

SunGuideSM Server Alternatives

Purpose:

Southwest Research Institute (SwRI) was asked to look at different alternatives to provide a high availability environment for the SunGuideSM software. There is no one solution that is applicable to deployments, each deployment will need to consider the costs of the alternatives and balance this with the required operational readiness of their center. SwRI will be happy to discuss this with deployments as the deployment plan is developed.

High-Level Concept:

As SwRI explored different options, a key consideration was to identify options that would not require any custom software to be developed; the motivation for this consideration is that a number of commercially available hardware and software solutions exist to provide the capability and SwRI recommends that the FDOT select one of these options rather than developing custom software.

The SunGuideSM application software operates as a collection of applications that can be distributed over a variety of computers. The applications use peer-to-peer communications technology so it is important to remember that the configuration of the SunGuideSM software requires that host name information be provided so that applications know to which peer they are to communicate. As servers come off-line or come on-line, the peer relationship between the applications must be maintained (i.e. the software must remain configured with valid hostnames to assume proper software operation).

The specific decision on how to configure servers will need to be made on a case-by-case basis as deployments evaluate their “up time” requirements and balance this against budget and staff skills that can support the implementation. Additionally, the number of servers will widely vary by deployment. SunGuideSM will operate on a single server but as SwRI has developed a *Computer Sizing Estimates* document that recommends the number of servers that should be used; multiple servers may be required based on how many devices will be accessed by the software. The following are some of the solutions that could be used (these solutions are discussed at a high level):

- Simple server approach: today’s PC based servers have high reliability and most vendors will claim very high mean time between failure (MTBF) numbers – typically in the range of 12 to 36 months. After initial loading and configuration, SwRI would recommend that a “disk image” be taken so that if the hardware fails the system could be rebuilt using the system image. As an example, a Hewlett Packard rack mounted server (3.6 GHz CPU, 2 GBs RAM, 36 GB disk, Ethernet) has a retail price of approximately \$3,200.
 - Pros:
 - Cost effective solution.
 - Simple to implement (no specialized training required).
 - No specialized hardware or software training needed for systems administrator.

- Cons:
 - After a hardware failure, the system would need to be reloaded (preferably from a disk image).
 - Downtime would be hard to predict but it would typically take several hours to rebuild a system.
 - If the configuration of the operational system changes the system administrator would need to make sure the disk images are also updated.
- Cold Spare: in a cold spare concept the system administrator first configures a simple server; once the server is configured to operate the SunGuideSM software the hard disk image is recreated on another computer (this computer is then turned off). If the first computer fails then the first computer is taken off-line and the second computer started and it takes over the “identify” of the first computer. No specialized hardware or software is required and the server costs would be twice that of a simple server approach. As an alternative, SwRI would recommend a minor deviation from a one-to-one spare approach and possibly procure a single spare computer with multiple disks (one for each of the operational) with each of the disks containing an image of one of the operational servers).
 - Pros:
 - Simple to implement (not specialized training required).
 - Downtime would be minimized to the amount of time it takes to boot a server and start the SunGuideSM applications (should be measured in the terms of several minutes).
 - Cons:
 - Server hardware will be sitting around un-used – given the typical failure times for servers this could be fairly wasteful of resources.
 - If the configuration of the operational system changes the system administrator would need to make sure the cold spares are also updated.
- High availability hardware: solutions for high availability hardware have been available for many years. High availability hardware incorporates redundant CPUs, RAM, network interfaces and hard disks into a single chassis, the firmware of the device can automatically failover when devices fail. Vendors will provide software to alert the system administrator that failures have occurred and once a device fails the system may be at “risk” until replacements are acquired for the failed component (replacement components are typically “hot pluggable” which implies they can be replaced while system operation continues). As an example, a Hewlett Packard rack mounted server (3.6 GHz CPU, 6 GBs RAM, RAID controller, 72 GB disk, Ethernet) with redundant components has a retail price of approximately \$10,000.
 - Pros:
 - One the hardware is initially configured (typically done by the manufacturer) little or no maintenance is required.
 - Failures are typically easy to detect and repair (repair is typically done by ejecting and inserting a new hardware component).
 - Cons:
 - The cost of the hardware can exceed the cost of a simple server by a factor of two to five times depending on options and vendor selected.

- Some high availability hardware does not operate as discussed in the marketing literature – FDOT should carefully evaluate any product before deploying in the field.
 - Solutions will widely vary by vendor (i.e. little consistency within the industry)
- Microsoft Server 2003 Clustering (software solution): Note: SwRI is not well versed in the application of this product. The Server 2003 Clustering software allows system administrators to utilize the Windows Clustering software to control the placement, management and restarting of applications. The Clustering software allows system administrators to identify mission critical applications and specify how they should be migrated around a cluster when hardware failures occur. The Clustering software can automatically have machines assume IP addresses so that when processes are restarted on other machines their restart will be mostly transparent to the operators (re-connection messages would appear on the GUI but functionality should continue without interruption).
 - Pros:
 - Provides a very flexible software “control” environment that could be used in place of the SunGuideSM Executive Handler software.
 - Provides a software solution as an alternative to the high availability solution.
 - If properly managed and configured this is probably the most robust solution available.
 - Cons:
 - Requires highly trained staff that is well trained in the software (note that multiple staff members should be available to cover vacation and sick days of the primary staff).
 - The SunGuideSM Executive Handler could not be used to view the overall system status.
 - The cost of the Clustering software.

Recommendations:

SwRI wishes to note that even a sophisticated hardware solution will need period maintenance. SwRI recommends that any Microsoft Operating System based solution should be rebooted on a periodic basis. SwRI has observed that after several weeks of continuous operation, the performance of many Microsoft Operating System based servers will experience performance slowdowns (due to fragmented memory or extensive paging to the system disk). In an effort to minimize the effect on the SunGuideSM software, SwRI recommends that all SunGuideSM servers be rebooted weekly.

SwRI would recommend that the most cost effective, least labor intensive solutions would be either the cold spare or high availability hardware solutions. If Districts have trained staff and the budget to maintain complex commercial software, the Microsoft Software Clustering option should be considered.