

SGI® InfiniteStorage NAS Manager User's Guide

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About This Guide

This manual describes the operation of the SGI InfiniteStorage NAS Manager.

Obtaining Publications

You can obtain SGI documentation in the following ways:

- See the SGI Technical Publications Library at <http://docs.sgi.com>. Various formats are available. This library contains the most recent and most comprehensive set of online books, release notes, man pages, and other information.
- If it is installed on your SGI system, you can use InfoSearch, an online tool that provides a more limited set of online books, release notes, and man pages. With an IRIX system, select **Help** from the Toolchest, and then select **InfoSearch**. Or you can type `infosearch` on a command line.
- You can also view man pages by typing `man <title>` on a command line.

Conventions

The following conventions are used throughout this publication:

| Convention | Meaning |
|----------------------|--|
| <code>command</code> | This fixed-space font denotes literal items such as commands, files, routines, path names, signals, messages, and programming language structures. |
| <i>variable</i> | Italic typeface denotes variable entries and words or concepts being defined. |

| Convention | Meaning |
|-------------------|---|
| user input | This bold, fixed-space font denotes literal items that the user enters in interactive sessions. (Output is shown in nonbold, fixed-space font.) |
| [] | Brackets enclose optional portions of a command or directive line. |
| ... | Ellipses indicate that a preceding element can be repeated. |
| manpage(x) | Man page section identifiers appear in parentheses after man page names. |

Reader Comments

If you have comments about the technical accuracy, content, or organization of this document, contact SGI. Be sure to include the title and document number of the manual with your comments. (Online, the document number is located in the front matter of the manual. In printed manuals, the document number is located at the bottom of each page.)

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Overview

SGI InfiniteStorage NAS Manager is a web-based interface that allows you to monitor an SGI fileserver. Typically, this will be an SGI InfiniteStorage NAS Server, but SGI InfiniteStorage NAS Manager can be used on any SGI server, provided the correct software is installed.

SGI InfiniteStorage NAS Manager provides current and historical views of the state and the performance of a file server. This includes CPU usage, disk and network throughput and many other metrics. It also allows you to view connected clients and work out how each of these contribute to the current workload.

Alongside the monitoring features, SGI InfiniteStorage NAS Manager also allows an administrator to investigate the configuration of the server and to track any problems that have been detected.

The following list summarizes the information that SGI InfiniteStorage NAS Manager displays. Each of these categories is available through a menu option displayed at the top of each SGI InfiniteStorage NAS Manager screen

- | | |
|-----------|---|
| Summary | Selecting this item displays a graphic summary of system utilization. |
| Alerts | Selecting this item displays messages from the system logs. See “System Alerts” on page 17 for further information. |
| Resources | Selecting this item displays a list of system resources that SGI InfiniteStorage NAS Manager monitors. You select a resource from this list to display the status of the resource. For further information, see “Resources” on page 7 |
| Services | Selecting this item displays a list of the tasks performed by the fileserver. You select a service from this list to display the status of that service. For further information see “Services” on page 11. |
- You can also select this item to generate an archive containing your NAS server’s configuration and log files, and to display the name and version number of each software package that is relevant to the system’s operation as a file server, as described in Chapter 4.

| | |
|----------|---|
| Clients | Selecting this item displays information about the fileserver's clients according to various I/O criteria. For further information, see "Clients" on page 15. |
| Site Map | Selecting this option displays a listing of each page that SGI InfiniteStorage NAS Manager displays. From the Site Map, you can link directly to each of these pages. |
| About | Selecting this option displays licensing and legal information about SGI InfiniteStorage NAS Manager. |

Installation and Configuration

Software Requirements and Installation

SGI InfiniteStorage NAS Manager requires IRIX version 6.5.25 or later.

If you are unfamiliar with software installation in the IRIX environment, refer to *IRIX Admin: Software Installation and Licensing*.

Some Freeware packages (package names beginning with `fw_`) are required for correct operation. All such packages are provided on the installation medium, along with an initialization script that determines the correct set of Freeware packages to install. The `swmgr(1)` or `inst(1)` programs will prompt for permission to run this script; you should agree.

Some IRIX packages (for example, `eo.e.sw.quotas`) may also be required. These are not provided on the NAS Manager installation medium, but can be installed from your IRIX installation medium.

Note: SGI InfiniteStorage NAS Manager is not currently supported on Linux systems.

SGI InfiniteStorage NAS Manager is able to display information gathered from optional products that may not be available on every server. Since these are optional products that may involve additional costs, SGI InfiniteStorage NAS Manager installs and operates without requiring their presence. The online release notes contain the list of these products. The `relnotes(1)` command can be used to display the SGI InfiniteStorage NAS Manager release notes.

The SGI InfiniteStorage NAS Manager installation process modifies a number of system configuration files. These are listed in the online release notes, but can also be displayed using the `versions(1)` command.

Licensing

SGI InfiniteStorage NAS Manager is licensed using a FlexLM node-locked license. You should have received a license with your copy of the software. The online release notes contain detailed instructions on how to request and install software licenses.

Note: If SGI InfiniteStorage NAS Manager is installed and accessed prior to being licensed, it will display the license request page and refuse to operate.

Performance Monitoring

SGI InfiniteStorage NAS Manager consists of a web server front end and a Performance Co-Pilot backend. The Performance Co-Pilot performance metrics infrastructure is used to gather data that is summarized and aggregated and presented in a series of web pages. For more information on Performance Co-Pilot, see the *Performance Co-Pilot for IRIX User's and Administrator's Guide*.

Figure 3-1 shows an architectural overview of the SGI InfiniteStorage NAS Manager.

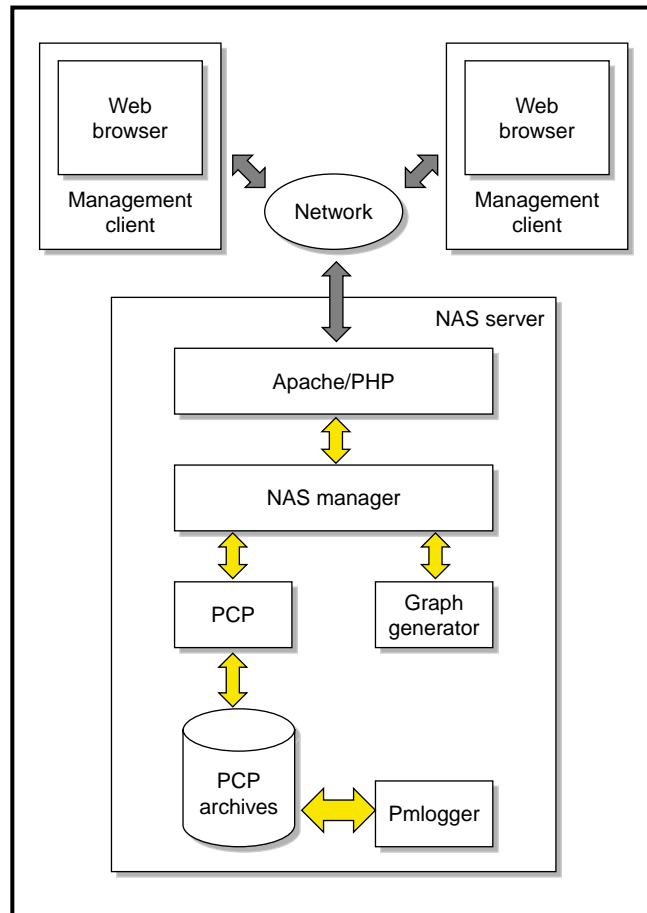


Figure 3-1 SGI InfiniteStorage NAS Manager Architectural Overview

To start using SGI InfiniteStorage NAS Manager, use your preferred web browser to load the following address (replacing the server name appropriately):

`http://your_server:3124/`

Performance metrics are continuously gathered and stored in archives in `/var/nasmgr/archives`. Each month, a data reduction process is performed on the metric gathered for the month. This reduces the size of the archives while retaining a similar amount of information.

Note: Although the size of metric archives has a bounded maximum, this can still be quite large depending on the configuration of the server and how many clients access it. For example, a server with a large number of filesystems could generate up to 100 Mbytes of archives per day. You should initially allow around 2 Gbytes of space for archive storage and monitor the actual usage for the first few weeks of operation.

SGI InfiniteStorage NAS Manager distinguishes between *current* and *historic* time. Current metrics are either drawn live from the server or are taken from the last few minutes of the metric archives. Historic metrics are taken exclusively from the metric archives. SGI InfiniteStorage NAS Manager is able to display this historical information for three time periods:

- the last hour
- the last day (the previous 24 hours)
- the last month (the previous 30 days)

The information provided by SGI InfiniteStorage NAS Manager can be roughly broken down into “who” and “how much”. The following sections do not describe all the details of each SGI InfiniteStorage NAS Manager page, since most pages are quite straightforward. Instead they attempt to explain why the displayed information matters, and how it can be sensibly interpreted. You may find it useful to read this chapter while displaying the SGI InfiniteStorage NAS Manager in your browser.

Resources

A resource is a finite capacity of the fileserver. SGI InfiniteStorage NAS Manager contains a separate page to display the utilization of each resource.

Resources are

- Buffer cache
- Disk IOPs
- Disk throughput
- Disk space
- Disk quotas

- CPU utilization
- Network throughput

Where multiple physical resources are bonded into a single logical resource (for example, load balanced NICs and XVM filesystems), SGI InfiniteStorage NAS Manager shows the structure of the aggregated resource, and (where possible), shows *real metrics* or *pseudo metrics* for both the aggregate and the component resources. A real metric is retrieved directly from the system instrumentation. A pseudo metric is calculated from a set of real metrics. For example, the total network throughput is the sum of the throughput of each NIC.

Buffer Cache

The *buffer cache* is a pool of memory where file data is stored in anticipation of it being accessed again in the near future. In most cases, the buffer cache increases performance because many programs access the same data many times.

The **Buffer Cache** page can be used to determine whether the client access pattern falls into a working set that fits in memory. If this is the case, the **Disk IOPS** and **Disk Throughput** pages will show quite low numbers, indicating that the disk subsystem is not being utilized very much. In contrast, the **Network Throughput** page will show that a large amount of data is being distributed to clients.

Note that the metrics shown in the **Buffer Cache** summary bar graph are not additive, despite their visual appearance. When the data being read is not found in the buffer cache, a block device read is performed to load it. This means that each block device read implies a buffer cache read. So we can say that if block device reads are equal to buffer cache reads, the workload is not very cache-friendly.

Disk IOPs and Throughput

Disk operations (also called *IOPs*, for I/O oPerations) occur when the result of a file operation is committed to disk. The most common types of disk operation are data reads and writes, but in some types of workload, metadata operations can be significant. Metadata operations includes file truncation and removal, file name lookups and determining the size and types of files.

Disk *throughput* is the amount of data that is transferred to and from the disks. This is predominantly the result of reading and writing data.

The **Disk IOPs** and **Disk Throughput** pages display a bar graph for each active filesystem. If the filesystem is an XVM volume, a separate graph is displayed for each volume element. This can be helpful when tuning an XVM configuration as it is possible to see how different workloads are distributed among volume elements. For more information on XVM, refer to the *XVM Volume Manager Administrator's Guide*.

Again, if the buffer cache hit rate is low and the network throughput is high, we would also expect the disk throughput to be high. Usually, the disk throughput would be steady somewhere a little under the maximum bandwidth of the disk subsystem. If the disk throughput is consistently too high relative to the network throughput, this might indicate that the server has too little memory for the workload.

Under heavy loads, our fileserver must be able to sustain a high rate of disk operations. The disk operations metrics can be used in conjunction with other metrics to determine the characteristics of a workload so that the server can be tuned appropriately. For example, if there is a high utilization of NICs but not very many IOPs going by, this could indicate a workload is coming straight from the buffer cache. If this were true, it is likely that it is dominated by data reads and we would expect the buffer cache metrics to show a high hit rate for reads. If the number of IOPs is high but the throughput (either disk or network) is low, then we probably have a metadata-dominated load. The contributing operations or clients can be determined from the **NFS**, **CIFS** and **Clients** pages.

Disk Space

The disk space resource is the number of bytes available on each filesystem. If the amount of disk space appears low on a filesystem on which disk quotas are enabled, the **Disk Quota** resource page can be used to find out who is using the most.

Disk Quotas

Disk quotas provide limits on the number of files and the amount of disk space a user is allowed to consume on each filesystem. A side effect of this is that they make it possible to see how much each user is currently consuming. For more information on quotas, refer to *IRIX Admin: Disks and Filesystems*.

Since IRIX quotas are applied on a per-filesystem basis, the limits reported in the **All Filesystems** page are not additive. This means that if a user has a 500MiB disk space limit on filesystem A and a 500MiB limit on filesystem B, the user cannot store a 1GiB file since there is no single filesystem with a large enough space allowance. However the current usage **is** additive, so this page can be used to determine the users who are consuming the most disk space. The quota page for all filesystems highlights users who have exceeded the quota on any filesystem on any filesystem on which they have been allocated a quota.

CPU utilization

Serving files places demands on the fileserver CPU as well as the I/O subsystem. The CPU helps with copying data to and from disks, calculating checksums and many other tasks.

The CPU metrics shown by SGI InfiniteStorage NAS Manager tell you how much time each CPU spends in interrupt, system, user, wait and idle time. CPU time is displayed as a percentage, where 100% is the total time available from a single CPU. This means that for an 8 CPU server, the total available CPU time is 800%.

Table 3-1 shows the CPU metrics that SGI InfiniteStorage NAS Manager reports.

Table 3-1 CPU Metrics Reported by SGI InfiniteStorage NAS Manager

| CPU Metric | Description |
|----------------|--|
| System time | Time the CPU spent executing kernel code. This is usually dominated by NFS file serving and accessing data from disks. |
| Interrupt time | Time the CPU spent processing requests from I/O devices. In a file server context, these are almost exclusively generated by disk operations, network packets and switching between processes. |
| User time | Time when the CPU is devoted to running ordinary programs. The biggest consumers of user time in a file server would usually be the CIFS server (samba) and the HTTP server (apache) |
| Wait time | Time when a CPU was forced to do nothing while waiting for an event to occur. Typical causes of wait time are filesystem I/O and memory swapping. |
| Idle time | Time that remained when the CPU could not find any tasks to run. |

In general, NFS workloads consume more system time, whereas CIFS, HTTP and FTP workloads consume more user time. The SGI InfiniteStorage NAS Manager performance monitoring infrastructure consumes only a small amount of user time.

The most useful problem indicator is consistently having little or no idle time. This can mean that the server is underpowered compared to the workload that is expected of it.

Network Throughput

The network throughput measures the amount of data transferred through each network interface (NIC).

If an interface is load balanced, SGI InfiniteStorage NAS Manager displays throughput for both the load balanced interface and its constituent interfaces. For more information about load balanced interfaces, see the *Network Load Balancing Software Administrator's Guide*.

Note that the throughput displayed is total network throughput (which includes protocol headers) so real data transfer will be somewhat lower than this value. The services pages show the amount of real data transferred from a variety of perspectives.

Services

A service is a task performed by the fileserver. While the primary service is “fileserving”, we break this down by the different methods of accessing the server. The services known to SGI InfiniteStorage NAS Manager are NFS, CIFS and HTTP.

NFS and CIFS

NFS and CIFS traffic are the primary contributors to file server utilization. In this section we will use the term “share” to refer to either a Samba share or an NFS export.

Both NFS and CIFS services report statistics aggregated across all shares as well as statistics for each share. Table 3-2 describes the statistics reported by both the **NFS** and **CIFS** services pages.

Note: There is not a one-to-one correspondence between CIFS and NFS IOPs. The former measures operations that are received from a network client, the latter measures operations that are sent to a local filesystem.

Table 3-2 Statistics Reported by NFS and CIFS Services Pages

| Graph | Description |
|-------------------------------|--|
| Throughput | Graph of current incoming and outgoing traffic for the share |
| IOPs | Graph of current IOPs rate for the share |
| Operation type histogram | Breakdown of share operations by class |
| Read and write size histogram | Breakdown of reads and writes by size |

Table 3-3 describes additional information reported by the **NFS Services** page only.

Table 3-3 Additional Information Reported by NFS Services Page

| Category | Description |
|-----------------------------|---|
| IOPs | IOPs are shows separately for TCP and UDP. This is not needed for CIFS because CIFS always uses a TCP transport. |
| Duplicate call cache hits | Normally we would expect few or no duplicate NFS calls. If there are a lot of Duplicate call cache hits, this can indicate that NFS replies are not being received by the client. This is often the result of network problems. |
| Bad calls | This should always be zero. If it is non-zero, it indicates there is a client on the network with a buggy NFS implementation. |
| Authentication cache misses | Clients mounting a share must be authenticated against any access list (see <code>exports(4)</code>). The results of this are cached for performance reasons. Authentication cache misses result in client mount operations taking longer. |
| Service time histogram | The NFS server tracks the service time for each operation. This histogram displays the number of operations falling into each service time band. |

Note: The NFS service throughput graph includes all types of operations, whereas the CIFS graph only shows actual data transfer.

Both the CIFS and the NFS services gather like operations into a smaller number of operation classes. While these classes are largely similar, there are some differences. Table 3-4 and Table 3-5 summarize these classes.

Table 3-4 CIFS Operation Classes

| Operation Class | Description |
|------------------------|---|
| getattr | operations that retrieve file attributes, such as access times |
| setattr | operations that set file attributes, such as ownership and permissions |
| access | operations that are used to perform access checking, including checks for file ownership and permission and file size and type checks |
| xattr | operations that manipulate XFS extended attributes |
| acl | all Access Control List operations |
| lookup | operations that result in file name translations; that is, operations that are applied to a filename rather than to a file handle, such as open |
| close | file close operations |
| write | file write operations |
| read | file read operations |
| commit | file data synchronization operations; these occur when an application requests that the contents of a file be flushed to disk |
| create | new file or directory creation, hard and symbolic link creation, file renaming and device file creation operations |
| remove | file removal |
| rmdir | directory removal |
| readdir | directory traversal operations |
| lock_request | all file locking operations, including lock requests and lock releases |
| misc | all other operations, including operations such as quota check that are not frequently used |

Table 3-5 NFS Operation Classes

| Operation Class | Description |
|------------------------|--|
| access | file accessibility tests; checks whether a client can open a particular file |
| commit | commit request; requests that the server flush asynchronously written data to stable storage |
| fsinfo | filesystem statistics and information requests, <code>pathconf</code> calls and service availability tests |
| inode_mods | new file or directory creation, hard and symbolic link creation, file renaming and device file creation operations |
| lockd | general lock operations not covered by other classes |
| lockd_granted | number of lock granting operations |
| lockd_share | number of share reservation operations |
| lookup | operations that result in file name translations; that is, operations that are applied to a filename rather than to a file handle, such as <code>open</code> |
| read | file read operations and symbolic link resolution operations |
| readdir | directory entry listing operations |
| readdirplus | extended directory entry listing operations; returns the attributes of the directory entries as well as their names |
| remove | file deletion operations |
| setattr | file attribute setting operations, which include file truncations and changing permissions and ownership |
| getattr | file attribute retrieval operations |
| write_async | asynchronous writes; the written data may be cached and scheduled for writing at a later time |
| write_sync | synchronous write; these do not complete until the data is written to stable storage |
| xattr | operations that manipulate XFS extended attributes |

Note: The NFS operation statistics measure classes of NFS protocol operations sent by clients. The CIFS statistics, on the other hand, measure classes of system calls performed by the CIFS server on behalf of a client. SGI InfiniteStorage NAS Manager does not provide a way to measure which CIFS protocol operations are requested. This is because the mapping from protocol operations to system calls is much more complex for CIFS than it is for NFS; in some cases, a single protocol operation can result in many thousands of system calls. The system call information is much more reflective of performance than the CIFS protocol operations.

HTTP

The HTTP metrics are reported by SGI InfiniteStorage NAS Manager for default installations on the SGI Apache server (`sgi_apache`) and the Freeware Apache server (`fw_apache`). Unfortunately there is no easy way to configure SGI InfiniteStorage NAS Manager to display information for other HTTP servers.

Note: The HTTP information reported by SGI InfiniteStorage NAS Manager does not include the traffic generated by accessing the SGI InfiniteStorage NAS Manager interface.

Clients

A client is a computer running a program that accesses the fileserver. Clients are known to SGI InfiniteStorage NAS Manager by their IP address, so if multiple accessing programs are running on the same computer, these are all counted as a single client.

Note: Client information is only gathered for CIFS and NFS protocols.

The SGI InfiniteStorage NAS Manager **Clients** page lets you display clients according to various I/O criteria. This facility is most useful for pinpointing how the current set of clients are contributing the workload profile. For example, upon noticing an unusually large amount of network traffic on the **Network Throughput** page, displaying the clients in order of aggregate throughput will quickly identify the contributing clients.

From the list of all current clients, you can display a detailed view of the NFS and CIFS traffic generated by a particular client. This is useful when trying to diagnose problems that affect only a single client or type of client. For example, by viewing the client detail it may be obvious that throughput is limited by the client using very small read and write sizes. Continuing from the client details to the client history page can help diagnose problems such as hung NFS mounts.

Server Maintenance

NAS Manager includes a number of features designed to make it easier troubleshoot an SGI file server.

System Alerts

The **Alerts** page displays messages from the system logs. These provide informative messages, notifications of unusual events and sometimes error conditions.

Alerts are only displayed if they have not been acknowledged. After a period of time, alerts are archived and will not be re-displayed when setting to show previously acknowledged alerts is used. By default, acknowledged alerts are archived after 2 days and unacknowledged alerts are archived after 7 days. The file `/var/nasmgr/alerts/archive` contains all the archived alert messages.

Software Versions

The **Versions** page displays the name and version number of each software package that is relevant to the file server operation. While there are more software packages installed on the system than those listed, they are not relevant to the system's operation as a file server.

Support Data

The **Gather Support Data** page provides an interface to the `netgather(1)` program. This is intended to help customers providing SGI Call Center Support Personnel with consistent data without typing any complicated commands.

When the script completes, you are prompted to download an archive containing all the information that was gathered. This archive can be examined locally, forwarded to support personnel or saved as part of a configuration management policy.

Network Interface Configuration

The **Network Throughput** page contains links to the configuration and location for each network interface.

The **Configuration** page displays the current link status and IP address for the interface. Among other things, this indicates whether the interface has negotiated the correct link speed.

The **Location** page displays all the information needed to locate a particular network card in a server rack. This is useful when a hardware fault occurs and the card must be replaced.

Glossary

Buffer cache

Pool of memory where file data is stored in anticipation of it being accessed again in the near future.

Client

Computer running a program that accesses the fileserver.

Current metric

Metric drawn live from the server or taken from the last few minutes of the metric archives.

Disk IOPs

Disk operations (I/O oPerations) that occur when the result of a file operation is committed to disk.

Disk throughput

The amount of data that is transferred to and from disks.

Historic metric

Metric taken exclusively from the metric archives.

NIC

Network interface.

Performance Co-Pilot

SGI package that provides a range of services that may be used to monitor and manage system performance.

Pseudo metric

Metric calculated from a set of real metrics. For example, the total network throughput is the sum of the throughput of each NIC.

Real metric

Metric retrieved directly from the system instrumentation.

Service

Task performed by the fileserver.

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