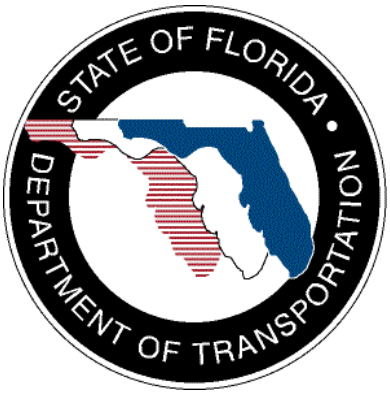
SunGuide™:

Computer Sizing Estimates

SunGuide-CSE-3.0.0



Prepared for:

Florida Department of Transportation
Traffic Engineering and Operations Office
605 Suwannee Street, M.S. 90
Tallahassee, Florida 32399-0450
(850) 410-5600

October 20, 2008

Document Control Panel			
File Name:	SunGuide-CSE-3.0.0		
File Location:	SunGuide CM Repository		
CDRL:	n/a		
Name		**Initial**	**Date**
Created By:	Steve Dellenback, SwRI	SWD	2/04/04
Reviewed By:	Stephen E. Novosad	SEN	2/04/04
	Stephen E. Novosad	SEN	9/7/04
	Stephen E. Novosad	SEN	3/31/05
	Steve Dellenback, SwRI	SWD	12/28/06
	Steve Dellenback, SwRI	SWD	10/20/08
Modified By:	Steve Dellenback, SwRI	SWD	9/6/04
	Steve Dellenback, SwRI	SWD	11/8/04
	Steve Dellenback, SwRI	SWD	3/31/05
	Steve Dellenback, SwRI	SWD	6/02/05
	Steve Dellenback, SwRI	SWD	11/15/05
	Robert Heller, SwRI	RWH	11/18/05
	Steve Dellenback, SwRI	SWD	12/28/06
	Robert Heller, SwRI	RWH	2/26/08
Completed By:			

List of Acronyms

CCTV.....Closed Circuit Television
DMS.....Dynamic Message Sign
FDOT.....Florida Department of Transportation
ITS.....Intelligent Transportation Systems
TCP/IP.....Transmission Control Protocol/Internet Protocol
TSS.....Traffic Sensor Subsystem
TXDOT.....Texas Department of Transportation

Revision History

Revision	Date	Changes
1.0.0	February 4, 2004	Initial Release.
1.1.0	September 6, 2004	Updated based on laboratory testing experience
1.1.1	November 8. 2004	Added dual monitor recommendation
1.2.0	March 31, 2005	Added basis for recommendations section
1.2.1	June 2, 2005	Added Incident Management to the sizing table
2.0.0	November 18, 2005	Updated based on deployment experience
2.1.0	December 28, 2006	Updated with information about “standalone” configurations
3.0.0	October 20, 2008	Updated to include sizing for ODS tables.

SunGuide™ Computer Sizing Estimates

The FDOT SunGuide system that is under development is a highly modular, highly scalable software architecture. The computers necessary to run the environment vary widely based on the number of projected users and Intelligent Transportation Systems (ITS) field devices that are to be interfaced. The following information can be used in the planning process for what type of workstations and servers should be procured to support a SunGuide deployment.

The SunGuide software consists of a large number of processes (software applications) that interact in a cooperative environment to provide the SunGuide environment. It is quite possible to run the SunGuide software on a single laptop computer, but this configuration would not support many ITS devices (this is discussed in the Laptop Configuration section below). The number of computers required to support the SunGuide will vary widely based on the deployment environment (the most significant factor is the number of ITS devices).

Server Configuration

A general configuration of the computers recommended by the SunGuide development team is presented below (all computers must be networked and Transmission Control Protocol/Internet Protocol (TCP/IP) must be supported between all computers):

- Workstations:
  - Microsoft Windows XP, Service Pack 3
  - Microsoft Internet Explorer 7.0 or greater
  - SVG Viewer 3.0 or greater
  - > 3.0 GHz processor
  - 2 GB RAM
  - 20 GB disk (this is for the operating system and other non-SunGuide applications, SunGuide requires no disk space on a workstation)
  - Dual display monitors
- SunGuide Database Server (these requirements will vary widely based on how much data the SunGuide implementation chooses to log and the backup policies implemented by the SunGuide implementation computer staff):
  - Microsoft Standard Server 2003
  - Oracle 10g Server and Client
  - > 2.4 GHz processor
  - > 2 GB RAM (the more RAM the better Oracle will execute)
  - 200 GB of disk using RAID architecture (This space estimate is based on keeping 90 days of TSS data, 3 years of TSS rollup data and 3 years of TVT data on line. This disk space will vary based on the amount of historical information logged to the database)
- SunGuide Application Servers (SunGuide processes):
  - Microsoft Standard Server 2003
  - Oracle 10g Client
  - SunGuide Executive Handler Service
  - > 2.4 GHz processor
  - 2 GB RAM

- 36 GB of disk

Note that dual processor servers could be used to reduce the number of application servers that would need to be deployed. The SunGuide software is being developed using techniques that should allow the full capability of a dual processor server to be utilized. However, one dual processor machine cannot simply replace two single processor machines because other issues such as memory requirements and I/O bandwidth (i.e., network connectivity) need to be carefully evaluated. Once the SunGuide software is in a final integration mode, the appropriateness of utilizing dual processor servers can be evaluated.

A diagram of a typical hardware configuration is included as Attachment 1 of this document. For typical center installations, each SunGuide implementation would need the following:

- Workstations: one for each user console.
- Database Servers: one for the local SunGuide implementation. Clustering technology or high availability technology can be used, but the SunGuide software should be transparent to these hardware architectures.
- Application Servers: the number of these required varies based on the number of SunGuide subsystems deployed and how many ITS devices each of those subsystems is required to support.

A formula approach has been developed to aid in determining how many SunGuide application servers would be required. The formula attempts to capture the projected load that each subsystem would add to the implementation in order to determine the overall server requirements. It is possible to mix and match the SunGuide applications (on the same server). Attachment 2 of this document provides a technique to roughly size how many servers would be necessary.

Laptop Configuration

To implement a "Portable Transportation Management Center" (PTMC) as defined in the SunGuide Software Users Manual, using laptops can be problematic depending on the speed/performance of the laptop(s) being used. The SunGuide software itself is implemented to allow it to execute on a single laptop. However, the use of Oracle as the database requires a significant computing platform and testing has demonstrated that the use of Oracle and SunGuide on the same laptop does not perform well (it is recommended that two laptops be used for a PTMC; one for Oracle and the other for the SunGuide applications). As a result of this testing, the following configuration is recommended if SunGuide is to be used as a PTMC (note that dual processor laptop will provide improved performance but does not alter the basic specifications below):

- SunGuide Database Server laptop:
  - Microsoft Standard Server 2003
  - Oracle 10g Server and Client
  - > 2.0 GHz processor
  - > 1 GB RAM (the more RAM the better Oracle will execute)
  - > 40 GB of disk
- SunGuide Application Server laptop:
  - Microsoft Standard Server 2003
  - Oracle 10g Client

    - > 2.0 GHz processor
    - 1 GB RAM
    - 40 GB of disk
- SunGuide demonstration laptop (optional – this computer is used to demonstrate the GUI):
    - Microsoft Windows XP, Service Pack 3
    - Microsoft Internet Explorer 7.0 or greater
    - SVG Viewer 3.0 or greater
    - > 1.8 GHz processor
    - 1 GB RAM
    - 20 GB of disk

When running a PTMC, a network device capable of connecting the laptops is required. If field devices are to be accessed, the field devices need to be accessible to the network device utilized to connect the laptops. For demonstration purposes, the use of a "demonstration laptop" (or workstation if connected to the network) is optional as the application server can be used for the demonstration – the use of a third laptop is left to the discretion of the PTMC operator.

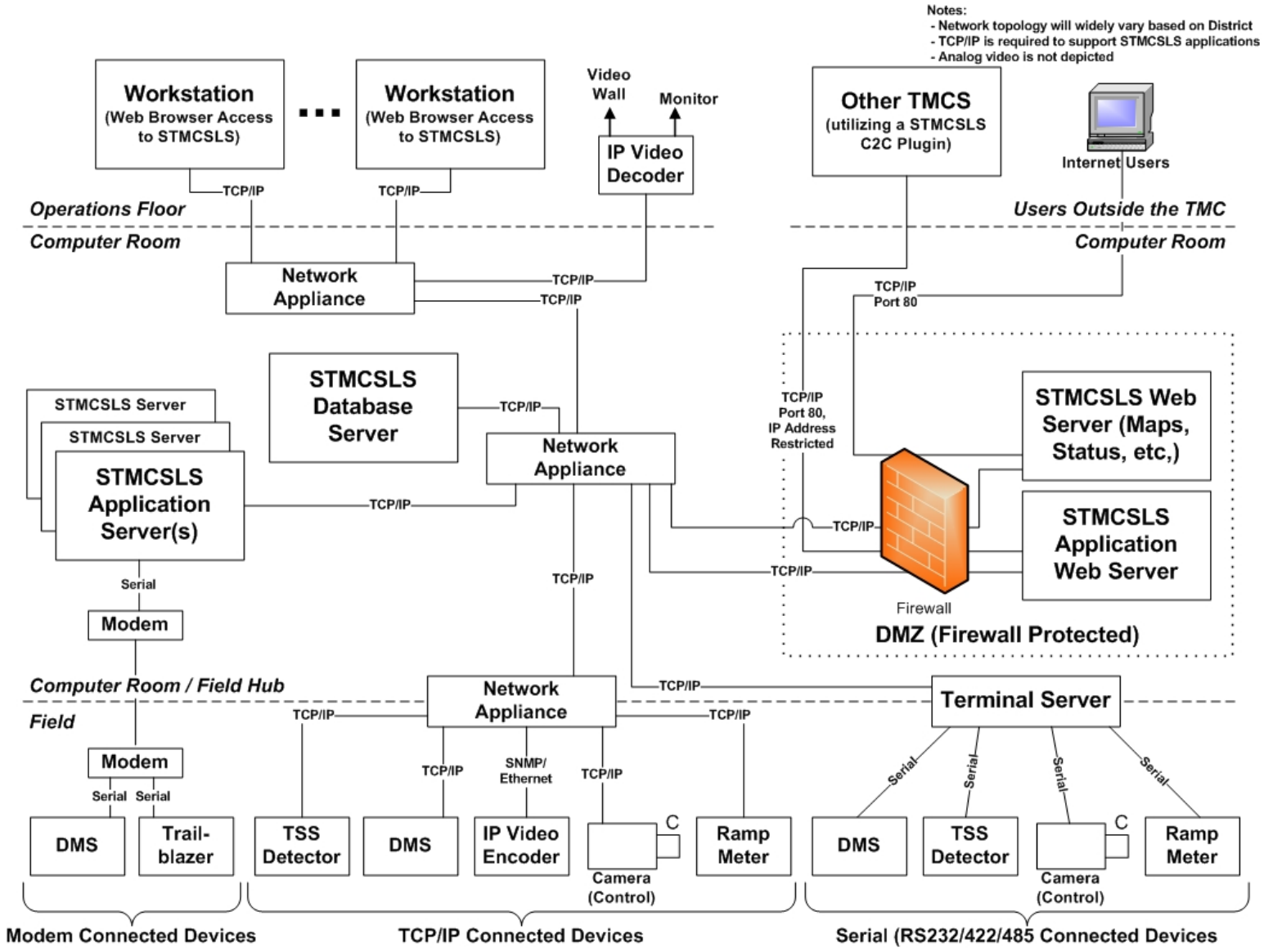
Notes

The following comments are important to consider when utilizing this document:

- The information in this document should be considered preliminary because each SunGuide deployment has a different set of operational needs which implies that one document cannot capture all of the configuration options for all deployments. One of the most critical steps in the deployment process is for a extensive site visit to be performed which result in the development of an "Implementation Plan" which describes the site specific deployment and configuration
- The final system configuration and process distribution will not be completed until the site visit that occurs prior to deployment is conducted. During this visit, issues such as how often the deployment plans to poll the ITS devices needs to be evaluated; very short poll cycles might require additional application server hardware.
- Many implementations have learned that the communications bandwidth allocated to their public Web server may not be sufficient during significant transportation events. While the size of this communication path does not directly affect the SunGuide software, the overall capabilities of the Web server need to be evaluated to make sure a combination of the hardware and software can support the worst case expectations of user access.

Attachment 1 - SunGuide Generic Deployment Concept

Note: Drawing provides conceptual framework – specific implementations will vary



Attachment 2
SunGuide Software Sizing Table

To use the table, determine what subsystems a deployment plans to use and for each of those subsystems determine the number of ITS devices that will be deployed. Add up the "pieces" of the number of servers required and round up to the next whole number to determine the approximate number of servers required.

SunGuide Subsystem	Number of Servers Required
Status Logger	0.1
Data Bus	
Base system up to 500 ITS devices	0.5
Over 500 devices	0.5
User Interface	
For every 10 users simultaneously logged in	0.5
DMS (DMS signs and trailblazers are counted the same)	
Base subsystem	0.3
Message Arbitration Subsystem (MAS)	0.2
For every 100 TCP/IP connected signs	0.5
For every 50 dialup signs (assumes 5 modems)	0.5
CCTV Control	
Base subsystem	0.25
For every 10 users simultaneously controlling cameras	0.25
For every 10 MCPs	0.25
Video Switching	
Base subsystem	0.5
For every 10 users simultaneously switching video	0.1
Video Wall	
Base subsystem	0.25
For each Barco/Argus Controller	0.1
TSS	
Base subsystem	0.50
For every 100 detectors (recommend each corridor on a separate machine to allow for growth)	0.5
Incident Management	
Base subsystem for up to 20 concurrent incidents	0.25
For each 20 concurrent incidents over the base amount	0.25
Ramp Metering	
Base subsystem	0.50
For every 20 ramps	0.25
RWIS	
Base subsystem	0.25
For every 50 TCP/IP connected sensors	0.25

HAR	
Base subsystem	0.25
For every 50 HARs	0.1
Safety Barrier	
Base subsystem	0.1
Every 20 PLCs	0.5
Inventory and Maintenance	
Base subsystem	0.25
Travel Time	
Base subsystem	0.25
Archive	
Base subsystem	0.5
Web Servers (should be protected with a firewall)	
General Web server	1.0
Center-to-Center interface server	0.5
Emergency Evacuation	0.5
Maintenance Management Systems	0.5

The reader is cautioned that the table presented is simply an approach to approximate server needs; when the site specific implementation plan is being developed for a specific deployment, the server data needs to be carefully evaluated with expected operations to determine optimal server sizing.

Some of the software being developed (enhanced) is based on software being used by the Texas Department of Transportation (TxDOT); they have been operationally using the software so this experience forms a basis for the above estimates. The following was used as a basis for the recommendations:

- Status Logger (this subsystem is mostly TxDOT code): CPU observation at a number of TxDOT implementations suggests that 10% CPU utilization will occur when Status Logger is being heavily utilized.
- Data Bus (software concept derived from TxDOT TransGuide): The performance of Data Bus is directly proportional to the number of devices that require status information to be exchanged. The size is based on 10 years of the TxDOT TransGuide "Data Server".
- User Interface: this application utilizes Microsoft Web Services and the TxDOT Web application for Center-to-Center was evaluated to determine expected size.
- DMS (this subsystem is mostly TxDOT code): TxDOT uses the DMS subsystem at Houston TranStar and they utilize a single DMS server (to its full capability) to control approximately 100 direct connect DMS devices. TxDOT in Amarillo uses the DMS subsystem to control approximately 10 dial-up signs, is it estimated that the single server system could support up to 50 signs.
- CCTV Control (software concept derived from TxDOT TransGuide): CCTV performance is minimally impacted by the number of cameras, the performance impact is the number of users trying to move cameras. The estimate is based on the CCTV subsystem that is deployed in TxDOT TransVISION (Ft. Worth), TranStar and TransGuide.

- Video Switching: the video switching subsystem must support snapshots as well as video tours, requests for video switching should be relatively few each minute so the sizing estimate was based on the expected time required to run tours and capture snapshots.
- Video Wall: the estimate was based on the expectation that the subsystem will provide periodic polling of XML messages to the Video Wall – this is envisioned to be a very low bandwidth application.
- TSS (software concept derived from TxDOT TransGuide): The TxDOT TransGuide system uses a server to communicate with every 300 to 400 loop (or acoustic) detectors being monitored.
- Incident Management: Load testing was performed on a test server and the CPU impact of handling of concurrent incidents was evaluated.
- Ramp Metering: no comparable deployed system was available to base this data on, the core subsystem will be executing data reduction algorithms that will require additional computation as the number of ramp meter stations is increased.
- RWIS: no comparable deployed system was available to base this data on, the estimates were based on observations from polling DMS devices (i.e. very similar to DMS) with the exception that the RWIS is a one-way information flow.
- HAR: The HAR devices to be supported have a very simple interface in that files are placed on a server for processing.
- Archive: due to the number of new components for SunGuide no comparable deployed system was available to estimate – the number provided is based on data archiving operations that have been observed at other centers – if FDOT decides to Archive very detailed information this size requirement will escalate.
- Web Server: a variety of DOT traffic web sites that SwRI is familiar with dedicate a server to the traffic web site. Other web sites to be developed should be less data intensive and can therefore be smaller.