

# HP-UX 11i System Fault Management



Executive summary.....	2
Definition of terms.....	2
Why hardware manageability and diagnostics? .....	3
SFM overview .....	3
Key components of SFM .....	3
High-level architecture .....	3
User interface .....	3
WBEM instrumentation and providers .....	4
Operating system, platform, and firmware abstraction .....	5
Key features of SFM.....	5
EVWEB.....	5
EVWEB subscription administrator.....	5
EVWEB event viewer .....	5
Error Management Technology.....	6
Indication providers.....	6
EMSWrapper provider.....	6
Event Manager Common Interface Module provider .....	7
Instance providers .....	7
Abstraction layers .....	7
Locating the failed component (Follow the Red) .....	7
Feature highlights of SFM .....	8
How to define a custom subscription .....	8
How to view subscriptions.....	9
How to receive emails for the events generated by a subscription .....	10
How to search and view events that occurred on a system .....	10
How to see processor inventory information .....	11
How to view memory inventory information.....	12
How to replicate a subscription request from one system to another system .....	12
How to search and view metadata for an error.....	12
How to add a custom action for an error .....	14
For more information.....	16

# Executive summary

This paper describes the key features of System Fault Management (SFM) and its use in the manageability domain. It explains the high level architecture of SFM and describes the key components of SFM. HP Systems Insight Manager (HP SIM) and SFM future features are beyond the scope of this paper.

Enterprise servers have a growing demand for strong fault management capabilities to meet business needs for stringent and time-sensitive Service Level Agreements (SLA). System Fault Management (SFM) offers tremendous benefit for HP field engineers and service personnel by assisting them in accurately isolating, analyzing, and resolving faults to the lowest granularity of the Field Replacement Unit (FRU). Furthermore, the current enterprise server market is moving toward consolidation that emphasizes solutions based on open standards. SFM is a new solution based on the Web-Based Enterprise Management (WBEM) standard for a wide range of diagnostic and system fault management capabilities: hardware inventory information, event management, and health status for computer system and individual devices. SFM also provides WBEM instrumentation enabling customers to manage heterogeneous systems in the data center through a single manageability application. This solution also offers the ability to browse and customize an online dictionary of error metadata for resolving system faults, including probable cause and recommended actions.

This document is useful for following people:

- System administrators of HP-UX 11i
- HP support staff

## Definition of terms

<b>Term</b>	<b>Definition</b>
CER	Common Error Repository
CIM	Common Interface Model
CIMOM	CIM Object Manager
CLI	command line interface
DIMM	Dual in-line memory module
EMS	Event Monitoring Service
EMT	Error Management Technology
GUI	graphical user interface
SFM	System Fault Management
SIM	Systems Insight Manager
SIMM	Single inline memory module
SMH	System Management Homepage
STM	Support Tools Manager
TLB	Translation Lookaside Buffers
WBEM	Web-Based Enterprise Management

# Why hardware manageability and diagnostics?

Although HP uses the highest quality components and processes in developing computer systems, it is still possible for hardware issues to occur because of RAM modules, overheated or broken processors, or bad sectors or clusters on disks.

Most IT organizations understand that ongoing administration and maintenance of existing infrastructure consumes the bulk of their IT budgets, while hardware and software acquisition costs only account for about 20% of overall expenditures.

How can IT expenses be reduced? By streamlining processes and reducing complexity. With HP Systems Insight Manager and optional Essentials software plug-ins, HP delivers a heterogeneous multi-operating system server and storage management solution that enables the user to holistically monitor and control the environment which improves operational efficiency and reduces costs.

With the ever-increasing pressure to reduce costs, enterprise customers are consolidating IT infrastructure. This consolidation results in the demand for unified hardware and system management tools that can manage a wide range of computer systems. Therefore, HP has developed a modular and scalable architecture for hardware fault management and diagnostic tools, SFM, based on industry open standard called WBEM. WBEM is a set of standards, developed by the Distributed Management Task Force (DMTF), to unify the management of enterprise computing environments, enabling a variety of information processing elements from different vendors to be managed in a uniform way. For more information on DMTF, refer to <http://www.dmtf.org/home>.

SFM integration also facilitates integration with HP SIM and HP, providing a common user interface across all HP-supported platforms and operating systems. Event and error management capabilities of System Management Homepage (SMH) enable users to view the inventory and health status of hardware subsystems like processor and memory.

## SFM overview

SFM is the next-generation hardware management solution that conforms to industry standards. The architecture of SFM provides advanced capabilities that can predict a hardware fault, provide a mechanism to isolate the faulty component, and enable the system to automatically recover from the fault. SFM facilitates improved health status reporting for the entire computer system, where a user can drill down to detect the specific faulty component using Follow the Red.

## Key components of SFM

SFM has three layers:

- Graphical user interface
- WBEM instrumentation and providers
- Operating system, platform, and firmware abstraction

## High-level architecture

### User interface

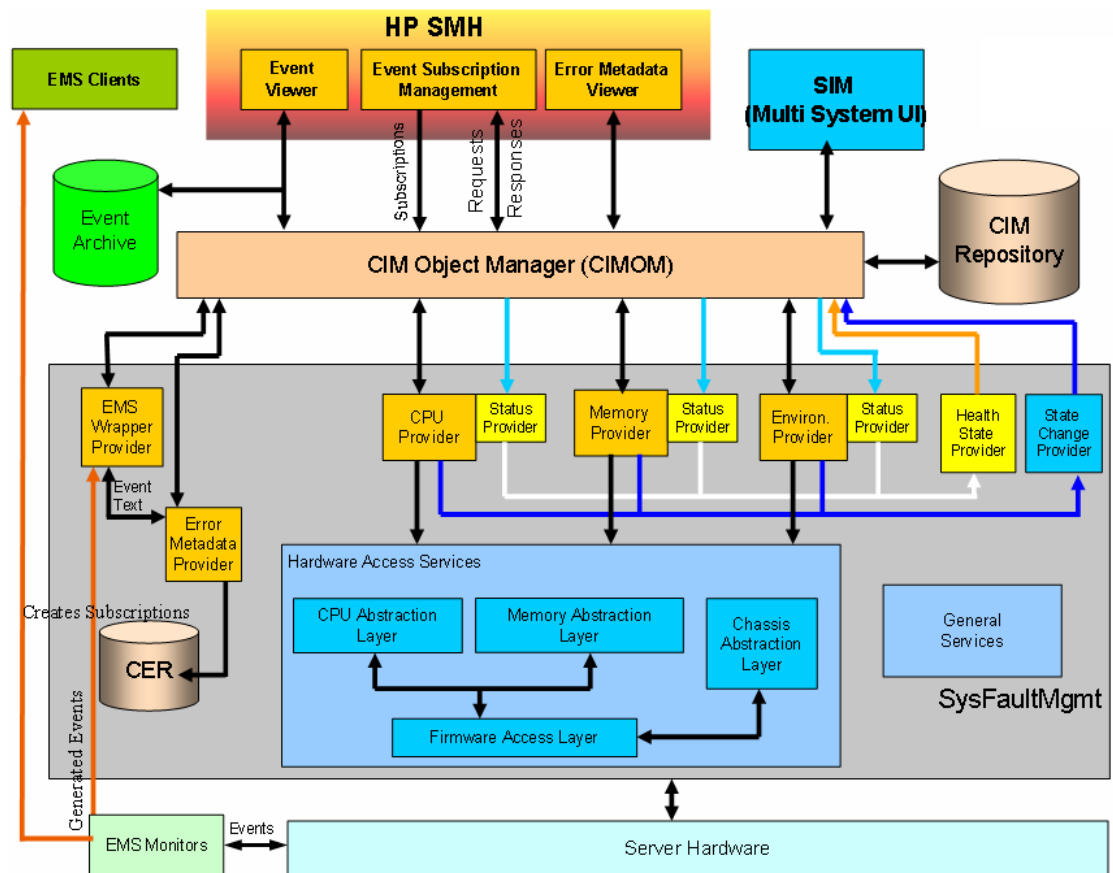
HP SIM is the multi-system manageability portal through which an administrator can manage the entire data center. HP SMH is the single system manageability portal through which an administrator can perform more specific management tasks for a given managed system. HP SIM, running on a central management system, collaborates seamlessly with HP SMH, running on each managed system, through single login. Both HP SIM and HP SMH offer browse based GUI (graphical user interface) and CLI (command line interface). Various components of SFM (EVWEB, EMT, hardware device inventory, and so on) are integrated with HP SIM and HP SMH. This interaction enables

administrators to perform fault management and diagnostic operations along with various other system management tasks. For more information on HP SIM, refer to <http://www.hp.com/go/hpsim>. For more information on HP SMH refer to <http://h20293.www2.hp.com/portal/swdepot/displayProductInfo.do?productNumber=SysMgmtWeb>

SFM offers the following GUI components:

- EVWEB (as a part of SMH) provides GUI for event viewing and subscription administration for a managed system.
- Inventory property pages in HP SIM and HP SMH facilitate a view of the system hardware information.
- EMT (as a part of SMH) enables viewing error metadata for various hardware, firmware, and software errors that can occur on a system running HP-UX 11i v3.
- Filter metadata controller enables an administrator to create persistent event subscription filters. sfmconfig utility provides a run-time notification mechanism to trigger various memory resident SFM components to reload any change in configuration files.

Figure 2. SFM High-level architecture



### WBEM instrumentation and providers

HP offers WBEM standard-based interface for various system management operations including fault management and diagnostics. This capability ensures SFM WBEM providers interoperability with any

third-party WBEM-based manageability application. HP WBEM Services provides Pegasus implementation of CIM Object Manager (CIMOM), which acts as the middleware.

SFM provides following WBEM providers:

- Various instance providers to enumerate device (CPU, memory, chassis, fan, power supply, and so on) inventory information.
- Indication providers (EMS Wrapper and EVM to CIM indication providers) to generate indications for hardware errors.

The property pages and the event viewer in HP SIM and HP SMH, using the SFM providers, offer the user interface to view the device inventory and events information.

### **Operating system, platform, and firmware abstraction**

One of the significant design features of SFM is the abstraction of operating system, platform, and firmware dependent implementation. This abstraction enables the WBEM providers to be independent of the operating systems (HP-UX 11i, Linux, Microsoft® Windows®, and OpenVMS), platforms, and firmware (PAL, SAL, IPMI, ACPI, PDC, and SMBIOS). Furthermore, this abstraction forms the foundation for enhancing provider instrumentation rapidly.

## Key features of SFM

### EVWEB

Users can manage event subscription and view events happening on the system using subscription administration and event viewer.

The EVWEB GUI is integrated with HP SMH; event viewer and subscription administration can be accessed through the Logs and Tools tab.

#### **EVWEB subscription administrator**

EVWEB subscription administrator enables users to view, create, delete, and modify new and existing subscriptions on the local system. These operations can be performed both through GUI and CLI. The subscription is characterized by criteria and destination. The default subscription is flagged as HP Advised subscriptions. Though the destination for such subscriptions cannot be changed, it can be modified to have move destinations, such as syslog and email address.

An administrator can create a subscription applicable to one device and define subscription criteria that are applicable for all devices. Similarly, if an administrator wants the matching event to reach more than one destination, a destination can be defined using one subscription creation request.

To more information on creating and modifying subscriptions, see the section on [Feature highlights of SFM](#).

#### **EVWEB event viewer**

The event viewer enables a user to view, search, and delete events from the local event archive. The wide range of intuitive and user-friendly search criteria includes event age, date-time, hardware device, event ID, and text.

A combination of criteria can be specified to narrow down the search results, as shown by the following command line example:

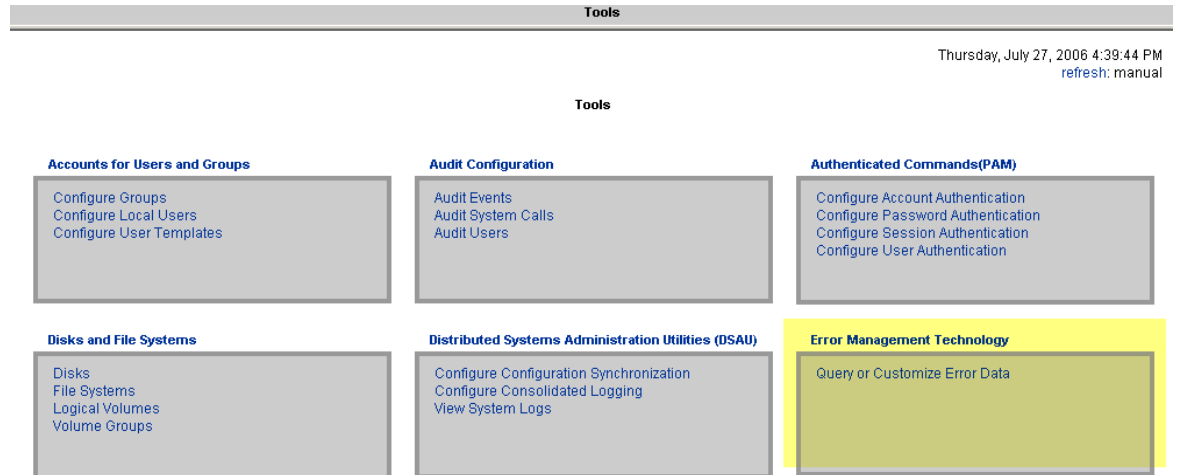
```
/opt/sfm/bin/evweb eventviewer -L -e eq:4 -a 10:dd -s desc:eventid
```

For more information on searching and viewing events in event viewer, see the section on [Feature highlights of SFM](#).

## Error Management Technology

Error Management Technology (EMT) enables a user to search, view, and customize metadata for all possible errors that can occur on an HP-UX 11i v3 system. EMT offers GUI integrated with SMH and CLI interfaces. To locate the EMT UI, select **The Tools>Error Management Technology>Query or Customize Error Data**.

Figure 3. EMT GUI



While all users can search and view error metadata, only an administrator can customize actions associated with events. The SFM installation provides HP-recommended actions for the errors. However, an administrator can add custom actions, which are persistent across system reboot. All error metadata is maintained in a database called CER (Common Error Repository). The CER can be updated without affecting the custom actions.

EMT also enables independent hardware vendors (IHV) and independent software vendors (ISV) to integrate error metadata for their products (software applications, device drivers, and so on) within CER. This innovative feature enables user to view and customize metadata for products from various vendors using EMT GUI. HP provides a device development kit (DDK) to IHVs to enable them to integrate with EMT on a customer system.

## Indication providers

### EMSWrapper provider

EMSWrapper is the current HP diagnostic solution that monitors system resources and notifies the subscribers of important events. Event Monitoring Services is a monitoring framework that provides a common mechanism for configuring resource monitoring and provides various notification methods for sending messages when a resource experiences an unusual event. The EMSWrapper provider enables WBEM clients to receive such events by wrapping the events into WBEM indications.

This provider generates events related to processor memory and chassis subsystem. It also generates events for backbone devices like cells, system bus adapters, and local bus adapters.

The following are some events generated by this provider:

1. Cache, Transition Lookaside Buffers(TLB), and bus errors associated with a particular processor when a certain threshold is reached.
2. Events related to correctable memory errors when a certain threshold is met.
3. Fan failure, power supply failures, and other chassis-related events.
4. Disk failure and other disk-related events.

### **Event Manager Common Interface Module provider**

Event Manager (EVM) is a comprehensive event management system that enables event information to be accessed in a uniform manner regardless of the method used to post or store it. The Common Interface Model (CIM) for the Event Manager provider converts Event Manager events into WBEM indications. The events generated by this provider are mainly related to the Kernel and other software events.

## Instance providers

CPU provider retrieves information about processors like status, family of processors, and clock speeds. It also provides physical information like slot numbers and cabinet numbers of the processor-chip.

Memory providers give information about system physical memory, operation status, size, or part number of DIMM or SIMM.

Chassis Provider provides logical information about system cooling devices, power supply devices, physical attributes, and physical information of these hardware modules. This provider also provides information about system thermal and voltage subsystems.

## Abstraction layers

SFM provides abstraction layers to support WBEM providers across many platforms and operating systems.

SFM offers a device abstraction layer that abstracts different devices like processor, memory, or fan. It also provides a firmware access layer that provides a uniform interface to different types of firmware interfaces like ACPI, IPMI, and PAL, and so on. SFM also has an operating system abstraction layer that provides access to system calls, library calls, and so on, enabling easy porting of SFM to different operating systems.

## Locating the failed component (Follow the Red)

Wouldn't it be useful if entities can be located in an Enterprise setup that needs immediate attention so that appropriate action can be taken before the Enterprise setup starts malfunctioning?

SFM integrates with HP SIM to locate the faulty entity. To determine if the health of all entities needs action, follow the red icon (❌) starting from HP SIM down to SMH page and then to the component page. The red icon designates a critical error. Other icons or legends represent minor, major, warning, and informational errors.

Following the red icon will help you to reduce:

- The time between an issue occurrence and customer awareness or corrective action.
- The time that an issue business application is not operating correctly, is operating at less than full potential, or will operate at less than full potential.
- The likelihood that a vulnerable state turns into an actual problem.

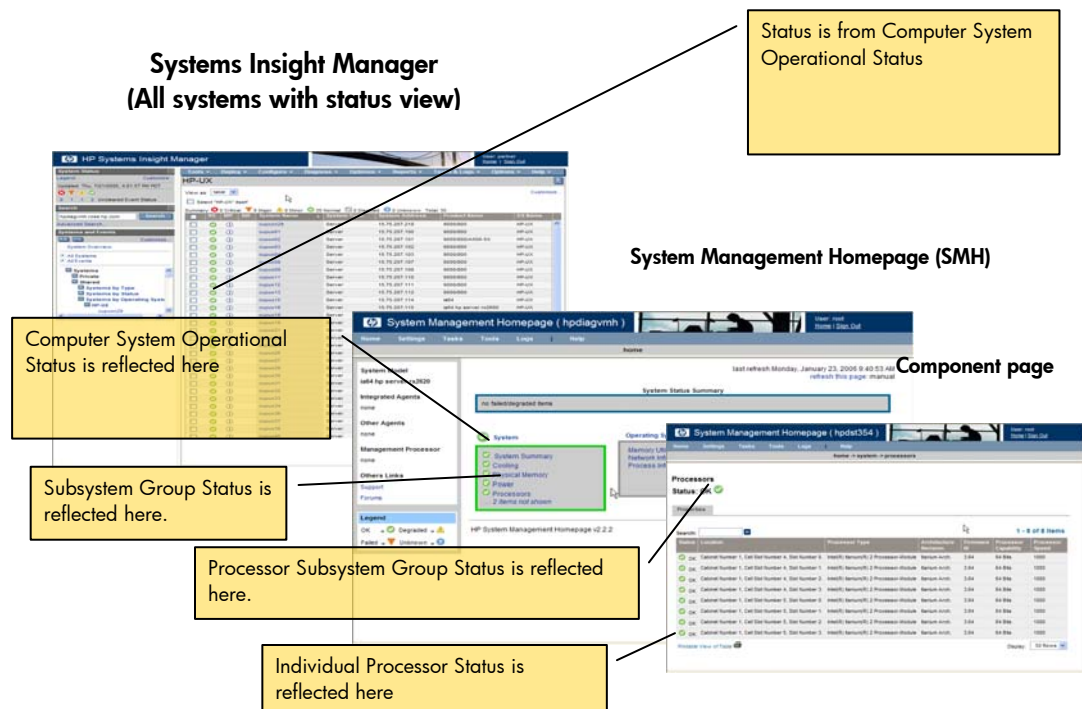
Figure 1 describes the Follow the Red concept to identify a faulty component. The HP SIM page displays the status of all managed systems, leading to the SMH page for the status of individual systems. The subsystems which comprise an individual system and the subsystem status are available on the SMH page. SMH page leads to the subsystems or components page for the health status of individual components.

A faulty component can be identified by traveling through the red icons through the different pages as shown in the following figure:

HP SIM>SMH >Subsystem group>Component

**Note:** SFM manages only HP-UX 11i- based systems.

**Figure 4.** Follow the red icon to determine the status of the individual entity.



## Feature highlights of SFM

### How to define a custom subscription

Navigate to EVWEB>Subscription Administration page. Click **Create subscription**. Enter the subscription details.

Figure 5. Create a custom subscription.

Tools -> Evweb -> Subscription Administration

### Create subscription

Create a new subscription

Subscription Name:

Severity:

Device:

Eventid:

Destination

Event Archive

Email

TO:  CC:

Command Preview:

```
[Create Subscription]: evweb subscribe -C -n "Customer_Subscription" -e ge:0 -t "email to:balask@hp.com:cc:balask@hp.com"
```

Alternatively, run the following command to create the subscription:

```
/opt/sfm/bin/evweb subscribe -C -n Custom_Subscription -t archive -t "email to:id@domain.com"
```

## How to view subscriptions


The Event Subscription Administration page lists both the factory-defined and customized subscriptions. The factory-defined subscription can be identified based on the  icon in the HP Known column.

Figure 6. View subscriptions

Tools -> Evweb -> Subscription Administration

### Event Subscription Administration

Click on the subscription to view its details [Enable tracing](#)

1 - 2 of 2 Items

Subscription Name	HP Known	Deprecated	Event Archive	Email
<input type="radio"/> Custom_Subscription	-	-		
<input type="radio"/> HP_General Filter@1_V1		-		-

Clear selection | Printable View of Table  Display: 50 Rows

- » Create subscription
- » Copy and create subscription
- » Modify subscription
- » Copy and modify subscription
- » Delete subscriptions
- » View external subscriptions
- » Help

Alternatively, run the `/opt/sfm/bin/evweb subscribe -L` command and notice those subscriptions that have HP Known flag set.

Output:

Subscription Name	HP Known	Is Deplicated	Event Archive	Email
Custom_Subscription	FALSE	FALSE	TRUE	TRUE
HP_General_Filter@1_V1	TRUE	FALSE	TRUE	FALSE

Similarly, the View External Subscription feature enables the user to view subscriptions created using tools other than EVWEB. The external subscriptions are created by using tools and interfaces provided by HP WBEM services.

## How to receive emails for the events generated by a subscription

The subscription can be created by specifying an email address in the destination segment. For an existing subscription, the email address can be added by clicking **Modify Subscription**.

**Figure 7.** Modify default subscription for email destination.

Alternatively, run following command:

```
/opt/sfm/bin/evweb subscribe -M -n HP_General_Filter@1_V1 -t archive -t email to:atambi@india.hp.com
```

## How to search and view events that occurred on a system

On Event Viewer page, click **Advanced Search**. On the Advanced Search page, enter the search criteria. Click the search button. The summary list of searched events appears. To view the complete details of an event that can be viewed, click a row in the summary table.

**Figure 8.** Search events on local system.

Alternatively, run following command for searching events:

```
/opt/sfm/bin/evweb eventviewer -L -a 10:dd -e ge:3
```

**Figure 9.** View events on local system.

EventNo	Severity	EventId	Event Category	Time Of Archive	Summary
1	Critical	100068	Secondary Storage Device	2006-07-24 16:55:53	The device has failed its power-on diagnostics for a specified field-replaceable ...
2	Critical	100068	Secondary Storage Device	2006-07-24 16:56:29	The device has failed its power-on diagnostics for a specified field-replaceable ...
3	Critical	100068	Secondary Storage Device	2006-07-24 17:04:11	The device has failed its power-on diagnostics for a specified field-replaceable ...
4	Critical	100068	Secondary Storage Device	2006-07-24 17:04:43	The device has failed its power-on diagnostics for a specified field-replaceable ...
5	Other	100	Secondary Storage Device	2006-07-24 17:05:17	The device has failed its power-on diagnostics for a specified field-replaceable ...
6	Unknown	66	Secondary Storage Device	2006-07-24 17:06:19	The device has failed its power-on diagnostics for a specified field-replaceable ...
7	Critical	100068	Secondary Storage Device	2006-07-24 17:08:33	The device has failed its power-on diagnostics for a specified field-replaceable ...

Run following command for viewing details of desired event:

```
/opt/sfm/bin/evweb eventviewer -E -n 123
```

## How to see processor inventory information

To show the processor inventory and status of each processor, on the SMH home page, select System>Processor as shown in the following figure:

**Figure 10.** View processor inventory information

Status	Location	Processor Type	Architecture Revision	Firmware ID	Processor Capability	Processor Speed
OK	Cabinet Number 0, Cell Slot Number 0, Slot Number 0	Intel(R) Itanium(R) 2 Processor-Module	Itanium Arch.	003.088	64 Bits	1500
OK	Cabinet Number 0, Cell Slot Number 0, Slot Number 1	Intel(R) Itanium(R) 2 Processor-Module	Itanium Arch.	003.088	64 Bits	1500
OK	Cabinet Number 0, Cell Slot Number 0, Slot Number 3	Intel(R) Itanium(R) 2 Processor-Module	Itanium Arch.	003.088	64 Bits	1500

## How to view memory inventory information

To show the memory inventory information and appropriate status, on SMH home page, click System>Physical Memory.

**Figure 11.** View memory inventory information

**Physical Memory**  
**Status: Major** ⚠

Properties

Search:

1 - 8 of 8 Items

Status	Location	Size	Module Type	Memory Type	Serial Number	Part Number
OK	Cabinet : 00, Cell Slot : 00, DIMM Slot : 0a	512 MB	DIMM	SDRAM	A56E04877455	A5198-60101
OK	Cabinet : 00, Cell Slot : 00, DIMM Slot : 0b	512 MB	DIMM	SDRAM	A56E04877187	A5198-60101
OK	Cabinet : 00, Cell Slot : 00, DIMM Slot : 1a	512 MB	DIMM	SDRAM	A56E04877175	A5198-60101
OK	Cabinet : 00, Cell Slot : 00, DIMM Slot : 1b	512 MB	DIMM	SDRAM	A56E04876864	A5198-60101
OK	Cabinet : 00, Cell Slot : 00, DIMM Slot : 2a	512 MB	DIMM	SDRAM	A56E04876417	A5198-60101
OK	Cabinet : 00, Cell Slot : 00, DIMM Slot : 2b	512 MB	DIMM	SDRAM	A56E04877443	A5198-60101
Error	Cabinet : 00, Cell Slot : 00, DIMM Slot : 3a	512 MB	DIMM	SDRAM	A56102939018	A5198-60001
Error	Cabinet : 00, Cell Slot : 00, DIMM Slot : 3b	512 MB	DIMM	SDRAM	A56102951883	A5198-60001

## How to replicate a subscription request from one system to another system

Because EVWEB is a scriptable command, various UNIX features can be used to execute this command on different systems. For example, to save the command (to create subscription) in a shell script, place the command on an ftp site so that you can transfer it to the desired system and run it on that system to replicate the subscription request.

## How to search and view metadata for an error

On the SMH page, Select Tools>Error Management Technology>Query or Customize Error Data page, and click **Advanced Search**. In the Advanced Search page, enter the search criteria. Click **Search**. The summary list of searched error metadata appears, as shown in the following figure. Complete metadata of that error can be viewed by selecting a row in the summary table,.

Figure 12. Advanced search for a metadata error.

Tools -> Error Management Technology -> Query or Customize Error Data

### Advanced Search

**Error Number:**  (supersedes all other fields)  
**Error Text:**  **Match:** any word  
**Category:** all **Scope:** all errors  
**Severity Operator:** greater than or equal to **Severity Level:** 0 - Unknown  
**Error Type:** SNMP  
 EMS Monitor Name:  EMS Event ID:   
 EVM Event Name:  NetTL Event ID:   
 NetTL Subsystem ID:  **SNMP Trap ID:**  **SNMP Enterprise ID:**   
 WBEM Provider Name:  WBEM Event ID:

[Search](#) [Cancel](#)

[Help](#)  
[Simple Search](#)  
[Enable Tracing](#)

Figure 13. Output of advanced search.

Tools -> Error Management Technology -> Query or Customize Error Data

### Simple Search

**Error Number:**  (supersedes all other fields)  
**Error Text:**  **Match:** any word  
[Search](#)

[Help](#)  
[Advanced Search](#)  
[Enable Tracing](#)

Search:  [»](#) **1 - 50 of 850 Items** [«](#) [»](#) [»](#)

	Severity ↑	Title	Error Text
<input checked="" type="radio"/>	? Unknown	SNMP	
<input type="radio"/>	? Unknown	SNMP	
<input type="radio"/>	? Unknown	SNMP	
<input type="radio"/>	? Unknown	SNMP	
<input type="radio"/>	? Unknown	SNMP	
<input type="radio"/>	? Unknown	SNMP	
<input type="radio"/>	? Unknown	SNMP	
<input type="radio"/>	? Unknown	SNMP	
<input type="radio"/>	? Unknown	SNMP	

[Help](#)  
[Add Solution](#)  
[Delete Selected Solution](#)  
[Modify Selected Solution](#)  
[Help](#)

Alternatively, run the following command for searching error metadata:

```
/opt/sfm/bin/emtui -b -l lt fatal
```

Output:

```
ErrorNum: 235 Severity: Information
Type: GENERIC
Summary: NOTICE: NFS3: failing over from host1 to host2
```

```
ErrorNum: 6 Severity: Information
Type: EMS Monitor: dm_memory EventNumber: 3000
Summary: Single bit error (SBE) event. A correctable single bit error has b...
```

To view detailed metadata of desired error, run command `/opt/sfm/bin/emtui -v -i 6`.

Output:

```
ErrorNum: 6 Severity: Information
Type: EMS Monitor: dm_memory EventNumber: 3000
Summary: Single bit error (SBE) event. A correctable single bit error has b...

Description:
A correctable single bit memory error has been detected and logged.
The memory component:

    Cab/Cell or Node: !
    MC/EXT: !
    DIMM: !
    Serial Number: !
    Part Number: !

    has generated a single bit memory error and the error information has been
logged in the memlog file.
-----
Error Properties:

Product Name: Online Diag
Product Category: Hardware
Platforms:
Keyword:
EMS Monitor Name: dm_memory
EMS Event ID: 3000
EMS Event Enabled: 0
EMS Event Threshold Occurrences: 0
EMS Event Threshold Period: 0
EMS Event Suppression Time: 0
```

## How to add a custom action for an error

On the EMT page, select the desired row from the summary table. In the detailed view, click **Add Solution**. On the Add Solution page, enter the desired solution for that error and click **Add Solution**, as shown in the following figure:

Figure 14. Add custom action for an error.

The screenshot shows a web browser window with the address `http://emlccase.cup.hp.com:17451/cgi-bin/emt?addSolution=30`. The page title is "Add a customer solution". Below the title, it says "This form will add a customer solution for the following error:". A table displays the error details:

Key	30
Severity	Critical
Error type	NettL
Subsystem ID	1234
Error ID	2217
Error summary	An invalid shell modification was attempted.
Error description	This message comes from a shell where an invalid history modification was attempted.

Below the table is a text input field labeled "Customer solution:". A red asterisk and the text "Required Field" are positioned to the left of the input field. At the bottom of the form, there are buttons for "Add Solution", "Preview", "Cancel", and "Help". Below the buttons is a "Command Preview" section showing the command: `[Add Solution] /some/path/emtui -i 30 -a ''`.

Alternatively, run `/opt/sfm/bin/emtui -a "Admin defined custom solution text" -I 6 -c all` command to add a custom solution.

## For more information

For more information on	See
CIM	<a href="http://www.dmtf.org/standards/cim/">http://www.dmtf.org/standards/cim/</a>
DMTF	<a href="http://www.dmtf.org/home">http://www.dmtf.org/home</a>
EMS	<a href="http://docs.hp.com/en/diag.html#EMS Hardware Monitors (for HP 9000)">http://docs.hp.com/en/diag.html#EMS Hardware Monitors (for HP 9000)</a>
HP SIM	<a href="http://www.hp.com/go/hpsim">http://www.hp.com/go/hpsim</a>
HP-UX 11i	<a href="http://www.hp.com/go/hpux11i">http://www.hp.com/go/hpux11i</a>
HP SMH	<a href="http://docs.hp.com/en/4AA0-4052ENW/4AA0-4052ENW.pdf">http://docs.hp.com/en/4AA0-4052ENW/4AA0-4052ENW.pdf</a>
HP WBEM Services	<a href="http://docs.hp.com/en/B8465-90017/index.html">http://docs.hp.com/en/B8465-90017/index.html</a>
Pegasus	<a href="http://www.openpegasus.org/">http://www.openpegasus.org/</a>
SFM	<a href="http://docs.hp.com/en/diag.html#System Fault Management (SysFaultMgmt)">http://docs.hp.com/en/diag.html#System Fault Management (SysFaultMgmt)</a>
STM	<a href="http://docs.hp.com/en/diag.html">http://docs.hp.com/en/diag.html</a>
WBEM	<a href="http://www.dmtf.org/standards/wbem/">http://www.dmtf.org/standards/wbem/</a>

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