# EXHIBIT I: TECHNICAL ARCHITECTURE

## BACKGROUND

The City is currently undertaking an upgrade of their financial system, FMS, as well as a replacement of their procurement and inventory system, SMS. Exhibit I: Technical Architecture outlines the hardware resource requirements needed to support CGI Advantage Financial with the additional modules. The recommendations in this Exhibit have been collaboratively reviewed, discussed, and fine-tuned by the City and CGI during the Envision phase and the findings are published in the Technical Specifications Document deliverable developed during the Envision phase.

## TECHNICAL ARCHITECTURE ASSUMPTIONS

CGI defines the following assumptions related to the Technical Architecture, in addition to other assumptions documented in Exhibit K: Assumptions:

- The production environment is sized to accommodate all production Web, Application, and Database servers for the following baseline CGI Advantage® applications:
  - CGI Advantage Financial v3.10 (Including addition of Procurement and Inventory modules)
  - CGI Advantage Vendor Self-Service v3.10
  - CGI Advantage infoAdvantage v3.10
- Data provided by City of LA for the current and expected usage of CGI Advantage® applications are used to determine the hardware specifications. The following expectations were used:
  - There will be an approximate total of 2200 CGI Advantage Financial software users after the system is fully rolled out to all users. CGI assumes that there will typically be 465 concurrent users at peak usage. A concurrent user is an CGI Advantage software user that is signed on to the System and is actively performing work, which includes user interface navigation, think (review) time, data entry time, and submission of new requests (transactions).
- Eight (8) Financial environments will be maintained, consisting of six (6) test environments, one (1) Production staging environment, and one (1) Production environment. All environments will contain Production size data volumes.
- Application servers running WebSphere Application Server will reside on Intel based processors. Servers will contain a maximum of two chip sockets.
- Servers running Business Objects, Pervasive Data Integrator (PDI), and Oracle database instances will reside on IBM Power7 hardware along with the AIX 7.1 Operating System. The City's Information Technology Agency (ITA) currently owns this hardware and will reconfigure existing partitions to accommodate Advantage Financial requirements.
- There will be 5 years of historical data maintained in the Production environment. Attachments within the Advantage Financial application will continue to reside in the City's Documentum system. The City is responsible for making any necessary configuration changes required for Documentum.

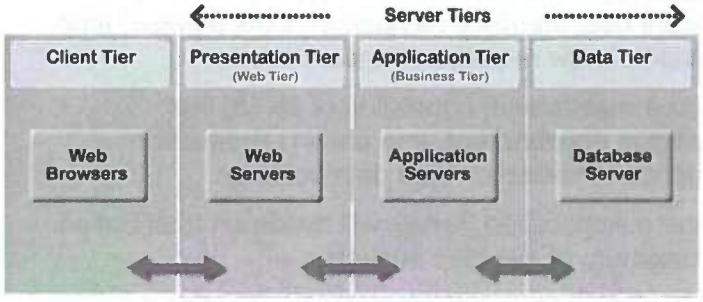
- The City will provide CGI with remote system access capabilities. The City and CGI will work together to establish procedures for remote access consistent with City security policies.
- Existing ITA infrastructure and software maybe utilized, where possible, during the Advantage Financial Project. The existing infrastructure to be utilized may include test application servers, test database servers and Oracle database instances, test PDI servers, and test conversion servers.

It is the City's responsibility to ensure high availability for all hardware components in support of the Advantage Financial server environment, including but not limited to:

- High speed load balancing switches for connectivity to the web servers
- Appropriate security measures such as firewalls and intrusion detection
- Redundancy of components (i.e., dual or quad network interface cards (NIC), dual switches, redundant power supplies, uninterruptible power supplies, etc.)
- Dedicated high-speed switch capacity (e.g., VLAN) for connectivity between the application servers and the database servers; establishing a private access network for only Performance Budgeting server network traffic; switch should be gigabit Ethernet or faster
- High speed, high availability storage area network (SAN) devices such as Hitachi USP V storage systems or equivalent with high speed fiber channel connectivity
- Corresponding server support equipment
- Availability of production hardware per the project schedule to complete the activities for production implementation of the Advantage Financial
- High speed peripherals such as printers and tape backup systems

## TARGET ARCHITECTURE TIERS

The Advantage Financial technical architecture consists of four major logical tiers: client tier, presentation tier, application tier, and data tier. This exhibit addresses the hardware required to support the processing requirements of Advantage Financial.




The target platform for the Advantage Financial system is a hybrid solution, consisting of IBM's Power Systems (formerly known as System p) with Power7 technology executing IBM's AIX 7 operating system for database servers (data tier), along with Intel Xeon based processors executing the Red Hat Enterprise Linux 6 operating system for the web (presentation tier) and application servers (application tier).

CGI Advantage is implemented as a Java Enterprise Edition standard application. IBM's WebSphere Application Server v8.5 (WAS) is the Java EE application server used in the CGI Advantage 3.10 technical architecture. The database management system will be Oracle 11g R2 (Enterprise and RAC).

As for the Client Tier, CGI Advantage 3.10 currently supports Internet Explorer 8, Internet Explorer 9, Internet Explorer 10, Firefox 17 ESR, and Safari on iOS 6.1. As technologies constantly progress, CGI may revise the list supported Web Browsers to certify support of newer browser releases.

## PROCESSING REQUIREMENTS

The capacity requirements identified in the table in the immediately following section entitled "Production" provide the recommended hardware requirements to meet the City's processing objectives. The hardware estimates provided in Exhibit I are based on the information available as of the execution of this agreement. If the City has infrastructure standards or processing requirements not identified, the proposed hardware components will have to be revised appropriately. For instance, if the City has a requirement for total hardware duplicity, the hardware configuration presented here must be revised. The process to develop the final configuration will be a series of collaborative discussions between the City's technical resources and CGI's infrastructure architects to integrate City standards with the minimum capacity requirements provided in this exhibit. In addition, capacity requirements for disaster recovery support are not included in this discussion.

### *Production*

CGI Advantage Financial – The following table provides a matrix of the hardware resources necessary for establishing a production environment.

| | Server Environment | Type of Processor | # of Proc | Amount of Memory (GB) | Notes |
|---|---|---|---|---|---|
| 1 | Internet Web Server | Intel Xeon 3.5 GHz | 1 | 4 | WebSphere Application Server & IBM HTTP Server for VSS Web Server |
| 2 | Web/Application Server | Intel Xeon 3.5 GHz | 8 | 64 | WebSphere Application Server & IBM HTTP Server for Advantage Financial, VSS, & ABI |
| 3 | Database Server | IBM POWER7 3.7 GHz | 6 | 64 | Oracle 11gR2 RAC for Advantage Financial, & VSS OLTP |
| 4 | Database Server | IBM POWER7 3.7 GHz | 4 | 32 | Oracle 11gR2 RAC for infoAdvantage DW |

| | Server Environment | Type of Processor | # of Proc | Amount of Memory (GB) | Notes |
|---|---|---|---|---|---|
| 5 | Reporting Web/Application Server | Intel Xeon 3.5 GHz | 1 | 4 | WebSphere Application Server & IBM HTTP Server for infoAdvantage for Advantage Financial |
| 6 | Business Intelligence Application Server | IBM POWER7 3.7 GHz | 4 | 24 | BusinessObjects BI 4.0 for infoAdvantage for Advantage Financial |
| 7 | PDI Server | IBM POWER7 3.7 GHz | 2 | 8 | Pervasive Data Integrator 9.2 |
| 8 | 3rd Party Server - Conversion | Intel Xeon 3.2 GHz | 2 | 6 | 3rd Party Applications: Conversion processes |
| 9 | 3rd Party Server – Build Machine | Intel Xeon 3.2 GHz | 2 | 8 | Windows 2008 – Build Machine for configuration management and deployment |

**VSS Web Server** (#1) – The VSS Web Server requires 1 processor and 4GB of memory. The VSS Web Server will reside in the DMZ in order to allow external users (Vendors) to access the application.

**Web / Application Servers** (#2) –The minimum number of processors for the web servers and the application servers is 8 processors and a minimum of 64GB of memory. To meet the City's online availability requirements, the Web / Application server configuration will be allocated across redundant physical servers in order to establish physical failover capabilities.

**Database Servers (OLTP)** (#3) – The database server requires 6 processors and 64GB of memory. For database failover support, Oracle 11gR2 RAC should be used for database failover support. These servers will be shared within ITA's existing FMS infrastructure.

**Database Servers (DW)** (#4) – The datawarehouse database server requires 4 processors and 32GB of memory. For database failover support, Oracle 11gR2 RAC should be used for database failover support. These servers will be shared within ITA's existing FMS infrastructure.

**Reporting Web/Application Server** (#5) – The minimum recommended number of processors for the web servers and the application servers executing CGI infoAdvantage is 1 processor and a minimum of 4GB of memory.

**Business Intelligence Application Server** (#6) – The minimum recommended number of processors for the application servers executing SAP's BusinessObjects BI 4.0 is 4 processors and a minimum of 24GB of memory.

**PDI Server** (#7) – The minimum recommended number of processors executing Action's Pervasive Data Integrator product is 2 processors and a minimum of 8GB of memory. This server will be shared within ITA's existing FMS infrastructure.

**Third Party Servers** – The City will need a Windows / Intel based technical environment running Windows Server 2008 to support other production services such as configuration management of the CGI Advantage codebase and for conversion processing.

- Conversion (#8) – The conversion server is a separate server used for development and execution of conversion processes will require 2 processors and 6GB of memory.
- Build Machine (#9) – This server is a separate server used for development, compilation, configuration maintenance and deployment of the CGI Advantage codebase and will require 4 processors and 8GB of memory.

### *Non-production*

The City will need non-production technical and application environments to support development, testing and ongoing maintenance activities. The non-production equipment in the following table is sized to support 6 application environments.

| | Server Environment | Type of Processor | # of Proc | Amount of Memory (GB) | Notes |
|---|---|---|---|---|---|
| 1 | Web/Application Server | Intel Xeon 3.5 GHz | 6 | 64 | WebSphere Application Server & IBM HTTP Server for Advantage Financial, VSS, & ABI |
| 2 | Database Server | IBM POWER7 3.7 GHz | 8 | 64 | Oracle 11gR2 RAC for CGI Advantage Financial® |
| 3 | Reporting Web/Application Server | Intel Xeon 3.5 GHz | 1 | 4 | WebSphere Application Server & IBM HTTP Server for CGI infoAdvantage® |
| 4 | Business Intelligence Application Server | IBM POWER7 3.7 GHz | 3 | 24 | BusinessObjects BI 4.0 for CGI infoAdvantage® |
| 5 | PDI Server | IBM POWER7 3.7 GHz | 2 | 8 | Pervasive Data Integrator 9.2 |

## DISK STORAGE

### *Local Disk Storage*

Each physical server will need local storage. Local storage is required to support operating system software, system software, application software, and temporary file storage. Local storage is not used for the CGI Advantage® operational database. The CGI Advantage®

database should be supported on a high-speed SAN. In general each physical or virtual machine will need 72 GB of space.

### *Database Storage*

The Advantage Financial database space requirements for the production and non-production environments are provided below. The Base Storage Requirement figure assumes that all six Non-Production databases will contain production size data volumes.

The matrix below details the database storage requirements, in GB, per year:

| Year | FIN Production | FIN Non-Production | infoAdvantage Production | infoAdvantage Non-Production | Total GB |
|---|---|---|---|---|---|
| 0 | 405 | 2430 | 225 | 1350 | 4410 |
| 1 | 555 | 2430 | 275 | 1350 | 4610 |
| 2 | 705 | 2430 | 325 | 1350 | 4810 |
| 3 | 855 | 2430 | 375 | 1350 | 5010 |
| 4 | 1005 | 2430 | 425 | 1350 | 5210 |
| 5 | 1155 | 2430 | 475 | 1350 | 5410 |
| 6 | 1305 | 2430 | 525 | 1350 | 5610 |
| 7 | 1455 | 2430 | 575 | 1350 | 5810 |
| 8 | 1605 | 2430 | 625 | 1350 | 6010 |
| 9 | 1755 | 2430 | 675 | 1350 | 6210 |
| 10 | 1905 | 2430 | 725 | 1350 | 6410 |

(Figures reflect usable space, not raw space.)

To support high volume processing against the operational database, the City must implement a high-end storage area network (SAN), such as Hitachi USP V. The SAN must be connected to the servers with 2-4gigabit fiber channels or equivalent to support the CGI Advantage® database storage. CGI Advantage® is dependent on City furnished hardware and off the shelf software for backup and recovery services.