SONY

Digital Cinema Remote Monitoring White Paper

2/27/09

Overview

To better meet the obligations of digital cinema support contracts, remote monitoring of customer projection systems is vital.

Remote monitoring enables Sony Professional Services (SPS) to maintain near real-time awareness of the health of installed systems without having to be persistently connected to customers' networks. Issues are immediately forwarded from the field to the centralized information system and then e-mailed and/or paged to on-call engineers.

Engineers can review past issues and current and historic operating conditions via the centralized information system to do preliminary analysis without having to remotely access customer systems.

Maintenance schedules for all customers and sites can also be centrally defined resulting in consistent ticket generation for regularly scheduled tasks.

Reports of maintenance required can be automatically forwarded to appropriate Sony support personnel while reports of maintenance completed and other contractually obligated information can be automatically issued to customer representatives.

Objectives

The remote monitoring system should:

- Be able to monitor a variety of equipment types and versions.
- Be easily configurable for a variety of installations and customer requirements.
- Avoid pre-installation of software on the target systems (i.e. no SMS agent).
- Be remotely supportable with minimal effort (i.e. automatic upgrades).
- Be customizable to present intuitive information matching end-user needs.
- Be scalable with the ability to consolidate information from multiple sites.
- Notify support personnel of significant events with minimal delay while avoiding excessive or redundant notifications.
- Enable support personnel to record work performed.
- Maintain a history of events and work performed for issue analysis.
- Provide access to current and historic system parameter values to support trend analysis.
- Integrate with the existing SPS application infrastructure.

Architecture

The SPS digital cinema remote monitoring solution builds upon the success of Sony Device Monitor (DM) and the SPS NOC Information System (NIS) while adding monitoring capabilities specific to digital cinema systems via the new SMS Monitor agent.

The hierarchical relationship between the applications that make up the monitoring system is illustrated below.

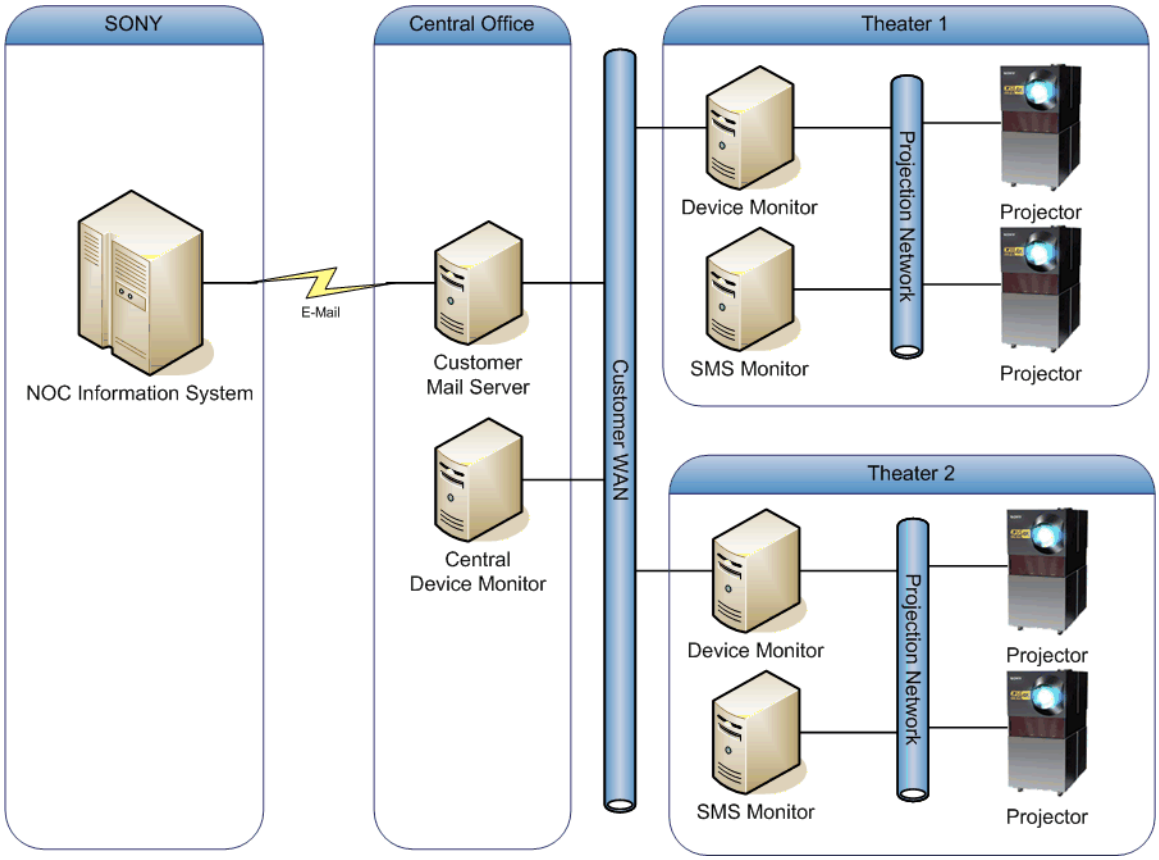

Figure 1 Remote Monitoring Architecture

The in-theater SMS Monitor collects projector information and forwards it to the in-theater Device Monitor (usually hosted on the same server). The central office Device Monitor consolidates information from each in-theater Device Monitor and provides the customer a corporate-wide view of all available information.

Each in-theater Device Monitor e-mails hourly system summary reports and immediate exception notifications to the NOC Information System via a customer's mail server. This eliminates the central Device Monitor as a single point of failure.

The NOC Information System consolidates all customer data, generates tickets and notifies Sony support personnel via e-mail and pager. Support personnel actions are logged within NIS. NIS e-mails reports both internally and to customer representatives.

SMS Monitor

Sony SMS Monitor collects operating information regarding each component within a projector via the SMS. This information is consolidated and forwarded to the Device Monitor server. The frequency at which each projector is polled and information is forwarded is configurable from once every five seconds up to once every five minutes.

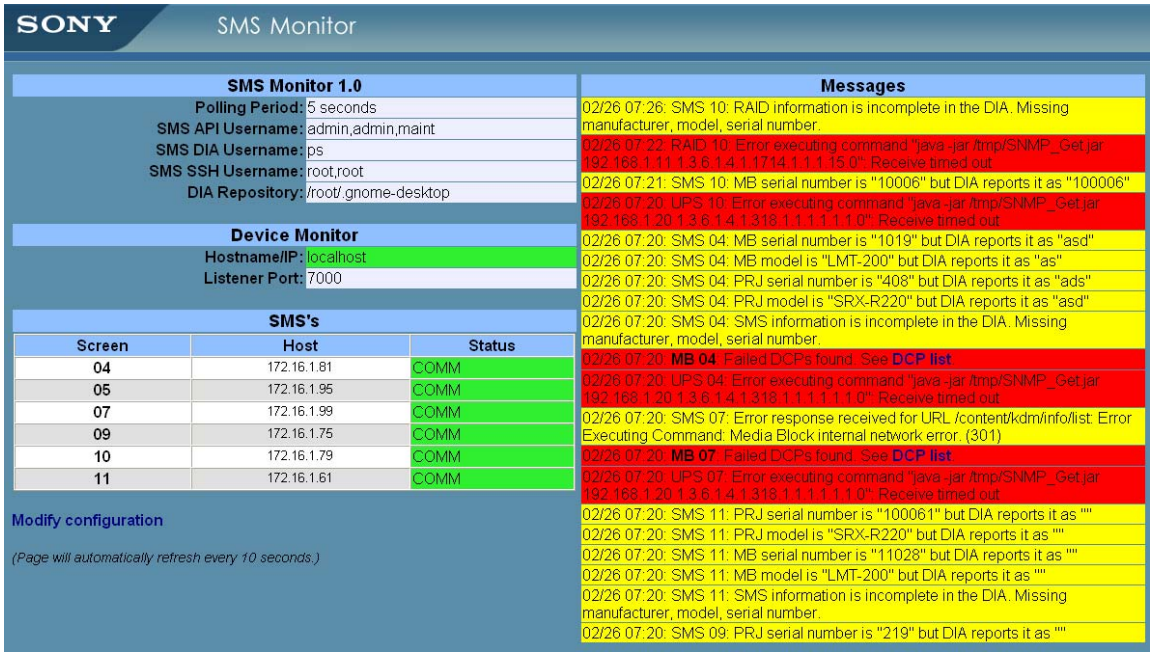

Figure 2 SMS Monitor Home Page

The SMS Monitor utilizes the built-in SMS API to retrieve operating information and show and importation status. It also generates a DCP and a KDM document that highlights incomplete DCPs and expired KDMs. A link to these documents is included in any exception messages generated.

In addition to the SMS API, the SMS Monitor also utilizes the SMS-hosted Device Inventory Application (DIA) to retrieve model, manufacturer and serial number information for the projection system components (i.e. SMS, MB, Projector, UPS). In those cases where this information is available via the SMS API, SMS Monitor verifies that the information agrees and issues warning messages if it doesn't. Any other information missing is also annunciated via warning messages.

Lastly, the SMS Monitor uses secure shell (SSH) sessions to the SMS to retrieve SMS operating information not available via the SMS API (i.e. CPU, memory and disk utilization, Network Time Protocol offset, etc…) and to query internal components via other means such as SNMP.

SMS Monitor does not perform any range checks of the operating parameters as this is left to Device Monitor to handle via thresholds. However, it will check for invalid DCPs and expiring KDMs and will issue messages accordingly.

All uncleared exceptions transmitted by SMS Monitor to Device Monitor are retained internally (unless restarted). Should the exception be resolved (i.e. over-temperature corrected), SMS Monitor will re-transmit the original message with a cleared status enabling Device Monitor to automatically clear its corresponding message.

Information collected and forwarded includes:

- Component model, manufacturer and serial number
- Firmware and software versions
- Current state (on, off, importing, etc…)
- Reading values such as lamp power, lamp hours, storage utilization, disk utilization, CPU utilization, memory utilization, network time protocol offset, hard drive read and write times, number of open network connections
- DCP list and notification of unsuccessfully ingested material
- KDM list and notification of expiring keys
- Exceptions such as failures with power supplies, fans, disks, temperature, enclosure security, real-time clock battery, audio, video, subtitles, fingerprints

Sony Device Monitor

Sony Device Monitor receives the information transmitted by the SMS Monitor over a network connection and retains it in an internal database. With its hierarchical capability, a central Device Monitor can consolidate information from all in-theater Device Monitors thereby providing customers with a corporate-wide view of their in-theater systems.

In addition to any exception messages received, Device Monitor uses thresholds to gauge system health (i.e. DCP storage utilization > 95%). All applicable thresholds are displayed in each machine's details page.

Maintenance performed by field engineers can be logged within Device Monitor. These become part of the machine's permanent history.

All machine information, including maintenance performed, is transmitted back to the SPS NOC Information System hourly via e-mail. Exception messages are transmitted when they occur. Each in-theater Device Monitor independently sends reports thus eliminating the central Device Monitor as a single point of failure.

Device Monitor is capable of presenting information in a variety of formats including graphical views and customizable views.

Screen Summary View

One example of a custom view is the screen summary (nine screens per page) below.

Figure 3 Screen Summary View

Each screen is displayed in an individual cell as illustrated below.

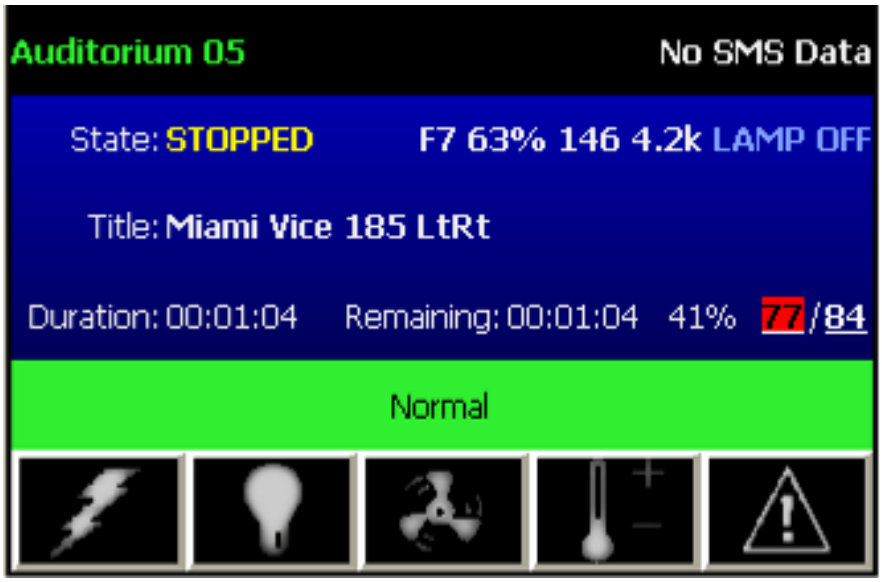

Figure 4 Screen Cell

A screen cell presents the following information.

- The auditorium name Auditorium 05
  The color is indicative of the health of the projection system.
- SMS IP address (or "No SMS Data" if unknown) No SMS Data
- Media block (show) status State: STOPPED
- Projector preset function F7
- Lamp power setting 63%
- Lamp hours 146
- Lamp maximum wattage 4.2k
- Projector status LAMP OFF
- Show title or currently transferring title Title: Miami Vice 185 LtRt
  If a test pattern is on, its name will be displayed with a yellow background (i.e. Title: Test Pattern Green-1)
- Show duration Duration: 00:01:04
- Show time remaining Remaining: 00:01:04
- DCP storage utilization 41%
  Color will change if thresholds exceeded.
- DCP count 77
  A red color indicates failed DCPs. Clicking on this value will display the list of DCPs in the media block.
- CPL count 84
  Clicking on this value will display the list of KDMs in the media block.

- Most severe exception Failed to mount /mnt/usb/dcp
  If no exceptions exist, then Offline will be displayed if any components are off-line. Otherwise, Normal will be displayed.
- Power, lamp, fan, temperature and alert status

  If any exception exist, the appropriate icon will be illuminated with a background color corresponding to the most severe message. Clicking on an illuminated icon will display the machine details page of the system that logged the message.

During DCP importations, the show duration and remaining time, DCP storage utilization, DCP count and CPL count information are replaced with a transfer progress bar.

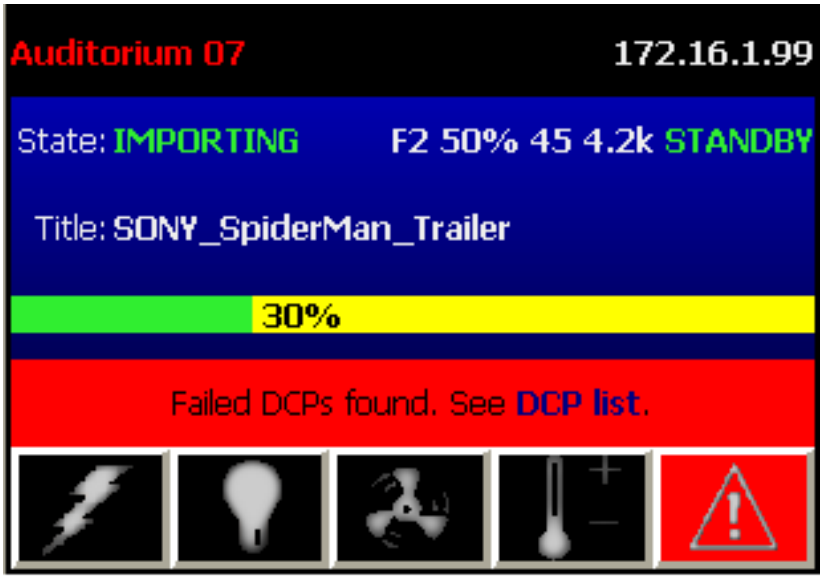

Figure 5 Screen Cell during DCP Importations

Guest Services Summary View

A second example of a custom view is the Guest Services view.

House	SPL Title	Status	Time Remaining
04		COMPLETED	--:--:--
05	Miami Vice 185 LtRt	STOPPED	00:01:04
06		NO COMM	
07	Encrypt	IMPORTING	100%
09		COMPLETED	--:--:--
10		COMPLETED	--:--:--
11		NONE	--:--:--

Figure 6 Guest Services View

Each screen is displayed as a single row in the view. The screen (house) number, currently playing (or importing) title (or test pattern name), the show status and time remaining (or transfer progress) are listed.

If an unclear message exists for any component within a screen's projection system, the row color will reflect the severity of the message and the screen number can be clicked on to display the machine details page of the system that logged the message.

Consolidated View

The central Device Monitor presents a consolidated view of all of the in-theater systems. Each site's information can be viewed without having to remotely access its Device Monitor server. This enables customers to create an operation center in which their entire organization can be monitored.

Centralizing the available information also enables customers to define their own operating thresholds and responses to exceptions. Error messages cleared on the central Device Monitor will clear the message on the in-theater Device Monitor and vice-versa.

A top-level view can be created using any image file background with each theater overlaid on the image appropriately. Below is an example of a geographical map of the United States (and some of Canada and Mexico) on which are placed links to individual theater views.

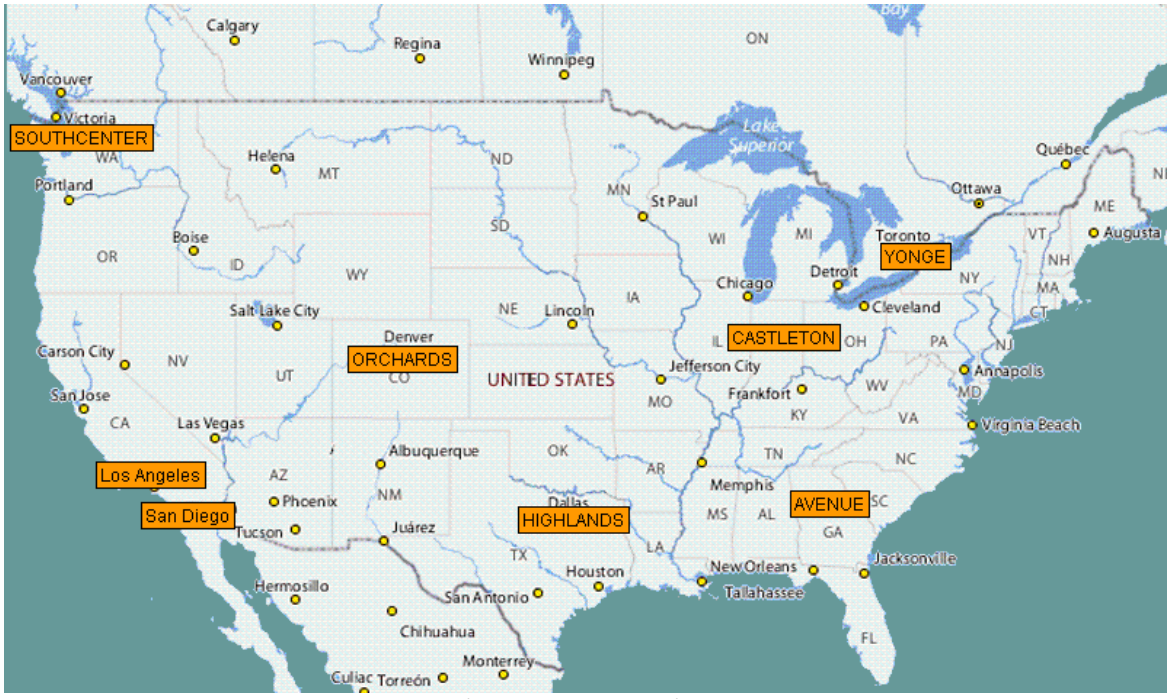

Figure 7 Country View

Where multiple sites exist in close proximity, a link to a view of a smaller geographical region can be included. In the example above, clicking on Los Angeles will display the Los Angeles city view below.

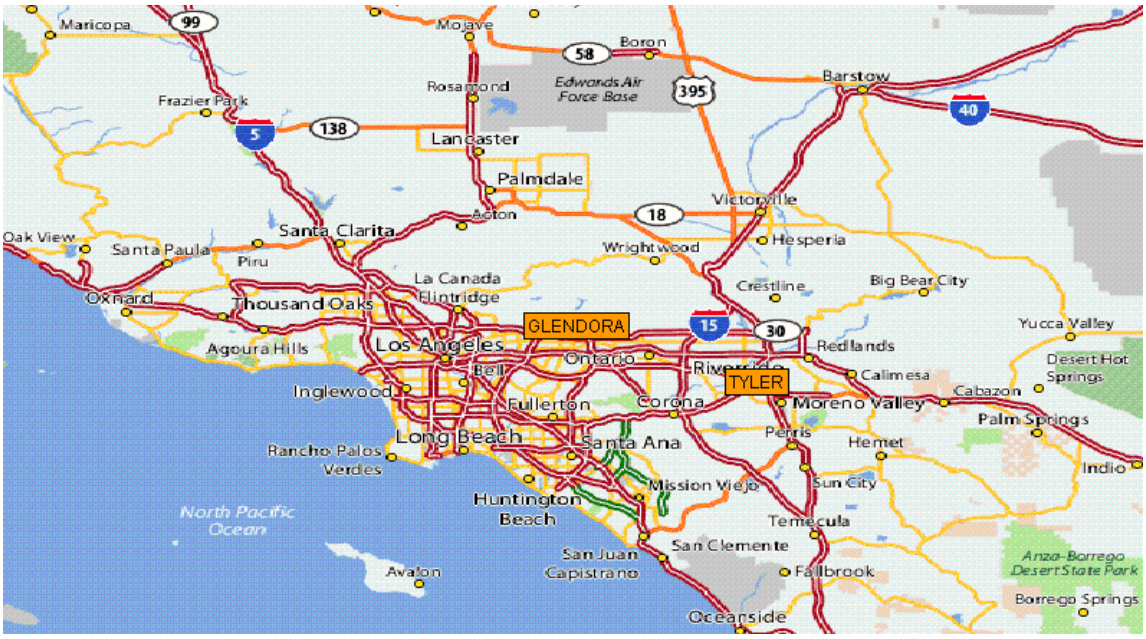

Figure 8 City View

Again, links to each theater are placed in the appropriate locations on the map. Clicking on any one of the theater names (i.e. GLENDORA) will display the theater view. This view is automatically maintained by the central Device Monitor.

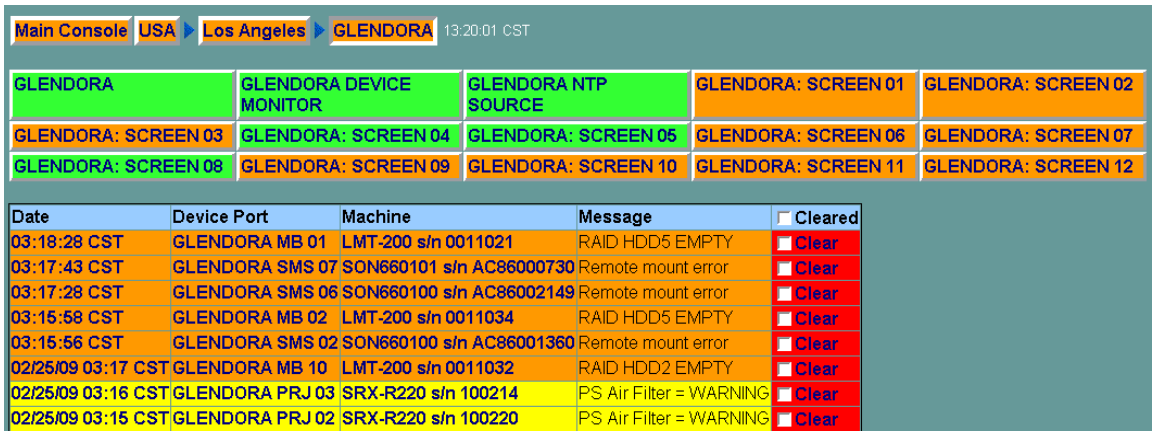

Figure 9 Theater View

Clicking on any one of the screens (i.e. GLENDORA: SCREEN 01) will display the auditorium view, which includes the components that make up that auditorium's projection system. Again, this view is automatically maintained by the central Device Monitor.

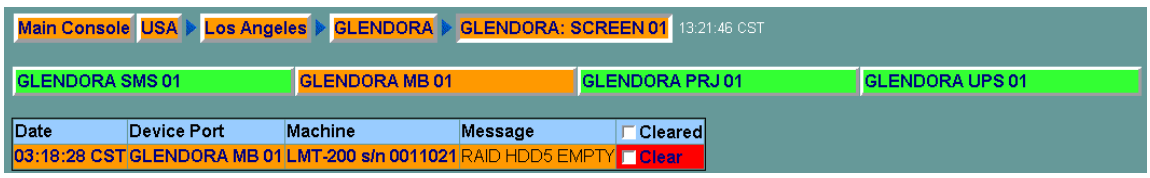

Figure 10 Auditorium View

Clicking on any one of the system names (i.e. GLENDORA MB 01) will display the machine's details page.

The background color of a view's label is indicative of the most severe unclear message that exists on any system within that view's scope. Similarly, the messages listed are limited to those originating from any system within the scope of that view.

Machine Details Page

The machine details page shows all available information for a given system including the model, serial number, location, status and any uncleared messages. Also displayed are all parameter values along with any thresholds that apply to those values.

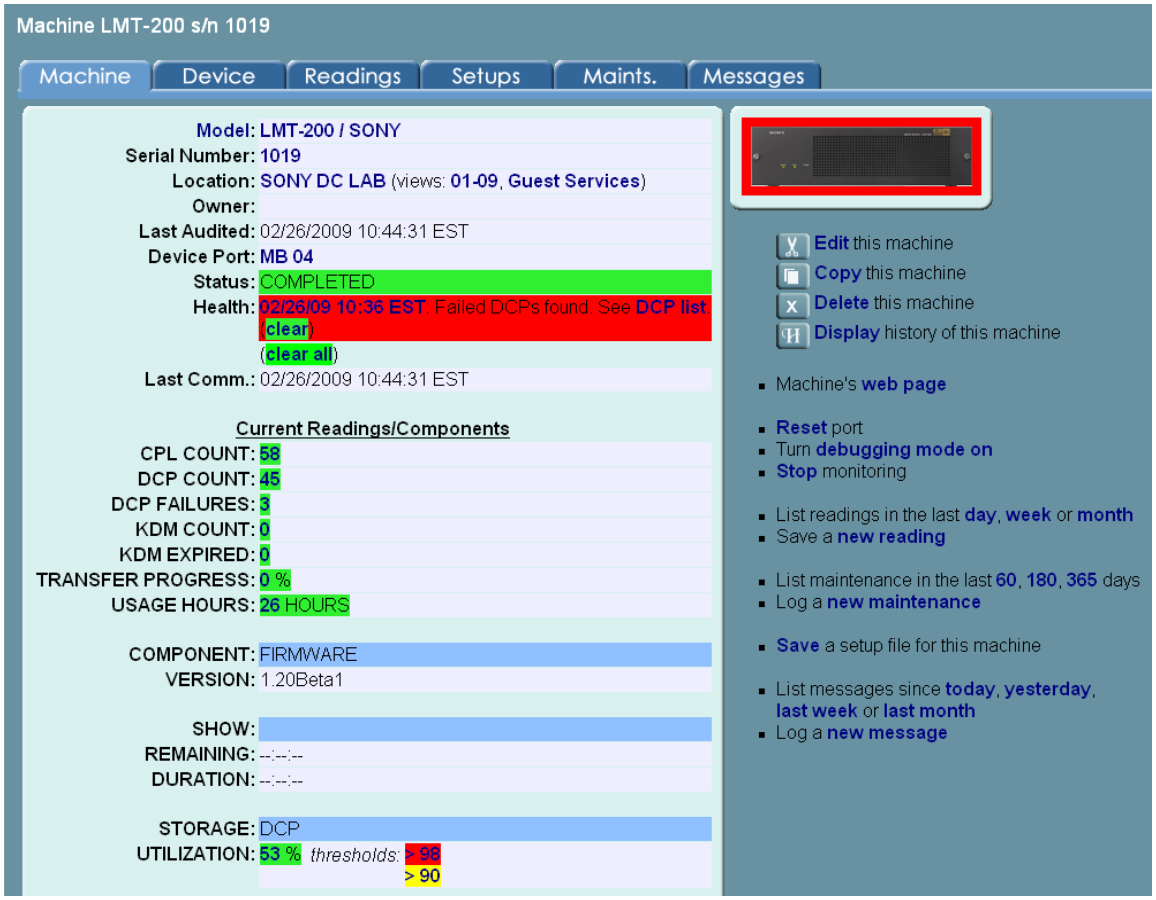

Figure 11 Machine Details Page

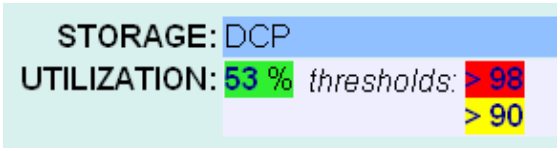

Figure 12 Parameter Value and Its Thresholds

All parameter values are offered as links to chart their historic values. For example, clicking on the DCP storage utilization value will display the history of all storage utilizations for that system as below.

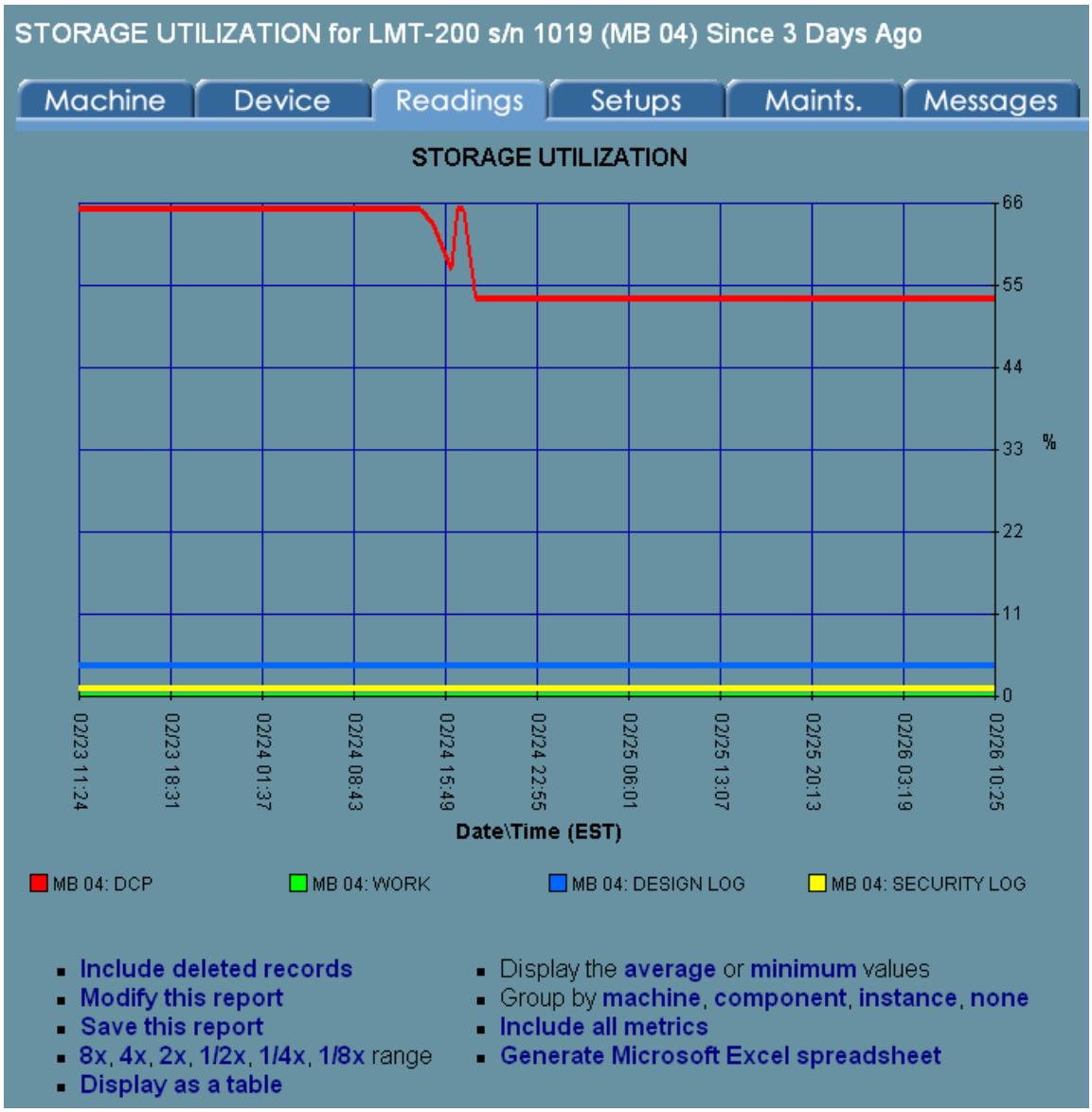

Figure 13 Parameter Chart

The chart's date range may be increased or decreased by clicking on one of the range modifier 8x, 4x, 2x, 1/2x, 1/4x, 1/8x range links.

The grouping of individual data sets may altered by clicking on one of the Group by machine, component, instance, none links.

Logging Maintenance Performed

Within Device Monitor, field engineers can log maintenance performed on systems. The link to log maintenance is included in the machine details page.

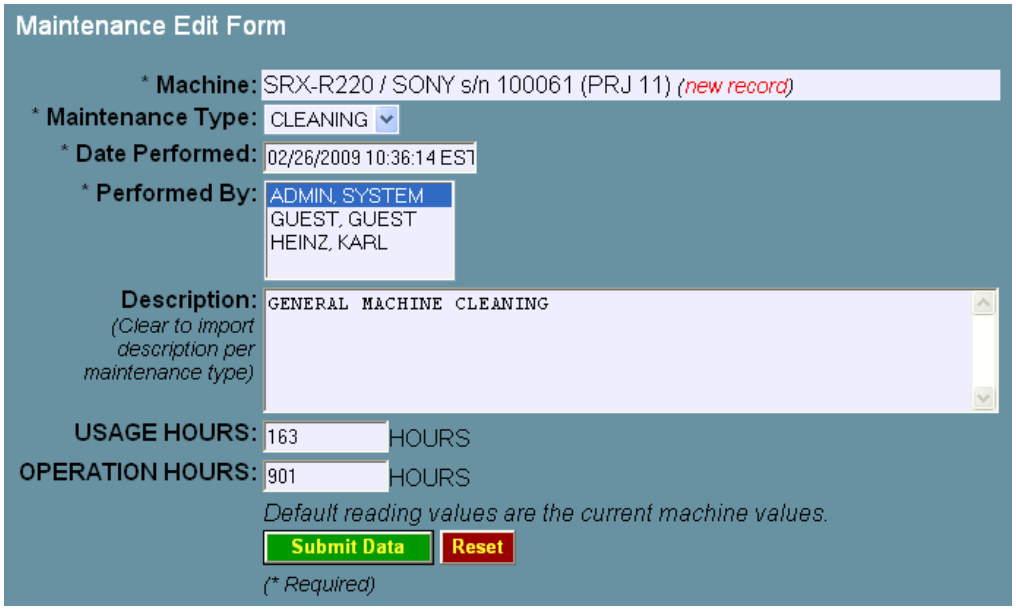

Figure 14 Maintenance Form

Within the form, the type of maintenance performed may be selected in addition to the person or personnel who performed the maintenance. A verbose narrative may be entered as well.

The current machine parameter values are included with the maintenance record.

Once logged, the information is transmitted to the SPS NOC Information System.

SPS NOC Information System

The NOC Information System consolidates all received information providing SPS with a single information system within which all monitored customer data can be viewed. It can automatically generate tickets as a result of events received and can forward notifications of open tickets to on-call support personnel.

With all customer data centralized, the NOC Information System can be configured to check for specific parameter values and schedule required maintenance accordingly.

Support personnel can document work performed and manage tickets within the system. Since the NOC Information System contains all of the Device Monitor data, personnel can review past events and tickets and graph historic system parameter values without having to remotely connect to the Device Monitor system.

Maintenance logged via an in-theater Sony Device Monitor will also close any open NIS ticket for that system matching the maintenance type performed.