



Changepoint 2017

Hardware Recommendations

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© 2017 Changepoint Canada ULC
Changepoint Canada ULC
30 Leek Crescent, Suite 300
Richmond Hill, Ontario
Canada

www.changepoint.com

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Revision History

1.0 [Mar 30, 2017]	Initial release – Removed AppFabric requirement, added Redis information, updated workstation hardware requirements
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1 INTRODUCTION

This document provides hardware recommendations based on sizing requirements for typical customer installations. The hardware guidelines are results of the analysis of over 60 customer implementations for one year period and subsequent internal performance testing. While these are relevant for any environment, we strongly recommend that you follow these guidelines for your production environment.

As hardware requirements are influenced by telecommunications and network infrastructure and the distribution of users, Changepoint recommends that you work with your IT staff to develop an appropriate hardware recommendation for your environment.

2 ASSUMPTIONS

- The hardware sizing recommendations are based on typical customer installation with the mixture of following user profiles, performing a distinct set of business transactions:
 - **Resource:** A regular Changepoint user that enters and submits time, views and updates requests, creates expense entries.
 - **Support Analyst:** Creates, views, updates requests and navigates request workflow.
 - **Project Manager:** Creates, updates, views projects and tasks. Modifies task assignments through project worksheet.
 - **Finance Manager:** Creates, updates, view engagements and budgets, approve times, and invoices.
 - **Relationship Manager:** Creates, updates, views opportunities and activities.
 - **Resource Manager:** Creates, updates, views resource requests, and assign resources through resource management worksheet.
 - **Administration:** Creates, updates, views customers, contacts, and invoices.

Each of these user profiles and their corresponding business transactions put load on the system differently, due to the difference in the level of complexity of the logic being executed for each business transaction. By performance testing these user profiles in various hardware configurations, resource cost of each user profiles were determined.

- All configurations presented in this document are recommended for installations of Changepoint 2017.
- We recommend that no other business applications are run on the Changepoint server.
- The recommendations are based on hardware dedicated for a single production or production-like Changepoint instance.
- Due to different network configurations found at customer sites, the illustrated topologies are suggested guidelines.
- The scope of this document does not include clustering, fail-over, multi-server replication, and backup strategies.
- The actual hard-drive space required may vary from the recommendation. Variables may include volume of data, projected data growth, etc.
- These recommendations are only applicable for physical hardware deployments.

3 VARIABLES

During the tests that resulted in the recommended configurations presented here, care was taken to duplicate real-life network conditions and typical user scenarios. However, situations may arise that could enhance (or degrade) perceived solution performance. These include:

- Client workstation configuration
- Customer LAN integrity/quality
- Customer Router network integrity/quality
- Patterns of client database usage
- Types of client activity
- Customer Changepoint Topology (site distribution, WAN bandwidth, etc.)

4 GENERAL RECOMMENDATIONS FOR ALL CONFIGURATIONS

The following best practices will minimize bottlenecks and contribute to optimal performance:

- Place the log files on a separate I/O channel (LUN) – suggest RAID 10 array.
- Place the database index files on a separate I/O channel (LUN) – suggest RAID 10 array.
- Place the tempdb database on a separate I/O channel (LUN) – suggest RAID 0 array.
- The tempdb database and Operating System's pagefile.sys must not be on the same I/O channel.
- Use multiple tempdb data files. The number of data files should match the number of processor cores on the database server and the sizes of the data files must be identical with same growth factor.
- SQL Server requires sufficient memory to operate optimally. However, over allocating can lead to insufficient memory left for OS and other services. When configuring the SQL Server, do not use the default value for "maximum server memory (in MB)" setting in the SQL Server properties. Instead, choose the maximum server memory value that will leave OS and other services with enough memory to minimize swapping. In general, at minimum of 1GB up to 4GB should be left for non-SQL Server use.
- Virtualization using VMWare® is supported with Changepoint 2017. However, the implementation should ensure that the virtualized Changepoint environment has sufficient resources (CPU, memory, I/O bandwidth and throughput) allocated for optimal performance. For a large or high transaction volume deployment, the recommendation is to limit the deployment of virtualization to the web servers only.
- For VMWare® virtualization, ESX 5 or higher is recommended for greater virtual vCPU support, improved I/O performance, and reduced virtualization overhead.
- When virtualizing the Web Application Tier, we do not recommend oversubscribing the environment. Maintain a 1:1 ratio between the physical and virtual resources.
- When virtualizing the web tier, better performance will be achieved by having a single virtual host with more vCPU than multiple virtual hosts with less vCPU. Bigger virtual hosts reduce the OS overhead.
- For Cognos BI implementation, IBM supports virtualization of hardware with IBM software. Customers can leverage virtualization strategies for IBM Cognos BI that is used with Changepoint as per the Virtualization Policy for IBM Software (http://www-01.ibm.com/software/support/virtualization_policy.html).

5 RECOMMENDATIONS FOR INSTALLATIONS OF 150 NAMED USERS*

When implementing a Changepoint installation of 150 users or less, a single-server can be configured to host IIS and the Redis cache service, alongside a dedicated SQL Server.

For the resource management worksheet (RMW) functionality, additional CPU and memory are required.

There is no architectural redundancy built into this solution. Intra-server fail-over capacity is limited to RAID configurations, power supply and NIC redundancy strategies.

5.1 Changepoint Web Server / Windows Server

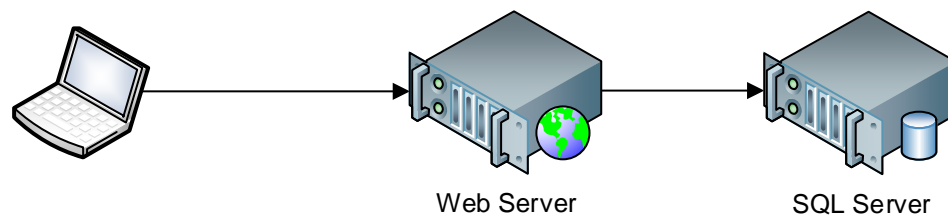
- Minimum 2 Processor Cores – 3.0GHz
- Minimum 4 Processor Cores for customers using RMW feature
- Minimum 4 GB DRAM memory
- Minimum 6 - 8 GB DRAM memory for customers using RMW feature
- Storage:
 - RAID 1 (2 drives, Mirrored) for Operating System
- Bandwidth: 1000 Mbps NIC
- Required File System: NTFS
- See the *Changepoint Product Architecture and Technology Matrix* for required software

5.2 Changepoint SQL Server

- Minimum 4 Processor Cores – 3.0GHz
- Minimum 8 GB DRAM memory
- Storage:
 - RAID 1 (2 drives, Mirrored) for Operating System
 - RAID 10 (4 drives, Stripe of mirrors) for SQL Database files
- Bandwidth: 1000 Mbps NIC
- Required File System: NTFS
- See the *Changepoint Product Architecture and Technology Matrix* for required software

* A named user represents one user being defined in the application, and does not represent the number of users using the application concurrently. Hardware configurations recommended within this document assume a 20% concurrency model, where a maximum 20% of the named users may access the system concurrently.

5.3 Solution Architecture



6 RECOMMENDATIONS FOR INSTALLATIONS OF 151 – 500 NAMED USERS

For Changepoint implementations between 151 and 500 users, a single-server can be configured to host IIS and the Redis cache service, alongside a dedicated SQL Server.

For the resource management worksheet (RMW) functionality, additional CPU and memory are required.

As with the 150 named user configuration, there is no inherent architectural redundancy, except for the RAID configurations, power supply and NIC redundancy strategies.

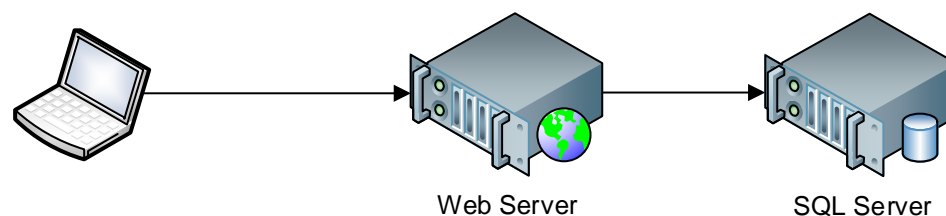
6.1 Web Server

- Minimum 2 Processor Cores – 3.0 GHz
- Minimum 4 Processor Cores for customers using RMW feature
- Minimum 4 GB DRAM
- Minimum 6 - 8 GB DRAM memory for customers using RMW feature
- Storage:
 - RAID 1 (2 drives, Mirrored) for Operating System
- Bandwidth: One 1000 Mbps NIC
- Required File System: NTFS
- See the *Changepoint Product Architecture and Technology Matrix* for required software

6.2 SQL Server

- Minimum 4 Processor Cores – 3.0 GHz
- Minimum 8 GB DRAM
- Storage:
 - RAID 1 (2 drives, Mirrored) for Operating System
 - RAID 10 (4 drives, Stripe of mirrors) for SQL Database files
 - RAID 0 (2 drives, Stripe set) for TEMPDB
 - RAID 1 (2 drives, Mirrored) for SQL Database transaction log files
- Bandwidth: One 1000 Mbps NIC
- See the *Changepoint Product Architecture and Technology Matrix* for required software

6.3 Solution Architecture



7 RECOMMENDATIONS FOR INSTALLATIONS OF 501+ NAMED USERS

A multiple web server implementation is recommended for solutions that extend beyond the 500 user range.

Comprising of multiple web servers and a dedicated SQL server, this solution can be scaled well beyond 500 users with the introduction of a load balancer and additional web servers to balance performance.

For the resource management worksheet (RMW) functionality, additional memory is required for the Redis cache service.

Redundancy for this configuration comes from the load balanced web servers, the RAID configurations, power supply and NIC redundancy strategies.

As hardware requirements are influenced by telecommunications infrastructure, distribution of users and network infrastructure, for implementations of more than 1000 users, Changepoint will work with your IT staff to develop an appropriate hardware recommendation.

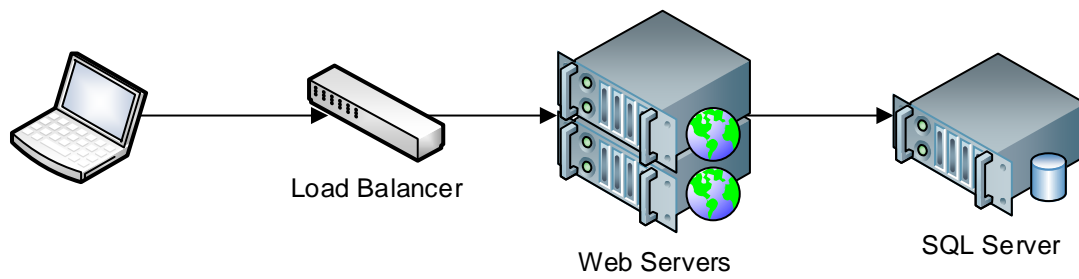
7.1 Web Servers

- Minimum 4 Processor Cores – 3.0GHz
- Minimum 8 Processor Cores – 3.0GHz in very large configurations (> 8,000 named users)
- Minimum 4 GB DRAM
- Minimum 6 - 8 GB DRAM memory for customers using RMW feature
- Storage:
 - RAID 1 (2 drives, Mirrored) for Operating System
- Bandwidth: One 1000 Mbps NIC
- Required File System: NTFS
- See the *Changepoint Product Architecture and Technology Matrix* for required software

7.2 SQL Server

- Minimum 4 Processor Cores – 3.0 GHz
- Minimum 8 Processor Cores – 3.0 GHz in very large configurations (> 8,000 named users)
- Minimum 16 GB DRAM
 - Minimum 32 GB may be required in very large configurations (> 8,000 named users)
- Storage:
 - RAID 1 (2 drives, Mirrored) for Operating System, including Operating System page file
 - RAID 10 (6 drives, Stripe of mirrors) for SQL Database files
 - RAID 0 (2 drives, Striped Set) for TEMPDB
 - RAID 1 (2 drives, Mirrored) for SQL Database transaction log files
- Bandwidth: One 1000 Mbps NIC
- See the *Changepoint Product Architecture and Technology Matrix* for required software

7.3 Solution Architecture



8 REDIS CACHE SERVICE

Redis is an open source (BSD licensed), in-memory data structure store, used as a database, cache and message broker. Redis also supports master-slave asynchronous replication and optionally provides high availability via Redis Sentinel.

Redis is a mandatory component that must be installed and configured. For details, see the *Installing and Configuring Redis* chapter of the *Changepoint 2017 Installation Guide*.

8.1 General Recommendations for Redis Cache Service

8.1.1 MEMORY CONSIDERATION

Redis is an in-memory object cache service. Therefore, its effectiveness is purely constrained by the amount of memory it has available for use. For its use with Changepoint, our recommendation is that at minimum 2 GB of DRAM is allocated to the Redis cache service. Please refer to the *Installing and Configuring Redis* chapter of the *Changepoint 2017 Installation Guide* for instructions on configuring the Redis cache. After the initial configuration, based on the cache usage statistics, physical memory and cache size may need to be adjusted for optimal end-user and server performance.

8.1.2 NON-DEDICATED HOST

It is recommended (and the default for installation) that the Redis service be co-hosted with IIS on the web servers.

8.1.3 CLUSTERING AND HIGH AVAILABILITY

To provide higher availability Redis cache provides the ability to create a cluster that can be distributed across multiple servers to provide a single, unified cache system. To implement a cache cluster, Redis Sentinel will need to be configured.

9 WORKSTATION HARDWARE REQUIREMENTS

Client-side workstation hardware requirement may vary based on the usage of Changepoint. Activities that perform large data calculation and interaction on the client-side may require additional hardware for best performance. These activities include project worksheet, scenario comparison, and resource management worksheet.

For the minimum software requirement, see the *Changepoint Product Architecture and Technology Matrix*.

9.1 Workstation hardware requirements (If not using project worksheet, project planning worksheet, scenario comparisons, or resource management worksheet)

- Minimum:
 - Processor: Dual Core – 1 GHz 32-bit (x86)
 - Memory: 1 GB
 - Hard disk space: 2 GB available
 - Monitor resolution: 1024 x 768 (normal size 96 DPI)
- Recommended:
 - Processor: Dual Core – 2 GHz 32-bit (x86)
 - Memory: 2 GB
 - Hard disk space: 2 GB available
 - Monitor resolution: 1920 x 1080 (normal size 96 DPI)

9.2 Workstation hardware requirements (If using project worksheet, project planning worksheet, scenario comparisons, or resource management worksheet)

- Minimum:
 - Processor: Dual Core – 2 GHz 32-bit (x86)
 - Memory: 2 GB
 - Hard disk space: 2 GB available
 - Monitor resolution: 1920 x 1080 (normal size 96 DPI)
- Recommended:
 - Processor: Dual Core – 2 GHz 32-bit (x86)
 - Memory: 8 GB
 - Hard disk space: 2 GB available
 - Monitor resolution: 1920 x 1080 (normal size 96 DPI)

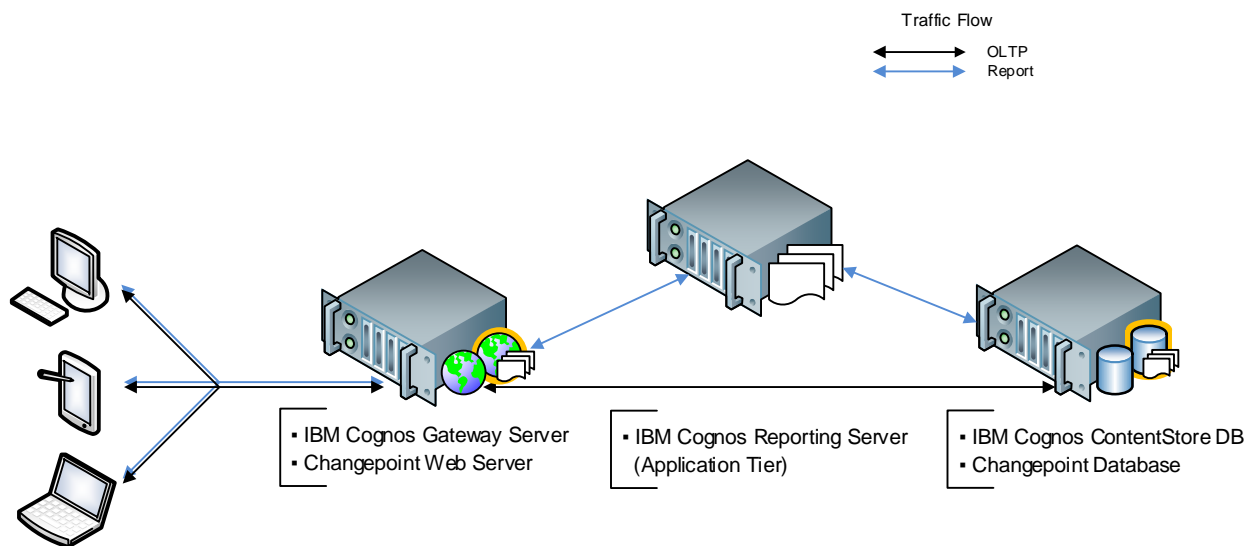
10 COGNOS BI IMPLEMENTATION

Changepoint provides an integrated IBM Cognos Business Intelligence solution. In order to enable this functionality, additional server hardware(s) are required.

10.1 High Level Architecture

Regardless of the size of customer implementation, the Cognos BI Reporting capabilities will require the following deployment:

- Web Server
 - IBM Cognos Gateway Server – **must** reside on the Changepoint Web Server (Changepoint requirement)
- Application Server – **additional** server is required
 - IBM Cognos Reporting Server (Application Tier)
- Database Server – will be installed by default on the Changepoint DB Server
 - IBM Cognos ContentStore DB



Changepoint 2017 includes Cognos BI 10.2.2 Fix Pack 7 as part of the Changepoint solution. Cognos Business Intelligence Architecture and Deployment strategies such as those noted above can be found on the IBM.com website (<http://www-01.ibm.com/support/docview.wss?uid=swg27042003>).

For further information, refer to the *Installing and configuring Cognos BI* section of the *Changepoint 2017 Installation Guide*.

The following recommendations represent hardware requirements for the Cognos BI environments supported within the Changepoint infrastructure.

10.2 Software and Operating System Requirements for Changepoint Cognos BI configuration

List of all software and operating systems supported by IBM Cognos BI solution is available via IBM.com:

<http://www-01.ibm.com/support/docview.wss?uid=swg27042164>.

There are specific requirements and dependencies for the Changepoint hardware configurations; therefore, the Web Server and Database server must follow the Changepoint certified Operating System configuration.

Certification information for the supported components is documented in the *Changepoint 2017 Product Architecture and Technology Matrix* and is the reference to use for installation and configuration.

10.3 Recommendations of installations for Production Environments of up to 150 named users

10.3.1 WEB SERVER

- IBM Cognos Gateway Server – must reside with Changepoint Web Server
 - Separate website directory typically as a virtual directory
 - Optimal Web Tier CPU Cores is 1
 - Optimal Web Tier RAM / Host is 6 GB (64-bit OS)
 - Optimal Web Tier RAM / Host is 4 GB (32-bit OS)

10.3.2 APPLICATION SERVER

- IBM Cognos Reporting Server (Application Tier)
 - Optimal CPU Cores / Host is 1
 - Optimal RAM / Host is 15 GB (64-bit OS)
 - Optimal RAM / Host is 8 GB (32-bit OS)

10.3.3 DATABASE SERVER

- IBM Cognos ContentStore database – installed by default on Changepoint Database Server
 - Optimal CPU Cores is 1
 - Optimal RAM is 8 GB

10.4 Recommendations of installations for Production Environments of 151-500 named users

10.4.1 WEB SERVER

- IBM Cognos Gateway Server – must reside with Changepoint Web Server
 - Separate website directory typically as a virtual directory
 - Optimal Web Tier CPU Cores is 1
 - Optimal Web Tier RAM / Host is 6 GB (64-bit OS)
 - Optimal Web Tier RAM / Host is 4 GB (32-bit OS)

10.4.2 APPLICATION SERVER

- IBM Cognos Reporting Server (Application Tier) – New Server Requirement
 - Optimal CPU Cores / Host is 2
 - Optimal RAM / Host is 16 GB (64-bit OS)
 - Optimal RAM / Host is 10 GB (32-bit OS)

10.4.3 DATABASE SERVER

- IBM Cognos ContentStore database – installed by default on Changepoint Database Server
 - Optimal CPU Cores is 1
 - Optimal RAM is 8 GB

10.5 Recommendations of installations for Production Environments of 500+ named users

10.5.1 WEB SERVER

- IBM Cognos Gateway Server – must reside with Changepoint Web Server
 - Separate website directory typically as a virtual directory
 - Minimum Web Tier CPU Cores is 1
 - Minimum Web Tier RAM / Host is 6 GB (64-bit OS)
 - Minimum Web Tier RAM / Host is 4 GB (32-bit OS)

10.5.2 APPLICATION SERVER

- IBM Cognos Reporting Server (Application Tier) – New Server Requirement
 - Minimum CPU Cores / Host is 4
 - Minimum RAM / Host is 18 GB (64-bit OS)
 - Minimum RAM / Host is 12 GB (32-bit OS)

10.5.3 DATABASE SERVER

- IBM Cognos ContentStore database – installed by default on Changepoint Database Server
 - Minimum CPU Cores is 1
 - Minimum RAM is 8 GB

10.6 Recommendations of installations for Non-Production Environments

Information in this section is designed to allow customers to configure smaller environments to test non-production scenarios. These specifications are not certified or supported in Production environments.

The Changepoint Cognos BI installation in non-production environments must be a fully segregated installation (i.e. all Test servers independent from Development servers etc. – they cannot be combined).

10.6.1 WEB SERVER

- IBM Cognos Gateway Server – must reside with Changepoint Web Server
 - Separate website directory typically as a virtual directory
 - Optimal Web Tier CPU Cores is 1

- Optimal Web Tier RAM / Host is 6 GB (64-bit OS)
- Optimal Web Tier RAM / Host is 4 GB (32-bit OS)

10.6.2 APPLICATION SERVER

- IBM Cognos Reporting Server (Application Tier) – New Server Requirement
 - Optimal CPU Cores / Host is 1
 - Optimal RAM / Host is 15 GB (64-bit OS)
 - Optimal RAM / Host is 8 GB (32-bit OS)

10.6.3 DATABASE SERVER

- IBM Cognos ContentStore database – installed by default on Changepoint Database Server, but not the mandatory location
 - Optimal CPU Cores is 1
 - Optimal RAM is 8 GB