenest datacenter in the U.S. An existing building at the IBM Boulder campus was retrofitted for the project, resulting in 98 percent use of the original building shell, 65 percent recycling of the materials in the original building, and purchase of 25 percent recycled new materials. The datacenter makes extensive use of server virtualization, clean water chillers, heat exchangers, variable speed compressors, and wind power to drastically reduce the center's carbon footprint.

Finally, Microsoft's new Virtual Earth datacenter is 100 percent wind powered, using energy provided by Boulder's Renewable Choice Energy.

DATACENTER TRENDS

In 2009 and beyond, we can expect to see many of the green energy trends continuing, especially expanded use of free cooling/ambient air, energy credits, wind power, and variable speed compressors.

In addition, datacenters will likely provide more managed services, becoming Full Service Providers (FSPs) rather than simply hosting companies or Internet Service Providers (ISPs.) Making this move not only allows datacenters to diversify their income streams, it also gives them the freedom to manage rack efficiency for the servers they control. Unfortunately, datacenters rarely have control of how efficiently customers fill their co-located rack space, which makes it difficult to predict cooling needs. The more managed services a datacenter offers, the more servers it uses directly, control it has over the efficiency of those servers.

Server virtualization and datacenter load balancing are already common, but we will probably see those aspects of the datacenter business model expand, as well. Various Internet pundits predict that 2009 is the year we will see an explosion in Software as a Service (SaaS) applications and cloud computing, which will also drive virtualization.

Finally, we can expect to see more acquisitions in the datacenter market in coming years. ViaWest acquired two companies in 2006 and 2008, Fortix and Dataside, respectively. In early 2006, Symantec acquired the datacenter company Relicore. Late 2007 marked HP's acquisition of EYP Mission Critical Facilities, and early 2008 saw Novell's purchase of PlateSpin. With Rocky Mountain datacenter companies growing at a faster rate than datacenters in the rest of the country in this tough economic climate, it would be surprising if we didn't see more acquisitions by locals companies in the near future.

Jeffrey Barnes returns to Galveston after Hurricane Nicholas to find his office in ruins. The plate glass has been blown in and a stain on the cubicle walls shows how high the water rose during the flooding. The whole block still has no power and there's a possibility that his office building may be condemned, rather than repaired. Barnes is not worried, though. His employees are safe, and during the week he was gone from Galveston, his company posted its highest sales of the year because they could all continue to work. Yes, things will be rough as Galveston rebuilds, but he knows that he and his employees will be okay, thanks to a datacenter on the edge of the Rocky Mountains. ■

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