

# SAS® IT Resource Management 3.6: Overview



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#### SAS® IT Resource Management 3.6: Overview

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# **Using This Book**

#### **Audience**

SAS IT Resource Management 3.6: Overview is intended to address the needs of the following types of users:

#### Information Consumers

Information consumers are business people who are interested in the overall performance aspects of IT at a company. They need to access IT intelligence reports from the office as well as from remote locations in order to support decision-making. Information consumers often function as system architects, IT managers, and IT executives.

#### Performance Analysts

Performance analysts understand how to analyze the IT resource measurement data that is managed by data administrators. They analyze this data in order to best benefit the business and to improve the utilization, availability, and performance of IT enterprise resources. To do this, performance analysts use SAS IT Resource Management to design, create, and share reports. They often function as capacity planners, system administrators, and business analysts.

#### **Data Administrators**

Data administrators create the analysis and report-ready data sources used by performance analysts and information consumers for the purposes of IT performance management and capacity planning tasks. They accomplish these tasks by setting up jobs to transform IT performance data measurements into actionable data sources from which IT intelligence is derived. They also create and schedule report jobs so that resulting reports are rendered and made accessible in

report galleries. Data administrators often function as IT performance managers and capacity planners.

# **Prerequisites**

Prerequisites for using SAS IT Resource Management are:

- An operating environment that includes SAS IT Resource Management software.
- A user ID and password with permissions and SAS metadata roles that are appropriate for that user's use of IT Resource Management functions.
- Depending on your role, you might need direct access to the SAS technologies upon which SAS IT Resource Management is built and which are installed with this solution. If you have questions about this, contact your system administrator.

# About SAS IT Resource Management

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## What Is SAS IT Resource Management?

SAS IT Resource Management is an IT performance management and capacity planning solution that enables the analysis of any IT data source. The solution creates an integrated IT performance data warehouse, delivers and applies the advanced analytic capabilities of SAS to that warehouse for the purposes of IT performance management and capacity planning, and renders the IT intelligence to optimize the IT infrastructure. In addition, the solution leverages the IT performance data warehouse and the SAS product capabilities that are included in the solution for purposes beyond the scope of IT performance management, such as IT financial management or IT service management. With SAS IT Resource Management, IT departments can manage and plan the usage of their resources to provide a stable yet scalable IT environment for current and future operations.

In today's business environment, superior IT operations is a competitive essential. To achieve this superiority, the IT department must deliver enough information about the performance and capacity of IT resources to allow the business's decision makers to understand and evaluate their current consumption of IT. Concurrently, the IT department must solicit information from the leaders of the business about the IT usage and anticipated demands that directly affect the IT infrastructure. As such, the communication of IT performance and capacity information must be in a language and format that is suitable for its intended purpose and audience. IT performance management and capacity planning software facilitates this communication so that the IT department can plan and implement adjustments to the IT infrastructure. This ensures that the business remains competitive and responsive to its customers.

SAS IT Resource Management renders the results of its IT analysis in reports that communicate many topics of interest, including the following:

- IT performance measurements and analysis over any time period
- comparative performance of IT resources over multiple time periods (for baseline, peak, seasonal, and change analysis)

- peak period identification and analysis of those periods (single and periodic) in support of load balancing, infrastructure elasticity, and resource consolidation initiatives
- workload analysis for enhanced business processing
- ranked (top, bottom, and so on) resource consumption, availability, and response time measurements
- correlation of performance measurements for root cause analysis
- operational level agreement analysis (for example availability and response time)
- candidate lists of resources that are appropriate for consolidation and virtualization consideration
- forecasted or predicted IT capacity needs
- exhaust prediction for resources
- compliance to regulatory requirements
- exception analysis for the identification of conditions in the data that are statistically exceptional

Unique to SAS IT Resource Management is its ability to facilitate the previously described IT performance management and capacity planning features and to socialize that information by using an application called SAS IT Resource Management Report Center. (Throughout the remainder of this document, the application is called ITRM Report Center.) ITRM Report Center is a web-based application that enables the many reports that are produced by the SAS IT Resource Management solution to be grouped, filtered, managed, and viewed.

# **Domain Intelligence Offered by SAS IT Resource Management**

# **Introduction to SAS IT Resource Management Domain Intelligence**

SAS IT Resource Management offers a wide variety of reports that provide analytical intelligence about IT resources. These are all delivered by ITRM Report Center.

ITRM Report Center is the single source of performance and capacity information about the IT infrastructure. It is designed to deliver IT Intelligence to any individual in an organization that wants that information. For example, see the following gallery that shows one page of an **ITRM Report Center** workspace view.

TRAM Domain Intelligence

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**Display 1.1** Example of an ITRM Report Center Gallery

Each of the reports shown in a gallery has a particular value to individuals throughout an organization. The selection of a report type to communicate an IT domain intelligence fact is best made by understanding both the message and the target audience. More than 4,000 unique reports are supplied with SAS IT Resource

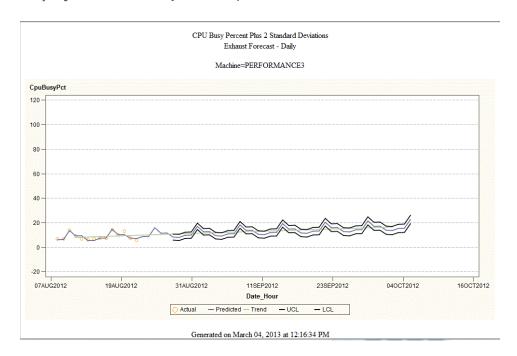
Management. Each of these reports can be used as is, or copied and edited to satisfy the unique needs of an organization.

### **Charts to Communicate Forecasts, Predictions, and Analytical Results**

#### **Using Charts to Present Analytic Results**

SAS IT Resource Management delivers sets of supplied reports that communicate trends, forecasts, predictions, and analytical results. It also delivers SAS analytical calculation and illustration capabilities as well as specific implementations of these capabilities for IT performance management and capacity planning. One such example of these special implementations is the exhaust forecast chart. This type of chart calculates and graphs the amount of time that is predicted for a particular aspect of an IT resource to reach a threshold.

**Display 1.2** CPU Busy Percent plus Two Standard Deviation



# **Example of Using Forecast Charts with Microsoft System Center Operations Manager Data**

As illustrated in the preceding exhaust forecast chart, the actual measurements (shown as yellow points) are used to create a forecast for the CPU Busy Percent with 2 Standard Deviations (shown in the purple line). This purple line indicates the variations over the reported time period (in this case, a span of a month) and the forecast (for the next two months). Next, this chart shows the trend line (the green smooth line on the chart). Finally, the upper and lower confidence boundaries are presented as an indication of the accuracy of the predicted and forecasted values presented on the chart.

# Using Forecast Charts for Performance Management and Capacity Planning

A primary job function of the capacity manager is to appropriately size the IT enterprise to accommodate the needs of the business that it services in terms of the availability and performance of IT resources. Successfully performing this task requires the capacity planner to accomplish the following objectives:

- provide sufficient resources to run the business
- allocate adequate resources to accommodate business growth and innovation
- eliminate excessive IT resource capacity (as well as the IT personnel effort, physical space, and resources to power that equipment) and the costs that are associated with it

Exhaust reports are an excellent means to accomplish this task. Exhaust reports are possible through the delivery of SAS statistics and advanced analytic capabilities with SAS IT Resource Management. For any IT element for which a fixed capacity exists (such as CPU, disk, memory, bandwidth, and so on), exhaust reports are essential. These reports can predict, with adequate lead time to respond, the exhaustion of those IT resources. Exhaust reports can also be used to anticipate the obsolescence of resources from the IT enterprise. SAS analytics can forecast and predict any aspect of the IT data available from the SAS IT Resource Management solution.

The forecast chart is configured to accommodate the amount of time that will be required to procure, install, and configure additional components to meet the demand for this server to ensure that the IT enterprise sustains the business that it supports.

The preceding example used data from a server to illustrate exhaust reporting. IT performance data from Windows and UNIX systems is derived from many sources. SAS IT Resource Management supports adapters for many of them, including those from HP, BMC, Microsoft, Demand Technology, and many UNIX operating system providers. Therefore, a consolidated IT performance data warehouse, such as the one delivered by SAS IT Resource Management, enables this data to be analyzed in a coordinated and consolidated fashion. SAS IT Resource Management also delivers special key metric summarizations of this data that present the most common measurements for these systems across the multiple adapters that deliver them. This facilitates long-term trending and analysis for and across all systems that are represented in the IT data warehouse.

For more information about key metric summarizations, see "What Are Key Metrics?" in Appendix 6, "Data Model," in the SAS IT Resource Management 3.6: Administrator's Guide.

### **Charts to Evaluate Data from a Large Number of Resources**

#### **Using Tile Charts**

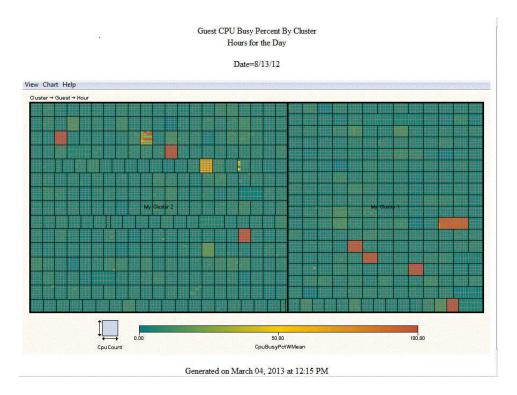
*Tile charts* are rectangular maps. (Tile charts are sometimes referred to as *treemaps*.) They enable you to view a large quantity of hierarchical data in a limited space. Each unique category combination is represented by a rectangular tile whose size and color are determined by response variables. These tiles are placed in a hierarchical arrangement. You can drill down into a tile to view it in more detail. You can also link to reports that are associated with tiles.

### **Using Tile Charts for Performance Management and Capacity Planning**

To maximize the performance and capacity of any IT environment, you can create a consolidated IT performance data warehouse and provide the tools to analyze and statistically enrich the data within it. Given this premise, tile charts are ideal for use by performance managers and capacity planners to provide both a first glance and a detailed view that enables the evaluation of large volumes of data. The scenarios that illustrate the value of this report technique include the evaluation of large volumes of

data for outlying measurements that are likely indicators of issues that need to be addressed in the IT infrastructure. Tile charts have been used by SAS IT Resource Management customers for consolidating and initializing servers, balancing workloads, creating high availability resource groups in support of critical business processing, orchestrating and defining the cloud, network tuning, and so on.





Performance managers and capacity planners use tile charts to evaluate data from a large number of resources that would otherwise be extremely difficult to work with. In the preceding display, the size of each tile shows the CPU count and the color indicates the CPU Busy Percent weighted mean. This provides an overall status of the VMware environment from a cluster perspective for a period of time. You can drill down to view the guests that are allocated to them.

From this single image, the performance manager can identify the utilization issues that need attention. These issues are easily identifiable because they are represented on the tile chart by boxes with the most intense colors (oranges and reds). Starting with this one quick view, the performance manager can prioritize issues.

Achieving benefits from virtualization technologies lies within the implementation, measurement, and management of the clusters, hosts, and guests that are established in that environment. By effectively managing the virtual infrastructure, the perception that virtual machines are established without a corresponding cost can be dispelled. By measuring the utilization, availability and performance of this environment, the anticipated value of virtualization can be proven and opportunities to further increase that value can be identified.

#### **Example of Using the Tile Chart with VMware Guest System Data**

In the preceding chart, each box represents a VMware Cluster and the VMware guests that are allocated to the Cluster on a particular day, and for each hour of that day.

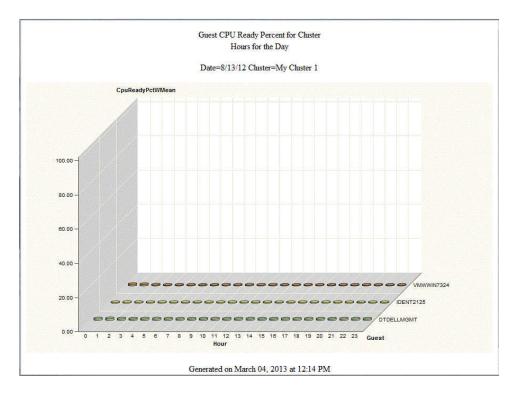
#### **Using Three-Dimensional Bar Charts**

Three-dimensional vertical bar charts show the relationships between three variables or statistics.

### **Using Three-Dimensional Bar Charts for Performance Management and Capacity Planning**

Presenting volumes of data from a large quantity of resources with vertical block charts is most useful when the relative magnitude of the bars is more significant than the exact magnitude of any particular bar.

Display 1.4 Three-Dimensional Bar Chart of Guest CPU Ready Percent



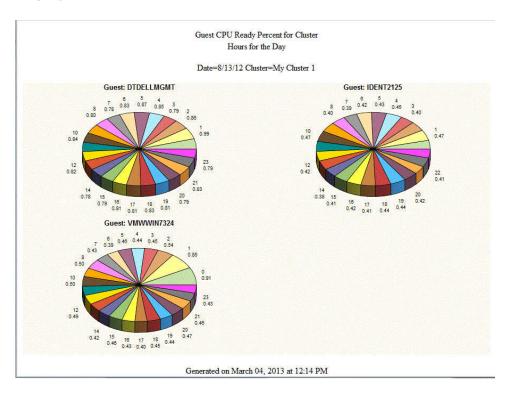
# Example of Using Three-Dimensional Bar Charts with VMware vCenter Server Data

In the preceding display, the vertical bar chart shows the CPU Ready Percent for all guests that are allocated to a VMware cluster. In VMware environments, closely monitoring the CPU Ready Percent measurement is critical. This measurement is the percentage of time for which a virtual machine has work that is ready to be performed but for which there is no physical machine ready to process that work. In well-tuned environments, this measurement should never exceed 10%. It should typically be a value of less than 5% in order to ensure that the needs of each of the consumers of virtual resources are satisfied. Any value in excess of this recommendation is cause for additional IT performance evaluation.

For an alternative view of this data, right-click anywhere on the chart to display pie charts for each guest in the cluster. Pie charts create simple, group, or stacked charts that represent the relative contribution of the parts to the whole by displaying data as

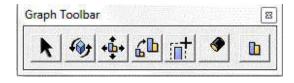
wedge-shaped "slices" of a circle. Each slice represents a category of data. The size of a slice of the pie represents the contribution of the data to the total chart statistic.

Display 1.5 Pie Charts of Guest CPU Ready Percent



Right-click a pie chart to display the graph toolbar.

Graph Toolbar Display 1.6



As shown in the preceding display, the graph toolbar provides a button ( ) that enables you to rotate the graph. You can also zoom into the graph by clicking

The pie charts enable performance and capacity analysts to gain a detailed perspective for a particular measurement that is associated with a designated resource. In the

preceding example, if a particular cluster had a guest with a disproportional value for CPU Ready Percent, that value would be easily identifiable in a pie chart view.

# **Charts for the Detailed Analysis of Resource Measurements**

#### **Using Tabular Reports**

Tabular reports enable you to generate crosstabulation tables, also known as *contingency tables*, from your data. Tabular reports are used extensively for communicating performance and capacity information. They typically present measurements in ranked orders to focus the report consumer's attention most appropriately.

# Using the Tabular Report for Performance Management and Capacity Planning

For the purposes of IT performance management and capacity planning, tabular reports are good for displaying measurements to view and understand the relationship (cause and effect or correlation) between them. Examples include the analysis of directly related measurements like CPU and Run Queue or Memory and Paging. Tabular reports are also useful for readily identifying suspect performance values that warrant further investigation.

Display 1.7 Tabular Report of RMF Data

	Hours for the Day													
Date=8/13/12 DayOfWeek=Mon Sysplex=DEVAPLEX Machine=DEVA														
Hour	Standard Engine CPU Busy Percent Weighted Mean	ZAAP CPU Busy Percent Weighted Mean	eHP CPU Busy Percent Weighted Mean	All Engines CPU Hardware Man Total	Standard Engine CPU Hardware Msn Total	gAAP CPU Hardware Msu Total	zHP CPU Hardware Msw Total	All Engines CPU Hardware Mips Total	Standard Engine CPU Hardware Mips Total	zAAP CPU Hardware Mips Total	zHP CPU Hardware Mips Total	Standard Engine CPU Active Time Total	zAAP CPU Active Time Total	zIIP CPI Active Tim Totz
13	54.37	97.27	4.66	768.73	593.55	171.07	4.10	5,748.73	4,438.75	1,279.32	30.65	6:44:58.63	1:56:43.28	0:02:47.8
12	78.56	96.67	4.88	727,00	552,70	170.02	4.29	5,436.73	4,133.22	1,271.42	32.09	6170606	1:56:00:00	0.02:55.6
11	78.58	87.40	5.08	710.97	552.78	153.72	4.47	5,316.85	4,133.86	1,149.55	33.44	6:17:09.59	1.44.52.89	0:03:03.0
10	77.70	64.67	3.97	663.84	546.62	113.73	3.49	4,964.40	4,087.79	850.53	26.08	6:12:57.36	1:17:35.97	0:02:22.7
14	76.03	65.66	4.83	654.60	534.86	115.49	4.25	4,895.27	3,999.84	863.63	31,79	6:04:55:95	1:18:47.69	0.02:54.0
15	74.10	60.66	2.96	630.59	521.30	106.69	2.60	4,715.75	3,898.41	797.88	19.47	5:55:40.65	1:12:47.74	0.01:46.5
9	76.11	51.10	0.09	625.40	535.44	89.88	0.08	4,676.90	4,004.19	672.13	0.58	6:05:19.75	1:01:19.37	0:00:03.1
16	69.20	68.21	0.17	606 94	486.83	119.96	0.15	4,538.89	3,640.63	897.12	1.13	5:32:09.56	1:21:51:04	0:00:06.1
2	78.37	21.09	0.20	588.63	551,35	37.10	0.18	4,401.89	4,123.14	277.44	1.31	6:16:10:89	0.25.18.78	0:00:07.1
1	78.55	20.15	0.09	588.11	552.59	35.45	0.08	4,398.07	4,132.40	265.08	0.60	6:17:01.57	0:24:11.07	0:00:03.2
7	77.25	20.35	0.08	579.32	543,44	35.80	0.07	4,332.30	4,064.02	267.72	0.56	6:10:47.26	0:24:25:55	0:00:03.0
23	73.94	28.99	0.18	571.30	520.14	51.00	0.16	4,272.31	3,889.77	381.36	1.19	5.54.53.36	034.47.62	0.00.06.5
22	67.34	50.10	0.26	562.08	473.74	88.11	0.23	4,203.38	3,542.77	658.91	1.70	5:23:13.82	1:00:07.02	0:00:09.2
0.	68.26	20.20	0.03	515.77	480.23	35.52	0.02	3,857.10	3,591.27	265.66	0.17	5:27:39.35	0:24:14:26	0:00:00.93
3	64.35	20.16	0.13	488.28	452.71	35.45	0.11	3,651.45	3,385.49	265.13	0.83	5:08:52.87	0.2411.38	0:00:04.5
4	62.69	21.28	0.23	478.67	441.04	37,43	0.20	3,579.65	3,298.24	279.90	1,51	5:00:55.24	0:25:32.26	0.00.08.2
8	59.10	29.46	0.05	467.63	415.76	51.81	0.05	3,497.02	3,109.19	387.49	0.34	4:43:40.35	0:35:21.18	0:00:01.8
5	59.48	19.90	0.00	453.44	418.43	35.00	9.00	3,390.95	3,129.15	261.76	0.03	4:45:29.60	0.23:52.95	0:00:00.1
21	50.99	41.35	0.11	431.58	358.76	72,73	0.10	3,227.46	2,682.86	543.86	0.74	4:04:46.54	0:49:37.19	0:00:04.0
17	44.95	44.16	0.04	393.94	316.23	77.67	0.04	2,945.96	2,364.85	580.84	0.27	3:35:45.64	0:52:59.63	0:00:01.4
6	49.54	19 60	0.02	382.98	348.49	34.47	0.01	2,864.01	2,606.10	257.81	0.10	3:57:46:32	0:23:31.29	0:00:00:5
20	41.70	27.01	0.01	340.86	293.35	47.51	0.00	2,549.07	2,193.73	355.31	0.03	3:20:08.90	0.32.25.03	0:00:00.1

### **Example of Using a Tabular Report with IBM System Management Facility RMF - System Data**

The preceding tabular report shows the available CPU Busy, hardware millions of instructions per second (MIPS), hardware millions of service units per second (MSUs), and CPU Active Time for all engine types that are available on a particular mainframe system for each hour of the day. The report includes standard, System z Integrated Information Processor (ZIIP), and System z Application Assist Processor (ZAAP) engine types. The report is sorted by All Engines CPU Hardware Mips Total. It presents the consolidation of key metrics data that is fundamental to managing the CPU performance and capacity of an IBM mainframe system.

The System CPU Busy Percent measurements that were used to create this report came from RMF data. SAS IT Resource Management obtains RMF data through MXG. For other sources of data that are made available to SAS IT Resource Management through MXG, see Appendix 2, "Supported Adapters," in SAS IT Resource Management: Administrator's Guide.

SAS IT Resource Management accommodates the analysis of mainframe and specialpurpose processors as well as the unique applications that operate on these systems. SAS IT Resource Management can provide an analysis of the eligible Java work (that

is, work that can be performed on a lower cost special-purpose engine) so that the cost advantages of implementing special- purpose engines can be explored. In the preceding report, the MSU values are calculated using appropriate CPU active times (based on the type of processor) with a hardware service unit factor that corresponds to the CPU model on which the resource is consumed. The MIPS values in the report are calculated from the resulting MSU values by multiplying with an MSU-to-MIPS conversion factor that also corresponds to the CPU model.

SAS IT Resource Management adapters enhance the value of IT mainframe performance measurements by providing mainframe processor performance data in the following formats:

- MIPS that accommodate the needs of the performance manager and capacity planner who assess the availability of mainframe resources
- MSUs that accommodate the capacity planner and IT financial analyst who need to determine how best to accommodate business demand for mainframe resources
- CPU time-expended measurements that are most appropriate for detailed system performance analysis.

IBM Large System Performance Reference (LSPR) tables are owned by and available from IBM. They are used as reference information to enable the calculation of MIPS and MSUs from the expended CPU time. Hardware MSUs are used in the physical engine type calculations for systems and logical partitions (LPARs). Software MSUs are used for application measurements.

**Note:** SAS and IBM worked together as partners to understand and create methods to accommodate full-capacity and subcapacity machines. This methodology includes the adjustment of machine model numbers for full-capacity machines to calculate the most accurate MIPS and MSU values.

For more information, see "How MSU and MIPS Columns Are Included in Staged Tables for the SMF Adapter" in Appendix 2, "Data Sources Supported by SAS IT Resource Management Adapters," in the SAS IT Resource Management 3.6: Administrator's Guide.

### **Charts for Cumulative Analysis**

#### **Using Stacked Bar Reports**

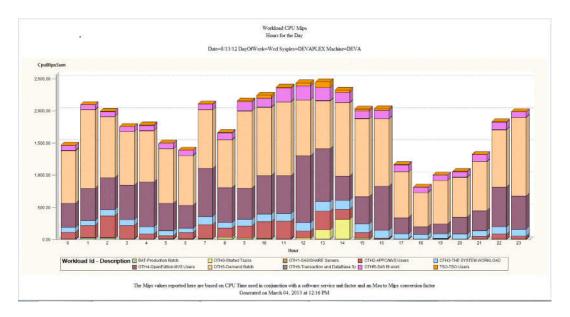
Stacked bar reports show the relative magnitude of data by displaying bars of varying height. Each set of color-coded segments in a bar represents a category of data. Stacked bar charts are most useful when the relative magnitude of the segments in the bars is as significant as or more significant than the exact magnitude of any particular bar. Stacked bar charts display the color-coded segments for each category of data. one on top of the other.

### **Using the Stacked Bar Report for Performance Management and Capacity Planning**

Reports of this type are essential to understanding the allocation of specific resources to workloads for a host system, network component, or virtual system environment. These reports also help create load-balancing strategies and enable users to adjust their workloads to minimize the use of resources.

Evaluating workload measurements such as transaction counts, I/O and exception rates, response times, and CPU, disk, and memory performance attributes is crucial for ensuring service quality and assessing charges that should be allocated to business units that share computer resources. Stacked charts are useful for understanding the parts of a whole entity, whether that entity is a resource, a segment of time, or any other quantifiable object. Facts that are communicated by stacked charts, along with other data, are effective in determining the proper allocation of resources to the business tasks that must be accommodated. For example, certain business processing must take place in a given time period. Therefore, the resource to accommodate this processing must be available.

Display 1.8 Workload CPU MIPS



# **Example of Using the Stacked Bar Report with IBM System Management Facility RMF - Workload Data**

The presentation of any data in a stacked bar chart enables you to make quick comparative observations. Viewing the resource utilization and workload components of an IT resource over the hours of a day enables the IT performance manager to understand how that resource can best be allocated and used.

In the preceding report, the CPU resource (specified in software MIPS) is segmented by the applicable active workloads defined to the system (typically through the RMF Workload Manager). Workload usage of the resource can be reviewed and analyzed. This analysis enables capacity planners to understand exactly how much of the resource is being used by workloads and when those resources are being used.

### **Charts for Time-Based Resource Analysis**

#### **Using Line Plots**

Line plots connect data points with straight lines. Points are connected in the order in which they occur in the input data set. From an IT perspective, line plots are most often used to show a particular aspect of IT performance over a designated period of time.

Line plots show the mathematical relationships between multiple numeric variables by revealing trends or patterns of data points.

### **Using Line Plots for Performance Management and Capacity Planning**

Line plots are used extensively for the purposes of performance management and capacity planning. They are a guick and easy way to understand variations on a single metric or comparative cause and effect relationships between multiple variables. For example, the CPU utilization of a resource over the course of an hour, day, week, or month can yield valuable information about the business cycles that are being accommodated by that resource. These facts are essential to planning for the capacity of that device. Similarly, evaluating the relationship between CPU utilization and system run queues, as well as memory utilization and paging rates, yields facts that can help capacity planners configure resources that can best accommodate assigned workloads.

Establishing and understanding the utilization and availability profiles of resources and sets of resources is useful for managing the performance and capacity of those machines. This type of time-based analysis enables you to readily identify exceptions to anticipated performance activities.

For example, at 9:00 a.m. resource utilization increases to accommodate the beginning of the work day, and you can observe user login activity. You can observe a decrease in utilization around noon when employees are at lunch. This observation is followed by another peak that ends around 5:00 p.m. when the work day ends. Overnight, peaks and valleys in utilization illustrate batch processing activities, routine system maintenance work such as backups, and lulls that are associated with business inactivity. Viewing this behavior over long periods of time and over various periods of time (days, weeks, quarters, or months) enables IT profiles to be characterized. These profiles provide information that is useful in the following ways:

- planning for future capacity needs
- identifying abnormal activities such as a security intrusion
- considering cost-based initiatives such as virtualization or the allocation of resources to accommodate work forces around the globe
- examining IT utilization, availability, and performance in relation to business cycles

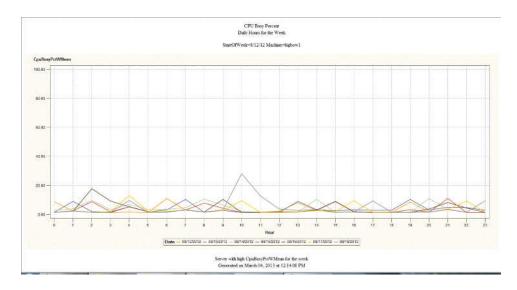
Business cycles and the performance and capacity of IT systems all change over time. The good news for IT performance managers is that these changes can be analyzed and reported on over different time periods. This information enables IT performance managers to make the correct and best IT business decisions. For example, performance measurements of a particular resource can be analyzed over time to assess its performance, utilization, and availability. From this assessment, the IT response to business events, economic drivers, or natural weather occurrences can be analyzed. If necessary, adjustments to the configuration of IT enterprise can be identified to accommodate these occurrences in the future.

#### **Example of Using Line Plots with HP Performance Agent Data**

In the following example, the CPU utilization of a particular UNIX machine is being evaluated. SAS IT Resource Management can obtain UNIX data through the following adapters:

- System Activity Reporter (SAR)
- HP Performance Agent (HP Perf Agent )
- HP Reporter
- BMC Performance Manager for Servers (BMC Perf Mgr)

Display 1.9 CPU Busy Percent



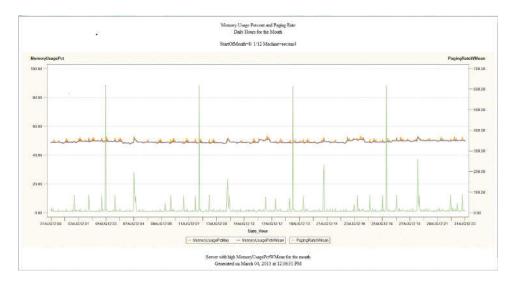
This chart shows the CPU Busy activity of a machine for the hours of the day over the course of a week. Analysis of this type facilitates load balancing and redistribution of workload activities as well as the overall capacity planning function.

An IT performance data warehouse benefits UNIX environments because it is the single best method to accommodate the many resource, enterprise systems management, and freeware monitoring tools that are used to measure the performance and manage the availability of these systems.

# Using Line Plots with Multiple Vertical Columns for Performance Management and Capacity Planning

Comparing the three lines on the following graph provides a perspective that shows how seemingly small variations in the maximum and mean memory measurements for a particular UNIX device relate to the paging rates that are associated with that device. This long-term (monthly) analysis can prompt more detailed memory analysis activity to ensure that the system is configured with an adequate quantity of memory for the processing allocated to this device. This long-term (monthly) analysis can prompt more detailed memory analysis activity to ensure that the system is configured with an adequate quantity of memory for the processing allocated to this device.





### **Charts for Comparative Analysis**

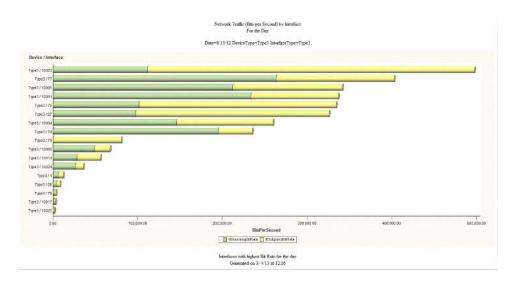
#### **Using Horizontal Bar Charts**

Horizontal bar charts show the relative magnitude of data by displaying horizontal bars of varying length.

# Using Horizontal Bar Charts for Performance Management and Capacity Planning

Horizontal bar charts illustrate the comparative volume of a measurement, typically over a time period. From a performance management and capacity planning perspective, bar charts are used for comparative analysis and to get a good perspective on the measurements being analyzed. You might consult these charts to prioritize issues or to quantify their severity.





# **Example of Using Horizontal Bar Charts with Simple Network Management Protocol Data**

The one element of the IT infrastructure that is common across large portions of the enterprise is the network. The best source of information that can be used to measure the performance and to assess the health of that network is a repository of Simple Network Management Protocol (SNMP) data.

The preceding chart shows the network interfaces that have the highest incoming and outgoing bit rates over the course of a day. Charts of this type establish an understanding of what is normal and expected activity with respect to network traffic. Deviations to measurements of this type and the trends associated with them should be more thoroughly analyzed.

SAS IT Resource Management provides a reference table that identifies the type of devices that are charted. (For example, in the preceding chart, the reference table was used to determine that the device measurements pertained to the traffic on a Type1 device.)

For information about this lookup table, see "Working with the ITMS SNMP DeviceType Lookup Table" in Chapter 2, "Preparing to Work with the SAS IT Resource Management Client," in the SAS IT Resource Management 3.6: Administrator's Guide. For information about this lookup table, see "Working with the ITMS SNMP DeviceType Lookup Table" in Chapter 2 of SAS IT Resource Management: Administrator's Guide.

SNMP measurements are essential for understanding the status and components of a network and the devices that are serviced by the network. These measurements can show the status of the network's routers, hubs, and switches as well as the status of the network's links and interfaces. Network administrators and performance analysts must be able to understand the behavior and error rates that are associated with network devices over time. In that way, they can identify and replace faulty hardware components that contribute to the overall degradation of the network. SNMP also communicates the utilization status and highlights instances where thresholds that were established for that utilization have been exceeded. All of this information, and its analysis, is used to best allocate traffic to the network and to tune its flow across individual network components.

SAS IT Resource Management enables you to import MIB definitions that can be used to create the metadata for SNMP staged tables.

Prior releases of SAS IT Resource Management used the repository of SNMP data that was created by the HP Network Node Manager and the Tivoli NetView snmpColDump utility. Newer releases of the HP and Tivoli network management system products do not support the snmpColDump utility. Accordingly, SAS IT Resource Management now supports data collection of SNMP data from a round-robin database to which the data is written. As a convenience for our customers, SAS IT Resource Management continues to support the collection of SNMP data from the repository created by the HP and Tivoli snmpColDump utility.

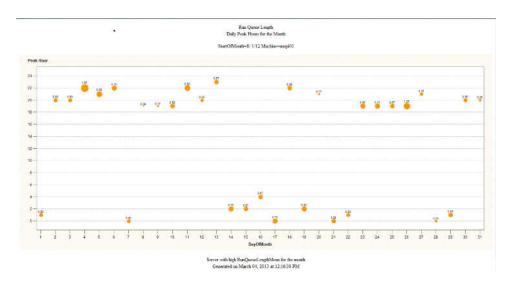
For information about the support that is provided for these two data sources, see "SNMP—Accessing Raw Data" in Appendix 2, "Data Sources Supported by SAS IT Resource Management Adapters," in the SAS IT Resource Management 3.6: Administrator's Guide.

### **Charts for Multi-Perspective Analysis**

#### **Using Bubble Plots**

Bubble plots display information from several perspectives to illustrate the relationships of those perspectives.





# **Example of Using Bubble Plots with Microsoft System Center Operations Manager**

In the preceding display, Run Queue Length measurements from Microsoft System Center Operations Manager for a particular machine is evaluated for each day of the month and each hour of the day. This analysis enables performance managers to

understand when Run Queue Lengths are at their peak so that systems can be sized or work can be prioritized and allocated or reallocated to alternate devices.

## **Exception Reports**

### **Using Exception Reports**

SAS IT Resource Management provides the ability to define, detect, evaluate, and report on conditions in the data that are statistically exceptional. Exception analysis systems notify users about potential conditions of concern in a proactive way through exception reports.

### **Example: Evaluating Server Usage with the Constant Threshold Expression Type**

#### **Problem Statement and Methodology**

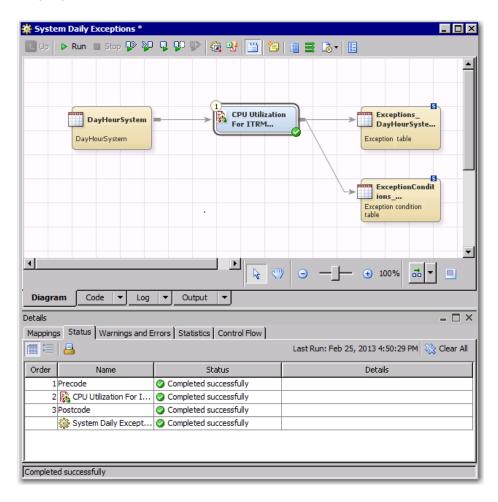
The capacity planner of a large enterprise wants to determine whether the MIS Business Intelligence servers (misbi4a, misbi5a, and misbi6a) in her company are underused. These servers are dedicated to the MIS group. The capacity planner wants to use facts to convince the MIS group to allow these BI servers to be shared by other teams in the organization that require access to the Business Intelligence software that is hosted on these servers. The following example describes how this is accomplished.

This example uses a filter to specify MIS Business Intelligence servers. To avoid seeing the same exceptions every day, the exception specification uses a filter to look for exceptions for the last day only. The input source is a DAYHOUR table called DayHourSystem. The exception definition is set up to flag an exception if it discovers six consecutive hours where the CpuBusyPctWMean is less than 20%. The group that is specified in the Exception transformation for this example is MACHINE.

#### **Setting Up the Exception Transformation**

For this example, the Exception transformation (CPU Utilization For ITRM Servers) is executed from the job called System Daily Exceptions. Both the exception table and the exceptional conditions table are specified for this transformation. Their contents can be used for additional processing.

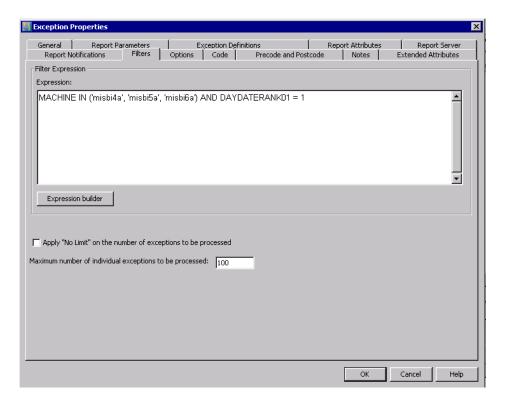
Display 1.13 Process Flow Diagram for the System Daily Exceptions Job



The name of the Exception transformation is specified on the **General** tab. In this example, the name is CPU Utilization For ITRM Servers.

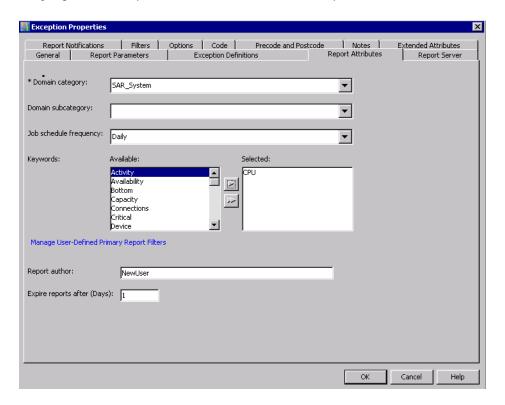
The **Filters** tab is set to cause the transformation to process only observations that pertain to the date of the last date of data and the three machines (misbi4a, misbi5a, and misbi6a).

Display 1.14 Filters Tab of the Exception Transformation



The filters that are specified on the Report Attributes tab are shown in the following display:

Display 1.15 Report Attributes Tab of the Exception Transformation



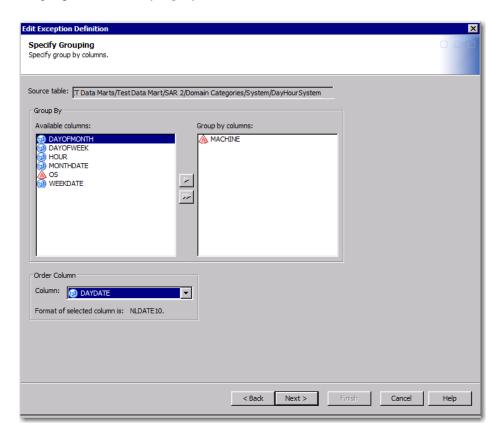
The **Domain subcategory** is not specified.

**Note:** The exception definition for this example is described in the following topic. This example maintains the default values for the remaining tabs of the Exception transformation.

#### **Setting Up the Exception Definition**

The value of the **Group by** column for this example is MACHINE. The **Order Column** is DAYDATE.

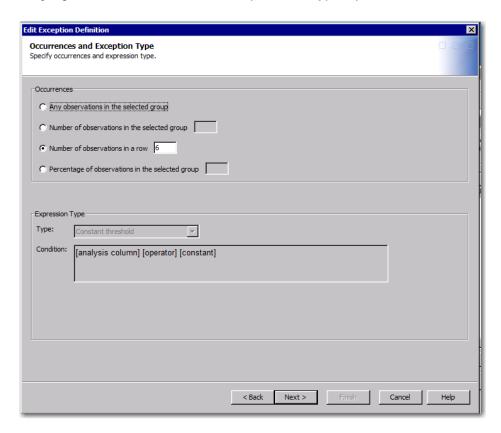
Display 1.16 Grouping Specification



As shown in the following display, the Exception Type is Constant threshold. The Number of observations in a row is set to 6.

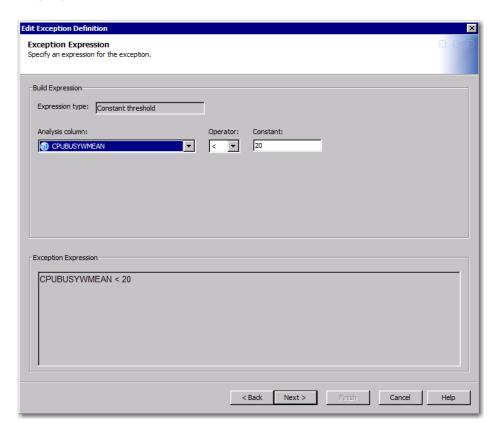
Note: The source data is hourly data. Therefore, each observation represents an hour.

#### Display 1.17 Occurrences and Expression Type Specification



In the following display, the **Expression** type for this **Constant threshold** exception is CPUBUSYMEAN < 20. (CPUBUSYWMEAN is calculated as a percentage.)

Display 1.18 Constant Threshold Expression Specification



#### **Running the Exception Job**

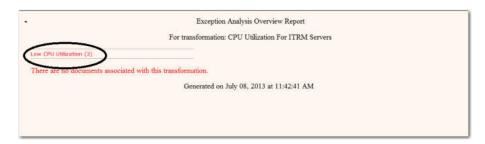
If an exception is detected, two types of reports are generated:

- an overview report.
- an individual report for each Group By value that met the exception condition. The individual report shows the details that pertain to the exception that was flagged.

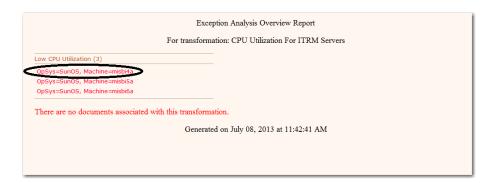
For this example, both the exception table and the exceptional conditions table are output from the transformation.

#### **Viewing the Exception Reports**

The Exception transformation creates an overview report as well as individual reports. The following display shows the unexpanded overview report.

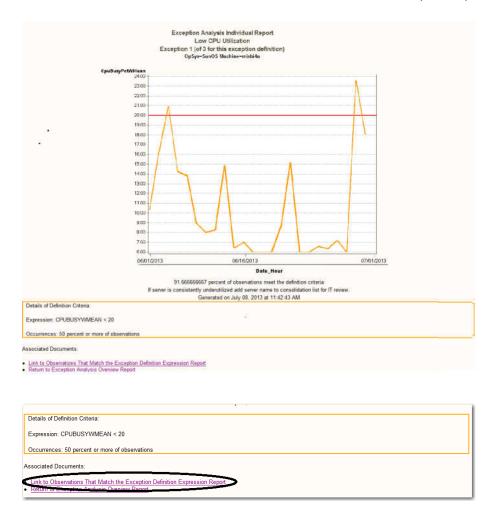


To see the expanded version of the overview report, click the name of the exception definition. (In the preceding display, this name is circled.) The expanded overview report lists the Group By values (for the **MACHINE**s) that matched the condition that was specified by the exception definition. In this example, the following **MACHINE**s had CPU utilization below 20% for 6 observations (hours) in a row: misbi4a, misbi5a, and misbi6a.



To see the individual reports for the MACHINES that experienced low CPU utilization, click the corresponding **MACHINE**. In the preceding display, the misbi4a MACHINE is circled. That action displays the individual report for misbi4a.

Note: The remainder of this example pertains to the misbi4a machine.



To see the observations that matched the expression that was specified in the exception definition, click Link to Observations That Match the Exception Definition Expression Report. (The link is circled in the preceding display.) The expression that was specified in the exception definition is CPUBUSYWMEAN < 20.

## Observations That Match the Exception Definition Expression Low CPU Utilization Exception 1 (of 3 for this exception definition)

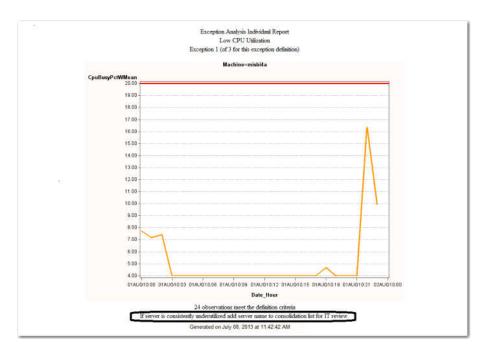
#### OpSys=SunOS Machine=misbi4a

Date_Hour	CpuBusyPctWMean	
30JUN13:00	10.36	
30JUN13:01	16.25	
30JUN13:03	14.25	
30JUN13:04	13.83	
30JUN13:05	8.92	
30JUN13:06	8.00	
30JUN13:07	8.25	
30JUN13:08	14.84	
30JUN13:09	6.42	
30JUN13:10	7.00	
30JUN13:11	6.00	
30JUN13:12	6.00	
30JUN13:13	6.00	
30JUN13:14	8.58	
30JUN13:15	15.17	
30JUN13:16	6.00	
30JUN13:17	6.00	
30JUN13:18	6.58	
30JUN13:19	6.33	
30JUN13:20	7.17	
30JUN13:21	6.00	
30JUN13:23	18.08	
Total (	Total Observations 22	

Generated on July 08, 2013 at 11:42:42 AM

## **Analysis and Recommendations**

As shown in the individual report for misbi4a, the server is consistently under-utilized. Except for two significant periods of moderate usage, the server is not experiencing much activity.



The recommendation that is circled in the preceding display suggests that this server be considered for consolidation with another server.

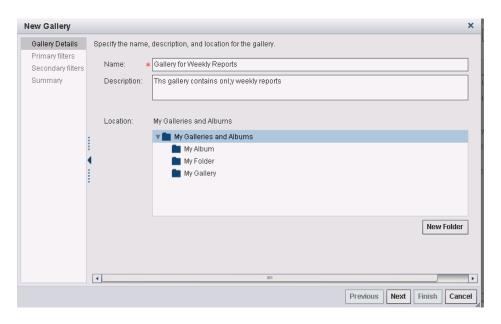
## **ITRM Report Center**

## **About ITRM Report Center**

ITRM Report Center is a web application that enables users to view, organize, filter, and share SAS IT Resource Management performance and exception reports. From the workspace bar, you can access the Home, Gallery, Resource, and Administration workspaces.

The following display shows the wizard that enables you to create a gallery.

Display 1.19 Create Gallery Wizard



Galleries are contained in folders and those folders can be shared with user groups. For a complete description of the features and functions of ITRM Report Center, see the SAS IT Resource Management 3.6: Report Center Guide.

## **Viewing Galleries**

## **About Viewing Galleries**

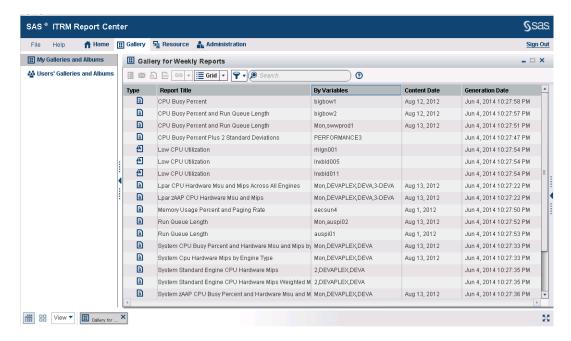
ITRM Report Center provides four methods of viewing your galleries:

- grid view
- tile view
- flow view
- preview view

## **Viewing Galleries with the Grid View**

When you access a gallery, you can select the grid view to review the reports as rows in a table, as shown in the following display:

Display 1.20 Grid View of a Gallery



## **Viewing Galleries with the Tile View**

When you access a gallery, you can select the tile view to display smaller images of the reports that are in that gallery.

Display 1.21 Example of a Gallery Showing the Tile View



You can double-click a tile image to generate a larger version of the report that is easier to view.

## **Viewing Galleries with the Flow View**

When you access a gallery, you can select the flow view to review the reports by leafing through them as if they were pages in a book. As shown in the following display, the reports are displayed as a horizontal stack:

**Display 1.22** Cover Flow View of a Gallery

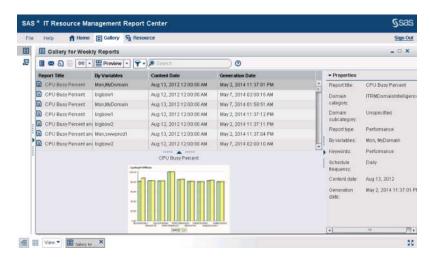


The flow view displays a horizontal stack of reports at one time. Each report image includes the report title, and BY variables and a small image of the report. This view displays the reports as moveable pages so that you can navigate through a sequence of reports that are stacked together. You can double-click an individual report to view a large image of it in a separate browser window.

## **Viewing Galleries with the Preview View**

When you access a gallery, you can select the preview view to review the reports as a shortened list of the reports that are shown in the grid view and preview pane here:

Display 1.23 Preview View of a Gallery



Click a report in the grid area to see an image of that report in the preview area. Doubleclick a report in the grid area or the preview area to see a larger view of the report in a separate browser window.

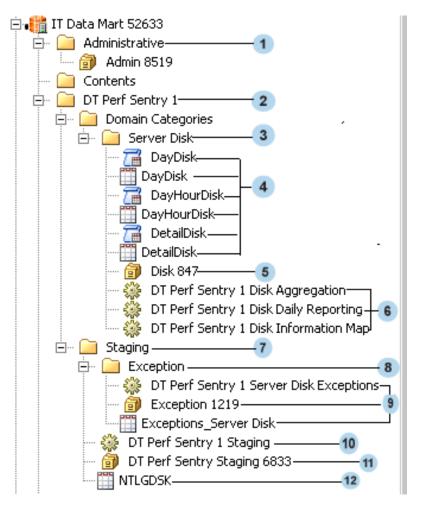
# Working with SAS IT Resource Management

About the IT Data Mart	39
What Are Adapters?	41
How Does SAS IT Resource Management Work?	42
Adapter Setup Wizard	45

## **About the IT Data Mart**

At the center of SAS IT Resource Management are IT data marts. IT data marts enable SAS IT Resource Management to store and access IT data as well as the jobs and processes that manipulate, analyze, and report on this data. The collection of IT data marts forms the IT performance data warehouse from which domain intelligence is derived.

Figure 2.1 Example of an IT Data Mart with Numbered Explanations



- 1 Admin folder that contains the Admin library that was generated for IT Data Mart 52663
- 2 Folder that is generated for the first instance of running the Adapter Setup wizard for the DT Perf Sentry adapter
- 3 Folder that contains objects related to the Server Disk domain category for DT Perf Sentry
- 4 Tables and information maps for the aggregations that are connected with the Server Disk domain

- 5 Library that contains all aggregation tables that are connected with the Server Disk domain
- 6 Jobs that generate the aggregation tables, information maps, and reports that are connected with the Server Disk domain
- 7 Folder that contains the staging library, staged tables, staging job, and Exception folder that are connected with DT Perf Sentry
- 8 Folder that contains the exception job, exception library, and the exception tables that are connected with the Server Disk domain
- **9** Exception job, exception library (that contains the exception tables), and exception tables that are connected with DT Perf Sentry.
- 10 Staging job for DT Perf Sentry
- 11 Library that contains all staged tables that are populated by the DT Perf Sentry Staging job
- 12 Staged table that is populated by the DT Perf Sentry Staging job

If a second instance of the adapter is specified, it is called "<adapter-name> 2" (DT Perf Sentry 2). For more information about IT data marts, see Chapter 4 "About the IT Data Mart," in the SAS IT Resource Management 3.6: Administrator's Guide.

## **What Are Adapters?**

An adapter is a collection of SAS IT Resource Management processes that start with raw IT data sources and end with sets of reports that deliver the domain intelligence about the resource from which that raw IT data was generated.

Raw data about an IT resource is represented using measures and formats that are specific to the software that collected it. In order for the data to be processed into statistics about an enterprise's IT resources, the raw data must be read, interpreted, and possibly converted into a more standard form. It can then be loaded into staged tables in preparation for subsequent aggregation and reporting. The raw data about an IT

resource is generated by the logging mechanism of that resource or by a system management utility that works with that data.

For those sources of data that are not natively supported by SAS IT Resource Management, a User-Written Adapter capability is provided. User-written adapters support the creation of processes to manage those sources by fully leveraging the staging, aggregation, information map, and reporting capabilities that are delivered with the solution.

For a list of the adapters that SAS IT Resource Management supports, see "Supported Adapters" in Appendix 2, "Data Sources Supported by SAS IT Resource Management Adapters," in the SAS IT Resource Management 3.6: Administrator's Guide.

# **How Does SAS IT Resource Management Work?**

SAS IT Resource Management provides the processes and the supporting technology that are required to regularly collect, aggregate, analyze, and report on the IT performance data that is vital to the management of the IT infrastructure. For data sources that are supported by SAS IT Resource Management, the Adapter Setup wizard guides the user through a series of specific choices that describe how that data is to be aggregated, analyzed, and reported on.

The following steps are necessary to gather and analyze data using SAS IT Resource Management 3.6:

1 Collect and stage the raw data about a resource.

IT performance data is information about IT resources, such as hardware, operating system software, virtual systems, networks, web servers, databases, and applications. Raw (or unprocessed) data about the usage, availability, or performance of these resources is generated by the logging mechanisms that are inherent to IT resources or is created by the Enterprise Systems Management tools that are used to manage the IT infrastructure. All of the data that is managed and analyzed by SAS IT Resource Management is first staged. The adapter's staging code performs functions such as reading the raw data source, normalizing

measurement units, separating into tables based on domain categories, generating computed columns, and checking for and managing duplicate data. Staging is performed by SAS IT Resource Management transformations that are set up in SAS Data Integration Studio.

For a list of the adapters that SAS IT Resource Management supports, see "Supported Adapters" in Appendix 2, "Data Sources Supported by SAS IT Resource Management Adapters," in the SAS IT Resource Management 3.6: Administrator's Guide.

**Note:** If exception definitions were set up for the domain category of the adapter, the staged tables that are generated can be analyzed to determine whether exceptions are detected. For information about the exception analysis process, see "Overview of Exception Analysis Processing" in Chapter 9, "Exception Analysis Processing," in the SAS IT Resource Management 3.6: Administrator's Guide. For information about the exception analysis process, see "Overview of Exception Analysis Processing" in Chapter 9 of SAS IT Resource Management: Administrator's Guide.

## **2** Aggregate the staged tables.

After the raw data is staged, it can be input to the aggregation step. Aggregation transformations can generate simple aggregation or summarized aggregation tables. Simple aggregations read data from the staged table and append that new data to an existing table without undergoing any summarization. Summarized aggregations read data from a staged table and then categorize and aggregate that data according to the specifications of the aggregation transformation. Aggregation transformations are created, updated, and deployed for execution using the SAS IT Resource Management client.

After the performance data has been aggregated, it is ready for the information mapping and reporting processes.

## 3 Generate information maps.

SAS IT Resource management generates transformations that create information maps that reference the tables of data that are generated by that adapter's aggregation transformations. Information maps provide clearly labeled analysis and report-ready references for all data fields that are used to create and view reports.

Information maps can be used in SAS Enterprise Guide and SAS Enterprise Business Intelligence applications such as SAS Web Report Studio and SAS BI Dashboard. They generate reports that provide domain intelligence about the data that is available for each adapter.

4 Define and run reports.

SAS Enterprise Guide, described below, generates reports by using information maps or by directly accessing data in SAS tables. The business friendly information maps that are provided by SAS IT Resource Management are the recommended data sources for all reporting activity.

In SAS Enterprise Guide, the ITRM Report Definition task can be selected. When the Report Definition task is run, it creates a report definition that is stored on the SAS Metadata Server. SAS IT Resource Management client provides features that enable report definitions to be selected, and creates the jobs that run these reports.

5 View and manage IT performance and exception reports.

SAS IT Resource Management provides ITRM Report Center to organize and view collections of reports called galleries. The contents of a gallery are determined by selecting filter values that are available for those reports that are created by SAS IT Resource Management. In ITRM Report Center, performance analysts and information consumers can access the reports that were created and stored in the SAS Content Server.

**Note:** The jobs that execute these transformations can run interactively, but more typically they are scheduled to run in batch mode.

In addition, ad hoc reporting is provided through several SAS products. Documentation for these products is available at http://support.sas.com/documentation/index.html.

- SAS Enterprise Guide is a Windows application that accesses data directly or uses information maps to select and report on data.
- SAS Web Report Studio, which has a web-based interface, uses information maps to select and report on data.

- SAS BI Dashboard is a web interface that is easy to administer and easy to use. It enables you to use dashboards to monitor key performance indicators that convey how well resources are performing.
- SAS Add-In for Microsoft Office enables SAS functionality to be accessed directly from the menus and toolbars of Microsoft Office products.
  - Performance analysts and information consumers who frequently work with Microsoft Office products can access the analysis and report-ready data that is created by SAS IT Resource Management.

Note: Reports that are created with SAS Web Report Studio, SAS BI Dashboard, or with stored processes can be viewed on a browser through SAS Information Delivery Portal.

For more detailed information about these tasks, see the SAS IT Resource Management 3.6: Administrator's Guide and the SAS IT Resource Management 3.6: Reporting Guide.

## **Adapter Setup Wizard**

For supported adapters, the preferred method of setting up the ETL and reporting jobs for IT performance data is to use the Adapter Setup wizard. Alternatively, you can set up the ETL and reporting jobs for IT performance data by specifying the required jobs and transformations manually, outside of the Adapter Setup wizard. For more information about the ETL processes, see the SAS IT Resource Management 3.6: Administrator's Guide . For more information about the reporting processes, see the SAS IT Resource Management 3.6: Reporting Guide.

Data administrators typically specify the ETL and reporting jobs for an adapter by means of the Adapter Setup wizard. The Adapter Setup wizard prompts the data administrator for the appropriate options and parameters and creates the jobs and transformations that are necessary to generate the required reports.

The Adapter Setup wizard automates the processes that are needed to generate reports from IT performance data. It guides you through the steps that set up the jobs that, when run, create the staged tables, aggregation tables, information maps, and report output for a supported input data source.

To set up the ETL jobs, the Adapter Setup wizard prompts you to specify the IT data mart, the adapter, the location and the format of the input data. In addition, the wizard prompts you for the parameters that specify how the data is delimited or how duplicate data checking is to be performed. (The Adapter Setup wizard uses supplied template tables to create the required staged tables for each adapter.)

In order to set up the jobs that generate reports, the Adapter Setup wizard prompts you for information such as this data:

- the domain categories and time periods for which you want report-ready data to be prepared
- the location of the formulas that are to be used in creating additional fields of data
- the location in the SAS Content Server where the reports and their associated metadata is to be stored.
- automatic deployment of the jobs that the wizard creates

When you click **Finish**, the ETL, report and exception jobs are created and stored in the IT data mart that you specified. In addition, the wizard generates the metadata for the tables, information maps, report definitions, exception definitions, and libraries that are needed.

The jobs that are created by the Adapter Setup wizard are intended to be deployed for scheduling and executed in batch mode on the operating environment where you created them.

**Note:** The Add Domain Category wizard provides a way to add more domain categories to staging transformations that were generated by the Adapter Setup wizard. For more information, see "About the Add Domain Category Wizard" in Chapter 11, "Add Domain Category Wizard," in the SAS IT Resource Management 3.6: Administrator's Guide.

## **Appendix 1**

# SAS IT Resource Management Resources

SAS IT Resource Management provides many other resources to assist you in using this product and in managing your IT resources.

## **Online Help**

Online Help is available for the user interfaces that SAS IT Resource Management uses. You can access the online Help from within the following SAS products by clicking **Help** on the associated window or pressing the F1 key. To access the user assistance for Gallery Manager, use place your mouse pointer over the field in question.

- SAS Data Integration Studio
  - Online Help consists of the standard help for SAS Data Integration Studio and the field-level help for the additional software that provides support for SAS IT Resource Management.
- ITRM Report Center
   User assistance consists of field-level help for managing IT resource reports.
- SAS Management Console
- SAS Enterprise Guide
   Online Help consists of the standard help for SAS Enterprise Guide, as well as help for the ITRM Report Definition task.
- SAS Web Report Studio

SAS Information Map Studio

To access the Help for SAS Add-In for Microsoft Office, on the toolbar for Microsoft Word or Microsoft Excel, select **SAS**. Then, select **SAS** Add-In for Microsoft Office.

To access the Help for SAS/CONNECT, from within SAS, click **Help** to open SAS Help and Documentation. From the SAS Products section, scroll down to the Help for SAS/CONNECT.

To access the Help for SAS/SHARE, from within SAS, click **Help** to open SAS Help and Documentation. From the SAS Products section, scroll down to the Help for SAS/SHARE.

## **Web-Based Product Documentation**

#### **About Web-Based Product Documentation**

SAS IT Resource Management is built on the SAS®9 architecture and leverages other SAS products and solutions. Web-based access to SAS product documentation is available for SAS IT Resource Management documentation and SAS System documentation.

To access these web pages, use a frame-capable version of a web browser such as the following browsers:

- Windows Internet Explorer 9, 10, and later
- Google Chrome 19 and later
- Mozilla Firefox 6 and later

## **SAS IT Resource Management Documentation**

Information about SAS IT Resource Management is available at: http://support.sas.com/documentation/onlinedoc/itsv/. Along with notes about topics of general interest, this site contains links to the following sets of documents:

SAS IT Resource Management 3.6: Overview: Provides an overview of SAS IT Resource Management.

- SAS IT Resource Management 3.6: Administrator's Guide: Provides a detailed description of the SAS IT Resource Management for data administrators.
- SAS IT Resource Management 3.6: Report Center Guide: Provides a detailed description of the ITRM Report Center web application, including how to manage and view report galleries.
- SAS IT Resource Management 3.6: Reporting Guide: Provides a detailed description of the reporting functionality of SAS IT Resource Management for performance analysts and information consumers. It also provides the Report Conversion appendix that describes how to convert your IT Resource Management 2.7 reports for use with the current version of SAS IT Resource Management.
- Installation documentation is available from the Install Center at this location: http://support.sas.com/documentation/installcenter/index.html. It describes how to install and configure the latest software.
- System Requirements--SAS IT Resource Management 3.6: Provides a list of the requirements for the server tier, middle tier, and client tier for the operating systems supported by SAS IT Resource Management.
- SAS IT Resource Management 3.6: Migration Guide: Describes how to convert your IT Resource Management environment to the current version of SAS IT Resource Management.
- Guide to Operating SAS IT Resource Management 3.6 without a Middle Tier:
   Provides reference documentation about installing and configuring SAS IT Resource
   Management without a middle tier.
- The Metrics Documentation section of the SAS IT Resource Management documentation web page provides documentation about Demand Technology Performance Sentry Data Collection Sets for SAS IT Resource Management. It also provides lists of available metrics documentation, including the data model for this version of SAS IT Resource Management, changes from previous versions of SAS IT Resource Management, and ITRM and MXG column mapping. Navigate to this web page from http://support.sas.com/documentation/onlinedoc/itsv/index.html.
- The **Samples of Supplied Reports** section provides reports and information about those reports for selected supplied reports.

**Note:** Information about the previous versions of the SAS IT Resource Management software is also available. Click the tab that corresponds to the version of SAS IT Resource Management documentation that you want to access.

The web page at http://www.sas.com/solutions/itresource/ provides access to white papers and articles about many topics that pertain to managing your IT resources.

## **SAS System Documentation**

On http://support.sas.com/, you can select **Knowledge Base** to access resources such as Products and Solutions, System Requirements, Install Center, Third-Party Software Reference, Documentation, Papers, Samples and SAS Notes, and focus areas.

The SAS System includes many software products and solutions that are leveraged by SAS IT Resource Management. You can access SAS documentation by using the A-Z index on this web page: http://support.sas.com/documentation/index.html.

## **Technical Support**

If you have questions about or problems with your licensed SAS software, you can explore the multiple resources that are available on the SAS Institute Support website at <a href="http://support.sas.com/techsup">http://support.sas.com/techsup</a>. This website provides an online mechanism for reporting and tracking problems and questions for Technical Support. These electronic services are available 24 hours a day.

Select **Training and Bookstore** to access links to the SAS bookstore, training information, and the certification program. In addition, you can access information about SAS Global Academic Program and SAS OnDemand for Academics.

If you want your question or problem handled by phone, ask your site's SAS Installation Representative or on-site SAS support personnel to call the SAS Technical Support Division. Sites in North America can call 919-677-8008 or send a Fax to 919-531-9449. Sites that are outside of North America should check the Technical Support website or their local SAS office.

## **Training and Consulting Services**

The SAS IT Resource Management solution is tightly integrated with other SAS solutions, such as SAS Data Integration Studio, SAS Enterprise Guide, and the business intelligence components of SAS Intelligence Platform. Therefore, customers might require training for these solutions as well for SAS IT Resource Management.

SAS offers training that is suitable for your needs. For example, you can select live web classes or instructor-led classes. Because SAS is a global company with customers in many different countries, SAS also provides training in the national language of many of these countries. For more information, see the Training web page at <a href="http://support.sas.com/training/index.html">http://support.sas.com/training/index.html</a>. At this website, you can select training that is appropriate for your location and language.

You can also contact the SAS Education department by calling 1-800-333-7660.

Note: You can also order SAS books from SAS Book Sales (1-800-727-3228).

## **SAS IT Resource Management Email Forum**

You can exchange information with other users of SAS IT Resource Management by subscribing to the ITMS-L listserv. This email forum is available for users to exchange tips, techniques, and information about SAS IT Resource Management.

To subscribe, send an email message to *listserv@listserv.sas.com* with the following information:

- Leave the subject line blank.
- In the body of the message, enter the following:

```
SUBSCRIBE ITMS-L <your first name><your last name>
```

For example, enter the following: subscribe ITMS-L John Smith

To send mail to the listsery, send email to itms-l@sas.com.

To remove your name from the email forum, send an email message to listserv@listserv.sas.com with the following information:

- Leave the subject line blank.
- In the body of the message, type

UNSUBSCRIBE ITMS-L

## **Recommended Reading**

- The "Administering SAS Enterprise Guide" chapter in SAS 9.4 Intelligence Platform: Desktop Administration Application Guide
- What's New in SAS IT Resource Management 3.6
- SAS IT Resource Management 3.6: Administrator's Guide
- SAS IT Resource Management 3.6: Reporting Guide
- SAS IT Resource Management 3.6: Report Center Guide
- SAS IT Resource Management 3.6: Migration Guide
- Guide to Operating SAS IT Resource Management 3.6 without a Middle Tier

For a complete list of SAS books, go to support.sas.com/bookstore. If you have questions about which titles you need, please contact a SAS Book Sales Representative:

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## **Glossary**

### adapter

specialized software that loads raw IT performance data from diverse data sources into staged tables that can then be input to other processes. Adapters that are supported by SAS IT Resource Management consist of template tables, transformations, and staging code.

## aged data

data that is deleted from a level of a table because the data exceeds the age limit.

## aggregation

the act or process of grouping data by using an operation that produces a statistic such as a sum, average, minimum, or maximum.

## analysis variable

a numeric variable that is used to calculate statistics or to display values. An analysis variable usually contains quantitative or continuous values, though it is not required.

## availability

See "system availability".

## batch job

a unit of work that is submitted to an operating system for batch processing. For example, under UNIX, a batch job is a background process; under Windows, a batch job is a task; and under z/OS, a batch job is a set of JCL statements.

#### batch mode

a noninteractive method of running SAS programs by which a file (containing SAS statements along with any necessary operating system commands) is submitted to the batch queue of the operating environment for execution.

### BY group variable

See "BY variable".

## BY variable (BY group variable)

a variable that is named in a BY statement and whose values define groups of observations to process.

## capacity planning

the process of measuring performance, availability, and workload volume in a particular computing environment and comparing these measurements over time to baseline values. The object of capacity planning is to predict when resources will need to be upgraded.

## catalog

See "SAS catalog".

## catalog entry

See "SAS catalog entry".

#### class variable

See "classification variable".

## classification variable (class variable)

a variable whose values are used to classify the observations in a data set into different groups that are meaningful for analysis. A classification variable can have either character or numeric values. Classification variables include group, subgroup, category, and BY variables.

#### client

an application that requests either resources or services from a server, possibly over a network.

#### client tier

the portion of a distributed application that requests services from the server tier. The client tier typically uses a small amount of disk space, includes a graphical user interface, and is relatively easy to develop and maintain.

### collector (collector)

software that collects raw performance data that is related to IT services. The data collector could be a facility of the operating system, a product that is provided by a third-party vendor, or software that is written by consultants or by SAS IT Resource Management customers.

#### continuous values

values of a variable that theoretically could indicate an uncountable number of possible values. For example, a variable for measuring the temperature of water in degrees Celsius can have any value from 0 to 100, even though the thermometer cannot measure temperatures beyond a particular level of decimal precision.

#### control data set

one of the data sets that the duplicate-data-checking macros maintain and use to determine whether data from a log has already been processed.

#### CPU normalization

the act or process of taking CPU usage values for CPUs that operate at different speeds and multiplying those values by normalization factors so that the charges assessed for CPU usage are equitable, no matter what type of CPU is used. The normalization factors are based on comparisons to one particular type of CPU that has been specified as the standard for a particular site. CPU normalization is sometimes referred to as processor normalization.

#### cron

a UNIX utility for executing batch jobs on a periodic basis.

## data collector (collector)

software that collects raw performance data that is related to IT services. The data collector could be a facility of the operating system, a product that is provided by a third-party vendor, or software that is written by consultants or by SAS IT Resource Management customers.

#### data set

See "SAS data set".

## data type (type)

an attribute of every column in a table or database, indicating the type of data in the column and how much physical storage it occupies.

#### data view

See "SAS data view".

#### date and time format

instructions that tell SAS how to write numeric values as dates, times, and datetimes.

#### date format

in SAS software, the instructions that tell SAS how to write numeric values as date values.

#### datetime format

in SAS software, the instructions that tell SAS how to write numeric values as datetime values.

#### datetime value

See "SAS datetime value".

#### delimiter

a character that serves as a boundary that separates the elements of a text string.

#### ETL

See "extract, transform, load".

## exit point

a point in the supplied software where additional code runs (if additional code is provided).

#### external file

a file that is created and maintained by a host operating system or by another vendor's software application. An external file can read both data and stored SAS statements.

## extract, transform, load (ETL)

a data warehousing process in which data is extracted from outside sources, transformed according to operational and quality needs, and loaded into a target database.

#### foundation services

See "SAS Foundation Services".

## gallery (report gallery)

a group of reports that are stored on the SAS Content Server and that can be filtered and managed by the ITRM Report Center application.

## global macro variable

a macro variable that can be referenced in either global or local scope in a SAS program, except where there is a local macro variable that has the same name. A global macro variable exists until the end of the session or program.

#### ID variable

a variable that contains an alternate identifier for the data in a CLASS variable. For example, the value of a CLASS variable could be a device address, and the value of the corresponding ID variable could be the name of the device. ID variables are useful for identification because their values rarely change.

#### index

See "SAS index".

#### informat

See "SAS informat".

#### information map

a collection of data items and filters that provides a user-friendly view of a data source. When you use an information map to query data for business needs, you do not have to understand the structure of the underlying data source or know how to program in a query language.

#### IT data mart

a logical collection of the jobs, data, information maps, tables, and other elements that support the extracting, transforming, and loading (ETL) of IT data.

## keep status

a value that indicates whether a table or value is to be used or ignored.

## key performance indicator (KPI)

a type of measurement that evaluates the success of an organization or of an activity in which it engages. Success might be defined as the periodic achievement of one or more operational goals, or in terms of progress toward strategic goals. Results are usually measured at regular intervals, against threshold values that are carefully selected according to their importance.

## keyword parameter

a type of macro parameter that is identified by its name, followed by an equal sign. Multiple keyword parameters can be provided in any order, and must follow any positional parameters.

#### **KPI**

See "key performance indicator".

## library reference

See "libref".

## libref (library reference)

a SAS name that is associated with the location of a SAS library. For example, in the name MYLIB.MYFILE, MYLIB is the libref, and MYFILE is a file in the SAS library.

#### local macro variable

a macro variable that is available only within the macro in which it was created and within macros that are invoked from within that macro. A local macro variable ceases to exist when the macro that created it stops executing.

#### machine

any type of data processing hardware that is recognized as a single unit. Examples include a physical unit (such as a computer, router, or telephone switch), a logical entity (such as a partition), or a set of CPUs that share the same memory. A machine can also refer to a deployment of software for a particular operating system on a computer that is running more than one operating system.

#### macro

a SAS catalog entry that contains a group of compiled program statements and stored text.

## macro call (macro invocation)

a statement that invokes a stored compiled macro program.

#### macro invocation

See "macro call".

## macro variable (symbolic variable)

a variable that is part of the SAS macro programming language. The value of a macro variable is a string that remains constant until you change it.

## master data dictionary

the master data definitions of tables and their associated variables, as well as override control statements, if any. Master copies of user-written definitions can be installed in the data dictionary, too.

## metadata repository

a collection of related metadata objects, such as the metadata for a set of tables and columns that are maintained by an application.

#### middle tier

in a SAS business intelligence system, the architectural layer in which web applications and related services execute. The middle tier receives user requests, applies business logic and business rules, interacts with processing servers and data servers, and returns information to users.

### migrate

to populate a new deployment of SAS software with the content, data, or metadata (or a combination of these) from an existing deployment. Migrating might include upgrading to a new software release, converting data or metadata, or other changes to ensure compatibility.

## missing value

a type of value for a variable that contains no data for a particular row or column. By default, SAS writes a missing numeric value as a single period and a missing character value as a blank space.

#### multi-tier architecture

a distributed architecture in which multiple components interact with each other in multiple configurations.

#### **MXG** software

the software from Merrill Consultants that processes IT performance data records that are generated by the System Management Facility (SMF) under the z/OS operating system, the OS/400 operating system, and their subsystems. MXG software reads the raw IT performance data records and writes them to SAS data

sets for further analysis. Examples of analysis are the measurement and management of IT resource capacity, resource utilization, measurement of service objectives, system tuning, and accounting and cost recovery.

#### n-tier architecture

a type of network architecture that is used in the development of relational business applications. N-tier architecture separates an application's interface, its business logic, and its databases into components, or tiers. This approach enables the tiers to interact with each other in multiple configurations. The tiers can easily be used and reused in new combinations in order to meet dynamic business requirements.

#### navigate

to purposefully move from one view of the data in a table (or in some other data structure, such as a cube) to another. Drilling down and drilling up are two examples of navigation.

## object

an entity that can be manipulated by the commands of a programming language. In object-oriented programming, an object is a compilation of attributes (object elements) and behaviors (methods) that describe an entity. Unlike simple data types that are single pieces of information (e.g. int=10), objects are complex and must be constructed.

## operating environment

a computer, or a logical partition of a computer, and the resources (such as an operating system and other software and hardware) that are available to the computer or partition.

#### **PDB**

See "performance data warehouse".

## PDB data dictionary

in a performance data warehouse (PDB), a SAS library that contains metadata such as definitions of tables and variables and status information for the data that the tables contain. The library's name and libref are DICTLIB.

#### performance data

information about how your IT system is doing its work. You use this information to determine whether your system is doing work efficiently and to determine how to change its load or its tunable parameters so that it will perform more efficiently.

## performance data warehouse (PDB)

logically, a data warehouse that contains detailed and summarized performance data, as well as information (metadata) that is needed for managing the data. Physically, each PDB consists of a coordinated set of nine SAS libraries that contain performance data plus other information that is related to one or more IT services.

#### **PGMLIB**

the libref (library reference name) for a SAS IT Resource Management program library that is on the local server host.

## positional parameter

a type of macro parameter that is named (using comma delimiters) in the %MACRO statement at invocation, and is defined in the corresponding position (again using comma delimiters) in the macro execution statement.

## procedure

See "SAS procedure".

## process

See "workflow process".

## program library

the SAS library in which most of the SAS IT Resource Management software resides. For example, the master data dictionary resides in the program library

## property

any of the characteristics of a component that collectively determine the component's appearance and behavior. Examples of types of properties are attributes and methods.

## protocol

a set of rules that govern data communications between computers, between computers and peripheral devices, and between software applications. TCP/IP, FTP, and HTTP are examples of protocols.

## publication channel (SAS publication channel)

an information repository that has been established using the SAS Publishing Framework and that can be used to publish information to users and applications.

#### rank

to order observations according to the values of particular variables. When a data item's values are ranked, the values are both sorted and filtered. For example, to rank an organization's top 10 customers based on sales figures, a query would sort the sales figures in descending order and then filter the results to show the 10 customers who have the highest sales figures.

## ranking

the process of ordering observations according to values of particular variables.

#### raw data file

an external file whose records contain data values in fields. A DATA step can read a raw data file by using the INFILE and INPUT statements.

## report definition

a specification that is used for generating a report. A report definition includes information such as the table, the names of the variables, the report style, and other attributes.

## report gallery

See "gallery".

## repository

a storage location for data, metadata, or programs.

## repository access control template

the access control template (ACT) that controls access to a particular repository and to resources for which access controls are not specified. You can designate one repository ACT for each metadata repository. The repository ACT is also called the default ACT.

#### response time

the amount of time that is taken to service a request as a measure of performance.

#### return code

a numeric value that indicates whether a request was successful. A return code can also indicate a specific error or warning.

## SAS catalog (catalog)

a SAS file that stores many different kinds of information in smaller units called catalog entries. A single SAS catalog can contain different types of catalog entries.

## SAS catalog entry (catalog entry)

an individual storage unit within a SAS catalog. Each entry has an entry type that identifies its purpose to SAS.

## SAS data set (data set)

a file whose contents are in one of the native SAS file formats. There are two types of SAS data sets: SAS data files and SAS data views.

## SAS data view (data view)

a type of SAS data set that retrieves data values from other files. A SAS data view contains only descriptor information such as the data types and lengths of the variables (columns) plus other information that is required for retrieving data values from other SAS data sets or from files that are stored in other software vendors' file formats.

## SAS datetime value (datetime value)

an integer that represents a date and a time in SAS software. The integer represents the number of seconds between midnight, January 1, 1960, and another specified

date and time. For example, the SAS datetime value for 9:30 a.m., June 5, 2000, is 1275816600.

## **SAS Foundation Services (foundation services)**

a set of core infrastructure services that programmers can use in developing distributed applications that are integrated with the SAS platform. These services provide basic underlying functions that are common to many applications. These functions include making client connections to SAS application servers, dynamic service discovery, user authentication, profile management, session context management, metadata and content repository access, information publishing, and stored process execution.

## SAS index (index)

a component of a SAS data set that enables SAS to access observations in the SAS data set quickly and efficiently. The purpose of SAS indexes is to optimize WHEREclause processing and to facilitate BY-group processing.

## **SAS** informat (informat)

a type of SAS language element that is used to read data values according to the data's type: numeric, character, date, time, or timestamp.

## **SAS IT Resource Management client**

a computer on which SAS IT Resource Management software is installed with a client license. The client accesses data on servers through a telecommunications protocol such as TCP/IP.

## **SAS IT Resource Management server**

a computer on which SAS IT Resource Management software is installed with a server license. The server has 'write' access to the IT performance data in IT data marts and is used for processing data through the host operating environment's file system. In addition, the server is used for administering IT data marts.

## SAS library

one or more files that are defined, recognized, and accessible by SAS, and that are referenced and stored as a unit. Each file is a member of the library.

## SAS Metadata Repository

a container for metadata that is managed by the SAS Metadata Server.

#### SAS Metadata Server

a multi-user server that enables users to read metadata from or write metadata to one or more SAS Metadata Repositories.

## SAS procedure (procedure)

a type of SAS language element that refers to a self-contained program for performing a specific task, such as to produce reports, to manage files, or to analyze data.

## **SAS** publication channel

See "publication channel".

## **SAS Stored Process (stored process)**

a SAS program that is stored on a server and defined in metadata, and which can be executed by client applications.

## SAS variable (variable)

a column in a SAS data set or in a SAS data view. The data values for each variable describe a single characteristic for all observations (rows).

## scheduled job

in SAS IT Resource Management, one of a set of batch jobs that run at a specified time, typically at night.

#### server

software that provides either resources or services to requesting clients, possibly over a network.

#### service

one or more application components that an authorized user or application can call at any time to provide results that conform to a published specification. For example, network services transmit data or provide conversion of data in a network, database services provide for the storage and retrieval of data in a database, and web services interact with each other on the World Wide Web.

## simple index

an index that uses the values of only one variable to locate observations.

## slowly changing dimensions

a technique for tracking changes to dimension table values in order to analyze trends. For example, a dimension table named Customers might have columns for Customer ID, Home Address, Age, and Income. Each time the address or income changes for a customer, a new row could be created for that customer in the dimension table, and the old row could be retained. This historical record of changes could be combined with purchasing information to forecast buying trends and to direct customer marketing campaigns.

## staged data

raw data that has been read, possibly transformed, and written to a SAS data set.

## staged table

a type of table that contains data that has been extracted from an input data store and transformed into a standard form for further transformation. A staged table is defined in metadata from a template table, which, after it is used, exists in physical form.

## staging code

SAS statements that read raw data, transform it, and write it to a SAS data set.

## stored process

See "SAS Stored Process".

## supplied format

a format that is shipped with SAS IT Resource Management.

## supplied report definition

a report definition that is shipped with SAS IT Resource Management.

## supplied software

software that is shipped with SAS IT Resource Management.

## symbolic variable

See "macro variable".

## system availability (availability)

the percentage of time that a system is available to respond to the requests of its users.

#### table definition

the attributes of a table and of its associated variables.

#### template table

a type of table that represents a model of a staged table for a particular adapter. A template table includes metadata that controls the wizards that are associated with an adapter.

## throughput

any measure of the amount of data, material, or requests for work that passes through a computer system over a given period of time.

#### transformation

in data integration, an operation that extracts data, transforms data, or loads data into data stores.

## type

See "data type".

#### variable

See "SAS variable".

## WebDAV repository

a collection of files that are stored on a web server so that authorized users can access them.

#### WebDAV server

an HTTP server that supports the collaborative authoring of documents that are located on the server. The server supports the locking of documents, so that multiple authors cannot make changes to a document at the same time. It also associates metadata with documents in order to facilitate searching. The SAS business intelligence applications use this type of server primarily as a report repository. Common WebDAV servers include the Apache HTTP Server (with its WebDAV modules enabled), Xythos Software's WebFile Server, and Microsoft Corporation's Internet Information Server (IIS).

## weight

a numeric indicator that is assigned to an item and that indicates the relative importance of the item in a frequency distribution or population.

## weighting variable

a variable whose values represent the weights for each observation.

#### WHERE clause

a syntax string that is composed of the keyword WHERE, followed by one or more WHERE expressions. A WHERE clause defines the conditions to be used for selecting observations in a data set.

## WHERE expression

is a syntax string within a WHERE clause that defines the criteria for selecting observations. For example, in a membership database, the expression "WHERE member type=Senior" returns all senior members.

#### wizard

an interactive utility program that consists of a series of pages. Users supply information on each page, and the wizard uses that information to perform a task.

## workflow process (process)

a functional unit of a program or task.

## **72** Glossary

## workload

the amount of work a system is experiencing. Workload can be measured in terms such as characters per second, processes per second, or transactions per second.

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