Cisco Workforce Optimization System Configuration Guide

Release 9.0

Workforce Management 9.0
Quality Management 9.0

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Cisco Workforce Optimization

System Configuration Guide

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1 Introduction
Cisco Unified Workforce Optimization (WFO) for Unified CCX is a full-featured solution for optimizing performance and quality and is an integral component of the Cisco Unified Communications System. The WFO suite provides two solutions: Workforce Management (WFM) and Call Recording and Quality Management (QM).

- Workforce Management allows for forecasting and development of schedules for agents across multiple sites and channels. It also provides real-time dashboard widgets, enabling supervisors to track key performance indicators and manage agents’ adherence to schedules directly from the unified dashboard.

- Call Recording and Quality Management is a voice and screen recording, compliance and evaluation solution for agent performance optimization and dispute resolution.

The following architecture diagram shows the overall service communications medium between the WFO solutions and Unified CCX.
1.1 **Unified CCX Compatibility**

It is our intention moving forward to use synchronized release numbering between Unified CCX and the WFO applications (including QM and WFM). For example, Unified CCX8.5 is compatible with QM 8.5 and WFM 8.5. Historically this has not always been the case. The table below shows the QM and WFM releases compatible that are different releases of Unified CCX. More detailed compatibility matrixes for Unified CCX are posted at [http://www.cisco.com/en/US/products/sw/custcosw/ps1846/products_device_support_tables_list.html](http://www.cisco.com/en/US/products/sw/custcosw/ps1846/products_device_support_tables_list.html).

<table>
<thead>
<tr>
<th>Unified CCX</th>
<th>QM</th>
<th>WFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0</td>
<td>2.7(3)</td>
<td>8.3(4), 8.3(3)</td>
</tr>
<tr>
<td>7.0</td>
<td>2.7(3)</td>
<td>8.3(4), 8.3(3)</td>
</tr>
<tr>
<td>8.0</td>
<td>8.0(2)</td>
<td>8.3(4)</td>
</tr>
<tr>
<td>8.5</td>
<td>8.5(1), 8.5(2)</td>
<td>8.5(1), 8.5(2)</td>
</tr>
<tr>
<td>9.0 or 8.5</td>
<td>9.0(1)</td>
<td>9.0(1)</td>
</tr>
</tbody>
</table>

1.2 **QM Features by Release**

This table lists the major feature additions for each release of QM.

<table>
<thead>
<tr>
<th>Release</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.7(3)</td>
<td>Windows client application user interface</td>
</tr>
<tr>
<td></td>
<td>Redundant QM CTI Service</td>
</tr>
<tr>
<td></td>
<td>Extended archival and quality recording retention policies</td>
</tr>
<tr>
<td></td>
<td>Localized for 13 languages</td>
</tr>
<tr>
<td></td>
<td>Mixed CR, QM and AQM user licensing</td>
</tr>
<tr>
<td>8.0</td>
<td>Browser-based user interface</td>
</tr>
<tr>
<td></td>
<td>Network (BIB) recording with live monitoring</td>
</tr>
<tr>
<td></td>
<td>Enhanced evaluation forms</td>
</tr>
<tr>
<td></td>
<td>Support for Server 2008 (32 bit) and Windows 7 clients (32 bit)</td>
</tr>
<tr>
<td>8.5.1</td>
<td>No feature changes from 8.0</td>
</tr>
<tr>
<td>8.5.2</td>
<td>New web 2.0 user experience</td>
</tr>
<tr>
<td></td>
<td>Support for 64-bit servers and Windows 7 clients</td>
</tr>
<tr>
<td>9.0</td>
<td>Cisco MediaSense Recording option</td>
</tr>
<tr>
<td></td>
<td>Quality evaluation of chat, email or other activities</td>
</tr>
<tr>
<td></td>
<td>Export option for recording search results</td>
</tr>
<tr>
<td></td>
<td>Support for evaluator calibration process</td>
</tr>
</tbody>
</table>
Configurable and lockable user dashboards
Mixed local and active directory authentication options
Displays silence and talkover events on player energy bar

1.3  **WFM Features by Release**
This table lists the major feature additions for each release of WFM providing clarity on the applicable feature set of each compatible release

<table>
<thead>
<tr>
<th>Release</th>
<th>Feature Additions</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.3(3)</td>
<td>Multi Skill Agent Queuing MSAQ scheduling Configurable and Graphical reporting</td>
</tr>
<tr>
<td>8.3(4)</td>
<td>No feature changes from 8.3(3)</td>
</tr>
<tr>
<td>8.5.1</td>
<td>No feature changes from 8.0</td>
</tr>
<tr>
<td>8.5.2</td>
<td>New web 2.0 agent user experience Support for 64-bit servers and Windows 7 clients</td>
</tr>
<tr>
<td>9.0</td>
<td>New web 2.0 supervisor user experience Unified schedule, adherence and coverage view with drag and drop schedule editing Adherence and Conformance statistics added to My Schedule widget</td>
</tr>
</tbody>
</table>

1.4  **Purpose of the Configuration Guide**
This document provides a step-by-step methodology for correctly configuring WFO systems, including one or both WFO applications: Call Recording and Quality Management (QM) and Workforce Management (WFM).

Correct configurations will ensure:
- Accurate customer quotations
- Successful customer deployments
- Continued customer satisfaction as the configured system provides both the performance and capacity to meet customer needs

Partners are encouraged to use this methodology identifying the necessary hardware and system software components required for their customer’s specific situation.

1.5  **Additional Information Sources**
Additional information and assistance is available from the following sources:
Cisco Sources:

- Cisco Workforce Optimization Website
  - Datasheets
  - User Guides
  - Software download links
- Cisco Community site for Contact Center Applications
  - Discussion Forums
  - Document postings
- Cisco Partner resources for WFO
  - Business and Technical slide decks

Calabrio Sources:

- Calabrio Partner web site [http://portal.calabrio.com](http://portal.calabrio.com) which contains:
  - Product collateral material – data sheets, presentations
  - Product documentation – install guides, release notes and service information for each WFO application
  - Product demonstration guides and flash-based demos
  - Product maintenance plans and pricing
  - Product Forums, searchable FAQ guides
  - Product roadmap information and a feature request tracker tool

Contact the Product Manager at:
- Gerry Johnsen
  Phone: 763-795-7691
  E-mail: gerry.johnsen@calabrio.com

Contact Calabrio’s Cisco Channel Specialist at:
- Dawn Pavel
  - Phone +1-763-795-7732
  - Email Dawn.Pavel@Calabrio.com
1.6 Note on product and service names

Prior to the 8.0 release references to the entire product or core services of Call Recording and Quality Management (QM) was typically referred to as QM. This reference in regards to core services has now been replaced by MR but some historical references to QM may still exist within this or other documents. The acronyms should be considered equivalent.

2 User Licensing Considerations

2.1 Named or Configured Versus Concurrent Users

Concurrent users are the basis for Cisco Unified Contact Center Express (Unified CCX) licensing and are generally defined as the maximum number of users which will be logged into the system at the same time, or concurrently. WFO application software licensing is based on the number of “named” users defined as all users of the application who have been configured and licensed within the administrative tool. The term configured is sometimes used in place of named when referring to application users and the terms are considered synonymous. Named users include all users who are being recorded or scheduled plus all supervisors, managers, evaluators or others with usernames for accessing the application.

2.2 Who Needs to be Licensed?

Active product users with login names and agents who are scheduled by the WFM application or users recorded by the QM application all require user licenses. It is not required to have WFO licenses for all agents within the ACD, just ones actively using the system. Each WFO application can also license a separate subset of agents or users, it is not required the same users be licensed for both applications.

2.3 Call Recording and Quality Management User License Levels

Three user licensing options are supported:

- Compliance Recording, CR. This user license enables selective or 100% audio recording of calls for agents or knowledge workers. Knowledge workers are defined as any IP telephony user of a phone supported through Unified CM. In addition to 100% call recording the compliance recording license also enables the user to do call search, playback and export functions within the Call Recording and Quality Management browser-based user interface. For the purposes of system configuration CR licensed users represent the same
load as QM agent users and together these are two types are just referred to as users.

- Quality Management, QM. Includes the same agent audio recording search and playback capabilities of the Compliance recording license plus these licensed agents can be assigned to Quality recording workflows for selective recording and their recordings can be evaluated using the evaluation forms configured within the system.
- Advanced Quality Management, AQM. Includes all Quality Management functions above plus screen recording on their calls recorded under a Quality workflow. AQM users represent an additional system load for the screen recording process as delimited in the system capacity tables.

Call Recording and Quality Management systems simultaneously support all three license types – QM, AQM and CR assigned to different users on the same system. User privileges like evaluations or screen capture are restricted to users based on their assigned license type.

2.4 Managing User Licenses
The QM user administration tool allows customers to license and unlicense users. Unlicensing previously-licensed users allows customers to reuse the named user licenses assigned to inactive user (for example, users who have left the organization). When you unlicense a user they can no longer log in to the user interface and then will no longer be recorded. Unlicensing a user does not affect their preexisting recordings or database information within the WFO applications. This allows supervisors and managers to continue to access their existing recordings and view their evaluation results through reports.
3 WFO Application Server Software

3.1 Operating System Requirements
Each WFO application server requires Microsoft Windows Server operating system to be provided separately by the partner or customer. Both WFO applications can use any one of the following operating systems:

- Windows Server 2008 R1 Standard edition, 32 bit
- Windows Server 2008 R2 Standard edition, 64 bit

Note: Windows Server 2008 R2 Standard edition, 64 bit is recommended for all new installations because of its support for large server memory and because backwards support for Server 2003 may be dropped in future product versions.


3.2 Database Requirements
Each WFO application – QM or WFM – requires one database hosted one of the following Microsoft SQL servers:

- Microsoft SQL Server 2005
- Microsoft SQL Server 2008

For WFM use SQL Standard or Enterprise editions.

For QM the edition: Express, Standard or Enterprise is determined by the number of current recording records in the system as defined later in this document.

Partners or customers must provide this separately for the WFO applications. WFO application deployments can meet this requirement in two ways:

1) Internally, by installing and hosting SQL Server on the application single server or on the database server within multi-server configurations
2) Externally, by creating an SQL database instance for the WFO application(s) on an external SQL server
Generally, systems will use the internal option but may consider the external option to reduce database licensing costs – particularly if the customer already has an enterprise-licensed SQL server capability or if the enterprise desires to share SQL licensing between WFO and other applications.

### 3.2.1 Differences between SQL editions

Here’s a table outlining key differences between SQL editions. It is provided as a reference, partners/customers should access source data from Microsoft for the most current data before making a final configuration decision.

<table>
<thead>
<tr>
<th></th>
<th>Datacenter</th>
<th>Enterprise</th>
<th>Standard</th>
<th>Web</th>
<th>Workgroup</th>
<th>Express</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of CPUs</strong></td>
<td>OS maximum</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Maximum memory used</strong></td>
<td>OS maximum</td>
<td>2 TB</td>
<td>64 GB</td>
<td>64 GB</td>
<td>4 GB</td>
<td>1 GB</td>
</tr>
<tr>
<td><strong>Maximum database size</strong></td>
<td>524 PB</td>
<td>524 PB</td>
<td>524 PB</td>
<td>524 PB</td>
<td>524 PB</td>
<td>10 GB</td>
</tr>
</tbody>
</table>


SQL Server only counts physical CPUs so if you have CPUs with multiple cores you only need to count the physical CPUs and not the total number of cores. In other words, look at physical processors (like in msinfo32) and not what is shown in Task Manager to find the number of CPUs on the server.

A few other options that will increase performance are available in Enterprise/Datacenter Editions but not available in Standard Edition and below are:
- Parallel index operations - this allows indexes to be traversed using multiple CPUs that can significantly improve query performance.
- Enhanced read-ahead scan - with this feature the SQL engine will perform fewer disk reads for the same query since it will read more pages at once.

### 3.2.2 SQL hosting requirements for QM

Starting with QM 8.8 the server requirements for hosting QM’s SQL database were changed from being dependent upon the user count to being dependent upon the number of recordings in the database. The calculation on recordings is done in the as part of calculating the recording storage space requirements hence the SQL requirements have now been integrated in to the Storage calculator spreadsheet available at [http://portal.calabrio.com/tiki/tiki-index.php?page_ref_id=72](http://portal.calabrio.com/tiki/tiki-index.php?page_ref_id=72). Use of this spreadsheet is described under the section: Recorded Contact Storage Calculator.
The SQL requirements worksheet uses the number of recordings calculated on the Storage Requirements worksheet to show the SQL requirements for the specific deployment in the yellow highlighted row. The other rows below show how the rules change for different numbers of recordings.

### SQL host requirements per number of recordings in database

These are the minimums for just SQL, if Co-res with Base then these need to be added to Base server.

<table>
<thead>
<tr>
<th>Number of recordings in database</th>
<th>CPU Cores</th>
<th>SQL Server Edition</th>
<th>Operating System &amp; SQL Width</th>
<th>Memory for SQL GB</th>
<th>SQL Server host</th>
</tr>
</thead>
<tbody>
<tr>
<td>from Storage Req 2,730,000</td>
<td>4</td>
<td>Standard</td>
<td>32(1) or 64 bit</td>
<td>6</td>
<td>Separate SQL server required</td>
</tr>
<tr>
<td>Less than 500,000</td>
<td>1</td>
<td>Express</td>
<td>32 or 64 bit</td>
<td>2</td>
<td>Can be Co-res w Base</td>
</tr>
<tr>
<td>Less than 2,000,000</td>
<td>2</td>
<td>Standard</td>
<td>32(1) or 64 bit</td>
<td>4</td>
<td>Can be Co-res w Base</td>
</tr>
<tr>
<td>Less than 4,000,000</td>
<td>2</td>
<td>Standard</td>
<td>32(1) or 64 bit</td>
<td>6</td>
<td>Separate SQL server required</td>
</tr>
<tr>
<td>Less than 6,000,000</td>
<td>4</td>
<td>Enterprise</td>
<td>64 bit</td>
<td>6</td>
<td>Separate SQL server required</td>
</tr>
<tr>
<td>Less than 12,000,000</td>
<td>8</td>
<td>Enterprise</td>
<td>64 bit</td>
<td>8</td>
<td>Separate SQL server required</td>
</tr>
<tr>
<td>Greater than 12,000,000</td>
<td>12</td>
<td>Enterprise</td>
<td>64 bit</td>
<td>12</td>
<td>Separate SQL server required</td>
</tr>
</tbody>
</table>

Note 1: 32 Bit OS systems limited to 4 GB Memory but SQL can use additional memory with AWE
Note 2: The yellow highlighted row reflects the SQL requirements for the number of recordings transferred from the Storage Requirements worksheet

These requirements are just for SQL hosting therefore if SQL is hosted co-res with the Base services as on a single-server configuration then the resources listed – CPU cores, memory need to be provides for SQL above and beyond the Base server specifications.

### 3.2.3 SQL Licensing Guidelines

Acquiring and properly licensing the SQL database used by the WFO application(s) is the responsibility of the deploying partner and the end customer. The following guidelines are provided as a convenience for our partners but are not guaranteed as to the accuracy of the information nor should this be construed as a replacement for the partner’s due diligence in understanding software licensing terms and how they apply to a specific implementation.

### 3.2.4 Guidelines for an Internal SQL Database Licensing

#### 3.2.4.1 Processor verses CAL Licensing

WFO applications require Microsoft SQL Server. Calabrio’s interpretation of Microsoft’s client access licensing (CAL) terms is that each WFO user would require a CAL. Since the cost of SQL server plus 30 or more CALs would be more expensive than the cost of a processor license, therefore it is recommended partners use the processor license which eliminates the need for user-based CALs. Additional information on Microsoft SQL licensing can be found at:
3.2.4.2 Multiple Processor SQL Licensing
If SQL is hosted on a server with multiple physical processors, like an MCS 7845 or equivalent server, then Calabrio’s interpretation of Microsoft SQL licensing terms is that multiple SQL processor licenses would be required.

3.2.4.3 Multi Core SQL Licensing
If SQL is hosted on a single physical processor with multiple cores, then only a single SQL processor license is required. See details at SQL how to buy URL above.

3.2.5 Guidelines for an External SQL Database
When using an external database, ensure the database server has additional capacity to handle the WFO application load. If sharing a SQL database between the WFO applications, QM and WFM, it is recommended that the SQL database be hosted on a dedicated SQL server on a platform equivalent to the largest platform recommended for either of the WFO applications.

3.3 Guidelines for updates and maintenance of OS and Database software
QM and WFM releases are not tested or qualified with each patch, SR or MR releases of the OS and database software. Our recommendation is that the client follows the OS and db software vendors recommended best practices for implementing these.

4 Server Hardware Configurations

4.1 Matching the Hardware to the Number of Users
The recommended server configuration is directly dependent on the expected number of named and concurrent users of the application. The maximum number of recommended users are based on scalability testing done to ensure a reliable and responsive system for the customer. Partners should take into account not only the initial number of users within the deployment but also consider potential growth factors and size the system to accommodate potential expansion of the user base, at least for the first year after deployment.

4.2 Server Hardware Specifications
The application server hardware specified was originally based on Cisco MSC 78xx H2 server specifications. Partners can substitute different hardware provided it is equivalent or better then the specified server configuration. Partners should verify their
proposed hardware is equivalent to the listed server configurations when designing a WFO system to ensure they are deploying equivalent or better configurations.

4.3 Virtual Servers

Virtual servers are now an approved WFO hardware configuration using:

- VMware ESX or ESXi 4.0+, 5.0+ Server

With the following caveat from the Product Installation Guide:

QM hosted on VMware was only tested for functionality. QM was not tested for performance or scalability in the VMware environment. Due to the many VM configuration factors and possible performance impacts of additional hosted virtual servers, determining the actual server performance results under the VMware environment is the customer’s responsibility. If a problem occurs, the customer may be required to shut down other VM sessions or reproduce the problem in a non-VMware configuration to assist in the isolation of the issue. Support for performance and scalability issues are limited to server-based deployments.

4.4 Cisco Unified Computing System, UCS, Virtual Servers

Scalability load testing has been performed for WFO applications hosted on virtual servers with resources specified in OVA files on Cisco UCS or equivalent platforms. The scalability guidelines and OVA files for Cisco WFO are available at on the Cisco docwiki under Virtualization for Unified CCX


WFO Services supported for virtualization include the following:

- Cisco WFM – Complete system on one virtual server
- Cisco QM Base Server – All QM services except recording
- Cisco QM Recording Server – Recording services for Network (BIB) or Server (SPAN) recording

Notes

1. Virtualizing the QM Monitor server for Server (SPAN) recording is not supported.
2. UCS support is spec based on the OVAs and therefore not directly dependent on specific UCS server models or versions.
3. vCPU currently there are no restrictions on the type of CPU used to fulfill this requirement
The Cisco WFO OVAs are posted at http://docwiki.cisco.com/wiki/Unified_Communications_Virtualization_Downloads_%28including_OVA/OVF_Templates%29#Cisco_Unified_Contact_Center_Express.2FCisco_Unified_IP_Intelligent_Voice_Response_.28IP_IVR.29

A copy of the table as of Oct 2012 is included below for convenience but the version posted on line is the official specifications.

<table>
<thead>
<tr>
<th>Application, OVA Capacity and Notes+Download Link</th>
<th>vCPU Cores</th>
<th>vRAM / Memory</th>
<th>vDisk</th>
<th>vNIC</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unified CCX WF M 9.0</td>
<td>2</td>
<td>4 GB</td>
<td>vDisk 1 = 40 GB Minimum Operating system, Cisco Unified Contact Center Express WFO WFM binaries, SQL Server, SQL Server Data files vDisk 2 = Optional - can be used to hold SQL Server Data files</td>
<td>1</td>
<td>Capacities • 900 named users • 300 concurrent users</td>
</tr>
<tr>
<td>Unified CCX WFO QM 9.0 Base Server Configuration (CRI/QM/AQM)</td>
<td>2</td>
<td>4 GB</td>
<td>vDisk 1 = 40 GB Minimum Operating system, Cisco Unified Contact Center Express WFO QM binaries, SQL Server, SQL Server Data files vDisk 2 = 146 GB Cisco Unified Contact Center Express WFO QM recordings (Size may vary depending upon usage )</td>
<td>1</td>
<td>Capacities • 3600 named users • 1200 concurrent users</td>
</tr>
<tr>
<td>Unified CCX WFO QM 9.0 Recording Server Configuration (CRI/QM/AQM)</td>
<td>4</td>
<td>4 GB</td>
<td>vDisk 1 = 40 GB Minimum Operating system, Cisco Unified Contact Center Express WFO QM recording service binaries, vDisk 2 = 146 GB Cisco Unified Contact Center Express WFO QM recording cache</td>
<td>1</td>
<td>Capacities • 300 concurrent voice recordings for Server (SPAN) and Network recording • 150 concurrent voice and screen recordings, recordings for Server (SPAN) and Network recording</td>
</tr>
</tbody>
</table>

### 4.4.1 Workforce Optimization (WFO) IOPS

IOPS specifications for these virtual environments are also posted at http://docwiki.cisco.com/wiki/UC_Virtualization_Storage_System_Design_Requirements#Cisco_Contact_Center_Express.2FIPIVR_IOPS.

A copy of the table as of Oct 2012 is included below for convenience but the version posted on line is the official specifications.

<table>
<thead>
<tr>
<th>Workforce Optimization Component</th>
<th>IOPS (Read)</th>
<th>IOPS (Write)</th>
<th>Operating Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>QM 8.5(2+) Base Server</td>
<td>4</td>
<td>2</td>
<td>Idle</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>12</td>
<td>Recording 300 concurrent calls</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>38</td>
<td>During recording upload</td>
</tr>
<tr>
<td>QM 8.5(2+) Recording Server or WFM</td>
<td>1</td>
<td>2</td>
<td>Idle</td>
</tr>
</tbody>
</table>
IOPS testing was not done for WFM but it is estimated to not exceed the IOPS load of the QM Recording server as listed above.

### 4.5 Workforce Management Hardware

#### 4.5.1 Workforce Management Single-Server Hardware Configuration

The current WFM release supports a single server configuration with all WFM services installed upon a single MCS equivalent server. The specific model required is defined by the maximum number of named or concurrent users as shown in the table below:

<table>
<thead>
<tr>
<th>Workforce Management Server Capacities</th>
<th>Intel 5140 Xeon 2.33 GHz</th>
<th>2 x Intel 5140 Xeon 2.33 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td>2 GB</td>
<td>4 GB</td>
</tr>
<tr>
<td>System Storage</td>
<td></td>
<td>40 GB</td>
</tr>
<tr>
<td>Cisco MCS Equivalent</td>
<td>MCS 7835</td>
<td>MCS 7845</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Workforce Management: Single Server Configuration</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of named users</td>
<td>450</td>
<td>900</td>
</tr>
<tr>
<td>Maximum number of concurrent agents users</td>
<td>150</td>
<td>300</td>
</tr>
</tbody>
</table>
4.5.2 WFM Services Descriptions

4.5.2.1 WFM Capture Service
The Workforce Management Capture Service watches for historical call data reports created by the Workforce Management OOC (Odysoft ODBC Collector) Service. When the Workforce Management Capture Service detects a new report, it sends a compilation request to the Workforce Management Compile Service.

4.5.2.2 Compile Service
The Workforce Management Compile Service listens for compilation requests from the Workforce Management Capture Service. The Workforce Management Compile Service can compile historical data for agents, services or teams by day, week, month, or year, for use in forecasting and scheduling. When requested by Capture Service, compiles historical data by day, week, and month.
4.5.2.3  **OOC Service**
Every 30 minutes, the Workforce Management OOC Service collects all of the call data for the preceding 30 minutes from the ACD database using the Open Database Connectivity (ODBC) interface. The Workforce Management OOC Service then writes the call data into historical reports.

High availability (HA) configurations can use multiple data sources. The Workforce Management OOC Service always connects to the first node, however, and fails over to the second node only if the first connection fails.

4.5.2.4  **Request Service**
Processes user requests to generate forecasts and schedules

4.5.2.5  **Adherence (RTE) Service**
The Workforce Management RTE (Real Time Engine) Service uses the Advanced Contact Management Interface (ACMI) protocol to get real-time information on agent states from the ACD server. WFM displays agent state information in the Supervisor Adherence dashboard.

4.5.2.6  **Sync Service:**
The Workforce Management Sync Service retrieves and processes user configuration data, such as skill group configurations, team configurations, and agent configurations from the ACD.

4.5.2.7  **Tomcat Service**
Provides web services for WFM browser based clients.
4.6 Call Recording and Quality Management Hardware

4.6.1 Recording Architectures: Desktop, Server (SPAN), Network (BIB) and Cisco MediaSense

Call Recording and Quality Management, QM, offers four different recording architectures that can be used on their own or together in a single deployment, depending on the customer’s needs.

Figure 1 Three Recording Architectures

4.6.1.1 Desktop Recording

Desktop recording uses a software recording service running on the recorded user’s Windows PC. This is the same capture technology as Cisco Agent Desktop (CAD)’s Endpoint recording. The user PC’s must be daisy chained off the phone and the Network Interface Card (NIC) is placed in promiscuous mode, allowing the Desktop recording service to copy the RTP voice stream packets as they are transferred to the IP phone. The service then caches the recordings locally on that user’s PC, and then
compresses, encrypts and uploads the recordings to the QM storage device at a time designated by the administrator.

The fundamental benefit that this architecture provides is being able to easily record users in multiple physical locations. Desktop recording does not need recording servers at every location in order to do the recordings, and the solution scales up with the number of users without requiring additional recording servers.

Notes:
- Certain Cisco phones such as the 79xx phones must be configured to span ports in the Unified CM administrator in order to pass these packets on to the agent’s PC
- The complete list of Cisco IP phones that support desktop recording is located in the Quality Management Installation Guide
- The recorded user’s PC must meet minimum criteria as listed in the Installation Guide. Generally the OS must be XP, Vista or 7 (32 bit mode); the processor must be at least 1 Ghz with 1 GByte memory and 1 GByte free disk space.

4.6.1.2 Server (SPAN) Recording

There are certain situations in which the customer is unable to use desktop recording:
- Customer uses a thin-client environment such as Citrix or Windows Terminal Services
- Customer uses IP Phone agent
- Recorded user’s PCs is not available or doesn’t meet the requirements for endpoint recording

To address these environments, Call Recording and Quality Management include a server recording option, again, similar to Cisco Agent Desktop. Server (SPAN) recording relies on the network switch interconnecting the phones support and be configured for Switched Port Analyzing (SPAN) sessions, where user phones are attached to the designated source ports, and the SPANning destination port forwards copies of the packets from those source ports to a server running the Server (SPAN) Monitoring Service which then forwards filtered RTP, telephony packets to the server running Server (SPAN) Recording services.

For a detailed explanation of server-based recording, as well as some example configurations, please see the Voice-Over IP Monitoring Best Practices Deployment Guide for CAD 6.0/6.1, located here:
Please disregard any server capacity numbers stated in the Best Practices guide and use the capacity numbers from the appropriate QM Installation Guide. A summary of the capacity figures for QM 8.0 are included in the Hardware Configuration sections below.

For more detailed information about configuring Cisco Catalyst switches for SPAN sessions, please see the Catalyst Switched Port Analyzer (SPAN) Configuration Example (Document ID 10570):


4.6.1.3 Network Recording

Network recording is similar to Server recording in that multiple phones are recorded via services running on an external recording server. The primary difference is that the Network recording server receives the IP telephony packets from the IP phone devices Built In Bridge, BIB, under control of Cisco Unified Call Manager, CUCM, instead of a SPAN port connection to the switch and thereby eliminates the switch dependency and the need for a monitoring server. For more information see the “Monitoring and Recording” section of the Cisco Unified Communications Manager Features and Services Guide available at:


Network recording does require CUCM of revision 6 or higher and a Cisco phone supporting the BIB functionality. Cisco has a list posted at

http://developer.cisco.com/web/sip/wikidocs?p_p_id=54_INSTANCE_d68B&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-2&p_p_col_count=1&_54_INSTANCE_d68B_struts_action=%2fwiki_display%2fview&_54_INSTANCE_d68B_nodeName=Main&_54_INSTANCE_d68B_tit

Notes:
• Network recording users also are enabled for live monitoring within QM via the live monitoring application.

4.6.1.4 Cisco MediaSense Recording
Beginning with version 9.0 Cisco QM also supports recording calls via Cisco’s MediaSense product as shown in the diagram below:

Call recordings are made and saved within the MediaSense cluster based on the MediaSense configuration. QM MediaSense Services then use the recording workflow.
configurations to select recordings from the MediaSense cluster for compression, encryption and upload to the QM system’s recording storage.

Supported MediaSense versions: 8.5(3) which in turn requires CUCM 8.5+

Important notes on QM and MediaSense:
- Cisco QM supports a single MediaSense cluster with a maximum of 5 servers supporting a maximum of 400 streams or 200 calls per server.
- The Cisco QM MediaSense services require 1 server for every 300 voice or 150 voice and screen recorded users.
- The Cisco QM MediaSense servers will initiate the call recording upload process from MediaSense upon the END RECORDING message enabling calls to be available for search immediately after they complete and be replayed shortly thereafter.

Advantages of MediaSense Recording:
- Redundant recording capture through the active active MediaSense cluster. See the Cisco MediaSense SRND at http://www.cisco.com/en/US/products/ps11389/products_implementation_design_guides_list.html for details on Cisco MediaSense recording and cluster configuration.
- Ability to record IVR via MediaSense CUCBE recording.
- Call recordings potentially available from either MediaSense directly or via QM depending upon the configured retention periods configured. It’s recommended to keep recordings on the MediaSense platform long enough to verify they have been successfully uploaded to the QM storage location.

QM Application Differences with MediaSense recordings
- Recording type in metadata listed as MediaSense
- Inclusion/exclusion lists – These normally determine if the call is recorded but with MediaSense controlling the recording these will only determine if the call is uploaded or not.
- Live monitoring is not supported with MediaSense recorded users
- Extension Mobility and Hot desking are not supported with MediaSense recording.
- The MANA CDR report will not be supported for devices recorded via Cisco MediaSense and if a site has a “mixed” environment where SPAN or network
recording and Cisco MediaSense are all used together, the CDR report will not be accurate since Cisco MediaSense devices will result in false positives.

- Outbound or Inbound calls recorded via MediaSense CUBE may have the calling and called number fields reversed due to challenges in determining these call’s direction, the default direction is configurable.

4.6.1.5 Screen recording with Server, Network or MediaSense recording

Screen recording if used is captured via the desktop recording service and therefore this must be installed on the desktop to facilitate screen capture. Screen recording can alternatively be done via a thin client server side capture service. See the Installation Guide for specific Citrix thin client server compatibilities.

The screen recording capture service streams the data to the recording service during every call if the recorded user logged into the PC hosting the desktop recording service is configured in a quality workflow. This screen recording streaming data can be a significant bandwidth load particularly in situations where the agent location is remote from the recording server forcing the streamed screen data to transverse the WAN.

4.6.2 Which Recording Architecture Should I use

Generally start with our Desktop (Endpoint) recording which records agent voice and screen with a Windows PC service installed on the agents PC daisy chained off the Cisco phone. This is the most efficient technique as it requires no recording servers. If the recorded users do not have a Windows XP, Vista or 7 PC daisy chained off the phone then we would next recommend Network recording which uses the built in bridge in Cisco G series phones to forward a replicated telephony packet stream to our recording server. This requires a recording server per 300 voice or 150 voice and screen concurrent recording sessions. If the user doesn’t have the “G” series phones and CUCM 6+ then we default to Server (SPAN) recording which requires configuring a SPAN port on the switch interconnecting the phone devices and a monitoring server for every 200 concurrent recording sessions in addition to the recording server.

4.6.3 QM Single Server Hardware Configuration; Desktop or Co Resident Server or Network recording services

The QM Single server configuration has all QM services installed on a single MCS-equivalent server including the Server monitoring, recording and/or Network recording services running co resident on the single QM server. The specific model required is defined by the maximum number of named, concurrent or co-resident recording users as shown in the table below:
<table>
<thead>
<tr>
<th>Monitoring and Recording Services Server Capacities</th>
<th>Intel 5140 Xeon 2.33 GHz</th>
<th>2 x Intel 5140 Xeon 2.33 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>2 x Intel 5140 Xeon</td>
<td>2 x Intel 5140 Xeon</td>
</tr>
<tr>
<td>Memory</td>
<td>4 GB</td>
<td>4 GB</td>
</tr>
<tr>
<td>System Storage</td>
<td>40 GB</td>
<td>40 GB</td>
</tr>
<tr>
<td>Recording Storage</td>
<td>From Storage Req</td>
<td>From Storage Req</td>
</tr>
<tr>
<td>Cisco MCS Equivalent</td>
<td>MCS 7835</td>
<td>MCS 7845</td>
</tr>
</tbody>
</table>

**Single Server with Co Resident Server, Network or MediaSense recording**  
*Note: When SQL is Co-resident then add SQL requirements for CPU cores and memory to Base server*  

| Maximum number of named users                      | 1500                     | 3600                        |
| Maximum number of concurrent agents/users         | 500                      | 1200 \(^1\)                |
| Co-res Server Based recording, Voice only         | 70                       | 100                         |
| Co-res Server Based recording, Voice & Screen     | 35                       | 50                          |

Note: Additional hardware requirements for hosting the SQL database are listed under section 3.2.1 SQL hosting requirements for QM.
4.6.4 QM Single Server Configuration with External SQL and/or Redundant CTI filter service

QM systems with more than 4 million recorded calls in the database are required to use an SQL database external to the QM Single server. Additional hardware requirements for hosting the SQL database are listed under section 3.2.1 SQL hosting requirements for QM.

QM systems requiring enhanced recording service availability may implement a redundant CTI filter service for each Cisco Unified Communications Manager Cluster. Both of these optional server components are included in the system diagram below.
4.6.5 External Server or Network Recording Configurations

In cases where Server, Network or MediaSense recording is used and the single server Server or Network Co-res recorded user capacity is exceeded these recording services need to be hosted on one or more separate external servers with Windows server OS.
The specific model of MCS server or servers required for the Recording servers is defined by the maximum number of concurrent recordings as shown in the table below:

<table>
<thead>
<tr>
<th>Monitoring and Recording Services Server Capacities</th>
<th>Intel 5140 Xeon 2.33 GHz</th>
<th>2 x Intel 5140 Xeon 2.33 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Storage</td>
<td>40 GB</td>
<td>40 GB</td>
</tr>
<tr>
<td>Recording Storage</td>
<td>Varies by Usage</td>
<td>Varies by Usage</td>
</tr>
<tr>
<td>Cisco MCS Equivalent</td>
<td>MCS 7835</td>
<td>MCS 7845</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External Server (SPAN) and Network Recording Capacities, in concurrent recorded calls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice only Recording Service</td>
</tr>
<tr>
<td>Voice and Screen Recording Service</td>
</tr>
<tr>
<td>Server (SPAN) Monitoring Service</td>
</tr>
</tbody>
</table>

Note 2: Server and Network recording servers require 0.5 GBytes for voice or 1.0 GBytes for voice and screen storage capacity per recorded user for caching daily recordings.

Example Customer Environment:

- 400 named (configured) users need to be recorded by the system
- Up to 300 users could be on the system concurrently
- 100 QM or CR licensed users need voice only recording simultaneously using server or network recording

Based on the above table, this customer should use an MCS 7835 for the QM single server and an MCS 7835 for the Recording server with 100\* 0.5 = 50 GBytes free storage. If using Server (SPAN) recording then another MCS 7835 is needed for the Server (SPAN) Monitoring Service.

- Customer has a total of 400 named users, with up to 300 recorded or logged into the QM desktop concurrently. The MCS 7835 allows for up to 1500 named users and 500 concurrent users.
- Customer needs to record up to 100 concurrent voice-only (no screen) calls, via Server or Network recording. The MCS 7835 recording server supports for up to 200 voice-only concurrent recordings.
- Server (SPAN) recording also requires a Monitor server to parse the SPANed packets, for 100 concurrent users a MCS 7835 meets the requirements
4.6.6 MediaSense Services Scalability

Our MediaSense uses two services

1) Subscription Service hosted on QM Central or CTI server, uses Cisco MediaSense API via primary or secondary server to track recordings

2) Transcoding Service on every server uploads recordings from Cisco MediaSense node, compresses, encrypts and uploads to QM Central Server. Scalability for the transcoding service is the same as for Network recording. A single 7845 class server will support 300 concurrent voice recording 150 concurrent voice and screen recordings and a 7835 class server handles half of the 7845 capacities. For Cisco MediaSense clusters larger then 300/150 concurrent users simply deploy multiple servers.

   a. Each Media Sense Transcoding Server can support a maximum of 400 named user/devices. This is because each user/device spawns a processing thread to accept CTI events from MediaSense

   b. The MediaSense Transcoding server must have 40 GB of base storage + 10 GB database storage and 0.5 GB recording storage per users. Therefore a 100 agent server needs 40+10+50= 100 GB

4.6.7 Calculating Call Recording and Quality Management Contact Storage Capacity

In addition to the normal disk storage for the operating system, SQL database and QM server software, QM deployments must also plan for storage space for the recorded contacts. The total amount of storage required is based upon the cumulative time and types of recording to be stored on the system. Calculate the cumulative storage requirements using these formulas:

\[
\text{Recorded minutes/day} = \text{average call time} \times \# \text{ calls/day} \times \# \text{ of users}
\]

\[
\text{Recorded minutes in QM} = \text{Rec minutes/day} \times \text{work days/user/month} \times \text{months to save}
\]

\[
\text{Voice Storage} = \text{Recorded minutes} \times 0.12 \text{ MBytes/min}
\]

\[
\text{Screen Storage} = \text{Recorded minutes} \times 1.0 \text{ MBytes/min}
\]

Note: The screen storage rate represents the average recording rate over thousands of contacts. The rate for individual contacts may vary with the amount of screen activity.


### 4.6.8 Quality Management Contact Storage Example

Average call time = 330 seconds or 5.5 minutes

# calls/day = 40

# of users = 60

**Recorded minutes /day** = 5.5 minutes * 40 calls * 60 users = 13,200 minutes

Average work days /user/month = 21 (full time, 5 days per week)

Months to save = 2 (Saving for 60 days through quality evaluation & review cycle)

**Recorded minutes in QM** = 13,200 minutes /day * 21 days /month * 2 months = 554,400 min

**Voice Storage** = 554,400 minutes * 0.12 MBytes/minute = 66 GBytes

**Screen Storage** = 554,400 minutes * 1.0 MBytes/minute = 554 GBytes

Note: A single system may have multiple groups of recorded users with variations in recording rules or retention periods so this calculation may need to be repeated for each group and the results summed together to get to total storage requirements.

### 4.6.9 Recorded Contact Storage Calculator

A spreadsheet to assist in calculating storage requirements and the number of recordings in the database for SQL hardware requirements is embedded below and is also available as a separate .xls file directly from the Calabrio partner portal at: [http://partners.calabrio.com/tiki/tiki-list_file_gallery.php?galleryId=24](http://partners.calabrio.com/tiki/tiki-list_file_gallery.php?galleryId=24)

<table>
<thead>
<tr>
<th>Group Name</th>
<th># of recorded Agents</th>
<th>Avg Call Time (Seconds)</th>
<th>Screen Time (Seconds)</th>
<th>Avg Calls per agent per day</th>
<th>Avg work days per month</th>
<th>Months to hold</th>
<th>Voice Recorded Minutes</th>
<th>Screen Recorded Minutes</th>
<th>Recording type</th>
<th>Voice Storage (Gb/day)</th>
<th>Screen Storage (Gb/day)</th>
<th>Number of recordings in database</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archive</td>
<td>150</td>
<td>210</td>
<td>0</td>
<td>60</td>
<td>31,500</td>
<td>27</td>
<td>214,920</td>
<td>0</td>
<td>Voice only</td>
<td>554</td>
<td>66</td>
<td>2,252,000</td>
</tr>
<tr>
<td>Quality workflow</td>
<td>250</td>
<td>210</td>
<td>30</td>
<td>15</td>
<td>3,500</td>
<td>27</td>
<td>147,000</td>
<td>0</td>
<td>Voice and screen</td>
<td>954</td>
<td>66</td>
<td>3,516,000</td>
</tr>
<tr>
<td>Tagged Workflow</td>
<td>50</td>
<td>210</td>
<td>30</td>
<td>10</td>
<td>1,750</td>
<td>27</td>
<td>73,500</td>
<td>0</td>
<td>Screen only</td>
<td>654</td>
<td>66</td>
<td>1,302,000</td>
</tr>
<tr>
<td>Incent Group Name</td>
<td>50</td>
<td>210</td>
<td>30</td>
<td>10</td>
<td>1,750</td>
<td>27</td>
<td>73,500</td>
<td>0</td>
<td>Screen and audio</td>
<td>0</td>
<td>66</td>
<td>0</td>
</tr>
<tr>
<td>Incent Group Name</td>
<td>50</td>
<td>210</td>
<td>30</td>
<td>10</td>
<td>1,750</td>
<td>27</td>
<td>73,500</td>
<td>0</td>
<td>Screen and audio</td>
<td>0</td>
<td>66</td>
<td>0</td>
</tr>
<tr>
<td>Incent Group Name</td>
<td>50</td>
<td>210</td>
<td>30</td>
<td>10</td>
<td>1,750</td>
<td>27</td>
<td>73,500</td>
<td>0</td>
<td>Screen and audio</td>
<td>0</td>
<td>66</td>
<td>0</td>
</tr>
<tr>
<td>Totals</td>
<td>970</td>
<td>168</td>
<td>2,730,000</td>
<td>0</td>
<td>214,920</td>
<td>0</td>
<td>554,400</td>
<td>0</td>
<td>Voice only</td>
<td>954</td>
<td>66</td>
<td>2,252,000</td>
</tr>
</tbody>
</table>

Note 1: Use Recording type = Screen only if the same calls have already been counted under voice only as only one copy of the audio is used

**Anticipated Growth Factor:** 10%

**Recommended Total Storage (Gb):** 1,252

This calculator can also be used to calculate the daily upload requirements. Just set Avg work days per month and Months to hold (columns H and I) both to 1 then the storage results will represent the file data accumulated per day for upload.

Note: The formulas and Calculator above will return the minimum amount of storage space required, additional storage capacity should be provided to accommodate for normal usage variations.
4.6.10 Options for Recorded Contact Storage

QM supports a variety of contact storage options including local hard disk drive (HDD), network attached storage (NAS) or storage area networks (SAN) by allowing the installer to specify the storage location for voice and screen recordings as server and pathname during install or change the location by moving the existing contacts and running the post-install process to specify the new contact storage location. It is recommended partners use external enterprise-class SAN or NAS storage for critical recordings because of the additional fault tolerant options provides by these storage architectures.

4.6.10.1 Local Storage

Contact storage can be hosted within the QM single server or on the Voice and Screen Storage servers in the multi-server configuration. The storage used can either be a portion of the server’s primary partition on the base disk(s) that came with the server or can be on a secondary partition using additional drives added to the base server. In either case, it is recommended that contact storage be provided on a RAID volume to protect the recorded contacts from drive failure.

4.6.10.2 Network Attached Storage or Shares

Configure the NAS or share to allow read and write access from the QM server and allocated the required storage capacity to the share. Set the server and storage share location during QM install to the server name and share to be used.

4.6.10.3 Storage Area Network (SAN)

Map a dedicated SAN volume to the QM server and create a file system partition on that volume. Then setup the recording storage to point to the mapped drive or a share name within the partition

4.6.11 Quality Management Backup CTI Services

QM supports a Backup QM CTI service option to provide redundancy for the communications path for CTI events like ringing, answered, dropped between the Cisco Unified Communications Manager, CUCM and the QM endpoint, Network or Server based recording services. A backup QM CTI service would be required for each primary QM CTI service, one of which is required for every CUCM cluster covering recorded users.

Notes:
1. The Backup QM CTI service shares the same server requirements as the primary CTI service
2. It is recommended the backup CTI server be located in a separate location from the primary CTI and CUCM servers. With this configuration the backups can provide a continued CTI event stream to recording services in the case of a WAN failure between the sites.

4.6.11.1 Description of Backup QM CTI Service Operation

- The base QM configuration includes a single QM server hosting all services. In order to ensure the desktop recording services continue operation through a QM server failure, use the redundant CTI service option. With the redundant option a backup CTI Service can be installed and configured on a separate server to ensure CTI events are forwarded to the endpoint recording clients.
- Then both QM CTI services will use the JTAPI link to Communications Manager which can be configured with both primary (publisher) and secondary (subscriber) links to Communications Manager.
- The recording clients select which QM CTI service to use starting with the primary service and proceeding down the list until a connection is established. Once a connection is in place the QM CTI service will register for the client’s phone events with Communications Manager via JTAPI.
- When a ringing or answered event occurs recording is started.
• If the recording client to QM CTI service connection is broken, the recording files in progress are closed, file number 1 and the recovery process is started.

• For Desktop recording, to recover, the endpoint recording service establishes a connection to the backup QM CTI service and if a call is in progress an event is forwarded immediately and the endpoint starts a new recording, number 2. Therefore the contact recording capability is maintained through failure of the primary CTI service. Once the service is restored the endpoints will reconnect to the primary CTI service.

• For Network and Server recording services, recording will not resume on the current call but will start with the next call.

• If the QM Base services are also down then the recordings services will also be unable to download recording workflows covering new users. The recording services will continue to record for all current users under their current workflow rules. But if a new user logs in to the PC hosting the Desktop recording service and the service can’t download their workflow from the QM base server recording will stop. Similarly for Server and Network Recording only the current users with workflows will continue to record. Once the QM Base server is restored new users will again record when they log in.

• Additional Failback details. Once the Primary CTI service is back up, even if the backup CTI service is running, we will connect back to the Primary CTI service as soon as possible, which may be immediately or immediately after any active call is disconnected. Our reason for going back to the Primary CTI service even when the backup CTI service is running, is to minimize the case where a desktop recording service is connected to the Primary CTI service and the server based recording service is connected to the backup CTI service and they are both recording the same phone. Staying on the primary CTI service also makes it easier to troubleshoot issues since only one CTI service is in use at a time.

4.6.12 Monitoring and Recording, QM, Services Descriptions
5 Additional Considerations

5.1 Active Directory Authentication Option
When deploying in an AD environment, both QM and WFM servers should be a member of the domain. The ACD server is recommended but not required to be a member of the domain – in which case additional setup is required. See the Installation Guide for more details.

- When deploying WFO, a user must exist or be created on the Unified CCE or CCX server who has read access to db_cra

5.2 WFM Application Hardware Redundancy
WFM does not offer application server hardware redundancy. However deployments looking to maximize uptime should consider the following options:

1. Provide redundant storage for the SQL database. The database contains all of the critical configuration and historical records to restore a system using a
cold standby or replacement server. Restoring the SQL database from a “point in time” backup will result in the loss of any historical service or user adherence data generated between the point in time of the backup and the time of the system restoration.

2. Consider deploying the SQL database on a MS SQL cluster. A resilient SQL service will also speed restoring a system after a failure of the application server.

3. Provision for a “cold standby” application server. Having the appropriate hardware on site can significantly reduce the mean time to repair, MTTR, after an application server fault. It is recommended the cold standby server only have the Server OS loaded and not the application itself because it would be difficult to insure the cold standby server’s application software was continuously upgraded to a level equal to the main application server. Instead it is recommended that media with the latest application software release be available for installation upon putting the cold standby server into production. This software load process should take less than 30 minutes.
   a. Standby server hostnames and IP address – It is suggested the cold standby server replace the original server by assuming the same hostname and IP address as the original server. This enables restoration of client application communications without changes to the web browser URL.
   b. Licensing is not required for the secondary server as it is not stored nor enforced by the WFM server.

5.3 QM Application Hardware Redundancy Options

Call Recording and Quality Management, QM, provides a layered approach to call recording resiliency providing the user options to add redundancy at multiple layers. These key layers and the redundancy options at each are:

1. Application - Recording search and playback. The browser based user interface is hosted on the QM Central server. A cold standby server can be used to minimize application down time. The cold server is deployed upon failure of the primary server after restoring QM’s SQL database connection and the recording storage share. The cold standby server assumes the hostname and IP address of the primary QM central server in order to restore communications with user’s application URL and the recording services.
   a. User licensing –
      i. Cisco QM – User licensing is held in the Unified CCXCVD license repository so once configured to connect with Unified CCX the cold
standby server will have access to the same set of licenses as the original.

ii. Calabrio QM – User licensing is maintained on the QM server, therefore a second set of user licenses should be acquired from Calabrio for the cold standby server.

2. QM SQL database. This database holds all of the recording metadata enabling searches from the application and all the configuration information enabling the recording services therefore its availability is critical to QM application availability and the upload of new recordings from QM’s recording services. A wide variety of SQL database redundancy options are available ranging from SQL clustering to redundant storage to backup and restore. The key considerations for QM are that the SQL database host be available to service the QM application requests from either the active or cold stand by system and have enough capacity to support the QM application performance and scaling. Furthermore it is recommended for high availability that the SQL database be external from the QM server and use SQL high availability options like clustering to insure its continuous availability. Use of point in time backup and restore approaches may result in a lack of access to recordings completed between the time of the backup and the restoration of QM services. Recordings made during this time may be assigned duplicate ids (CCR #) as the restored database would not reflect ids distributed after the backup. In the case of duplicate ids only the first recording uploaded with that ID would be available via the recordings application, the second recording would upload but would not be available via searches. Due to this known issue and other potential problems a SQL high availability approach such as clustering with high availability storage is recommended. Note: It is expected that partners and customers are familiar with Microsoft SQL and the redundancy options available to make their own decisions based on the application insights provided

3. QM recordings storage share. Again a wide variety of Windows file share and or redundant disk storage options are available. The key is the recording storage share must be restored and available to the primary or cold standby server to resume recording upload from the recording services and recording playback via the application. Again as with SQL an external high availability storage solution is recommended over a point in time backup and restore as this avoids issues with recordings that may upload between the time of the backup and the QM server failure. Note: It is recommended that RAID storage solutions include any optional battery backup to safely enable write caching as this generally provides
a significant increase in the write IOPs performance. This is specifically recommended for deployments using Cisco UCS C series servers.

4. Recording workflows - These are hosted on the QM Central server within the QM database and distributed to recording services upon recorded user login. The cold standby described above restores this critical function to maintain call recording as users log out and back in to recording services.

5. User Synchronization service with ACD – QM can be configured with redundant ACD connections which will automatically failover to the secondary connection if the primary fails.

6. Call event notification – QM relies on receiving the call event feed from CUCM via the JTAPI interface. QM provides a CUCM configuration page enabling the administrator to designate a primary and multiple secondary CUCM servers within the cluster. Upon detection of a failure in the CTI feed QM will automatically failover to the next CUCM server configured.

7. QM CTI service. Both a primary and backup QM CTI service can be deployed on different physical servers. QM software will manage the automatic failover and failback of the CTI service between these services insuring the recording services always receive call recording trigger events such as ringing, answered and dropped which are required for recording.
   a. The redundant CTI service does not maintain the recording workflow distribution to the Desktop recording service; this is done by the Base/Central server. Therefore Desktop recording service will only continue to record calls for the current desktop user. Desktop recording will not be able to record calls for a new user logging in until the QM Central Service distributing recording workflows is restored. Network and Server recording maintain the recording workflows for multiple users locally so they will continue to record under the redundant CTI service as long as they have a recording workflow for the current user/device.

8. QM Recording services.
   a. Redundant Network Recording Services. QM’s Network recording option starting with the 8.8 release supports the deployment of redundant network recording services on separate servers enabling hardware redundant audio capture. Notes:
      i. Recording stops on the primary recording service upon failure of the recording service or hardware. No recording is done for the remainder of the current call.
      ii. Recording resumes on the backup recording service with the start of the next call.
iii. The backup recording service will not record any screen as the screen capture service doesn’t have the ability to redirect its recording stream.

iv. The backup recording service also will not assign recorded calls to the current user under hot desking or extension mobility configurations if the API calls informing the recording service of the changed user do not route to the backup recording service. In this case the calls will be recorded, just under the physical device instead of the current user.

b. Distributed Desktop recording services executes on the windows PC of each recorded user leveraging the call events from the QM CTI service to start and stop recording. Since each recorded user has their own independent recording service to record their calls a failure of the desktop recording service only impacts the single user being recorded by that service. It is expected the recorded user will move to another functioning Phone and PC with the desktop recording service to resume recording after a failure event.
5.4  WFM and QM Application Server to ACD latency

WFM has no specific requirements for latency to the ACD. The primary feature of concern would be the real time service, RTE, but WFM only uses this to get the agent state information for displaying the agent’s status and tracking their schedule adherences. If it is acceptable for a customer to have a latency delay in RTE display and
adherence tracking then this latency will not disrupt the functionality of the WFM application.

The critical network latency path for QM is for signaling CTI events. The network latency from CUCM to the QM CTI service and on to the endpoint or server based recording service will delay the start of recording by the sum of the latency time. Acceptable latency is at the customers discretion as to the amount of recording delay is tolerable for their business needs. Generally recording delays of fewer than one second have no perceptible impact to users.

As for the amount of QM CTI Event data transferred from the QM CTI service to the recording services each event is approximately ~200 bytes per event with ~6 events per call (simple call scenario) multiplied by the calls per agent and number of agents. QM CTI starts monitoring the phone when the agent logs in during End Point recording (and removes registration on log out). For Server-based recording it is constantly monitoring the phone. Agent login/logout has no bearing on monitoring. Only phones configured for QM are monitored.

QM also connects with the ACD database for syncing purposes and the CUCM database for SPAN configuration and the MANA CDR task that does call count comparisons. Latency is not an issue for any of these connections.

5.5 **Can WFM and QM deploy on the same server**
Not currently as there are conflicts between some of the common services like Tomcat. This is a recognized goal which is under consideration for future releases.

6 **For further Information**
All product documentation is available online; please visit Cisco.com for the latest product documentation. For additional product questions see the Cisco Community Central Contact Center Applications page at https://www.myciscocommunity.com/community/partner/collaboration/contactcenter/apps.