

Mitel MiContact Center Enterprise

OPEN APPLICATION SERVER
PERFORMANCE MEASUREMENT USER GUIDE

Release 9.5



NOTICE

The information contained in this document is believed to be accurate in all respects but is not warranted by Mitel Networks™ Corporation (MITEL®). The information is subject to change without notice and should not be construed in any way as a commitment by Mitel or any of its affiliates or subsidiaries. Mitel and its affiliates and subsidiaries assume no responsibility for any errors or omissions in this document. Revisions of this document or new editions of it may be issued to incorporate such changes.

No part of this document can be reproduced or transmitted in any form or by any means - electronic or mechanical - for any purpose without written permission from Mitel Networks Corporation.

TRADEMARKS

The trademarks, service marks, logos and graphics (collectively "Trademarks") appearing on Mitel's Internet sites or in its publications are registered and unregistered trademarks of Mitel Networks Corporation (MNC) or its subsidiaries (collectively "Mitel") or others. Use of the Trademarks is prohibited without the express consent from Mitel. Please contact our legal department at legal@mitel.com for additional information. For a list of the worldwide Mitel Networks Corporation registered trademarks, please refer to the website: <http://www.mitel.com/trademarks>.

Open Application Server Performance Measurement User Guide
Release 9.5 – September 2020

®,™ Trademark of Mitel Networks Corporation
© Copyright 2020 Mitel Networks Corporation
All rights reserved

INTRODUCTION

Open Application Server (OAS) performance measurement provides information about system resources. Specifically OAS performance measurement indicates if system resources are:

1. Under-utilized (too many system resources)
2. Over-utilized (too few system resources)
3. Need to be tuned (re-configured)
OAS performance measurement does not tell you exactly what to do, how to re-configure your system, why something has happened, or how to interpret report information.

System performance measurement consists of the following tools and components:

1. Start and stop measurement application (OAS Management Console)
2. Generate report user application (OAS Management Console)
3. A server component that stores the data (communications with Microsoft SQL Server)

WHAT YOU WILL LEARN

The topics covered in this document include:

1. Which system resources can be measured
2. Installing the PDC SQL database
3. Accessing performance measurement and reporting
4. Measuring performance
5. Generating and viewing performance reports
6. Database schema

WHAT CAN BE MEASURED

The following system resources (object types) can be measured. Each of these resources is described in detail in this section.

1. Basic Virtual Devices (devices through which applications handle the call)
2. Call termination points (logical mapping to a Media Server port)
3. CTI groups (“holding tank” for a call)
4. Media resources
5. Automatic speech recognition (ASR)
6. Media player
7. Media recorder

8. Signal Detector
9. Signal generator
10. Text To Speech (TTS)
11. Resource allocation (the algorithm of fulfilling requests for resources)

BASIC VIRTUAL DEVICE

The Basic Virtual Device (BVD) is the device through which applications manipulate calls. Following are characteristics of BVDs:

1. One BVD can handle one or more CTI groups per CTI Server
2. A CTI group cannot be shared among BVDs

The following data can be measured and reported. One or more BVDs can be included in one measurement.

1. Number of inbound calls
2. Number of calls deflected to a particular extension
3. Number of speech recognize functions executed
4. Number of speech recognize success functions received
5. Number of speech recognize failed events received
6. Number of times speech started
7. Number of times speech ended
8. Number of times words received
9. Average latency between speech ended and words received
10. Number of calls that were successfully deflected
11. Number of calls that were not successfully deflected

CALL TERMINATION POINTS

Call termination points (CTPs) exist within the Media Server. The Media Server is indirectly connected to MX-ONE via analog or ISDN channels through Dialogic hardware or via IP extension channels. Note the following about call termination points:

1. A CTP is a IP Media Port connecting the MX-ONE to the Media Server
2. Multiple Media Servers can be installed per system
3. Only one Media Server can be installed per host computer

CTPs are always measured per Media Server. One or more Media Servers can be included in one measurement. The following data can be measured and reported.

1. Number of CTPs becoming busy
2. Average busy duration time

Duration is reported in the period where the CTP becomes idle. In the example shown below in Figure 1, the 0-15 minute interval reports no durations, the 15-30 minute interval reports durations for call A, and the 30-45 minute interval reports CTP busy durations for calls B and C.

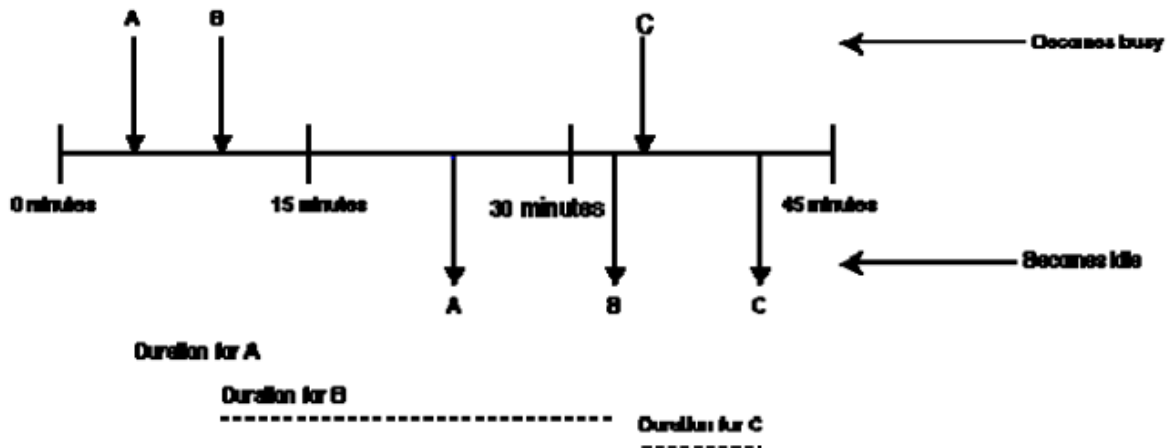


Figure 1: Call Termination Points – Example

CTI GROUPS

CTI groups are the holding tanks for calls that are being manipulated. There are two types of CTI groups.

1. Regular CTI groups - Receive incoming calls and are handled through a BVD. Each CTI Server can support many CTI groups.
2. CTI deflection group - Used when a call is deflected from one CTI Server to another CTI Server and for the Make Predictive Call service. Each CTI Server can support only one CTI deflection group.

Note the following about CTI groups:

1. Incoming calls are first received in a CTI group.
2. Each CTI Server can support one or more CTI groups.
3. Number of queue positions that a CTI group can hold depends on the QUE parameter setting for the CTI group in MX-ONE.

CTI groups are always measured per CTI Server. One or more CTI Servers can be included in one measurement. The following data can be measured and reported.

1. Number of inbound calls
2. Average queue duration time

- Duration is reported in the period where the queue position becomes idle. In the example shown below in Figure 2, the 0-15 minute interval reports no durations, the 15-30 minute interval reports durations for call A, and the 30-45 minute interval reports queue durations for calls B and C.

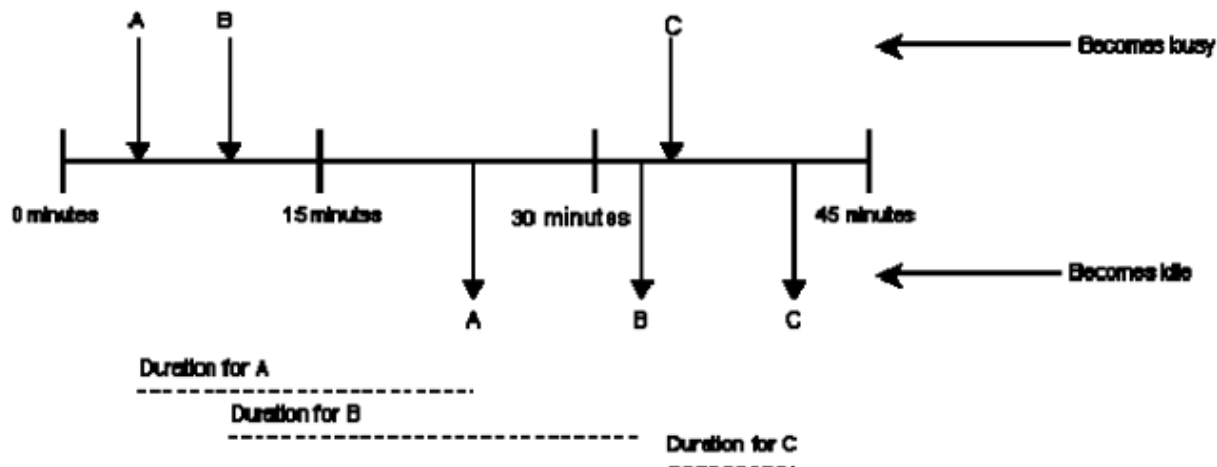


Figure 2: CTI Groups - Example

MEDIA RESOURCES

Media resources exist within Media Servers. The media resources are:

- Automatic speech recognition (ASR)
- Media player
- Media recorder
- Signal detector
- Signal generator
- Text To Speech (TTS)

All media resources are measured the same way per Media Server. One or more Media Servers can be included in one measurement. The following data can be measured and reported.

- Number of successful allocations
- Average busy duration time

Duration is reported in the period where the media resource becomes idle. In the example shown below in Figure 3, the 0-15 minute interval reports no durations, the 15-30 minute interval reports durations for call A, and the 30-45 minute interval reports media resource busy durations for calls B and C.

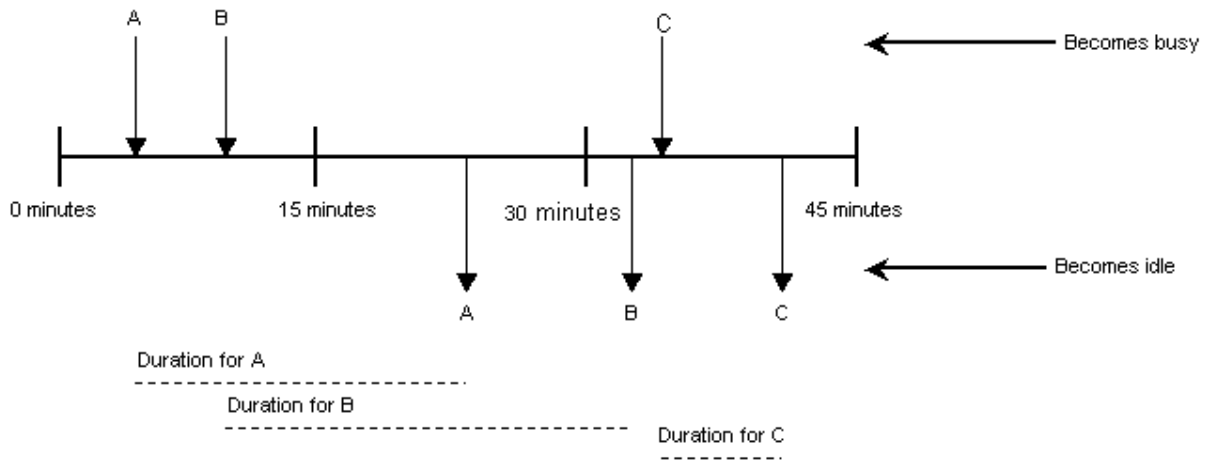


Figure 3: Media Resources - Example 3

RESOURCE ALLOCATION

Resource allocation consists of locating and allocating requested resources in the network. Applications access this functionality indirectly via the BVD. For more information, refer to the Resource Allocation Algorithm section.

Resource allocation is always measured per system. The following data can be measured and reported.

1. Number of successful requests
2. Failed as no Media Server matched the request
3. Failed as no Media Server requested available resources
4. First choice hit
5. Second choice hit
6. Third choice hit (current release supports two choices only)
7. Third choice hit

PDC SQL DATABASE INSTALLATION

Performance data is stored in the PDC (Performance Data Collection) SQL database. The PDC SQL database is normally installed during the installation of OAS software (This is described in the OAS Software Installation section).

Performance Data Service and its related databases can also be installed separately (after installation of OAS is done) by following the below steps:

1. Find out the password for the 'sa' user account on SQL Server.
2. Open a command prompt window and change the current directory to OAS\Bin\Dbsetup, then enter the following command:

```
oas_db.bat <sa_password> <Hostname\InstanceName> > <log_file>
```

where,

```
sa_password    = Password for 'sa' SQL Login Account,  
HostName       = SQL Server name or IP Address  
InstanceName  = SQL Server's Instance name  
log_file      = log file name where the output is copied
```

Example: oas_db.bat Password123 SQLServer\Instance1 > logfile.txt

Note: HostName and InstanceName are optional parameters. HostName can be omitted if the SQL server resides in the same machine as OAS and InstanceName can be omitted when using a default instance.

Example: oas_db.bat Password123 > logfile.txt

3. Verify that the command executed successfully by checking the following:
 - Three new databases have been created: OASDEFDB, OASPCD AND OASPPM
 - A new SQL user ID "oaspmg" is created
 - The user oaspmg is set as DB owner for all the 3 databases.
 - Tables are created under OASPCD and OASPPM databases
4. Set Performance Data Service to start automatically:
 1. Open OAS Management console and navigate to Open Application Server -> Configuration-> Basic Services
 2. Right Click on Performance Data Service and select All Tasks -> Modify
 3. Set the Start Mode to Automatic and click on OK.
5. Start Performance Data Service:
 1. Open OAS Management console and navigate to Open Application Server -> Oas Maintenance Tool -> Basic Services
 2. Right Click on Performance Data Service and select All Tasks -> Start.

UNINSTALLING THE PDC SQL DATABASES

If it ever becomes necessary to uninstall the SQL databases related to OAS (PDC related tables), you can do this using the uninstall process. (This process is described in the OAS Software Installation section.)

ACCESSING PERFORMANCE MEASUREMENT AND REPORTING

ACCESSING PERFORMANCE MEASUREMENT AND REPORTING

To access the OAS Management Console application:

1. On the Start menu, point to Programs, point to Mitel then Open Application Server, and then click Management Console.

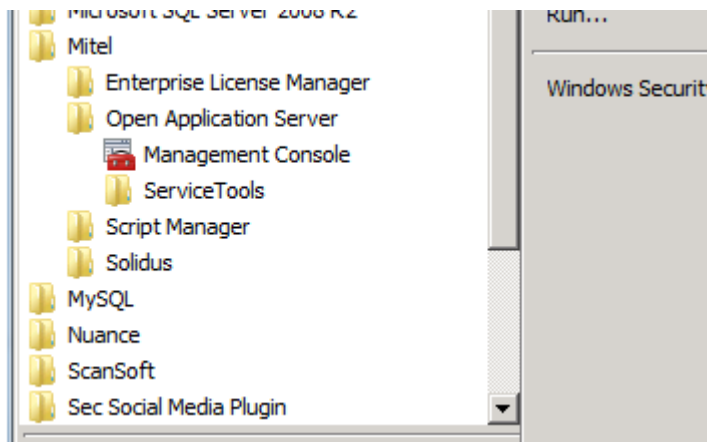


Figure 4: Accessing Performance Measurement and Reporting

2. The **OAS Management Console** screen appears. To start or stop performance measurement, click the **plus** icon next to **Performance**. To generate performance reports, click the **plus** icon next to **Reports**, and then click **Templates**. The steps required for each of these activities are described in detail later in this section.

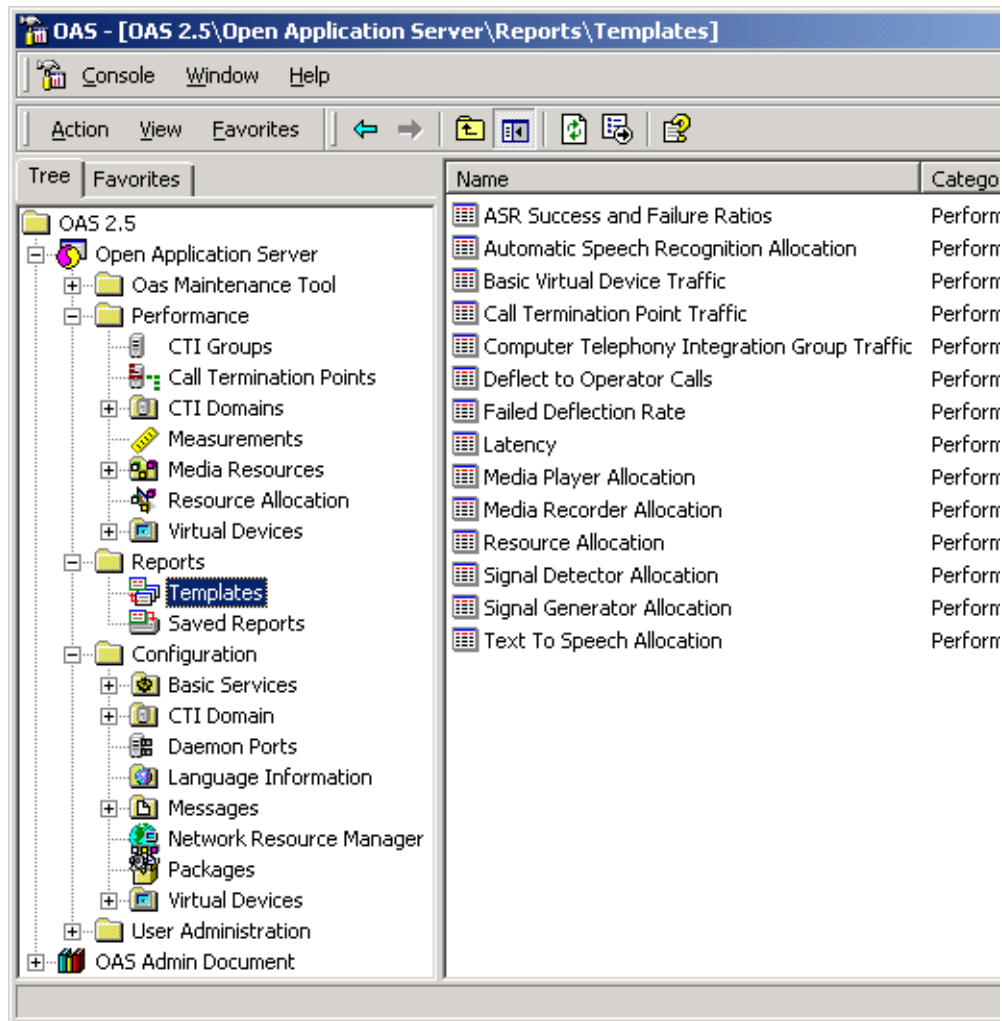


Figure 5: OAS Management Console screen

EXITING OAS MANAGEMENT CONSOLE

To exit the OAS Management Console, on the **Console** menu, click **Exit**.

MEASURING PERFORMANCE

Measuring performance involves starting and stopping performance measurements for selected resources. All performance measurements are listed by the following object types:

1. CTI Domains
2. Media Resources
3. Resource Allocation
4. Virtual Devices

All performance measurements also are listed under Measurements in the configuration tree.

In this section, the following will be described:

1. Starting a performance measurement
2. Stopping a performance measurement
3. Deleting a performance measurement

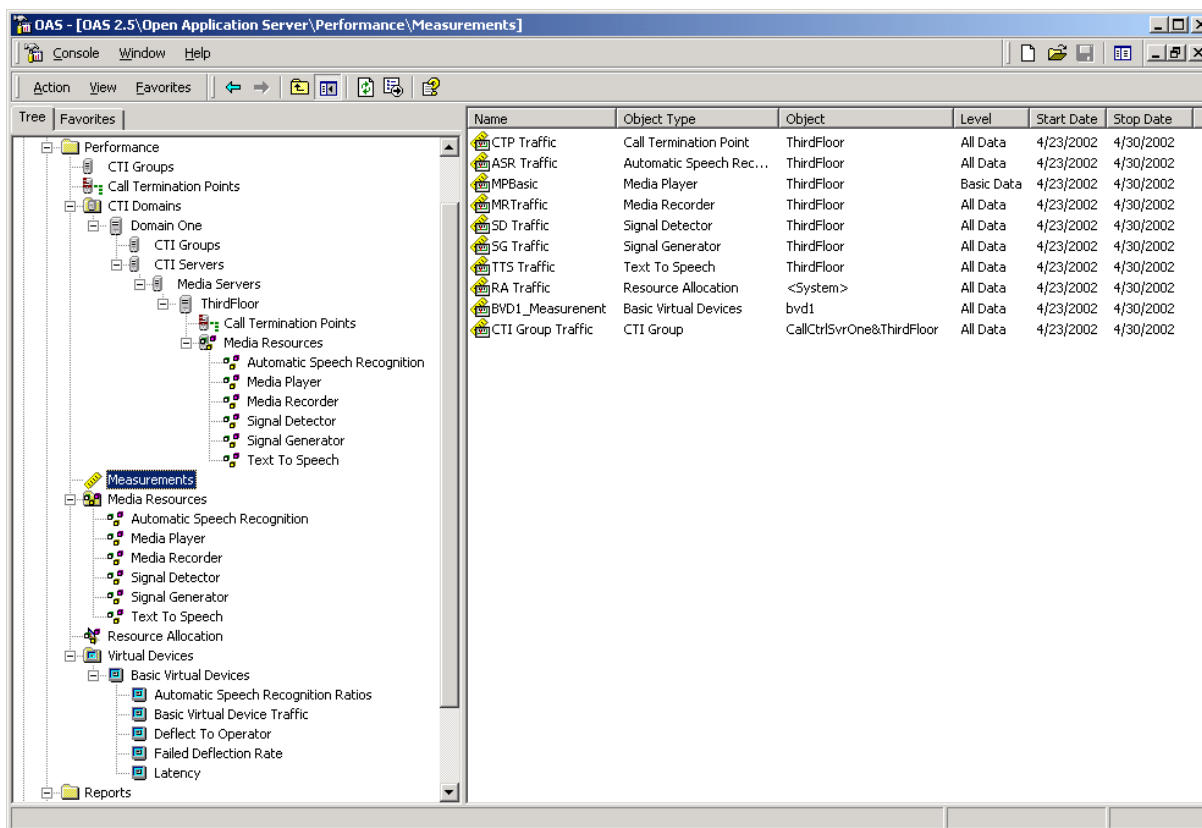


Figure 6: Performance measurements shown in the configuration tree

STARTING A MEASUREMENT

To start a performance measurement:

1. From the configuration tree, right-click an object type, point to **All Tasks**, and then click **Start New Measurement**.

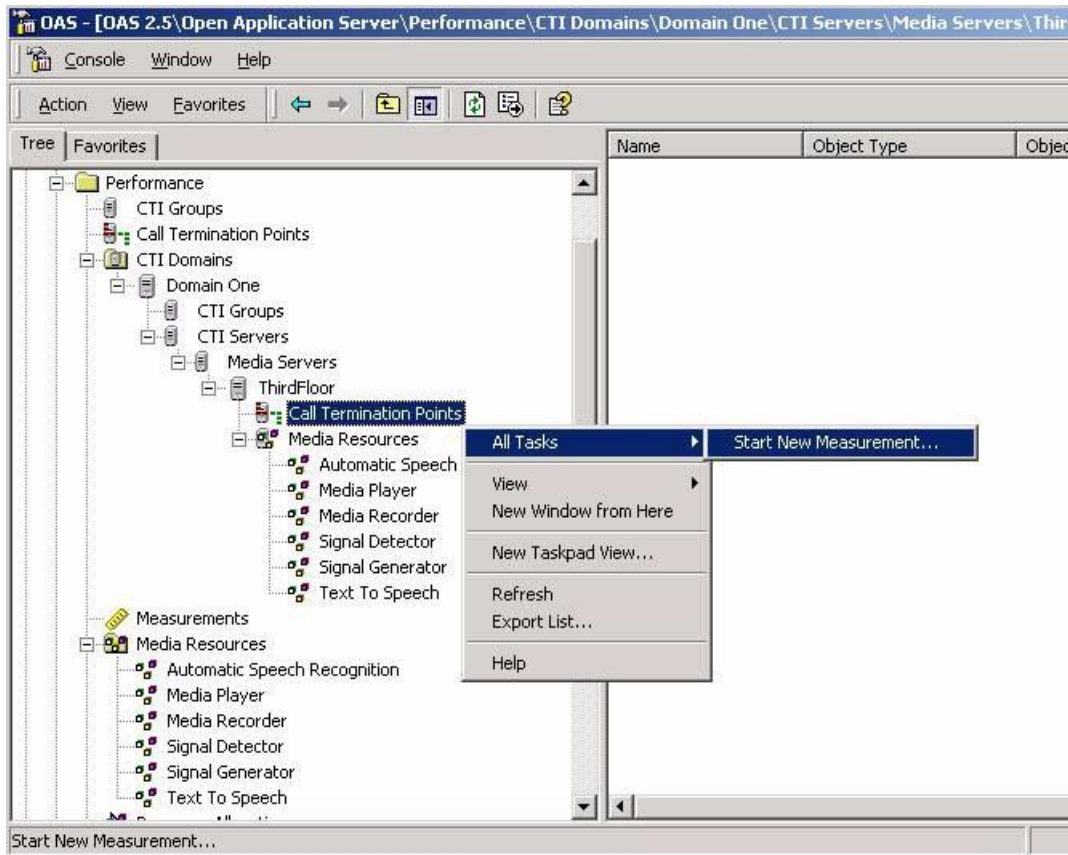


Figure 7: Starting a performance measurement from the tree

-OR-

From the performance measurement display, right-click an existing measurement, point to **All Tasks**, and then click **Start New Measurement**.



Note: Starting a new measurement from an existing measurement uses the existing measurement as a template. The dates and name must be entered; the other information also can be modified.

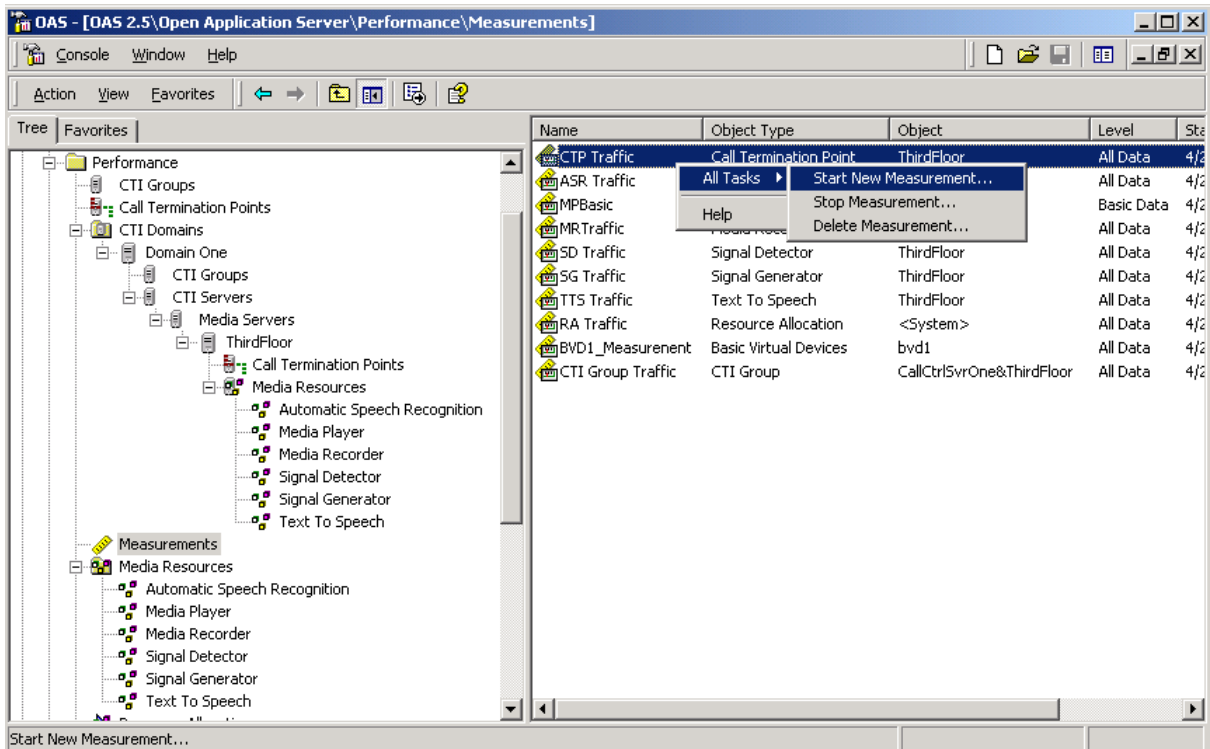


Figure 8: Starting a performance measurement from an existing measurement

2. The Start New Measurement dialog appears.

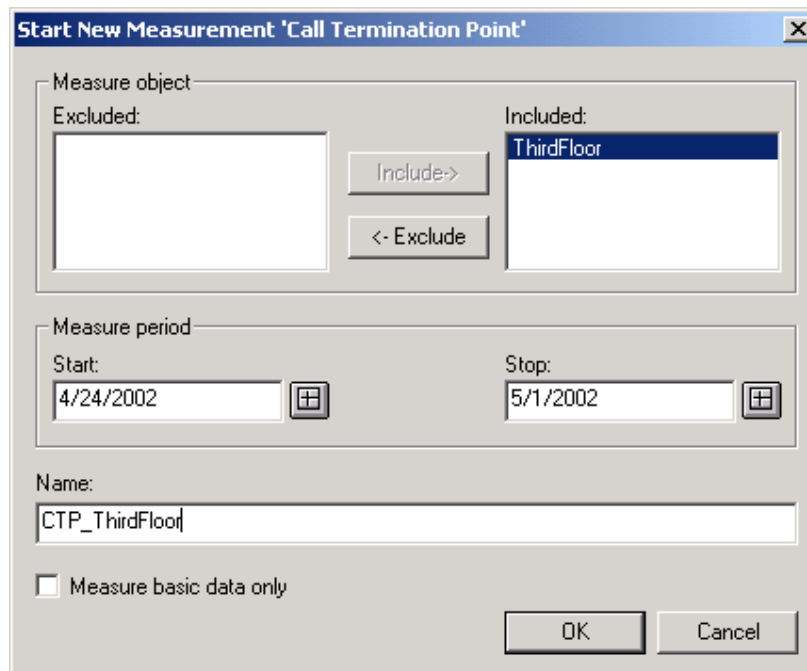


Figure 9: Start New Measurement Dialog

3. The **Excluded** and **Included** fields contain the objects that can be measured for the selected object type. To add an object to the **Included** field, click the object in the **Excluded** field, and

- then click **Include**. To move an object from the **Included** field, click the object in the **Included** field, and then click **Exclude**.
4. In the **Start** field, type or select the date (mm/dd/yy) to start the measurement.
 5. In the **Stop** field, type or select the date (mm/dd/yy) to stop the measurement.
 6. In the **Name** field, type a descriptive name for the measurement.
 7. To measure basic data only, select **Measure basic data only**. This option disables report filtering. The default is to measure all data.
 8. Click **OK** to close the dialog.

STOPPING A MEASUREMENT

To stop an active performance measurement:

1. From the configuration tree, right-click an existing measurement, point to **All Tasks**, and then click **Stop Measurement**. The **Stop Measurement** dialog displays the name of the measurement and the current stop date for the measurement as shown in on page 16.

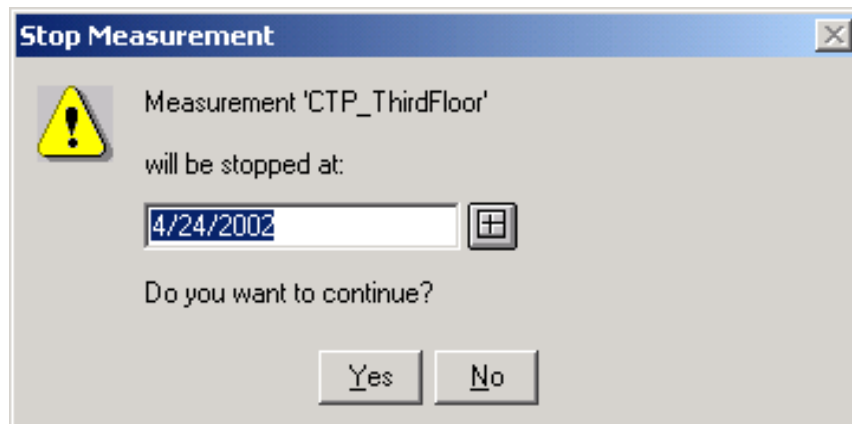


Figure 10: Stop Measurement Dialog

2. In the **Will be stopped at** field, type or select the date (mm/dd/yy) to stop the measurement.
3. Click **Yes** to stop the measurement on the selected date and exit the **Stop Measurement** dialog.

DELETING A MEASUREMENT

To delete a performance measurement from the performance measurement display:

1. From the performance measurement display, right-click a measurement, point to **All Tasks**, and then click **Delete Measurement**. The **Delete Measurement** dialog appears.

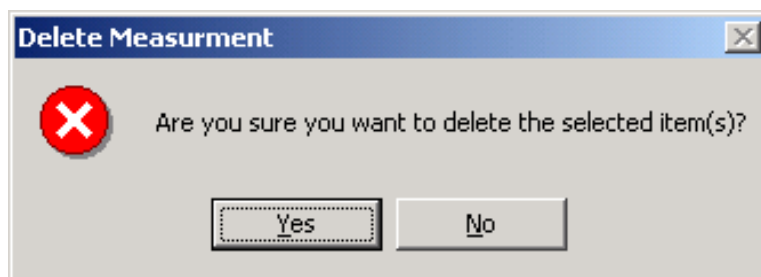


Figure 11: Delete Measurement Dialog

2. Click **Yes** to delete the selected items or click **No** to cancel the request.

GENERATING AND VIEWING PERFORMANCE REPORTS

To generate a report, you must specify several parameters, including:

1. Template for the report.
2. Performance measurement from which to generate the report.
3. Dates (to and from) to use when generating the report.
4. Whether to generate a detailed report or a filtered report based on selected data type.

GENERATING A REPORT

To generate a report:

1. From the performance report display, right-click an existing template, point to **All Tasks**, and then click **Generate Report**. The **Generate Report** dialog appears.

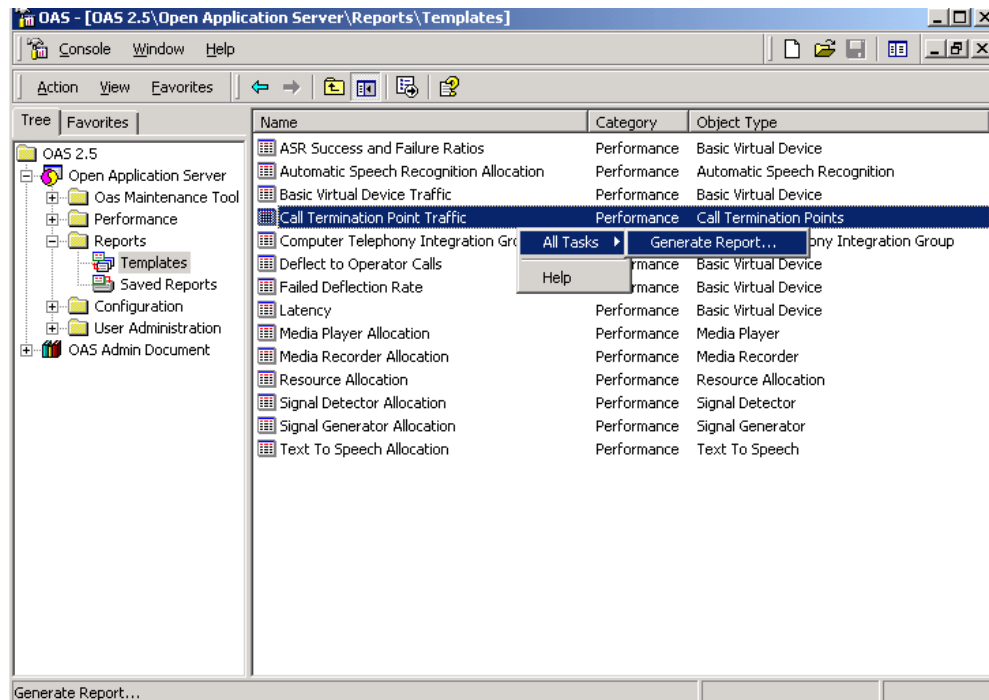


Figure 12: Generating a report

Generate Report 'Call Termination Point Traffic'

Report context

Display by: Averaging hour of day

From: 4/23/2002 To: 4/30/2002

Description:

Daily From: 12:00:00 AM Daily To: 11:59:00 PM

Use From and To dates from database

Measurement to report

	Name	Type	Object	Start	Stop
	CTP Traffic	CTP	ThirdFloor	4/23/2002	4/30/2002
	CTP_ThirdFloor	CTP	ThirdFloor	4/23/2002	4/30/2002

Data available from 4/23/2002 to 4/23/2002 2 found

Detailed measurement information

By: <None> Value:

View Print Save Cancel

Figure 13:Generate Report Dialog

This dialog consists of the following controls and data fields.

1. Select the report template from the **Display by** drop-down list.
2. Enter a description of the report in the **Description** field (optional).
3. Select the dates for the report. To use the from and to dates from the database, click **Use From and To dates from database**.

-or-

In the From and To fields, type or select from and to dates (mm/dd/yy). Do not click Use **From and To dates from database**.

1. If you wish to generate measurements for a partial day, rather than the entire day, type or select times in the **Daily From** and **Daily To** fields.
2. Select the performance measurement from which to generate the report from the **Measurement to report** drop-down list.

- If you wish to use detailed (filtered) measurement information, select the criteria from the **By** drop-down list, and specify the value from the **Value** drop-down list.

-or-

If you don't wish to use detailed information, select **<none>** in the **By** field.

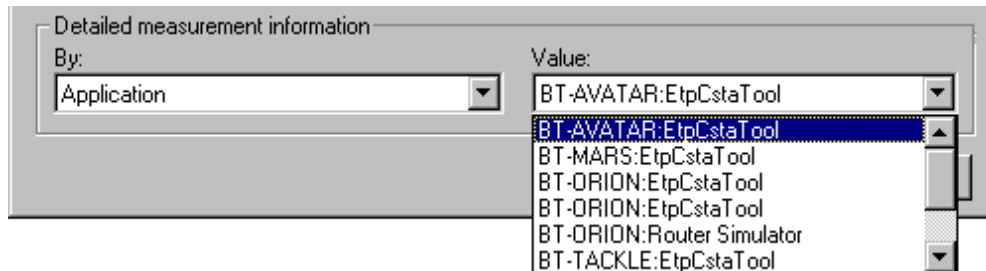


Figure 14:Detailed Measurement Information options

The following filters can be used for a report.

Table 2

OBJECT TYPE	FILTER DATA TYPES		
	APPLICATION	LANGUAGE	CTI SERVER
BVD	Yes		
CTI group			
Call termination point			
Resource allocation			Yes
Automatic speech recognition	Yes	Yes	
Media player	Yes	Yes	
Media recorder	Yes		
Signal detector	Yes		
Signal generator	Yes		
Text to speech	Yes	Yes	

To view, print, or save the performance measurement:

- Click **View** to display the report on the monitor.
- Click **Print** to print the report.
- Click **Save** to save the report.

SAVED REPORTS

Saved reports can be viewed, printed and/or deleted. Following are the steps for each of these activities:

VIEWING SAVED REPORTS

To view a saved report:

1. From the performance report display, right-click a saved report, point to **All Tasks**, and then click **View Report**. The report appears on the monitor. (Samples of the reports are provided in *Sample Reports* later in this section.)

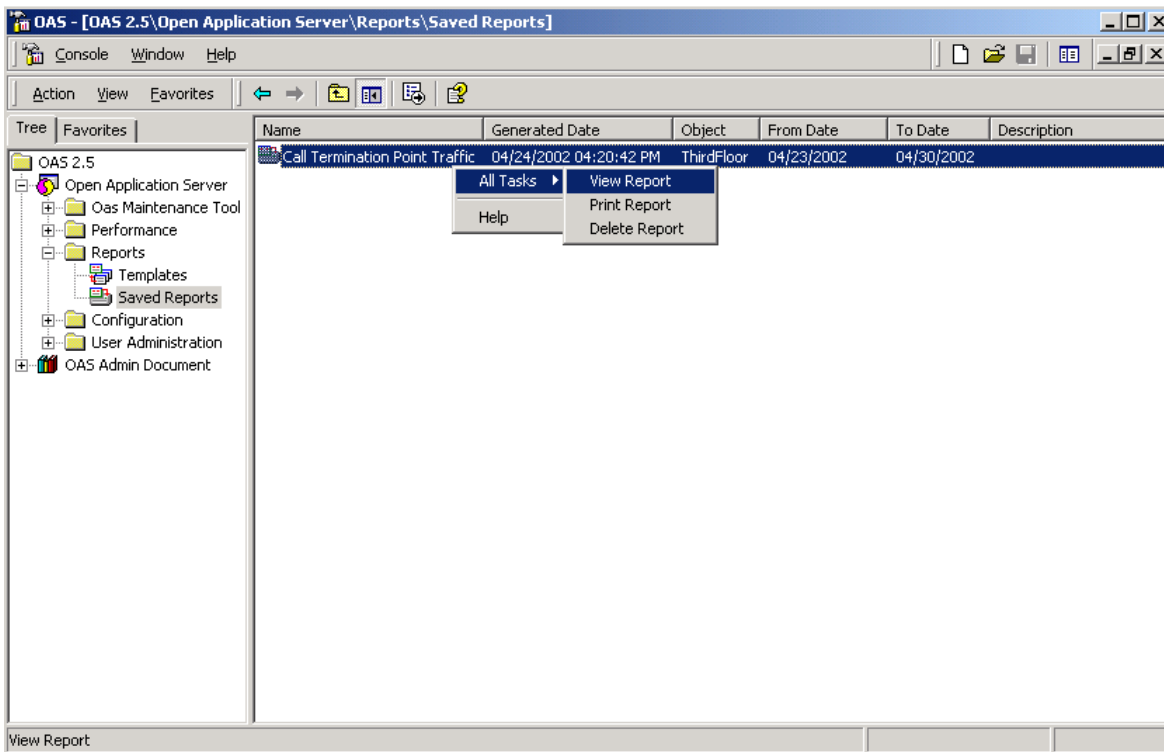


Figure 15: Viewing a saved report

PRINTING SAVED REPORTS

To print a saved report:

1. From the performance report display, right-click a saved report, point to **All Tasks**, and then click **Print Report**.

DELETING SAVED REPORTS

To delete a saved report:

1. From the performance report display, right-click a saved report, point to **All Tasks**, and then click **Delete Report**.

PARTS OF A REPORT

There are four parts to a report: Template, Header, Data, and Filter.

REPORT TEMPLATE

The report template governs the layout and contents of a report. For each report template, the following criteria apply:

1. Each template will correspond to only one performance measurement.
2. Each template is categorized by different objects.
3. By default, “Grouping Interval” is the first column.

The following table provides a list of the available templates.

Table 3

TEMPLATE	REPORT BASED ON OBJECT TYPE	INFORMATION
CTI Group	Virtual Device CTI Group Call Traffic Report	Number of calls Number of incoming calls
	Resource Allocation Deflection CTI Group Call Traffic Report	Average queue duration Queue duration/Number of calls
Media Resources	ASR Allocation Report	Number of times <Media Resource Type> was allocated successfully Average busy time Average time duration of all <Media Resource Type> in the groups that were allocated during the measured time interval. Busy Time Duration/Number of <Media Resource Type>
	TTS Allocation Report	
	Media Player Allocation Report	
	Media Recorder Allocation Report	
	Signal Detector Allocation Report	
	Signal Generator Allocation Report	

Table 4

Resource Allocator	Resource Allocation Request and Deflection Report	Number of requests succeeded Number of requests failed due to no CTIS satisfying the request found Number of requests failed due to resource unavailability
	Resource Allocation and Choice Selection Report	Number of first choice hits Number of times that the first CTI server selected received the allocated resource Number of second choice hits Number of times that the

		<p>second CTI server selected received the allocated resource</p> <p>Number of third choice hits Number of times that the third CTI server selected received the allocated resource</p> <p>Number of >3 choice hits Number of times that a CTI server other than the first, second, or third selected received the allocated resource</p>
BVD	BVD Traffic Report	<p>Number of inbound calls Number of incoming calls</p> <p>Number of outbound calls Number of outgoing calls</p> <p>Number of calls deflected Number of calls deflected due to resource allocation</p> <p>Number of calls abnormally failed Deflection to Media Server Call Channel or deflection to another CTI Server may fail due to different reasons</p>
	Deflect to Operator Calls	Number of calls deflected to a particular extension
	ASR Success and Failure Ratios	<p>Number of speech recognize functions executed</p> <p>Number of speech recognize success functions received</p> <p>Number of speech recognize failed events received</p>
	Latency	<p>Number of times speech started</p> <p>Number of times speech ended</p> <p>Number of times words received</p> <p>Average latency between speech ended and words received Latency is calculated for an individual call between when the speech ended and when words executed.</p>

	Failed deflection rate	Number of calls that were successfully deflected Number of calls that were not successfully deflected
Call Termination Point	Call Termination Point Traffic Report	Number of call termination points becoming busy Number of call termination points busy for incoming and outgoing calls Number of call termination points becoming idle Number of call termination points that became idle Average busy time Average time calls occupied the call termination points during the specified measured intervals. Note that Busy Time Duration includes incoming and outgoing calls. Busy Time Duration / Number of call termination points that are available

REPORT HEADER

The report header provides the following information about the report:

Table 5

OBJECT	DESCRIPTION
Report Title	Title of the report. Identifies the type of report with respect to the template. For example, for a report titled “CTI Group Traffic Chart,” the template used is CTI Group. For details on report templates, refer to <i>Report Template</i> earlier in this section.
Report Period	Defines the start and end date and time of measurements.
Partial Day Reporting	Defines the grouping interval for the From and To times. Available intervals include 15 minutes, 30 minutes, 1 hour, 1 day and 1 month. The default time range is for the whole day (00:00 to 23:59).
Description	Description information about the report entered by the user.

REPORT DATA

Report Data is the contents that will be displayed in a report based on the information provided by the user. Such information includes:

1. Object Type (ASR, Media Player, Media Recorder, Signal Generator, Signal Detector, TTS)

2. Report Template
3. Measurement Type (specific combination of objects that will be used in the measurement)
4. Partial Day Reporting Times (time interval?Daily From and Daily To?in which data is selected for every day in the grouping interval)
5. Report Period (start and end dates for the report contents)
6. Grouping Interval (time interval for the presentation)

REPORT FILTER

Report filtering is used so that specific data can be extracted or queried from a performance report object. Two types of Report Filters are available:

1. **Application Filter** – When applied, report data that is specific to a particular application (that is, an application that uses the OAS platform to answer calls) will be extracted. This filter can be applied to Media Resources, Resource Allocator, or BVD.
2. **Resource Characteristics Filter** – Applicable to Media Resources only. When applied, report data that is specific to a Media Resource (such as the number of resource requests on German ASR) will be extracted.

SAMPLE REPORTS

The following sample reports are available:

1. Averaging Hour of Day
2. Averaging Day of Week
3. Averaging Day of Month
4. By 15 Minutes
5. By 30 Minutes
6. By 1 Hour
7. By 1 Day
8. By 1 Month

SAMPLE REPORT: AVERAGING HOUR OF DAY

The Averaging Hour of Day report shows average values on an hour-by-hour breakdown for 24 hours for the specified date range.

Following is sample data that was used for the sample report:

Table 6

DATE/ TIME	10-NOV-99	11-NOV-99	12-NOV-99	13-NOV-99	14-NOV-99	15-NOV-99	16-NOV-99
0:00	497	689	1000	947	744	922	955
1:00	490	968	737	909	920	682	973

DATE/ TIME	10-NOV-99	11-NOV-99	12-NOV-99	13-NOV-99	14-NOV-99	15-NOV-99	16-NOV-99
2:00	491	935	676	742	975	883	959
And so on...							

A sample Averaging Hour of Day report is provided.

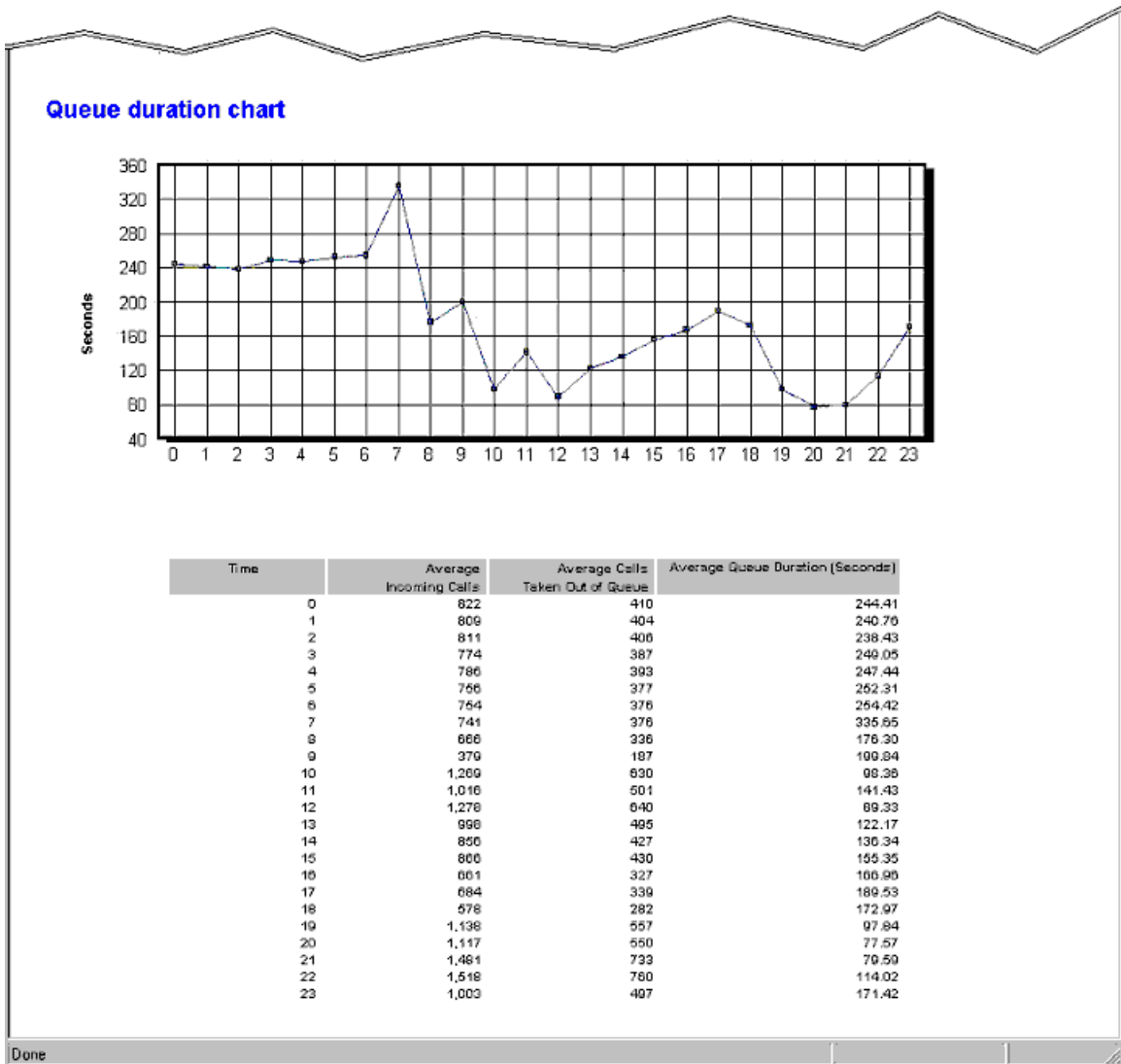


Figure 17: Sample Averaging Hour of Day report

SAMPLE REPORT: AVERAGING DAY OF WEEK

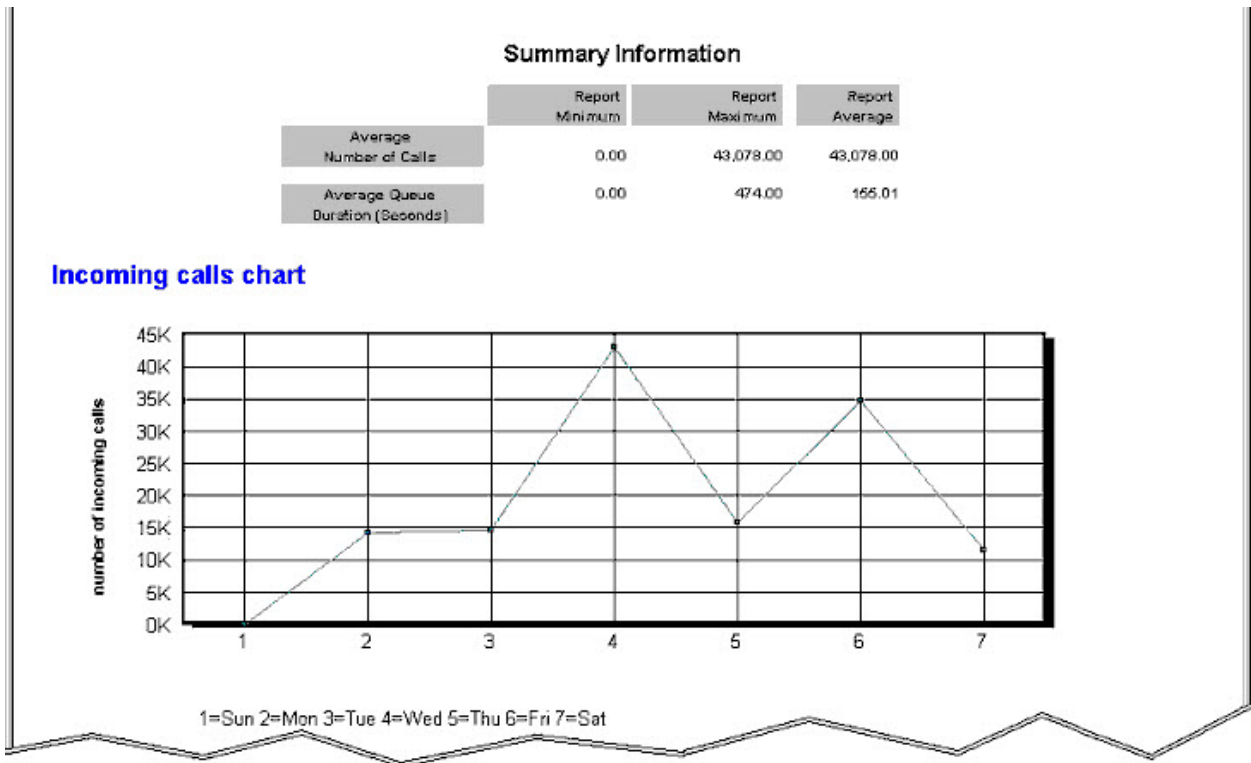
The Averaging Day of Week report shows average values on a day-by-day breakdown for one week starting with Sunday for the specified date range.

Following is sample data used for the sample report:

Table 7

DAY OF WEEK/ DATE	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
08-Nov-99	0						
09-Nov-99		14000					
10-Nov-99			14140				
And so on...							

A sample Averaging Day of Week report is provided below.



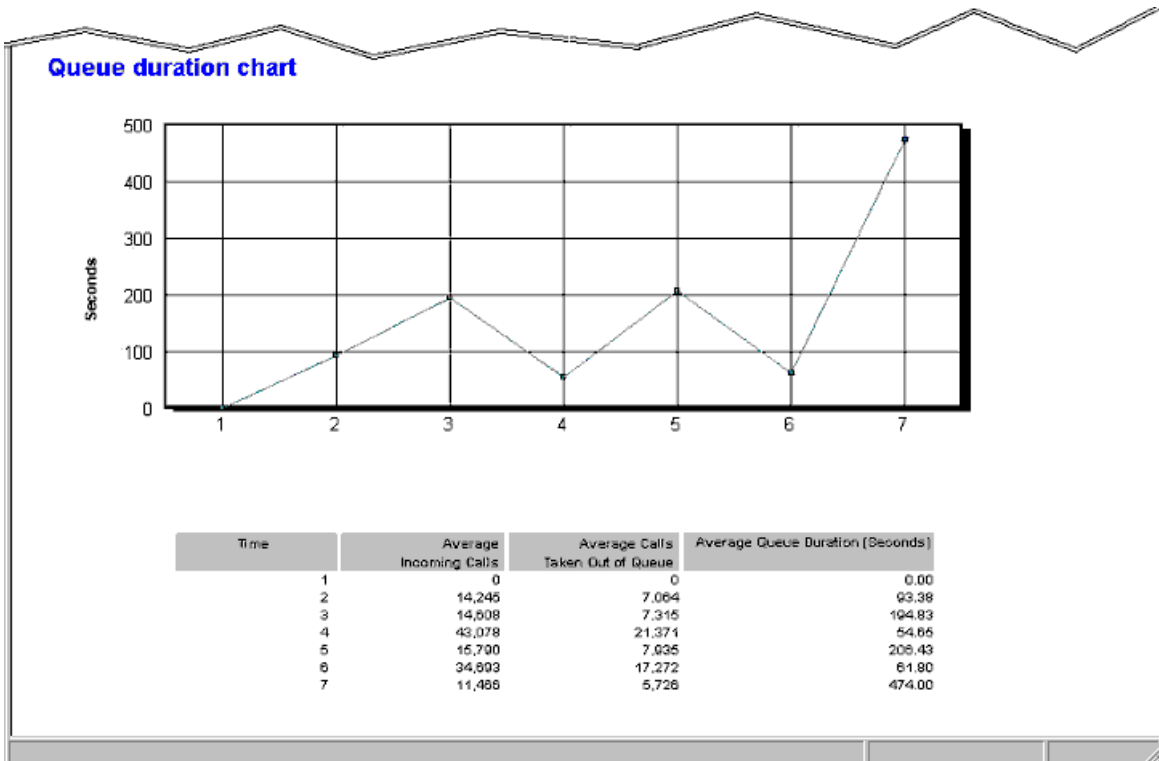


Figure 19: Sample Averaging Day of Week report

SAMPLE REPORT: AVERAGING DAY OF MONTH

The Averaging Day of Month report shows average values on a day-by-day breakdown for one month starting with the 1st for the specified date range.

Following is sample data that has been used for the sample report:

Table 8

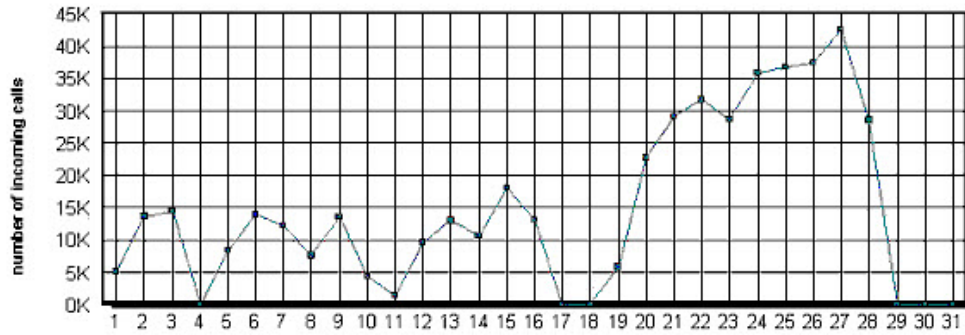
DAY OF MONTH/ DATE	1 ST	2 ND	3 RD	4 TH	5 TH	6 TH	AND SO ON...
01-Oct-99	2236						
02-Oct-99		5634					
03-Oct-99			12589				
And so on...							

A sample Averaging Day of Month report is provided below.

Summary Information

	Report Minimum	Report Maximum	Report Average
Average Number of Calls	0.00	42,548.00	42,548.00
Average Queue Duration (Seconds)	0.00	28,134.60	945.87

Incoming calls chart



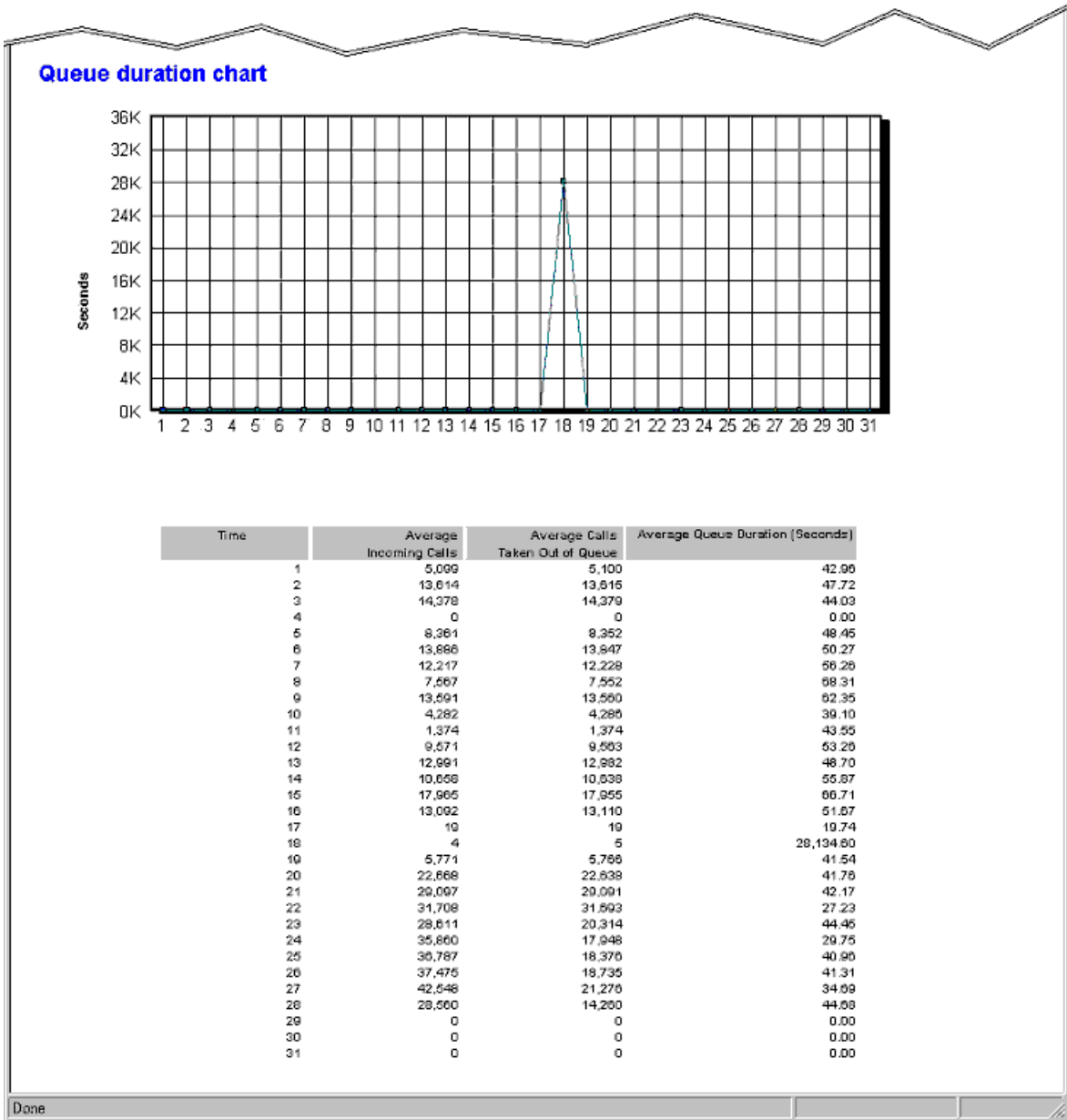


Figure 21: Sample Averaging Day of Month report

SAMPLE REPORT: BY 15 MINUTES

The By 15 Minutes report shows average values on a 15-minute break- down for the specified date range.

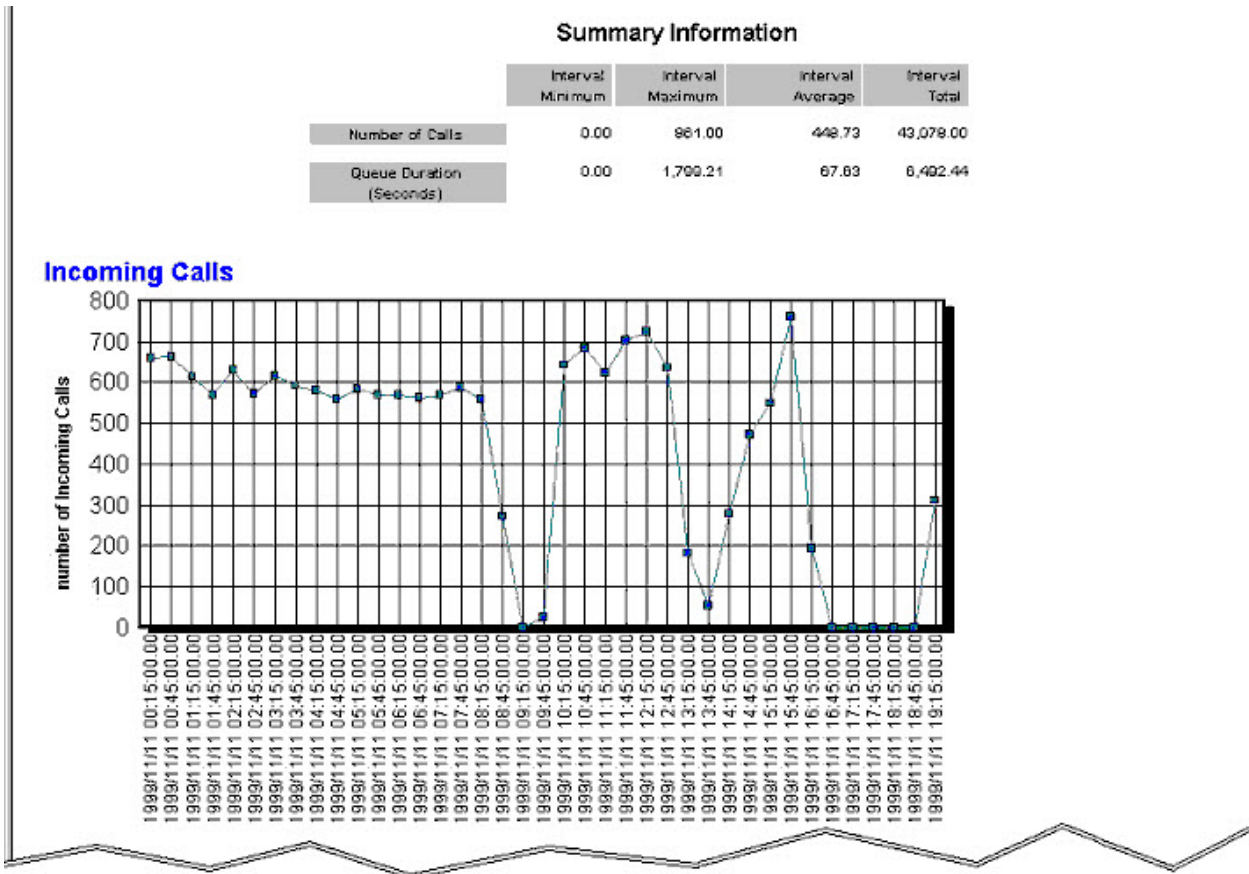
Following is sample data used for the sample report:

Table 9

DATA/DATE	DATA 1	DATA 2	DATA 3	DATA 4	AND SO ON...
11-Nov-99	50	100	200	70	

DATA/DATE	DATA 1	DATA 2	DATA 3	DATA 4	AND SO ON...
00:00					
11-Nov-99 00:15	63	23	5	74	
11-Nov-99 00:30	21	32	16	200	
And so on...					

A sample By 15 Minutes report is provided below.



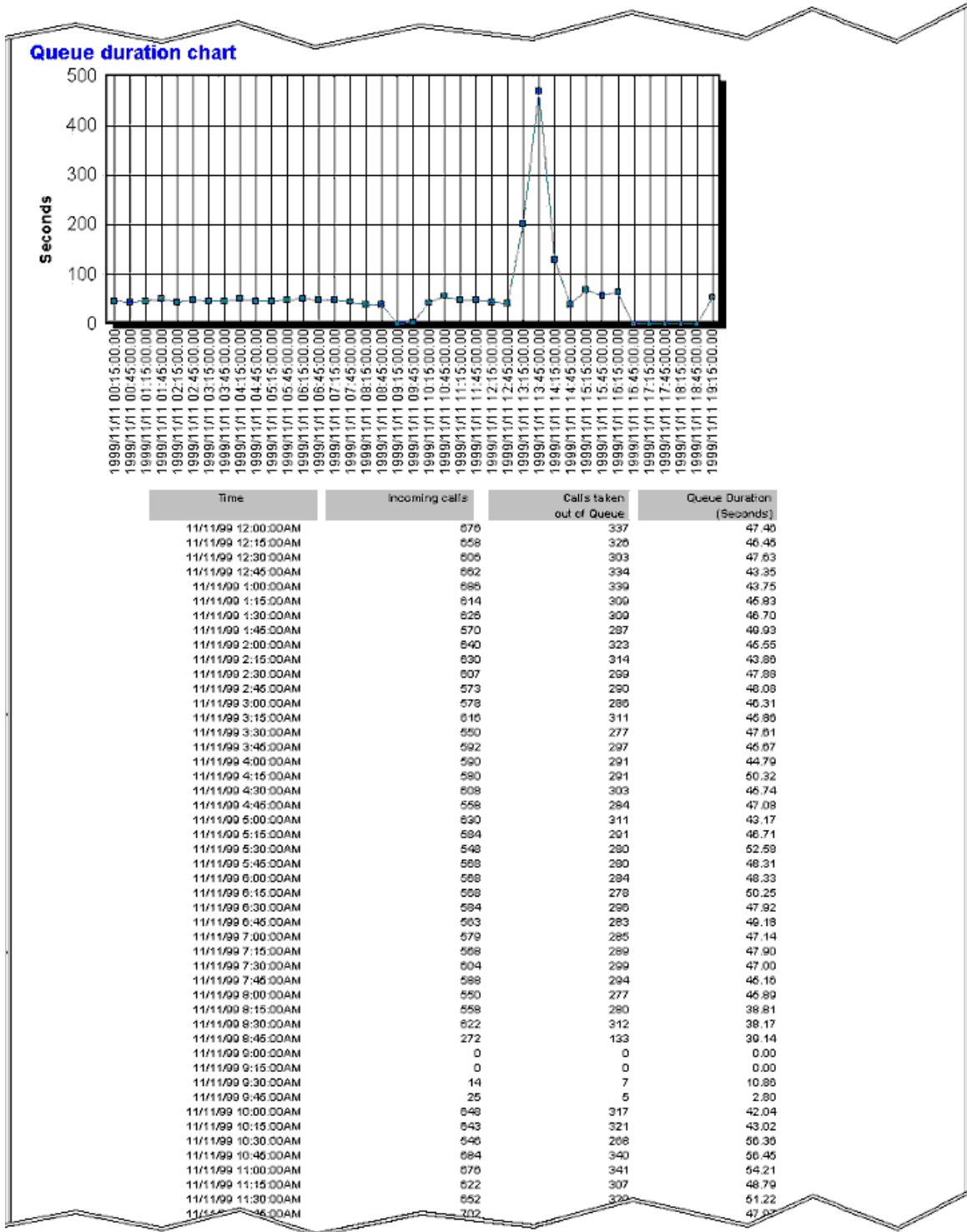


Figure 23:

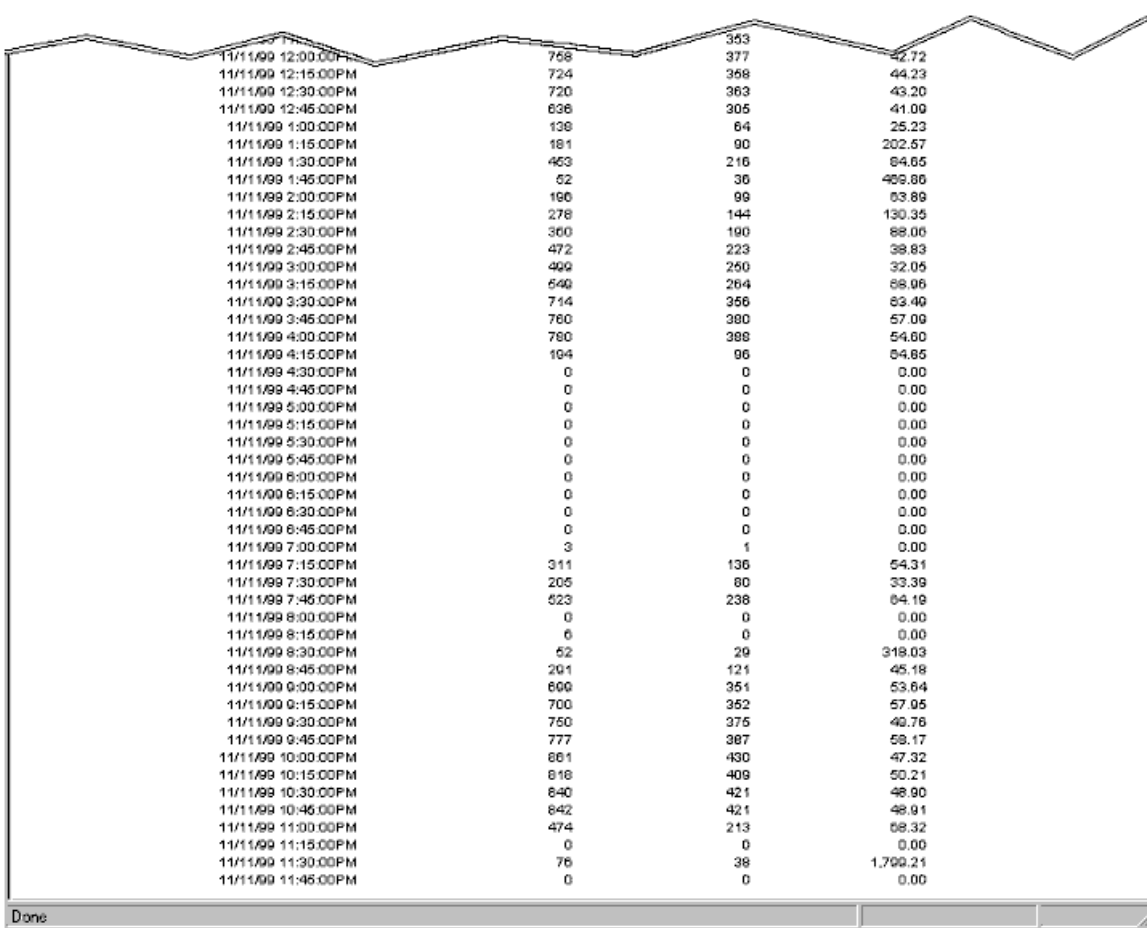


Figure 24: Sample By 15 Minutes report

SAMPLE REPORT: BY 30 MINUTES

The *By 30 Minutes* report shows average values on a 30-minute break- down for the specified date range.

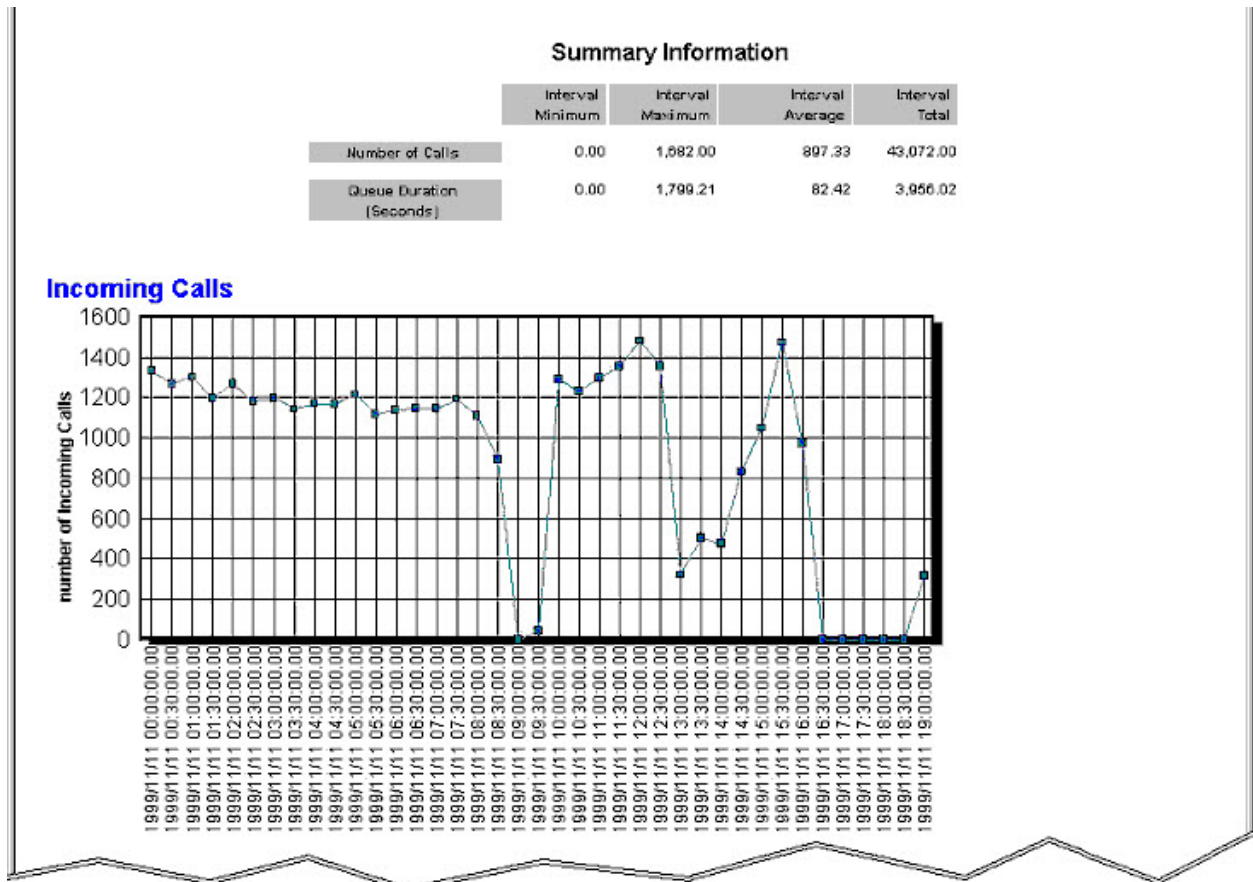
Following is sample data used for the sample report:

Table 10

DATA/DATE	DATA 1	DATA 2	DATA 3	DATA 4	AND SO ON...
11-Nov-99 00:00	50	100	200	70	
11-Nov-99 00:30	63	23	5	74	
11-Nov-99 01:00	21	32	16	200	

DATA/DATE	DATA 1	DATA 2	DATA 3	DATA 4	AND SO ON...
And so on...					

A sample By 30 Minutes report is provided below.



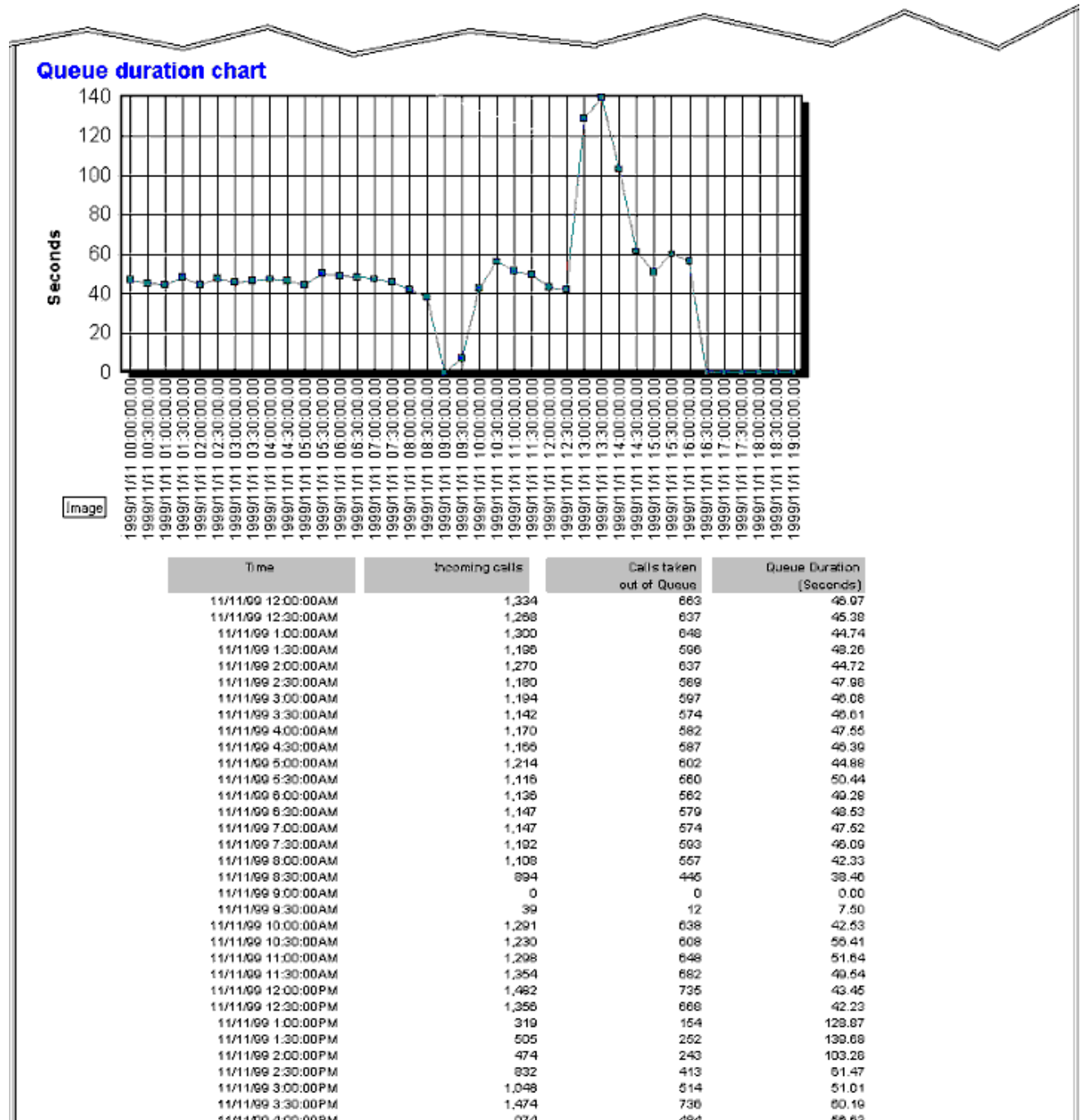


Figure 26: Sample By 30 Minutes report

SAMPLE REPORT: BY 1 HOUR

The By 1 Hour report shows average values on a one-hour breakdown for the specified date range.

Following is sample data used for the sample report:

Table 11

DATA/DATE	DATA 1	DATA 2	DATA 3	DATA 4	AND SO ON...
11-Nov-99 00:00	50	100	200	70	
11-Nov-99 01:00	63	23	5	74	
11-Nov-99 02:00	21	32	16	200	
And so on...					

A sample By 1 Hour report is provided below.

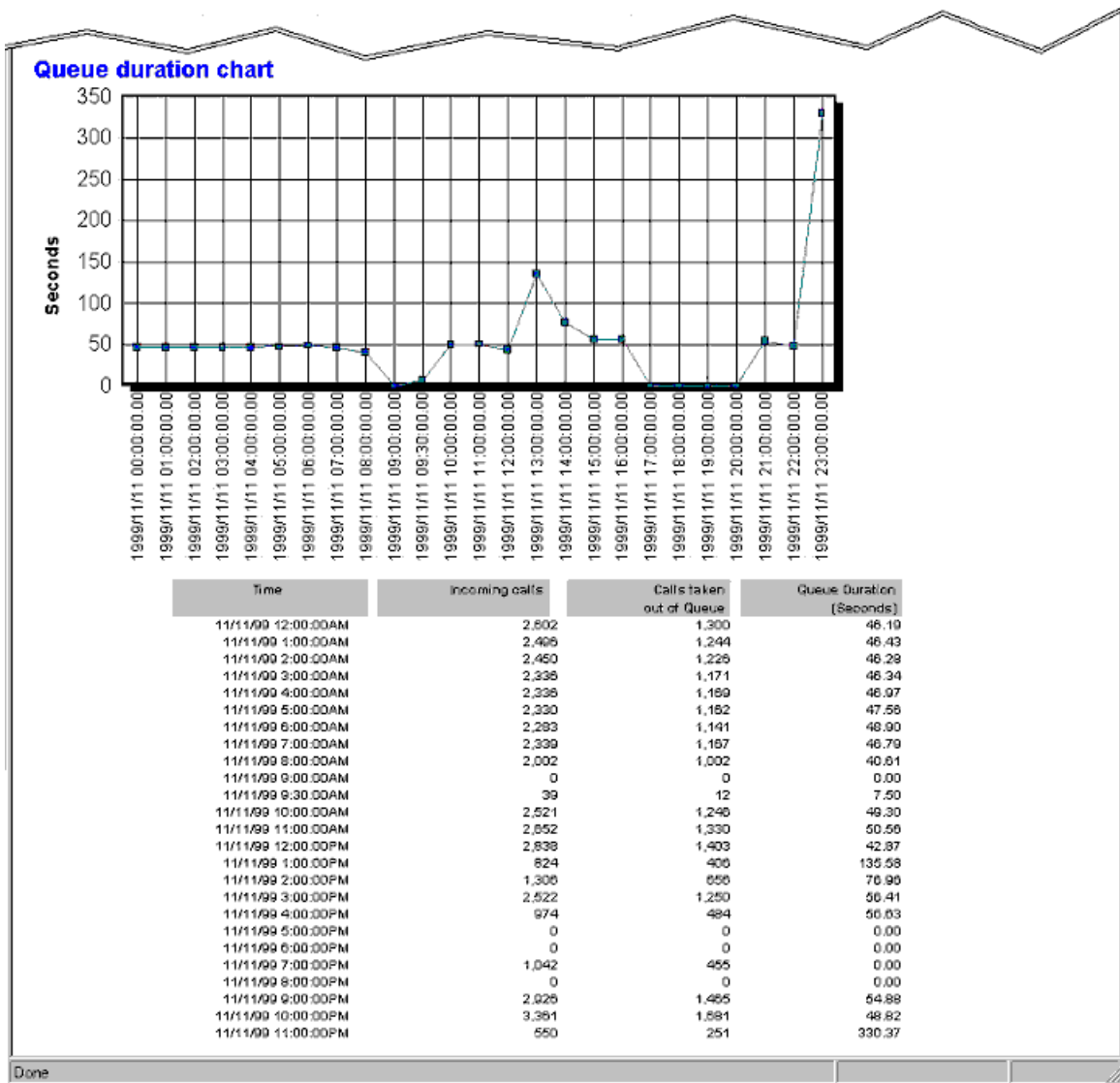


Figure 28: Sample By 1 Hour report

SAMPLE REPORT: BY 1 DAY

The By 1 Day report shows average values on a one-day breakdown for the specified date range.

Following is sample data used for the sample report:

Table 12

DATA/DATE	DATA 1	DATA 2	DATA 3	DATA 4	AND SO ON...
01-Oct-99	50	100	200	70	
02-Oct-99	63	23	5	74	
03-Oct-99	21	32	16	200	
And so on...					

A sample By 1 Day report is provided below.

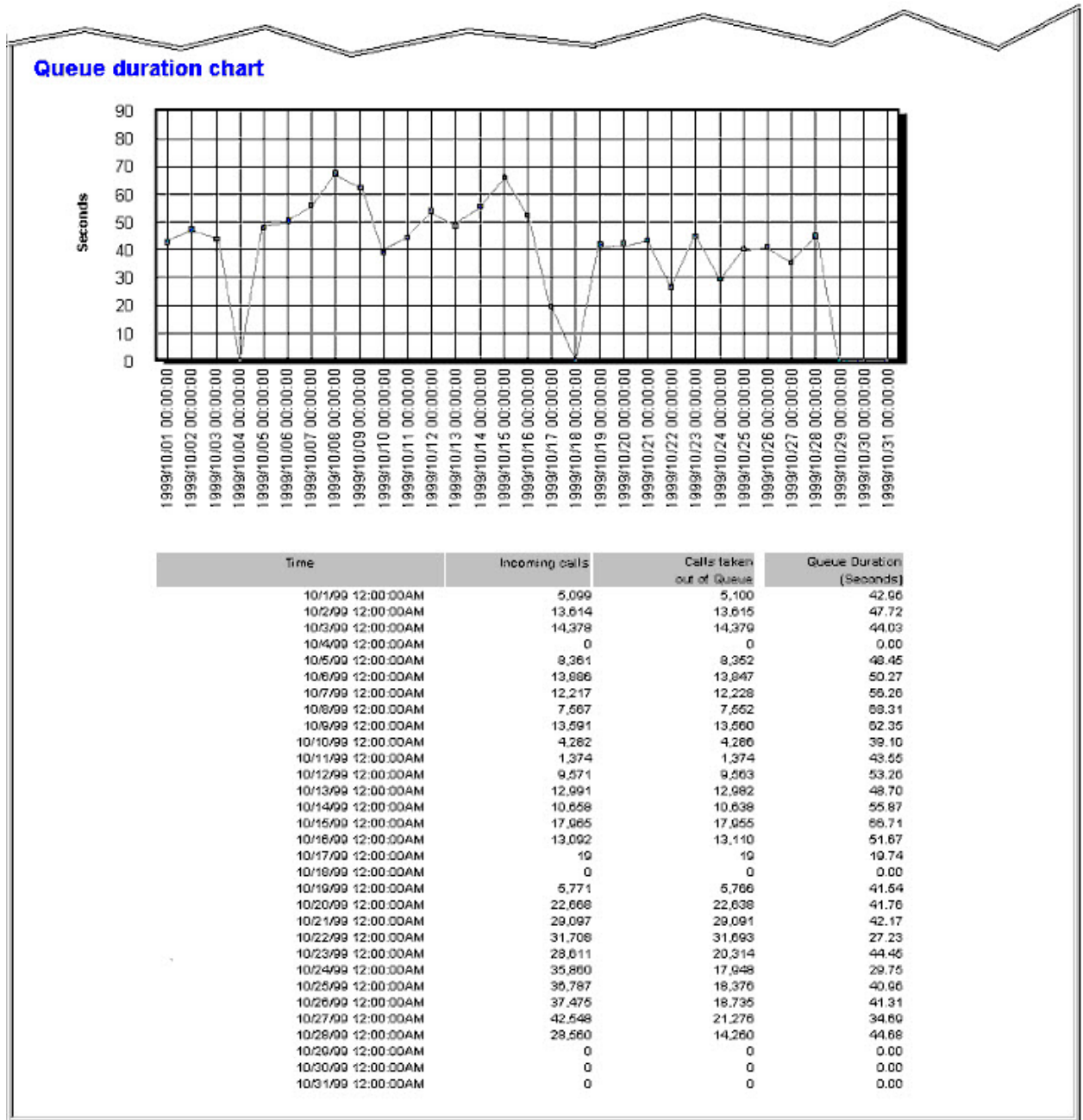


Figure 30: Sample By 1 Day report

SAMPLE REPORT: BY 1 MONTH

The *By 1 Month* report shows average values on a one-month break-down for the specified date range.

Following is sample data used for the sample report:

Table 13

DATA/DATE	DATA 1	DATA 2	DATA 3	DATA 4	AND SO ON...
Oct-99	50	100	200	70	
Nov-99	63	23	5	74	
Dec-99	21	32	16	200	
And so on...					

A sample By 1 Month report is provided below.

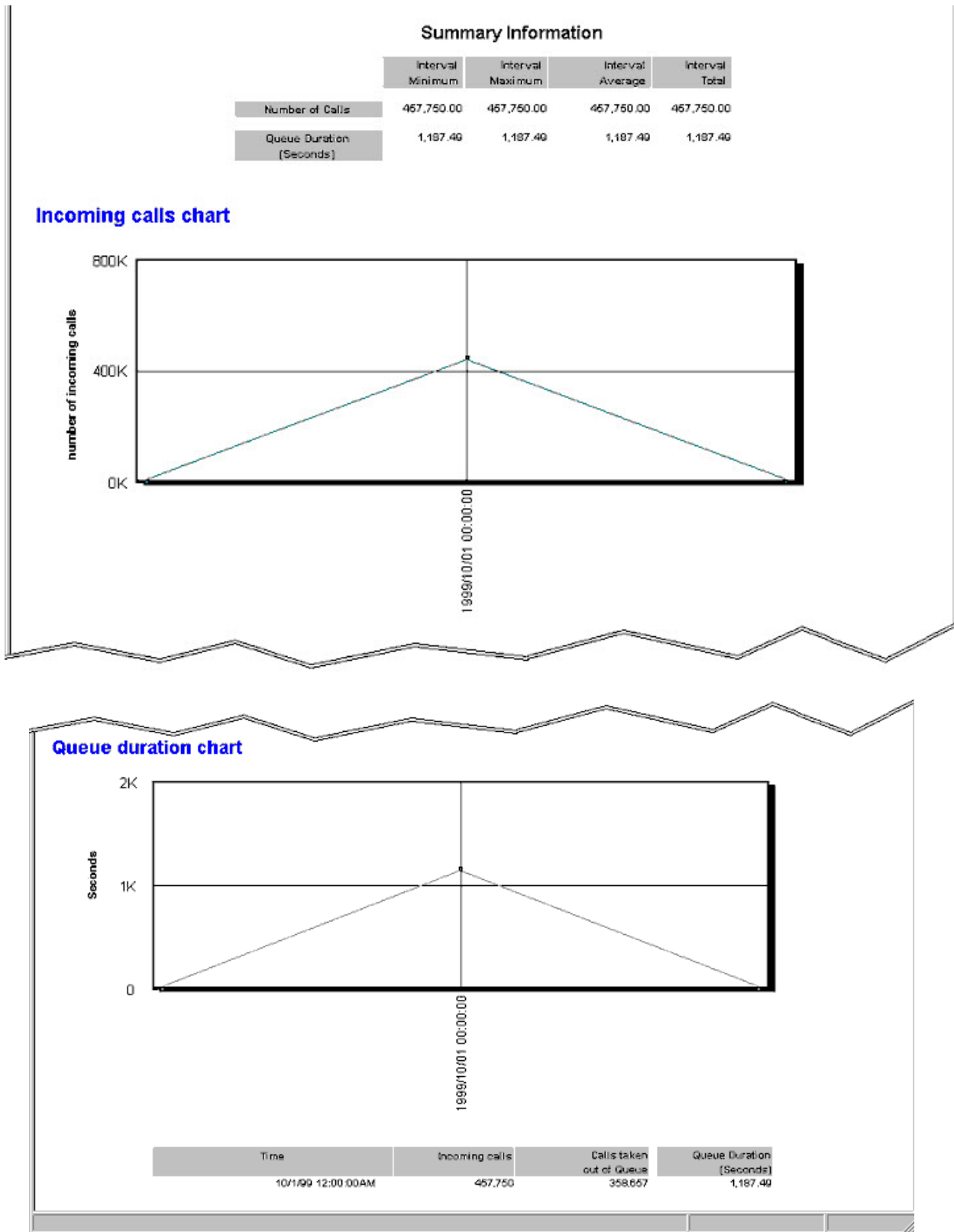


Figure 32: Sample By 1 Month report

DATABASE SCHEMA

Performance measurement uses the SQL server database to store measurement data and the report templates. The database schema:

1. Is independent of objects
2. Supports adding or changing measurements without changing the database schema
3. Data is mainly stored in one table for all measurements
4. Data is retrieved through stored procedures for report generation
5. Contains two databases:
6. Oaspcdc - Stores the measurement data.
7. Oasppm - Stores information about the report templates. The remainder of this section discusses the Oaspcdc database.

OASPCDC DATABASE

The Oaspcdc database, which stores the measurement data, consists of the following tables.

Table 14

TABLE	DESCRIPTION
MeasInfo	Stores information about the measurements.
Data	Stores basic attribute values for measurements.
TypeInfo	Describes the measured attributes in the Data table.
ExtraInfoLink	Describes the one-to-many relationship between a measured attribute value and the corresponding run-time information
ExtraInfo	Describes the different run-time information that can be attached to a measured attribute value.

MEASINFO TABLE

This MeasInfo table contains a description of a particular measurement for a particular object. This table links to the actual data in the Data table with the **MID** column.

Table 15

COLUMN NAME	TITLE	TENANT	CLASS	OBJECT	SUB OBJECT	VERSION	START	END	SAMPLE TIME	MID
Data- type	String	String	String	String	String	4*Short	Time	Time	Un-signed	Un-signed

COLUMN NAME	TITLE	TENANT	CLASS	OBJECT	SUB OBJECT	VERSION	START	END	SAMPLE TIME	MID
	First measurement	Volvo	Oper	Lisa	Internal Queue	2.0.0.0	7/1/99 00:00	12/31/99 23:59	15	23456
	Sorens extension	Ericsson	Ext	66594		2.0.0.0	10/1/99 00:00	10/31/99 23:59	15	23457

Following is a description of each of the columns in the MeasInfo table:

Table 16

COLUMN NAME	DESCRIPTION
Title	Text description of this measurement.
Tenant	Owner of the object (who is getting billed for this).
Class	Object type.
Object	Unique identifier for the object.
Sub Object	Optional identifier for a subcomponent in the object.
Version	Version number of the data provider that produced the data (four columns).
Start	Timestamp (date and time) indicates when the measurement starts (one-minute resolution).
End	Timestamp (date and time) indicates when the measurement ends (one-minute resolution). The End timestamp must be greater than the Start timestamp.
Sample time	The length of time (minutes) of the sample for this measurement.
MID	Unique number that describes the one-to-many relationship between the MeasInfo table and the Data table.

DATA TABLE

The actual data is stored in the Data table. The properties of the measured attributes can be found in the TypeInfo table through the Type column. Extra run-time information is stored in the ExtraInfo table linked with the ExtraInfoLink table.

Table 17

COLUMN NAME	MID	TYPE	EXTRA INFO	START	VALUE
-------------	-----	------	------------	-------	-------

COLUMN NAME	MID	TYPE	EXTRA INFO	START	VALUE
Datatype	Unsigned	Unsigned	Unsigned	Time	Integer
	23456	1	34	10/10/99 13:15	23
	23456	2	56	10/10/99 13:15	5

Following is a description of each of the columns in the Data table:

Table 18

COLUMN NAME	DESCRIPTION
MID	Unique number that describes the one-to-many relationship between the MeasInfo table and the Data table.
Type	Unique number for the attribute that links it to the TypeInfo table, which describes how this attribute should be displayed and processed.
Extra Info	Optional unique number for the attribute that links it to the ExtraInfoLink table. Gives the provider the ability to supply extra run-time information about how this value was generated.
Start	Timestamp (date and time) indicates when this sample was started.
Value	Actual value that was recorded. If not a whole number, it is stored with a scale factor. See the TypeInfo table for details.

TYPEINFO TABLE

This table describes the measured attributes in the Data table.

Table 19

COLUMN NAME	TYPE	NAME	SCALE
Datatype	Unsigned	String	TinyInt
	1	Incoming	0
	2	Aband.	0

Following is a description of each of the columns in the TypeInfo table:

Table 20

COLUMN NAME	USAGE
Type	Unique number for the attribute that describes the one-to-many relationship between the Data table and the TypeInfo table.

COLUMN NAME	USAGE
Name	Display name for the attribute.
Scale	Scale factor for the value in the data table. It denotes the power of ten with which the value should be multiplied. 0 = use as is, 1 = multiply with 10 ¹ , -1 = multiply with 10 ⁻¹ , and so on.

EXTRINFOLINK TABLE

This table describes the one-to-many relationship between a measured attribute value and the corresponding run-time information.

Table 21

COLUMN NAME	LINK	TYPE IDS
Datatype	Unsigned	Unsigned
	34	1
	34	4
	56	2
	56	4

Following is a description of each of the columns in the ExtrInfoLink table:

Table 22

COLUMN NAME	EXPLANATION
Link	Unique number for the attribute that describes the one-to-many relationship between the Data table and the ExtrInfo table.
Type IDs	Identifies the rows from the ExtrInfo table that are applicable to this measured attribute.

EXTRINFO TABLE

This table describes the different run-time information that can be attached to a measured attribute value.

Table 23

COLUMN NAME	TYPE ID	TYPE	VALUE
Datatype	Unsigned	String	String
	1	Language	English
	2	Language	French

COLUMN NAME	TYPE ID	TYPE	VALUE
	3	Application	Router
	4	Application	Scheduler

Following is a description of each of the columns in the ExtralInfo table:

Table 24

COLUMN NAME	EXPLANATION
Type ID	Unique number for this combination of type and value.
Type	Describes this value's type.
Value	The actual value.