Maintaining Quality of Service Based on ITIL-Based IT Service Management

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Interest in the IT Infrastructure Library (ITIL) of system management best practices has increased in recent years, and corporations are starting to incorporate ITIL in their IT systems. To help with this incorporation, Fujitsu provides the Systemwalker product group, which supports ITIL-based IT service management. ITIL contains many kinds of management processes. In this paper, we focus on the service delivery area, which includes capacity, availability, and service level managements, and discuss the functions provided by Systemwalker Service Quality Coordinator (SSQC) and Systemwalker Availability View (SAView) from the ITIL perspective. An overview of the architecture used to implement these functions is also included.

1. Introduction

The IT service management processes of the IT Infrastructure Library (ITIL)[1)] arise from the following two core areas:

1) Service support: Processes related to the daily operation and support of an IT service
2) Service delivery: Long-term planning and improvement processes related to IT service provision

In this paper, we mainly discuss the service delivery part of these two core areas, which contains the processes used to maintain the high quality of the services provided by an IT system.

In 2006, the Systemwalker products, which were launched in 1995 as Japan's first integrated IT service management products, were enhanced to the V13 versions to support all of ITIL.

Especially, Systemwalker Service Quality Coordinator (SSQC) and Systemwalker Availability View (SAView) are related to the service delivery area. **Figure 1** shows the Systemwalker architecture.

SSQC was launched at the end of 2003. It provides capacity and performance management functions and has been widely accepted in the Japanese IT market.

SAView is a new product that was launched in 2006 and provides visualization of business service availability.

SSQC and SAView can be positioned as products that play a supporting role in implementing the following management processes that fall under the ITIL service delivery core area:

1) Capacity management
2) Availability management
3) Service level management

The functions and architecture of SSQC and SAView are described below.

2. Capacity management

The aim of capacity management is the continued provision, now and in the future, of business services that are highly cost-effective in terms of capacity and performance. To achieve this end, capacity management clarifies the business service requirements, the business service capabilities that the current IT system can

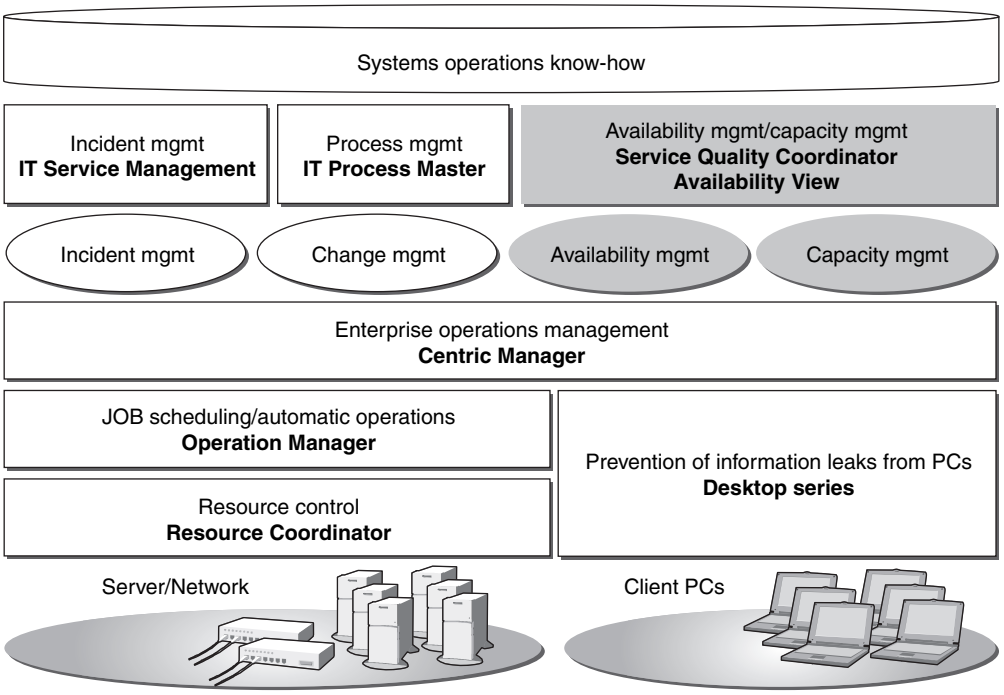


Figure 1
Systemwalker architecture.

provide, and the IT infrastructure required to provide business services in the future.

Some examples of the use of capacity management are:

1) Expanding the IT infrastructure in preparation for future increases in transaction throughput
2) Performance tuning so IT system resources are used effectively
3) Predicting the requirements of business services in the future

The personnel of an IT infrastructure support organization must perform various processes to implement capacity management. For example, they must measure and monitor IT system performance, predict service deployment and demand, and perform capacity planning and tuning.

To assist in these capacity management processes, SSQC provides functions for collecting and analyzing capacity and performance information from all parts of an IT system, ranging from the infrastructure to the business application software.

The capacity and performance information collected by SSQC is about the following types of resource usage in the IT system infrastructure:

1) CPU usage rate, CPU queue length
2) Disk busy rate, number of disk queue requests
3) Available memory capacity, number of swap-in/swap-out operations
4) Disk usage rate

SSQC can also collect the following types of performance information concerning the middleware of an IT system:

1) Response time at each client PC
2) Number of Web server processing requests and the response times for those requests
3) Number of application (AP) server requests, wait time, and processing time
4) Execution multiplicity for batch processing
5) SQL execution time on the DB server
6) Amount of free table space area for the DB

In addition, SSQC can collect the throughput of business applications by establishing a

data import interface with them.

The above information can be used to perform, for example, the following types of capacity management:

1) Establishment of the criteria for the resource capacity required for business based on correlation analysis of business application throughput, Web server throughput, and CPU usage rates
2) Prediction of future processing demands based on time series analysis of business application throughput
3) Prediction of CPU and disk resource capacities that will be required in the future based on predictions of future business throughput

Figure 2 shows some example SSQC reports. Figure 2 (a) shows the result of a correlation analysis, and Figure 2 (b) shows the result of a time series analysis.

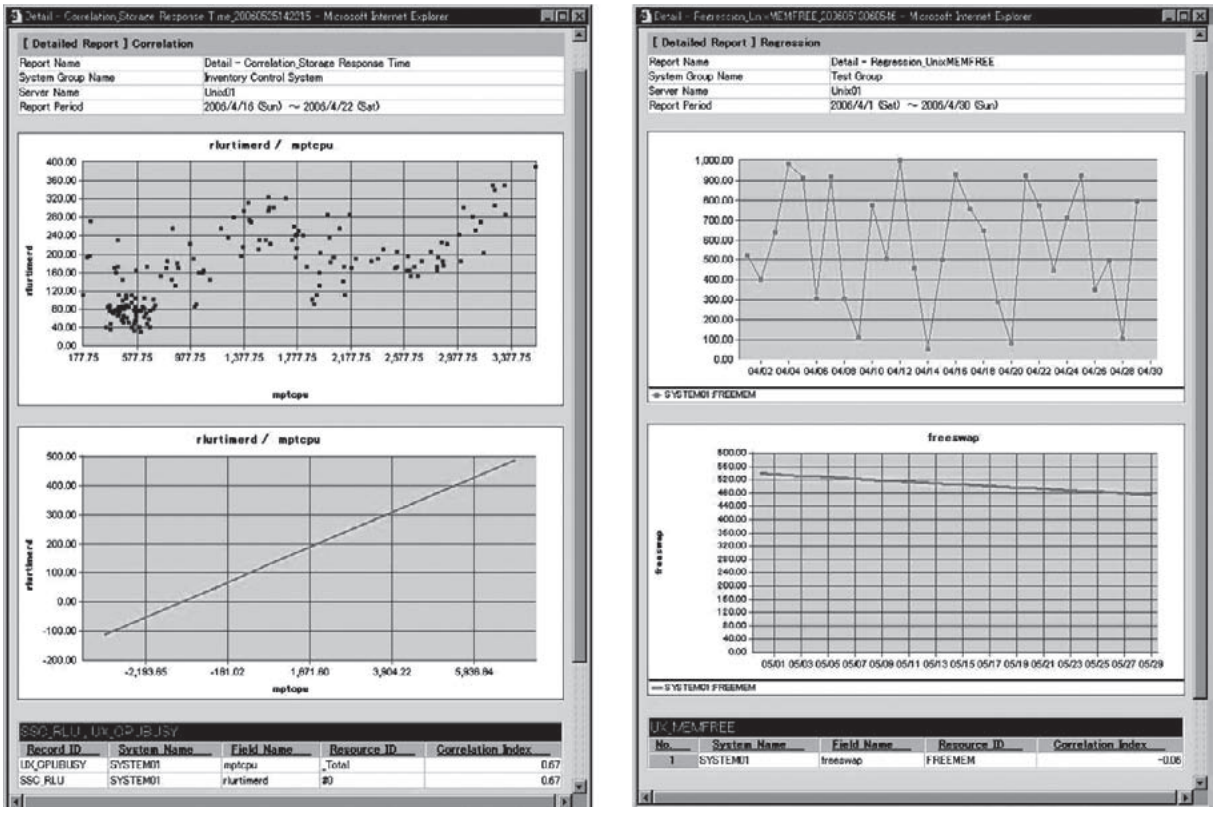
SSQC provides many kinds of analyses functions, and by using these functions, the IT infrastructure support organization can easily perform the capacity management processes defined in ITIL.

3. Availability management

The purpose of availability management is to maintain a high level of availability for the services provided by an IT infrastructure with a favorable cost-effectiveness in order to achieve business goals.

For example, availability management can be used to:

1) Monitor whether IT services are being processed as planned
2) Reduce the fault occurrence frequency in an



(a) Result of correlation analysis

(b) Result of time series analysis

Figure 2
Example SSQC reports.

IT infrastructure by performing preventive maintenance

3) Keep the mean time between failures (MTBF) at a high level by minimizing the downtime due to faults

The personnel of an IT infrastructure support organization must perform various processes to implement availability management. For example, they must design and implement the IT system availability and measure, monitor, report, and improve the IT system availability.

To assist in these availability management processes, SAView provides a function for monitoring business services according to their operation plans. SAView can also maintain activity logs of business services to enable the availability to be visualized. **Figure 3** shows two examples of SAView screens.

SSQC also assists in availability visualization by polling to check the service availability and by providing service downtime reports.

In addition, SSQC provides the following troubleshooting functions for minimizing service interruptions caused by performance problems in the IT infrastructure:

1) Drill Down View screen

SSQC can display detailed IT infrastructure resource information and middleware performance information from the time a performance problem arises. Users can compare these values with the values obtained at times of normal operation to see at a glance the cause of the problem. Items showing large fluctuations in value can be considered related to the cause of the problem.

Figure 4 shows an example of a Drill Down View screen.

2) Transaction breakdown analysis

When SSQC is used together with Fujitsu's Interstage[2] Application Server and Symfoware[3] Server, it can detect the location of performance bottlenecks in online transactions.

Figure 5 shows an overview of transaction breakdown analysis.

3) Response time breakdown analysis

SSQC monitors the responses of Web applications. It also measures and displays the time taken for these responses and the time taken to download the elements of the displayed HTML screen. SSQC, therefore, not only monitors availability but also provides functions for investigating the causes of problems.

To maintain IT system availability, periodic IT system reviews about failures and system weaknesses are important. Furthermore, Fujitsu regards these investigation functions as being important for maintaining availability from the viewpoint of reducing the mean time to repair

(a) Monitoring business services

(b) Activity logs of business services

Figure 3
Example SAView screens.

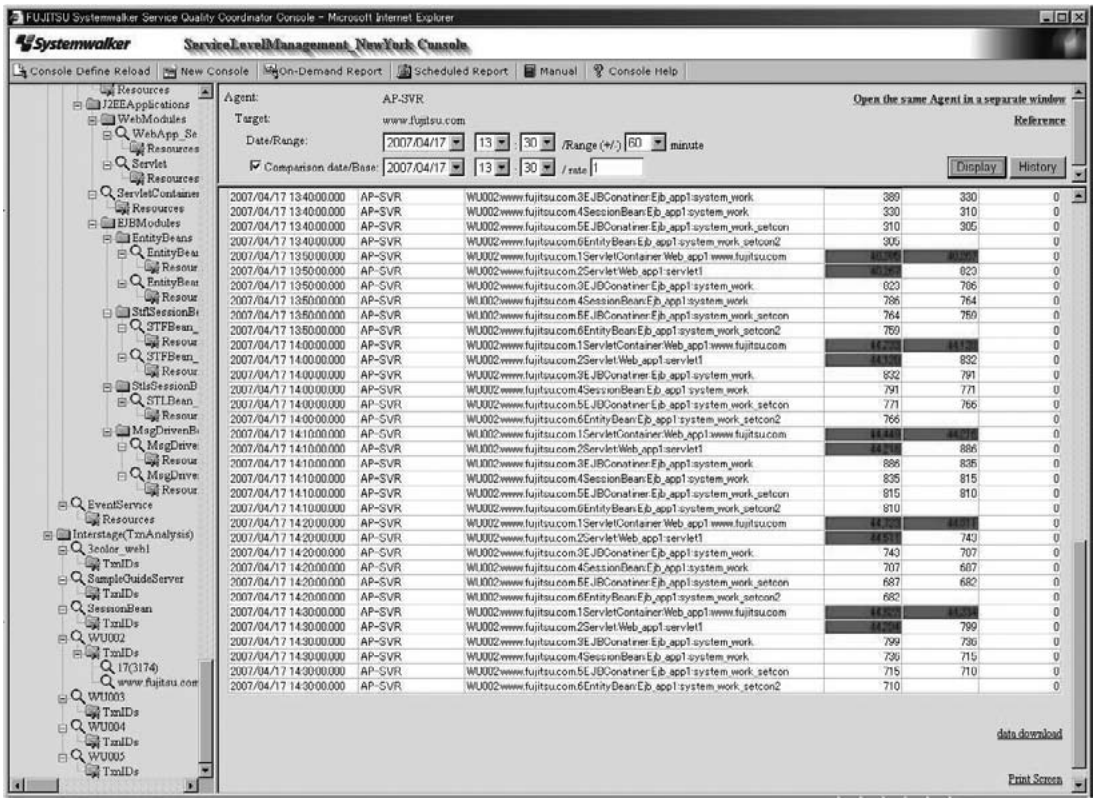
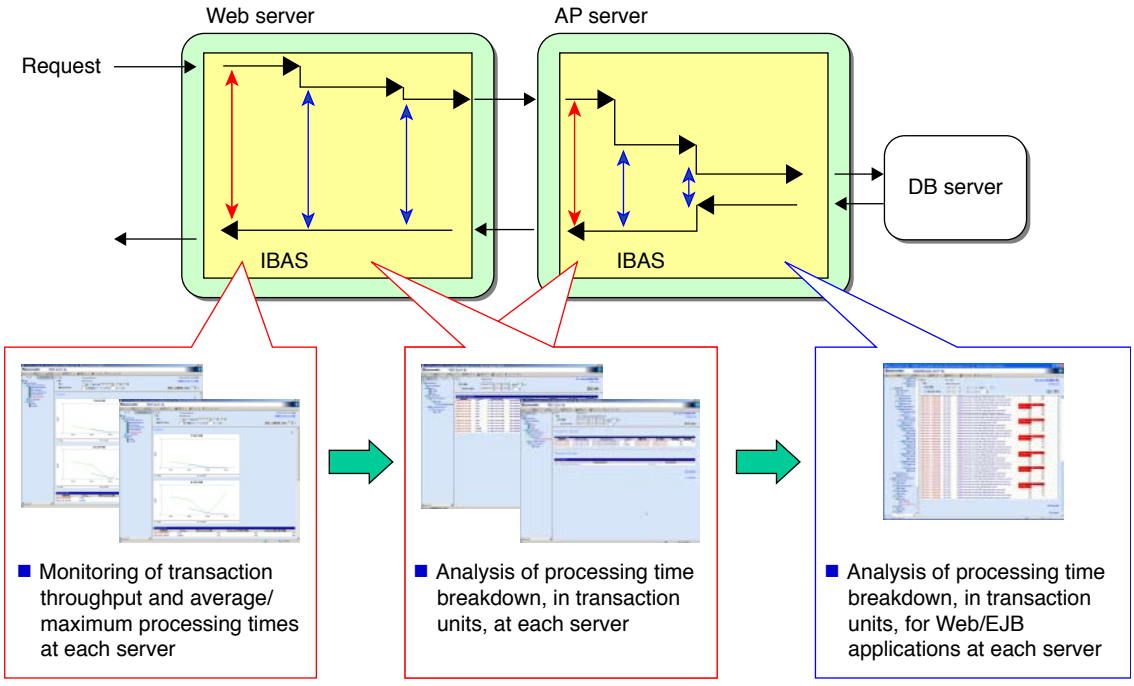


Figure 4
Drill Down View screen.



IBAS: Interstage Business Application Server

Figure 5
Overview of transaction breakdown analysis.

(MTTR).

For example, in a certain data center, by using SSQC, the cause of a slowdown was detected and system operation was restarted in an hour. The problem was caused by an exhaustion of DB temporary area and had also occurred in the previous year. However, because SSQC was not in use at that time, the cause was not investigated and it took 10 hours to restart operation. In this case, SSQC reduced the IT system MTTR to just 10% of the previous value.

These investigation functions were incorporated into the first version of SSQC and distinguish it from other similar products.

4. Service level management

The purpose of service level management is to maintain and improve the quality of an IT service. Service level management obtains a consensus between a service provider and recipient concerning the quality of an IT service and monitors, reports, and reviews the quality for a specified period.

The following are some examples of service level management:

1) The IT service provision department guarantees the maximum response time and reports the monthly response status to the IT service users.
2) The IT service provision department guarantees the upper limit for the amount of service down-time in a month and provides continuous monitoring and improvement to uphold this guarantee.

The first requirement of service level management is for the service provider and recipient to reach an agreement and establish a service level agreement (SLA). Service level management must then incorporate the SLA into the IT infrastructure and continually monitor and report the service level. The Quality of Service (QoS) provided to the recipient must then be maintained and improved.

In practice, not all SLAs are explicitly agreed on and set between the provider and recipient. Instead, some SLAs are implicitly set, especially in in-house IT systems.

4.1 Management processes

Because Fujitsu has constructed and operated many mission-critical IT systems, we have abundant experience of service level management.

The ultimate aim of service level management is to maintain and improve the QoS. To achieve this, the following management processes related to the service level must be continuously performed:

1) Monitoring
2) Reporting
3) Reviewing
4) Predicting
5) Maintaining

The above processes suggest implementation of the capacity management and availability management described above.

We have previously postulated the following as service level management processes:[4), 5)]

1) Determine the SLA.
2) Determine configurations in accordance with the SLA.
3) Collect information required for automation of on-going processes, regular performance information, and other information.
4) For short-term problems:
   - Detect problems
   - Identify potential problems
   - Predict problems
   - Generate alerts indicating problem occurrences

   These processes relate to availability management.
5) Write regular service level reports based on the SLA. Include predictions concerning the next reporting period.
6) Predict medium-term problems.
   This process also relates to availability management.

7) If required, conduct capacity planning and tuning studies.
   This process relates to capacity management.
8) Submit an SLA report.
9) Review SLA-related requirements.
10) Change tools and the environment.

Figure 6 shows the relationships between these processes.

Items to note are the regular implementation of information collection, problem detection, reports, and reviews. The processes to be performed only on demand are capacity planning and tuning.

4.2 Provided solutions

SSQC supports all of the above capacity and availability related processes, for example, information collection, analysis, and reports.[6)]

The SLAs that are subject to service level management are not limited to performance and availability related items. Information handled by the ITIL service support components — incident management, problem management, and change management — are also used as indices. Some examples of this information are:

1) Average time required for the service desk managed by the IT service provision department to resolve incidents reported by IT service recipients
2) The number of proactive problem analyses performed by the IT service provision department

These types of indices must also be targeted as part of service level management.

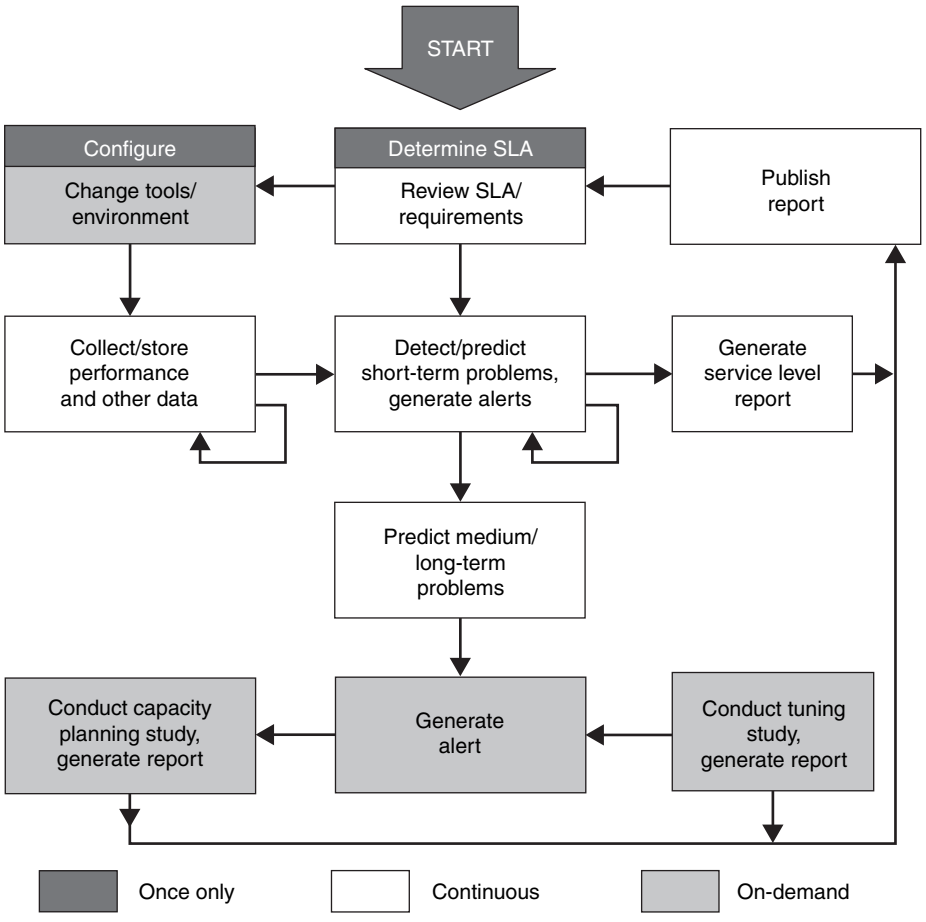


Figure 6
Service level management processes.

SSQC can handle these types of information as user information and supports the reporting of this information.

5. Architecture

SSQC enables capacity management, availability management, and service level management of an IT system, and SAView enables the visualization of availability. The architectures of SSQC and SAView are described below.

5.1 SSQC

5.1.1 Three-layer construction

As shown in **Figure 7**, SSQC is implemented using a three-layer architecture. The functions of these layers are as follows:

1) Agent layer

This layer performs data collection.

- Agent

An agent is an operation unit installed on a managed server. Agents collect resource information and performance information concerning applications, Web servers, AP servers, DB servers, and the platform operating system itself. Agents also store the collected information, without changing its format, during periods specified for problem analysis purposes.

- Browser agent

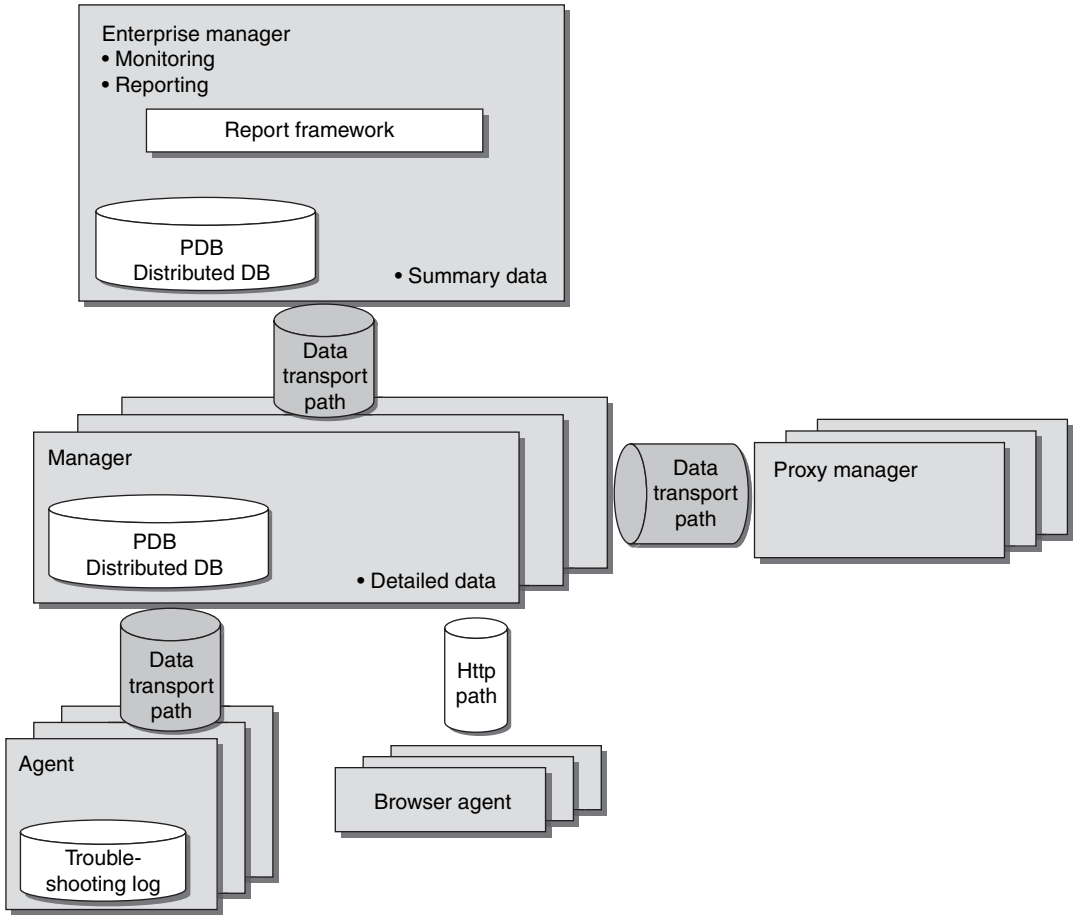


Figure 7
SSQC architecture.

A browser agent is an operation unit installed on an end-user PC that measures the end-user response time.

2) Manager layer

This layer collects and stores information.

- Manager

A manager is an operation unit installed on an admin server in the department. Managers gather the information collected by the agent layer and store detailed information. They also send summary information to the enterprise manager described below.

Managers also perform polling to collect service activity status information.

- Proxy manager

A proxy manager is an operation unit that operates on behalf of a manager to collect service activity information and information from agents. Proxy managers are used for two reasons.

One reason is to distribute the processing load by collecting information on behalf of overloaded managers. The other is to reduce the number of data transport paths. Especially as a security policy, it is generally recommended to reduce the number of internal-external paths that pass through a firewall server such as data transport paths connecting external agents with internal mangers protected by the firewall. For example, if a proxy manager is set outside the firewall, it can collect information from external agents and send it to internal managers through a single data transport path.

3) Enterprise manager layer

This layer shows information about the entire IT system.

- Enterprise manager

The enterprise manager is an operation unit on an enterprise admin server. The enterprise manager stores the information sent from the managers in each department, holds the report framework, and performs status monitoring and reporting.

Collected data is sent from the lower layers to the upper layer through data transport paths.

Either of the following two information transfer modes can be selected for the data transport paths:

1) Push mode: This mode enables just-on-time information transfer when data is collected. A proprietary protocol is used to push data up from the lower layers to the upper layer.
2) Pull mode: HTTP requests are sent from the upper layer to the lower layers, and information is pulled up in response to these requests. This mode enables secure data transfer from agents or proxy managers outside the firewall to the internal manager.

In many cases, both the enterprise manager and the managers are installed together on a single server that runs as just one IT service management server.

As described above, the functions of each layer can be customized. For example, the enterprise manager and the managers can be arranged by installing the report frameworks of the enterprise manager in each department server. In this configuration, senior managers can access all systems data from the enterprise manager, and department managers can use the managers to access systems data only in their departments.

5.1.2 Distributed database and presentations

The information collected by SSQC is handled in a number of forms by agents and stored in a distributed database in the enterprise manager and the managers.

The collected data is classified by resolution. SSQC keeps data having a rather coarse resolution for long-term analysis and fine-resolution data for the trouble investigation function.

This data is automatically deleted from the distributed database at the specified expiration time.

One of the distinguishing points of SSQC is that it collects several types of calculated data for different purposes in a distributed database.

Table 1 shows the data management scheme that shows the type of stored servers and

Table 1
Data management scheme.

Data form	Storage scheme
1-minute resolution	Stored at agent system
10-minute resolution	Stored on department server and kept for 7 days
1–hour resolution	Stored on department server and kept for 6 weeks
1-day resolution	Stored on department server and kept for 53 weeks
Summary	Stored on enterprise server and kept for 3 days (renewed daily)

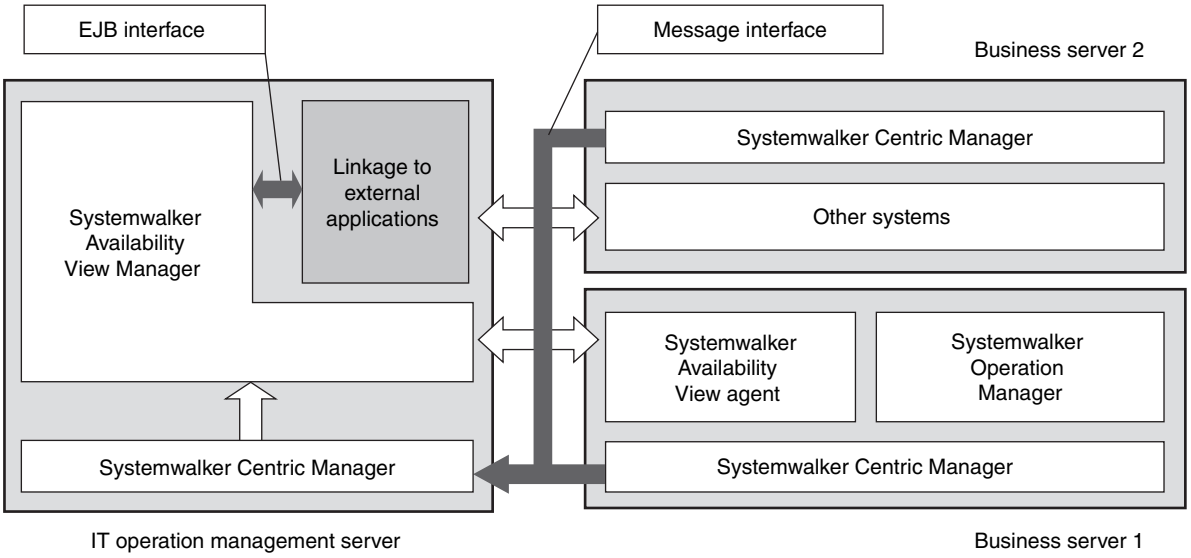


Figure 8
SAView architecture.

the retention period of each type of data.

The report base is the main presentation function in the enterprise manager. It accesses the above distributed database to access the contents to be displayed and analyzed. It extracts and analyzes the required information, implements presentations and monitoring, and provides reports for managers.

The utilization of these reports completes the series of service level management processes and enables service level reporting, short-term and long-term status analyses, and trouble investigation.

5.2 SAView architecture

Figure 8 shows the SAView architecture.

Like other Systemwalker products, SAView comprises a manager and agents.

Agents are assigned to each business server and collect batch processing activity information from Systemwalker Operation Manager.[7] The collected activity information is sent to the manager, where it is stored as activity logs. A comparison of this information with the business planning information defined in the manager enables batch processing availability to be visualized based on plans and actual results.

SAView also has the following interfaces for collecting activity information concerning other types of processing:

1) EJB interface

This interface is provided by the manager

of SAView. It receives business system activity information directly from applications.

2) Message interface

This interface receives event messages from Systemwalker Centric Manager on business servers and admin servers.

SAView can collect start and stop information about any business activity by defining event messages.

6. Conclusion

In this paper, we described the functions provided by SSQC and SAView with reference to ITIL and described the management processes these functions support. We also described the product architectures required to implement these processes.

Currently, SSQC and SAView are accepted by customers as effective tools for performing ITIL service delivery processes.

However, to improve their flexibility and usability, we are planning to add the following SSQC and SAView functions in the future:

1) SOA-based architecture support

Support for Service Oriented Architecture (SOA) based architectures will enable flexible access to the information held by the ICT infrastructure management functions so this information can be used for service level management. This support will also make it easy to implement service level management that is linked to the information held by ITIL service support functions.

2) Flexibility by using a federated CMDB

By using system configuration information stored in a federated configuration management database (CMDB), our products will improve the availability of IT systems by providing capabilities such as troubleshooting of problems caused by resource faults or by changing the IT system configuration.

In addition, the information held by SSQC and SAView will be able to be used more flexibly when it can be provided through a federated CMDB.

3) Dashboard

A dashboard that supports all the components of service delivery — service level management, availability management, and capacity management — will provide a flexible and integrated visualization GUI.

In conjunction with the above product enhancements, we also plan to continue research into service management systems that conform to ITIL.

We hope that these activities will lead to even greater benefits for Fujitsu's customers.

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