Santa Ana Water

Do-it-yourself civil engineers create clustering network

David Patton is a civil engineer for the Water Resources Division of the Public Works Agency of the City of Santa Ana. This is the utility that delivers municipal water service to more than a quarter of a million residents and businesses in Southern California.

Several years ago David and another engineer decided to wire together a few computers to share CAD files and network a pen plotter. Gradually, that system expanded into a Windows NT domain on a local area network with a few dozen NT Workstations and multiple servers running file and database services. This system connects to another trusted NT domain across a leased line that has several dozen additional computers and users. The City of Santa Ana is currently implementing additional wide area connections that will link the majority of its 1500 employees together in a totally integrated system.

Internally, the Division manages records for infrastructure locations which include scanned bi-tonal and color bitmaps with a retrieval database, field data collection forms that are brought into the office and scanned, CAD and related document files for projects that are referenced with other engineers within the Agency, and miscellaneous databases that track customer and/or our own compliance with regulatory agencies. Patton was responsible for developing a system that would accommodate future needs and keep data safe and flowing.

Effective Solution

“With the release of Windows NT Server and its software-based disk management, our goal was to provide a better method of safeguarding our file and database systems against drive failure. In many ways NT provided an effective solution”, says Patton.

“Gradually we began to realize that disk fault tolerance was not the only issue. Over the past few years what eventually started out as a CAD file management system turned into a general file and database management system that a number of people have come to rely upon to do their jobs. We needed systems that had the ability to come back on line immediately if a server failure occurred.

“The installation of server based software or upgrades were also becoming risky. On one occasion the upgrading of the operating system caused the failure of our network adapters. On many other occasions we would lose disk drives in the array after shutting the system down to replace another component in the server. Powering down the server turned into a nerve-wrecking experience.”

Today Santa Ana employs a modular system that has reduced their potential for down time from several days to less than one minute.

Configuration
The basis for their current server implementation comes from Microsoft’s Windows NT Server Enterprise Edition, most importantly the Cluster Server (MSCS) component.

Hardware consists of what are essentially two off-the-shelf, rack mounted, dual processor Pentium Pro PC’s, another rack cabinet housing dual Mylex DAC960SXI SCSI to SCSI RAID controllers, and a few disk array cabinets that hold nothing but 4 Gb disk drives in removable sliders. All components came from different suppliers. All cases are mounted in an APC Netshelter cabinet.

As required with MSCS, both rack mounted PC’s must share the same SCSI bus. So an external SCSI cable exits the back of each host controller in each PC and connects in a single loop to the cabinet that contains the array controllers.

Since the servers do not contain the array subsystem, the only consideration given to them was their capacity to run Windows NT. Santa Ana chose host SCSI controllers, network and video adapters accordingly. They also wanted systems that would hold up to 512Mb of RAM (as recommended by Microsoft) but were still be reasonably priced.

**Mylex RAID Controllers**

“The selection of the Mylex external RAID controllers was based on several considerations,” says Patton. “I became aware of Mylex several years ago while reviewing trade magazine articles that benchmarked desktop PC performance. The systems that incorporated Mylex EISA SCSI controllers were several times faster than those without.

“Since then I’ve noticed that Intergraph and other companies are using Mylex RAID controllers in their server lines. What ultimately convinced us to go with Mylex was the quality of the pre-sales technical support. The assistance of their engineers was so good that it resulted in what turned out to be the basis of our total system design. Repeated contacts with a larger competitor that recently released an external RAID controller turned out to be non-productive.

“In addition, these units have been tested for what’s called a dual active configuration. This means that two identically configured controllers can be run in a tandem mode that gives greater performance. If either one fails, the other takes over automatically. Also these units allow for serious drive expandability. Since each unit has one host and five disk channels that can each run fourteen drives, that gives us a gross capacity of 224Gb using 4Gb disk drives.”

But even if external controllers were not required for MSCS, Santa Ana would probably have used them anyway. This is because the controllers themselves are much more tolerant of operating system upgrades than are PCI RAID controllers. “You don’t load drivers for an external SCSI controller during an NT upgrade,” says Patton.

**Downtime Eliminated**
Everything is now redundant, from the servers to the array controllers to the power supplies within the enclosures. The failure of any single component appears to a user as an interruption of approximately one minute. If they were not actively writing data to a server at the time, they would not notice anything at all. Not only is the system resistant to unexpected failure, it is designed to allow us to upgrade or replace units without interruption. There is no more scheduling of server down time or logging users off to reboot a server.

Since the system is modular, components can be replaced on a case by case basis. For instance, if Patton wants to replace the servers with newer, faster units, he only replaces the PC’s and continues to utilize the arrays. This makes upgrading incremental and drives down the cost, making the system more economically and politically feasible.

**Ease of Use**

“Many people, including those working for related manufacturers have acted surprised when they found out that we were not system integrators but end users,” says Patton. What was surprising to us was how easy it was to get the system up and running. We made sure that we observed all the rules about cable length and other related issues as prescribed within the Mylex documentation. We also tested all of the failure modes that we could think of before going with live data. In addition, Microsoft spells out in detail about the limitations with MSCS regarding the addition of drives or modifications to the system. But even though this is MSCS version 1.0, we are impressed with its stability.”

Since this implementation went so smoothly, Patton’s group is working with their Engineering Division to construct a similar system.

**Cost Efficiency**

“The previous manager that approved the budget for this current system used to come to me and ask how much money we would need in the coming fiscal year computer budget. I always used to tell him that it would be as much as we could get, considering that whatever it was it would never be enough. The philosophy that we have adopted is to get as much as we could with every dollar spent.

“The current system that we have in place would have had a price tag in the six figure range if we had purchased an integrated system. The current system has cost half of that. But the purchase of such a system would not have been possible without the trust of management in our abilities and the cooperation of our purchasing department that spent many extra hours chasing down prices and cutting purchase orders on individual components. Those are two major factors that have helped to make the implementation of this system gratifying.”

Summing up, Patton says, “Actually the best thing about this new system is that for the first time in several years I actually can afford to relax a little.”