Genesys 8.1

Performance Management Advisors Hardware Sizing Guide

TEMPORARY DOCUMENT: Available until the information contained herein is integrated into the *Genesys Hardware Sizing Guide*.

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Chapter

1 Performance Management Advisors

This chapter provides recommendations for hardware sizing for typical contact center scenarios. It contains the following sections:

Overview

The following acronyms are used:

- CCAdv—Contact Center Advisor
- WA—Workforce Option/Workforce Advisor
- FA—Frontline Advisor
- AA—Agent Advisor
- AGA—Advisors Genesys Adapter
- AM—Administration Module
- ACA—Advisors Cisco Adapter
- SDS—Supervisor Desktop Service
- RMC—Resource Management Console
- ActionMgt—Action Management

- CCAdv-ME—Contact Center Advisor - Mobile Edition

For more information about terminology and concepts used in this chapter, see:

- *Genesys Performance Management Advisors Deployment Guide*
- *Genesys Performance Management Advisors Frontline Advisor Administration User's Guide*
- *Genesys Performance Management Advisors Contact Center Advisor and Workforce Advisor Administrator User's Guide*.

Performance Considerations

A key performance measurement is the number of concurrent dashboard users (that is, the load-carrying capacity) on a specific deployment architecture. The hardware requirements of the different products within the suite depend on a number of factors that impact this performance measurement.

Contact Center Advisor and Workforce Advisor

The performance of Contact Center Advisor (CCAdv) and Workforce Advisor (WA) are not tied directly to the number of calls handled by the underlying platform(s). Instead, their performance depends on the complexity of the configured hierarchy and the number of statistics handled. The number of underlying base objects (queues, agent groups, and agents) that are being monitored, and their relationships to each other, determine the performance of these applications. This is further complicated when you use filters to segment the data for a given base object.

Table 1 shows the default number of statistics that are requested by the Advisors Genesys Adapter (AGA) for each type of base object (if the base objects are not segmented by filters) when CCAdv and WA are deployed on a Genesys platform. Note the following:

- These are the numbers of statistics that are requested as standard (out-of-box). Additional statistics can be enabled for a specific deployment.
- WA contact group metrics are not counted in this type of stat server load sizing.

Table 1: CCAdv/WA Source Metrics

Release	Agent Group Voice	Agent Group Multimedia	Application Voice	Application Multimedia	Agent
8.1.5	24	50	41	35	3

Frontline Advisor and Agent Advisor

The performance of Frontline Advisor (FA) and Agent Advisor (AA) are not tied directly to the number of calls handled by the underlying platform(s). Instead, their performance depends on the number of agents that are being monitored, the number of rules that have been activated for each agent, and the depth of the organizational hierarchy.

Table 2 shows the default number of statistics that are requested by the Advisors Genesys Adapter (AGA) when FA is deployed on a Genesys platform. Note the following:

- These are the numbers of statistics that are requested as standard (out-of-box). Additional statistics can be enabled for a specific deployment.
- FA rule metrics are not enabled out-of-box; if you enable rule metrics, then you can have up to 12.
- The count of Agent Performance voice and multimedia source metrics in Table 2 reflect one time profile enabled out-of-box. If you enable additional FA time profiles, performance and rule metrics are multiplied by the number of enabled time profiles to get the total number.

Table 2: FA Source Metrics

Release	Agent State	Agent Performance Voice	Agent Performance Multimedia
8.1.5	5	19	16

Advisors Genesys Adapter

The performance of the Advisors Genesys Adapter (AGA) depends mostly on the number of statistics it is handling and the number of base objects (queues, agent groups, and agents) configured in the Configuration Server. Since the AGA extracts these objects from the Configuration Server on start-up and stores them in its memory, a large configuration requires the AGA be allocated extensive amounts of memory. The default value for the AGA maximum heap space size is 1 GB. Consider increasing this size for the larger deployments.

The number of statistics that the AGA is handling depends on the set of selected base objects and whether the AGA is serving CCAdv/WA or FAAA. (Note that a single instance of AGA cannot serve both CCAdv and FA.)

The performance of the AGA also partly depends on the call volume since the number of T-Events being generated in the Platform drives the number of updates being sent from the Stat Server to the AGA.

Cisco Adapter

The performance of the Advisors Cisco Adapter (ACA) depends on both the call volume and the number of agents that are being monitored. ACA is designed to work only with FA/AA, hence the number of base objects being monitored in CCAdv has no effect on ACA. The ACA works off the call records retrieved from the underlying Cisco HDS database. The more calls going through the Platform, the more records the ACA must process to extract the statistics required by FAAA.

Summary

Table 3 summarizes the factors that impact performance for each Advisors component.

Table 3: Factors Impacting Performance of Advisors Components

Product	Hierarchy Complexity	Statistics	Base Objects	Filters	Agents	Rules	Call Volume	Metric Graphing
CCAdv/WA	X	X	X	X	X			X
FAAA	X				X	X		
AGA		X	X		X		X	
ACA					X		X	

Keeping all these considerations in mind, the information is organized according to the size of the contact center as a function of the number of base objects being monitored and the number of calls that are flowing through the platform on a daily basis.

General Guidelines for Contact Center Sizing Categories

Table 4 shows the contact center sizing categories based on the number of base objects being monitored and the daily call volume.

Table 4: Contact Center Sizing Categories

Size Category	Number of Agents	Number of Agent Groups	Number of Queues	Daily Call Volume
Small	Fewer than 500	Fewer than 50	Fewer than 50	Of the order of tens of thousands
Medium (1)	Fewer than 5000	Fewer than 400	Fewer than 1000	Up to 500,000
Medium (2)	Fewer than 5000	Fewer than 400	Fewer than 1000	Up to 500,000
Large	Fewer than 30,000	Fewer than 1000	Fewer than 8000	Up to 4 million

Example Configurations for Contact Centers based on Size

The following are examples of possible configurations based on contact center size. You can use these examples as general guidelines when deploying the full Advisors suite, particularly for Advisors releases prior to 8.1.5. However, see also "Capacity, Measurement, and Sample Architecture" on page 12, which provides performance information from tested environments running Advisors release 8.1.5 software. "Capacity, Measurement, and Sample Architecture" discusses each Advisors component separately (CCAdv, WA, and FA) and

provides specific deployment architectures for each to successfully achieve 1500 concurrent dashboard users.

Note: In the configurations listed below, FAAA running on a Cisco platform using the ACA has not been shown. If you have a Cisco environment and wish to use FAAA, a separate instance of FAAA needs to be installed along with an instance of the ACA. Hence, the hardware requirements shown in this section for FA and the AGA (for FA) will need to be duplicated.

Contact Center Size—Small

Table 5 shows an example of the Contact Center Size-Small architecture.

Note: In this architecture, there is no separate server for the Web tier. Apache is deployed on one of the servers hosting the applications.

Table 5: Contact Center Size—Small

Server Number	Application Component(s)	Processor(s)	Memory	Hard Drive Space	Operating System
1	Platform, AM, CCAdv, WA, XMLGen, AGA, ActionMgt, RMC	Quad-core 2.0 GHz+	4 GB	10 GB	Windows 2003 or Windows 2008
2	CCAdv-ME	Dual-core 2.0 GHz+	2 GB	5 GB	Windows 2003 or Windows 2008
3	Apache, Platform, FA, AGA	Quad-core 2.0 GHz+	2 GB	10 GB	Windows 2003 or Windows 2008
4	Databases	Dual Quad-core 2.0 GHz+	4 GB+	30 GB	Windows 2003 or Windows 2008; Linux or Unix; (Oracle)
5	SDS	Quad-core 2.0 GHz+	2 GB+	10 GB	Windows 2003 or Windows 2008

Contact Center Size—Medium (1)

Table 6 shows an example of the Contact Center Size-Medium architecture.

Table 6: Contact Center Size—Medium (1)

Server Number	Application Component(s)	Processor(s)	Memory	Hard Drive Space	Operating System
1	Apache Web Server	Dual-core 1.86 GHz+	512+ MB	5 GB	Windows 2003 or Windows 2008
2	Platform, AM, CCAdv, ActionMgt, RMC	Dual Quad-core 2.0 GHz+	4 GB	10 GB	Windows 2003 or Windows 2008
3	Platform, XMLGen, WA	Dual Quad-core 2.0 GHz+	4 GB	10 GB	Windows 2003 or Windows 2008
4	CCAdv-ME	Dual-core 2.0 GHz+	2 GB	5 GB	Windows 2003 or Windows 2008
5	AGA (for CCAdv), AGA (for FA)	Dual Quad-core 2.0 GHz+	4 GB	10 GB	Windows 2003 or Windows 2008
6	Platform, FA	Dual Quad-core 2.0 GHz+	4 GB	10 GB	Windows 2003 or Windows 2008
7	Databases	Dual Quad-core 2.0 GHz+	4 GB+	50 GB	Windows 2003 or Windows 2008; Linux or UNIX; (Oracle)
8	SDS	Quad-core 2.0 GHz+	2 GB+	10 GB	Windows 2003 or Windows 2008

Contact Center Size—Medium (2)

Table 7 shows an example of the Contact Center Size-Medium (2) architecture.

Table 7: Contact Center Size—Medium (2)

Server Number	Application Component(s)	Processor(s)	Memory	Hard Drive Space	Operating System
1	Apache Web Server	Dual-core 1.86 GHz+	512+ MB	5 GB	Windows 2003 or Windows 2008
2	Platform, AM, CCAdv, ActionMgt, RMC	Dual Quad-core 2.0 GHz+	4 GB	10 GB	Windows 2003 or Windows 2008
3	Platform, XMLGen, WA	Dual Quad-core 2.0 GHz+	4 GB	10 GB	Windows 2003 or Windows 2008
4	CCAdv-ME	Dual-core 2.0 GHz+	4 GB	5 GB	Windows 2003 or Windows 2008
5	AGA (for CCAdv), AGA (for FA)	Dual Quad-core 2.0 GHz+	4 GB	10 GB	Windows 2003 or Windows 2008
6	Platform, FA, SDS	Dual Quad-core 2.0 GHz+	4 GB	10 GB	Windows 2003 or Windows 2008
7	Databases	Dual Quad-core 2.0 GHz+	4 GB+	50 GB	Windows 2003 or Windows 2008; Linux or UNIX; (Oracle)

Contact Center Size—Large

Table 8 shows an example of the Contact Center Size-Large architecture.

Table 8: Contact Center Size—Large

Server Number	Application Component(s)	Processor(s)	Memory	Hard Drive Space	Operating System
1	Apache Web Server	Dual-core 1.86 GHz+	8 GB	5 GB	Windows 2003 or Windows 2008
2	Platform, AM, CCAdv, ActionMgt, RMC	Dual Quad-core 2.83 GHz+	16 GB	20 GB	Windows 2003 or Windows 2008
3	Platform, XMLGen, WA	Dual Quad-core 2.83 GHz+	16 GB	20 GB	Windows 2003 or Windows 2008
4	CCAdv-ME	Dual-core 2.0 GHz+	4 GB	5 GB	Windows 2003 or Windows 2008
5	AGA (for CCAdv)	Dual Quad-core 2.83 GHz+	16 GB	20 GB	Windows 2003 or Windows 2008
6	AGA (for FA)	Dual Quad-core 2.83 GHz+	16 GB	20 GB	Windows 2003 or Windows 2008
7	Platform, FA	Dual Quad-core 2.83 GHz+	16 GB	10 GB	Windows 2003 or Windows 2008
8	Databases	Dual Quad-core 3.0 GHz+	32 GB	80 GB	Windows 2003 or Windows 2008; Linux or UNIX; (Oracle)
9	SDS	Quad-core 3.0 GHz+	4 GB+	10 GB	Windows 2003 or Windows 2008

Stat Server Sizing

Currently, a single instance of the Advisors Genesys Adapter can only communicate with one Stat Server. The Stat Server cannot be co-located with any of the Advisor applications. Since the Stat Server is a single-threaded application, it should be allowed to use one complete core on a server without any other processes also using that core.

The Advisor applications are all multi-threaded and therefore use all the cores on a server; hence, there is a real chance that installing the Stat Server on the same machine as an Advisor application would hinder its performance.

Hardware sizing information for the Stat Server is located elsewhere in this document. More than one Stat Server can be deployed on a single server; in such cases, the server should have one core dedicated to each Stat Server and at least 2GB of memory available for each Stat Server.

Apache Tuning Tips

There are some useful Apache tuning tips available at http://www.devside.net/articles/apache-performance-tuning.

Desktop

The Advisor Suite is accessed through a thick-client application called the Advisors Browser. This application is installed on each user's desktop or laptop. The minimum hardware requirements for a PC hosting the Advisors Browser are as follows:

- Processor—Dual-core 2.0 GHz
- Memory—2 GB RAM
- Hard Drive—1 GB
- Operating System—Windows XP, Windows 2003, Windows 2008

You must also install the Flash player plug-in for non-IE browsers (for example, Firefox) on each user's desktop or laptop that runs the Advisors browser.

Note: Contact center size makes no difference here since the Advisors Browser is located on an end-user's local machine.

Capacity, Measurement, and Sample Architecture

Genesys tested the information in this section using Advisors release 8.1.5. This section includes the following:

Performance Measurement Environment

The key measurement for Performance Management Advisors products is the number of concurrent dashboard users (that is, the load-carrying capacity) on a specific deployment architecture.

The *deployment architecture* is a combination of the following:

- Object count
- Metric count
- Hardware capacity
- Product Configuration

Object count for a given product includes a subset of the number of Geographic Regions, Reporting Regions, Operating Units, Contact Centers, Agent Groups, Application Groups, and Applications. The layout of the object hierarchy (that is, the number and nature of the objects, as well as the nature of the relationships) may impact the performance of Advisor products, but the number of objects is the main factor affecting performance.

The metric count includes both default and defined custom metrics. Metrics may affect Advisors performance, depending on the metrics definitions, but like object count, the variance is assumed to be minimal.

Unless otherwise specified, performance measurements rely on an environment in which each individual Advisor component is running in its own operating environment, which includes specific hardware (physical or virtualized) and operating system.

The sizing information provided is applicable only to the specific deployment architecture described in this section. For each of the Advisor products, there is also a *best practices* section that contains general guidelines for performance optimization.

Load-Carrying Capacity

Load-carrying capacity is the number of concurrent dashboard users without significant performance degradation in the deployment architecture.

You can scale up the load-carrying capacity of Advisor products by increasing the number of presentation instances (presentation instances service the dashboard requests).

Table 9, "Presentation Load-Carrying Capacity with Advisors 8.1.5," on page 13 lists the load-carrying capacity for each product based on the following configurations:

- Single-Presentation instance load carrying capacity: The user load that a single independent (with distributed cache) presentation instance can carry in Genesys' recommended deployment architecture.
- Dual-Presentation instance load carrying capacity: The user load that a pair of independent (with distributed cache) presentation instances can carry in Genesys' recommended deployment architecture.
- Triple-Presentation instance load carrying capacity: The user load that three independent (with distributed cache) presentation instances can carry in Genesys' recommended deployment architecture.

The information in the following Table is limited to demonstrating the capability to support at least 1500 concurrent users for each product. The deployment architecture that was used to collect the key performance measurement for each product is described in the following sections:

- "CCAdv Deployment Architecture and Recommendations for Optimal Performance" on page 14
- "WA Deployment Architecture and Recommendations for Optimal Performance" on page 22
- "FA Deployment Architecture and Recommendations for Optimal Performance" on page 29

Table 9: Presentation Load-Carrying Capacity with Advisors 8.1.5

Product	Single-Presentation Instance Load-carrying Capacity	Dual-Presentation Instance Load-carrying Capacity	Triple-Presentation Instance Load-carrying Capacity
CCAdv	600	1300	1600
WA	700	1200	1500
FA	1500	Not required; 1500 concurrent users achieved with a single-presentation instance.	Not required; 1500 concurrent users achieved with a single-presentation instance.

CCAdv Deployment Architecture and Recommendations for Optimal Performance

CCAdv Object Configuration Information

The following Table describes the high-level dimensions controlling the environment used to achieve the results described in "Load-Carrying Capacity" on page 13.

Table 10: CCAdv Presentation Object Configuration

Object	Count
Geographic Regions	1
Contact Centers	40
Reporting Regions	20
Operating Units	1
Application Groups	150
Applications	1600
Agent Groups	3200 (2 for each application)

CCAdv Environment Topology

The following diagram shows the environment topology used to successfully achieve 1500 concurrent users of CCAdv. VM is a *virtual machine*. The *Aggregation Instance* performs data aggregation; the *Presentation Instance* services the dashboard.

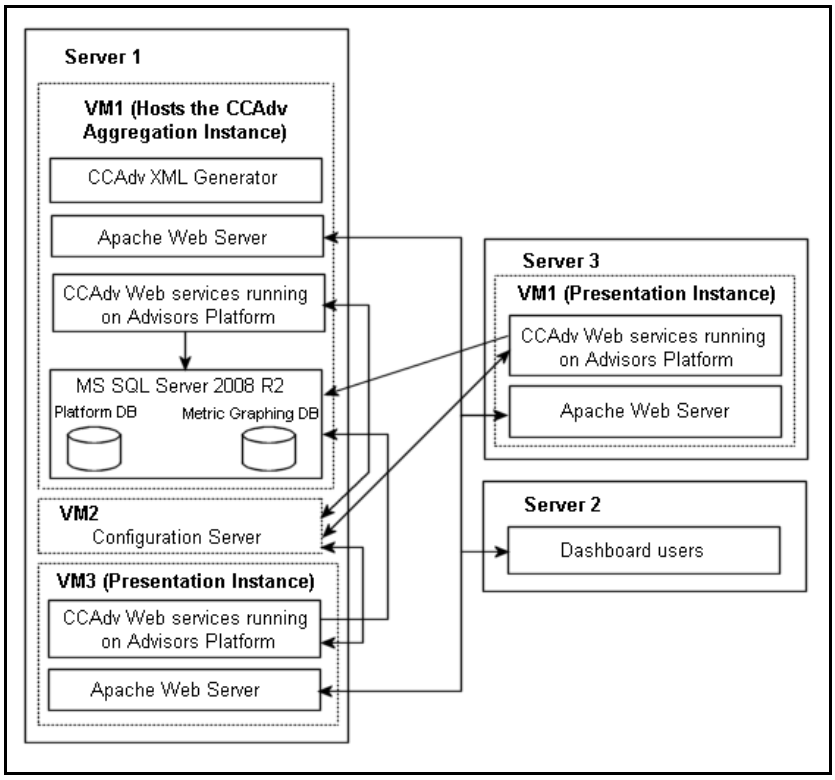

Figure 1: Contact Center Advisor Environment Topology

CCAdv Presentation Machine and VM Information

The following Table describes the characteristics of the hardware and virtualization environment shown in Figure 1, which supports 1500 concurrent users of CCAdv.

Table 11: CCAdv Presentation Machine and VM Information

Server	# of Processors	Processor Type	# of Cores	Total Cores	RAM	OS	Application
Server 1 VM-Host	2	Intel Xeon X5675 @ 3.07GHz	6	24 logical cores (with hyper-threading)	32 GB	VMWare ESXi 5.0 Standard 64bit	
Server-1 VM-1	2	(same as host)	4	8	12 GB	Windows Server 2008 Standard SP2 64bit	MS SQL (Advisor database), Apache Geronimo (CAXML on Advisors Platform), XML Generator Simulator, Apache

Table 11: CCAdv Presentation Machine and VM Information (Continued)

Server	# of Processors	Processor Type	# of Cores	Total Cores	RAM	OS	Application
Server-1 VM-2	2	(same as host)	1	2	1.5 GB	Windows Server 2003 Standard SP2 64bit	Configuration Server
Server-1 VM-3	2	(same as host)	4	8	8 GB	Windows Server 2008 R2 Standard SP1 64bit	Apache Geronimo (CAXML on Advisors Platform), Apache
Server 2	1	Intel Xeon X3440 @ 2.53GHz	4	4	8 GB	Windows Server 2008 R2 Standard SP1 64bit	Dashboard simulator
Server 3 VM-Host	2	Intel Xeon X5675 @ 3.07GHz	6	24 logical cores (with hyper-threading)	32 GB	VMWare ESXi 5.0 Standard 64bit	
Server-3 VM-1	2	(same as host)	4	8	8 GB	Windows Server 2008 R2 Standard SP1 64bit	Apache Geronimo (CAXML on Advisors Platform), Apache

CCAdv Configuration for High Performance

The following Table describes settings you can change to improve CCAdv performance.

Table 12: Recommendations for Performance Improvement

Location	Sub-directory or File, where applicable	Settings

On each CCAdv node	{CCAdv home}\geronimo-tomcat6-minimal-2.2.1\bin\setenv.bat	Change
		`GERONIMO_OPTS=-ms128m -mx1024m -XX:MaxPermSize=128m`
		To
		`GERONIMO_OPTS=-Xms6g -Xmx6g -XX:MaxPermSize=256m`

	{CCAdv home}\geronimo\var\catalina\server.xml	Under the `<Connectorname="TomcatAJPConnector">` section, add `maxThreads="1600"`

Table 12: Recommendations for Performance Improvement (Continued)

Location	Sub-directory or File, where applicable	Settings
On CCAdv presentation nodes only	{CCAdv home}\geronimo\var\config\config-substitutions.properties	Set `MaxThreadPoolSize` to "`3000`"
Dashboard Administration setting		For optimal performance: • Select independent configuration mode (not integrated configuration mode) • Set `Show Totals and Averages` to `No`

On AGA	{AGA home}\conf\wrapper.conf	Change
		`Wrapper.java.initmemory=128`
		`Wrapper.java.maxmemory=1024`
		To
		`Wrapper.java.initmemory=4096`
		`Wrapper.java.maxmemory=14336`

	{AGA home}\conf\inf_genesys_adapter.properties	Change
		`informiam.genesys_connector.statServer.maxOpenReqsPerGroup = 1000`
		`informiam.genesys_connector.statServer.messages.queuesize = 500000`
		`informiam.genesys_connector.GCStatisticsObjectDao.batchSizeOverride = 100`
		`informiam.genesys_connector.statsissue.pausechecklimit = 5000`
		To
		`informiam.genesys_connector.statServer.maxOpenReqsPerGroup = 6000`
		`informiam.genesys_connector.statServer.messages.queuesize = 350000`
		`informiam.genesys_connector.GCStatisticsObjectDao.batchSizeOverride = 1000`
		`informiam.genesys_connector.statsissue.pausechecklimit = 10000`

Table 12: Recommendations for Performance Improvement (Continued)

Location	Sub-directory or File, where applicable	Settings

On AGA (continued)	{AGA home}\conf\ table-config.xml	For optimal performance, you can also disable the update to the Agent Skill Group Real Time table. In `{AGA home}\conf\ table-config.xml`, comment out the following block:
		`<tableconfig title="AgentSkill GroupRealTime">`
		`<type>data</type>`
		`<tablename>t_Agent_Skill_Group_ Real_Time</tablename>`
		`<formatfile>format_files/Agent_ Skill_Group_Real_Time.fmt</format file>`
		`<key-fields>SkillGroupSkillTarget ID,SkillTargetID</key-fields>`
		`</tableconfig>`

Table 12: Recommendations for Performance Improvement (Continued)

Location	Sub-directory or File, where applicable	Settings

On each Apache HTTP proxy	httpd.conf	• Uncomment or add the following modules:
		◆ `LoadModule deflate_module modules/mod_deflate.so`
		◆ `LoadModule headers_module modules/mod_headers.so`
		◆ `LoadModule proxy_module modules/mod_proxy.so`
		◆ `LoadModule proxy_ajp_module modules/mod_proxy_ajp.so`
		◆ `LoadModule proxy_balancer_module modules/mod_proxy_balancer.so`
		◆ `LoadModule proxy_http_module modules/mod_proxy_http.so`
		• Add the following block to increase the number of Apache worker threads (note that this is for a Windows-based server):
		`<IfModule mpm-winnt-module>`
		`StartServers 16`
		`MinSpareServers 8`
		`MaxSpareServers 64`
		`KeepAlive Off`
		`MaxKeepAliveRequests 50`
		`KeepAliveTimeout 10`
		`ServerLimit 1000`
		`MaxClients 500`
		`MaxRequestsPerChild 5000`
		`ServerSignature On`
		`</IfModule>`

Table 12: Recommendations for Performance Improvement (Continued)

Location	Sub-directory or File, where applicable	Settings
On each Apache HTTP proxy (continued)		• Add the following to enable a request response proxy: ◆ `ProxyPass /am/ ajp://localhost:8009/am/` ◆ `ProxyPass /admin/ ajp://localhost:8009/admin/` ◆ `ProxyPass /am-admin/ ajp://localhost:8009/am-admin/` ◆ `ProxyPass /ca/ ajp://localhost:8009/ca/` ◆ `ProxyPass /ca-ws/ ajp://localhost:8009/ca-ws/` ◆ `ProxyPass /ea-ws/ ajp://localhost:8009/ea-ws/` ◆ `ProxyPass /base-ws/ ajp://localhost:8009/base-ws/` ◆ `ProxyPass /dashboard/ ajp://localhost:8009/dashboard/` ◆ `ProxyPass /nav-service/ ajp://localhost:8009/nav-service/` ◆ `ProxyPass /prefs-service/ ajp://localhost:8009/prefs-service/` ◆ `ProxyPass /wu/ ajp://localhost:8009/wu/` ◆ `ProxyPass /rmc/ ajp://localhost:8009/rmc/` ◆ `ProxyPass /gc-admin/ ajp://localhost:8009/gc-admin/` ◆ `ProxyPass /ca-xml/ ajp://localhost:8009/ca-xml/`

Best Practices for CCAdv Sizing

Use the following notes and best practices for optimizing CCAdv performance:

- Use Gigabit connectivity between the CCAdv aggregation node (runs CCAdv XML Generator) and CCAdv presentation node(s).
- Enable an Apache JServ Protocol (AJP) connection between the Apache HTTP proxy and CCAdv presentation node(s).
- Allocate as much CPU resource to CCAdv as possible; CCAdv performance is improved if you provide multiple CPU cores and faster clock speeds.
- Allocate sufficient memory for CCAdv components (Genesys recommends 6GB).

- Genesys recommends increasing the number of presentation nodes if the dashboard request response time exceeds acceptable thresholds.
- Apply role-based access control to minimize the number of hierarchy objects and metrics that each user can access.
- Regarding Stat Server performance:
  - Stat Server is a single threaded process. Carefully monitor the CPU usage of your Stat Server(s).
  - Consider adding more Stat Server pairs if a Stat Server is saturating a CPU. You may require up to four pairs of Stat Servers for best performance.
- Regarding XML Generator performance:
  - Increasing the "Thirty Mins And Today" metrics processing cycle duration reduces XML Generator processing overhead. The configuration parameter name is `generationForThirtyMinsAndToday` (default=120s) and it is located in the following file:

    {CCAdv home}\conf\xmlgen.properties
  - Performance improves with a small number of objects and degrades with a large number of objects, however a large number of reporting regions, geographic regions, and/or contact centers causes less degradation than a large number of operating units and/or application groups.
  - The number of columns displayed on the dashboard does not impact XML Generator performance.
- Regarding metrics graphing:
  - The greatest impact to load for the metrics graphing feature is against the aggregation node (XML Generator), not the presentation nodes.
  - The key scaling factor is the number of graphable metrics:
    - The XML Generator CPU usage scales up linearly with the number of graphable metrics.
    - Up to 15 graphable metrics are supported.
  - The number of users and number of requests for distinct graphs has minimal impact on performance.

WA Deployment Architecture and Recommendations for Optimal Performance

WA Object Configuration Information

The following Table describes the high-level dimensions controlling the environment used to achieve the results described in "Load-Carrying Capacity" on page 13:

Table 13: WA Presentation Object Configuration

Object	Count
Contact Groups	1552[1]
Contact Centers	20
Application Groups	200
Reporting Regions	20
Operating Units	1
Applications	600
Agent Groups	1300

[1] In this environment, the forecast data for all 1552 contact groups is updated every 10 minutes.

WA Environment Topology

The following diagram shows the environment topology used to successfully achieve 1500 concurrent users of WA. VM is a *virtual machine*. The *Aggregation Instance* performs data aggregation; the *Presentation Instance* services the dashboard.

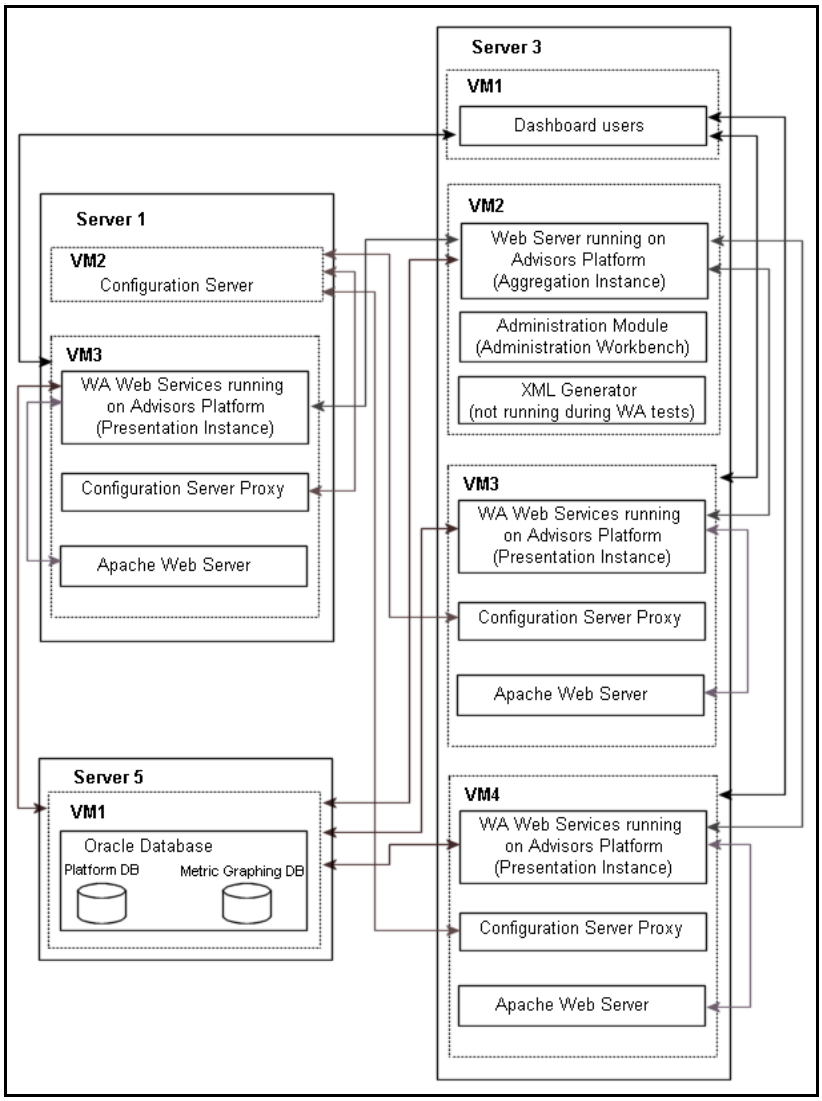

Figure 2: Workforce Advisor Environment Topology

WA Presentation Machine and VM Information

The following Table describes the characteristics of the hardware and virtualization environment shown in Figure 2, which supports 1500 concurrent users of WA.

Table 14: WA Presentation Machine and VM Information

Server	# of Processors	Processor Type	# of Cores	Total Cores	RAM	OS	Application
Server 3 VM-Host	2	Intel Xeon X5675 @ 3.07GHz	6	24 logical cores with hyper-threading	32 GB	VMWare ESXi 5.0 Standard 64bit	
Server 3 VM-1	1	(same as host)	1	1	8 GB	Windows Server 2008 Standard SP2 64bit	Dashboard simulator
Server 3 VM-2	2	(same as host)	2	4	8 GB	Windows Server 2003 Standard SP2 64bit	Apache Geronimo (WA Aggregation instance on Advisors Platform)
Server 3 VM-3	2	(same as host)	4	8	8 GB	Windows Server 2008 R2 Standard SP1 64bit	Apache Geronimo (WA Presentation instance on Advisors Platform), Configuration Server Proxy, Apache
Server 3 VM-4	2	(same as host)	4	8	8 GB	Windows Server 2008 R2 Standard SP1 64bit	Apache Geronimo (WA Presentation instance on Advisors Platform), Configuration Server Proxy, Apache
Server 1 VM-Host	2	Intel Xeon X5675 @ 3.07GHz	6	12	32 GB	VMWare ESXi 5.0 Standard 64bit	

Table 14: WA Presentation Machine and VM Information (Continued)

Server	# of Processors	Processor Type	# of Cores	Total Cores	RAM	OS	Application
Server-1 VM-2	2	(Same as host)	1	2	1.5 GB	Windows Server 2003 Standard SP2 64bit	Configuration Server
Server-1 VM-3	2	(Same as host)	4	8	8 GB	Windows Server 2008 R2 Standard SP1 64bit	Apache Geronimo (WA Presentation instance on Advisors Platform), Configuration Server Proxy, Apache
Server 5 VM-Host	2	AMD Opteron 2439SE @ 2.8GHz	6	12	32 GB	VMWare ESXi 5.0 Standard 64bit	
Server-5 VM-1	2	(Same as host)	1	2	8 GB	RHEL Server 5.7 64bit	Oracle database

WA Configuration for High Performance

The following Table describes settings you can change to improve WA performance.

Table 15: Recommendations for Performance Improvement

Location	Sub-directory or File, where applicable	Settings

On each WA node	{WA home}\geronimo-tomcat6-minimal-2.2.1\bin\setenv.bat	Change
		`GERONIMO_OPTS=-ms128m -mx1024m -XX:MaxPermSize=128m`
		To
		`GERONIMO_OPTS=-Xms6g -Xmx6g -XX:MaxPermSize=256m`

	{WA home}\geronimo\var\catalina\server.xml	Under the `<Connectorname="TomcatAJPConnector">` section, add `maxThreads="800"`
On WA presentation nodes only	{WA home}\geronimo-tomcat6-minimal-2.2.1\var\config\config-substitutions.properties	Set `MaxThreadPoolSize` to `"3000"`

Table 15: Recommendations for Performance Improvement (Continued)

Location	Sub-directory or File, where applicable	Settings
Dashboard administration setting		For optimal performance: • Select independent configuration mode (not integrated configuration mode) • Set `Show Totals and Averages` to `No`

On AGA	{AGA home}\conf\wrapper.conf	Change
		`Wrapper.java.initmemory=128`
		`Wrapper.java.maxmemory=1024`
		To
		`Wrapper.java.initmemory=4096`
		`Wrapper.java.maxmemory=14336`

Table 15: Recommendations for Performance Improvement (Continued)

Location	Sub-directory or File, where applicable	Settings

On each Apache HTTP proxy	httpd.conf	• Uncomment or add the following modules:
		◆ `LoadModule deflate_module modules/mod_deflate.so`
		◆ `LoadModule headers_module modules/mod_headers.so`
		◆ `LoadModule proxy_module modules/mod_proxy.so`
		◆ `LoadModule proxy_ajp_module modules/mod_proxy_ajp.so`
		◆ `LoadModule proxy_balancer_module modules/mod_proxy_balancer.so`
		◆ `LoadModule proxy_http_module modules/mod_proxy_http.so`
		• Add the following block to increase the number of Apache worker threads (note that this is for a Windows-based server):
		`<IfModule mpm-winnt-module>`
		`StartServers 16`
		`MinSpareServers 8`
		`MaxSpareServers 64`
		`KeepAlive Off`
		`MaxKeepAliveRequests 50`
		`KeepAliveTimeout 10`
		`ServerLimit 1000`
		`MaxClients 500`
		`MaxRequestsPerChild 5000`
		`ServerSignature On`
		`</IfModule>`

Table 15: Recommendations for Performance Improvement (Continued)

Location	Sub-directory or File, where applicable	Settings
On each Apache HTTP proxy (continued)		• Add the following to enable a request response proxy: ◆ `ProxyPass /am/ ajp://localhost:8009/am/` ◆ `ProxyPass /admin/ ajp://localhost:8009/admin/` ◆ `ProxyPass /ca-ws/ ajp://localhost:8009/ca-ws/` ◆ `ProxyPass /ea-ws/ ajp://localhost:8009/ea-ws/` ◆ `ProxyPass /dashboard/ ajp://localhost:8009/dashboard/` ◆ `ProxyPass /nav-service/ ajp://localhost:8009/nav-service/` ◆ `ProxyPass /prefs-service/ ajp://localhost:8009/prefs-service/` ◆ `ProxyPass /ca-xml/ ajp://localhost:8009/ca-xml/` ◆ `ProxyPass /wu/ ajp://localhost:8009/wu/` ◆ `ProxyPass /base-ws/ ajp://localhost:8009/base-ws/` ◆ `ProxyPass /fa/ ajp://localhost:8009/fa/` ◆ `ProxyPass /static/ ajp://localhost:8009/static/`

Best Practices for WA Sizing

Use the following notes and best practices for optimizing WA performance:

- Use Gigabit connectivity between the WA aggregation node and WA presentation node(s).
- Enable an AJP connection between the Apache HTTP proxy and WA presentation layer(s).
- Allocate as much CPU resource to WA as possible; WA performance is improved if you provide multiple CPU cores and faster clock speeds.
- Allocate sufficient memory for WA components (Genesys recommends 6GB).
- Genesys recommends increasing the number of presentation nodes if the dashboard request response time exceeds acceptable thresholds.
- Apply role-based access control to minimize the number of hierarchy objects and metrics that each user can access.

- Avoid unnecessary updates to forecast data; that is, avoid calculations that consume processing power unnecessarily. For example, do not configure 10-minute updates of forecast data if hourly updates are sufficient.
- Regarding Stat Server performance:
  - Stat Server is a single threaded process. Carefully monitor the CPU usage of your Stat Server(s).
  - Consider adding more Stat Server pairs if a Stat Server is saturating a CPU. You may require up to four pairs of Stat Servers for best performance.

FA Deployment Architecture and Recommendations for Optimal Performance

FA Object Configuration Information

The following Table describes the high-level dimensions controlling the environment used to achieve the results described in "Load-Carrying Capacity" on page 13:

Table 16: FA Presentation Object Configuration

Object	Count
Agents	30,000
Depth (levels)	6
Multiplicity* * Refers to the average number of teams to which an agent belongs.	1
Agent Groups	5000 (with agents)
Time Profiles	3

FA Environment Topology

The following diagram shows the environment topology used to successfully achieve 1500 concurrent users of FA. VM is a *virtual machine*. The *Aggregation Instance* performs data aggregation; the *Presentation Instance* services the dashboard.

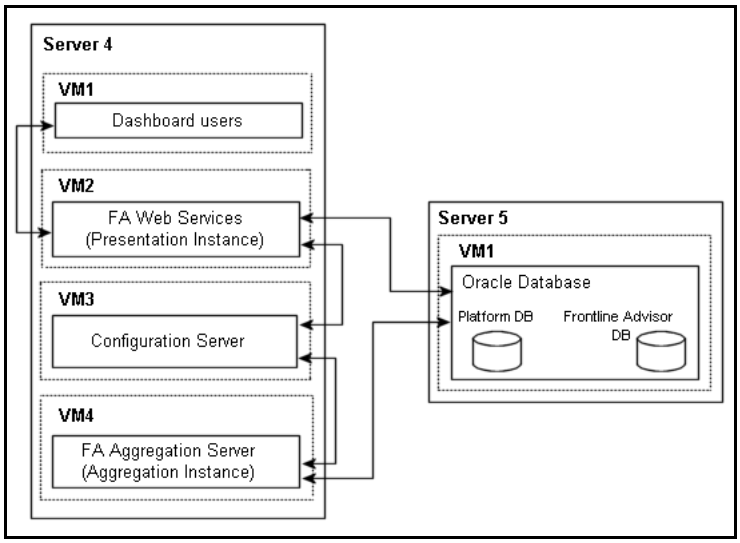

Figure 3: Frontline Advisor Environment Topology

FA Presentation Machine and VM Information

The following Table describes the characteristics of the hardware and virtualization environment shown in Figure 3, which supports 1500 concurrent users of FA.

Table 17: FA Presentation Machine and VM Information

Server	# of Processors	Processor Type	# of Cores	Total Cores	RAM	OS	Application
Server 4 VM-Host	2	Intel Xeon X5675 @ 3.07GHz	6	12	32 GB	VMWare ESXi 5.0 Standard 64bit	
Server 4 VM-1	2	(same as host)	4	8	8 GB	Windows Server 2008 Standard SP1 64bit	Dashboard simulator
Server 4 VM-2	2	(same as host)	4	8	8 GB	Windows Server 2003 Standard SP1 64bit	Geronimo (FA Presentation instance on Advisors Platform)
Server 4 VM-3	2	(same as host)	1	2	4 GB	Windows Server 2003 32bit	Configuration Server
Server 4 VM-4	2	(same as host)	4	8	8 GB	Windows Server 2008 R2 Standard SP1 64bit	FA Aggregation instance on Advisors Platform

Table 17: FA Presentation Machine and VM Information (Continued)

Server	# of Processors	Processor Type	# of Cores	Total Cores	RAM	OS	Application
Server 5 VM-Host	2	AMD Opteron 2439SE @ 2.8GHz	6	12	32 GB	VMWare ESXi 5.0 Standard 64bit	
Server-5 VM-1	2	(same as host)	1	2	8 GB	RHEL Server 5.7 64bit	Oracle database

FA Configuration for High Performance

The following Table describes settings you can change to improve FA performance.

Table 18: Recommendations for Performance Improvement

Location	Sub-directory or File, where applicable	Settings

On each FA node	{FA home}\geronimo-tomcat6-minimal-2.2.1\bin\setenv.bat	Change
		`GERONIMO_OPTS=-ms128m -mx1024m -XX:MaxPermSize=128m`
		To
		`GERONIMO_OPTS=-Xms4g -Xmx8g -XX:MaxPermSize=512m`

	{FA home}\geronimo\var\catalina\server.xml	Under the `<Connectorname="TomcatAJPConnector">` section, add `maxThreads="2000"`

On AGA	{AGA home}\conf\wrapper.conf	Change
		`Wrapper.java.initmemory=128`
		`Wrapper.java.maxmemory=1024`
		To
		`Wrapper.java.initmemory=4096`
		`Wrapper.java.maxmemory=14336`

Table 18: Recommendations for Performance Improvement (Continued)

Location	Sub-directory or File, where applicable	Settings

On AGA
(continued)
	{AGA home}\conf\inf_genesys_adapter.properties	Change
		`informiam.genesys_connector.statServer.addp.clienttimeout = 120`
		`informiam.genesys_connector.timing.messagerate.numberofmessages.batch = 500`
		To
		`informiam.genesys_connector.statServer.addp.clienttimeout = 360`
		`informiam.genesys_connector.timing.messagerate.numberofmessages.batch = 100000`

Table 18: Recommendations for Performance Improvement (Continued)

Location	Sub-directory or File, where applicable	Settings

On each Apache HTTP proxy	httpd.conf	• Uncomment or add the following modules:
		◆ `LoadModule deflate_module modules/mod_deflate.so`
		◆ `LoadModule headers_module modules/mod_headers.so`
		◆ `LoadModule proxy_module modules/mod_proxy.so`
		◆ `LoadModule proxy_ajp_module modules/mod_proxy_ajp.so`
		◆ `LoadModule proxy_balancer_module modules/mod_proxy_balancer.so`
		◆ `LoadModule proxy_http_module modules/mod_proxy_http.so`
		• Add the following block to increase the number of Apache worker threads (note that this is for a Windows-based server):
		`<IfModule mpm-winnt-module>`
		`StartServers 16`
		`MinSpareServers 8`
		`MaxSpareServers 64`
		`KeepAlive Off`
		`MaxKeepAliveRequests 50`
		`KeepAliveTimeout 10`
		`ServerLimit 1000`
		`MaxClients 500`
		`MaxRequestsPerChild 5000`
		`ServerSignature On`
		`</IfModule>`

Table 18: Recommendations for Performance Improvement (Continued)

Location	Sub-directory or File, where applicable	Settings
On each Apache HTTP proxy (continued)		• Add the following to enable a request response proxy: ◆ `ProxyPass /fa/ ajp://localhost:8009/fa/` ◆ `ProxyPass /am/ ajp://localhost:8009/am/` ◆ `ProxyPass /admin/ ajp://localhost:8009/admin/` ◆ `ProxyPass /am-admin/ ajp://localhost:8009/am-admin/` ◆ `ProxyPass /ca/ ajp://localhost:8009/ca/` ◆ `ProxyPass /ca-ws/ ajp://localhost:8009/ca-ws/` ◆ `ProxyPass /ea-ws/ ajp://localhost:8009/ea-ws/` ◆ `ProxyPass /base-ws/ ajp://localhost:8009/base-ws/` ◆ `ProxyPass /dashboard/ ajp://localhost:8009/dashboard/` ◆ `ProxyPass /nav-service/ ajp://localhost:8009/nav-service/` ◆ `ProxyPass /prefs-service/ ajp://localhost:8009/prefs-service/` ◆ `ProxyPass /wu/ ajp://localhost:8009/wu/` ◆ `ProxyPass /rmc/ ajp://localhost:8009/rmc/` ◆ `ProxyPass /gc-admin/ ajp://localhost:8009/gc-admin/` ◆ `ProxyPass /ca-xml/ ajp://localhost:8009/ca-xml/`

Best Practices for FA Sizing

Use the following notes and best practices for optimizing FA performance:

- Use Gigabit connectivity between the FA aggregation node and FA presentation node(s).
- Enable an AJP connection between the Apache HTTP proxy and FA presentation node(s).
- Allocate as much CPU resource to FA as possible; FA performance is improved if you provide multiple CPU cores and faster clock speeds.
- Allocate sufficient memory for FA components (Genesys recommends 6GB).

- You may require multiple AGAs (up to two).
- Regarding Stat Server performance:
  - Stat Server is a single threaded process. Carefully monitor the CPU usage of your Stat Server(s).
  - Consider adding more Stat Server pairs if a Stat Server is saturating a CPU. You may require up to six pairs of Stat Servers for best performance.

FA Dashboard Age

Dashboard age is a performance measure used in assessing the state and performance/rule processing cycles. It represent the age of the statistics on the dashboard, which includes the following:

1. Pre-Rollup Delay: The time from the end of the last rollup until the scheduled start of the next rollup.
2. Rollup Duration: The duration of the rollup + the time to publish to the distributed cache.
3. Request Response Time (RRT): The 95th percentile of response time for a dashboard request. That is, 95% of the time, a response is returned to a dashboard request after X number of seconds, where X is a constant.

The following Table shows results from Genesys' performance testing. *State processing* refers to the state metric rollup cycle and *performance/rule processing* is the performance metric rollup cycle (state and performance metric cycles run independently).

Table 19: Dashboard Age Results from FA Performance Testing

Measure (seconds)	State Processing			Performance/Rule Processing		
	95th Percentile	Median	Average	95th Percentile	Median	Average
Dashboard age	18 seconds	12 seconds	12 seconds	70 seconds	62 seconds	62 seconds