Database Server Configuration Best Practices for Aras Innovator 10

Aras Innovator 10 Running on

SQL Server 2012 Enterprise Edition

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Contents

Executive Summary

This paper describes the best practices for deploying Aras Innovator 10 on SQL Server 2012 Enterprise Edition for the largest enterprise deployments, with expected workloads ranging in size from less than 25,000 concurrent users to over 100,000 concurrent users.

Aras is a global provider of next generation enterprise product lifecycle management (PLM) software. With solutions for global product development, multi-site manufacturing, supply chain operations and quality compliance, Aras is ideally suited for companies that have complex products and processes.

Aras Innovator 10 is Aras' flagship product and is a modern, lean, and scalable platform with a suite of PLM applications that deploy quickly and adapt easily to evolving business needs at low total cost of ownership.

The underlying enterprise application framework in Aras Innovator 10 is a model-based service oriented architecture (SOA) designed for scalability, flexibility, and supportability. Aras Innovator 10 employs a scale-out and scale-up approach to accommodate large implementations and extended enterprise environments.

Aras Innovator 10 is designed to scale-out on the file system and web servers, and scale-up on the database server. By moving non-transactional data to scale-out servers and using frequent, short database transactions, the Aras Innovator 10 architecture is able to handle very large levels of throughput.

A significant benefit of Aras Innovator's architecture is that it does not require complex and costly IT hardware or database configurations to run large scale deployments. Aras Innovator 10 running SQL Server 2012 Enterprise Edition on Windows Server 2012 Enterprise Edition requires minimal setup, and works out-of-the-box for 90 percent of deployment scenarios.

As expected in an online transaction processing workload like Aras Innovator 10, a constraint that should be taken into account is the I/O subsystem's ability to read and write to disk. Upgrading the server's I/O subsystem for loads of more than 75,000 concurrent users is recommended.

Aras Innovator 10 running on SQL Server 2012 Enterprise Edition scales nearly linearly with hardware upgrades and is architected for large data sets and concurrent user workloads. Recommended hardware configurations and database setting best practices for optimal performance at scale are included in this paper.

Introduction

To understand the optimal deployment strategy for Aras Innovator 10 it is important to understand the application's architecture at a high level.

Overview

Product Lifecycle Management (PLM) software has become increasingly important for enterprises to conduct global product development with suppliers worldwide and manufacturing at multiple locations. However, industry trends are pushing many corporate PLM environments beyond their scalability limits.

To address these new scalability requirements, Aras has introduced Aras Innovator 10 which is intended to provide a new level of PLM platform scalability for enterprises with global supply chains and a significant number of PLM users. Aras Innovator 10 is based on an innovative web architecture which scales up, scales out, and which was designed specifically for large, distributed enterprise scenarios.

- "In switching to Aras we now have a highly capable, global PLM platform."

- Bruce Leidal
CIO, Carestream Health

Aras Innovator 10

Aras Innovator 10 is Aras' flagship product and is a modern, lean and scalable platform with a suite of PLM business solutions that deploy quickly and adapt easily to evolving business needs at a low total cost of ownership.

An HTML5 web browser user interface provides application functionality for:

- Multi-CAD data management and mechatronics
- Bill of materials (BOM) management
- Requirements management
- Configuration management
- Enterprise change workflows
- Stage-gate program management
- Project portfolio management
- Quality compliance, APQP, FMEA, CAPA, and other PLM processes

- "What really drove our selection of Aras was the comprehensive PLM functionality and advanced technology."

- Tony DeGregorio
CIO, Textron Defense Systems

Aras Innovator 10 is built entirely on proven infrastructure technologies and open web standards. Because of its web architecture Aras Innovator 10 provides a range of deployment options, including conventional data center, private and public cloud, or hybrid scenarios with compliance-grade security and robust integration capabilities.

The underlying enterprise application framework in Aras Innovator 10 is a model-based service oriented architecture (model-based SOA). The model-based SOA technology is a metadata architecture with a dynamic schema that relies on a loosely coupled set of federated web services designed for scalability, flexibility, and extensibility.

The model-based SOA technology in Aras Innovator 10 enables scalable performance whether running business applications out-of-the-box or highly customized. Applications are changed by modeling instead of complex coding and compiling which makes satisfying specialized business requirements faster and easier while performance remains consistent and upgradability is maintained without impacting the customizations.

- "Aras is providing a more modern alternative that delivers significantly more scalability, flexibility, and resiliency than typical PLM solutions of the past."

- Peter Bilello
President, CIMdata

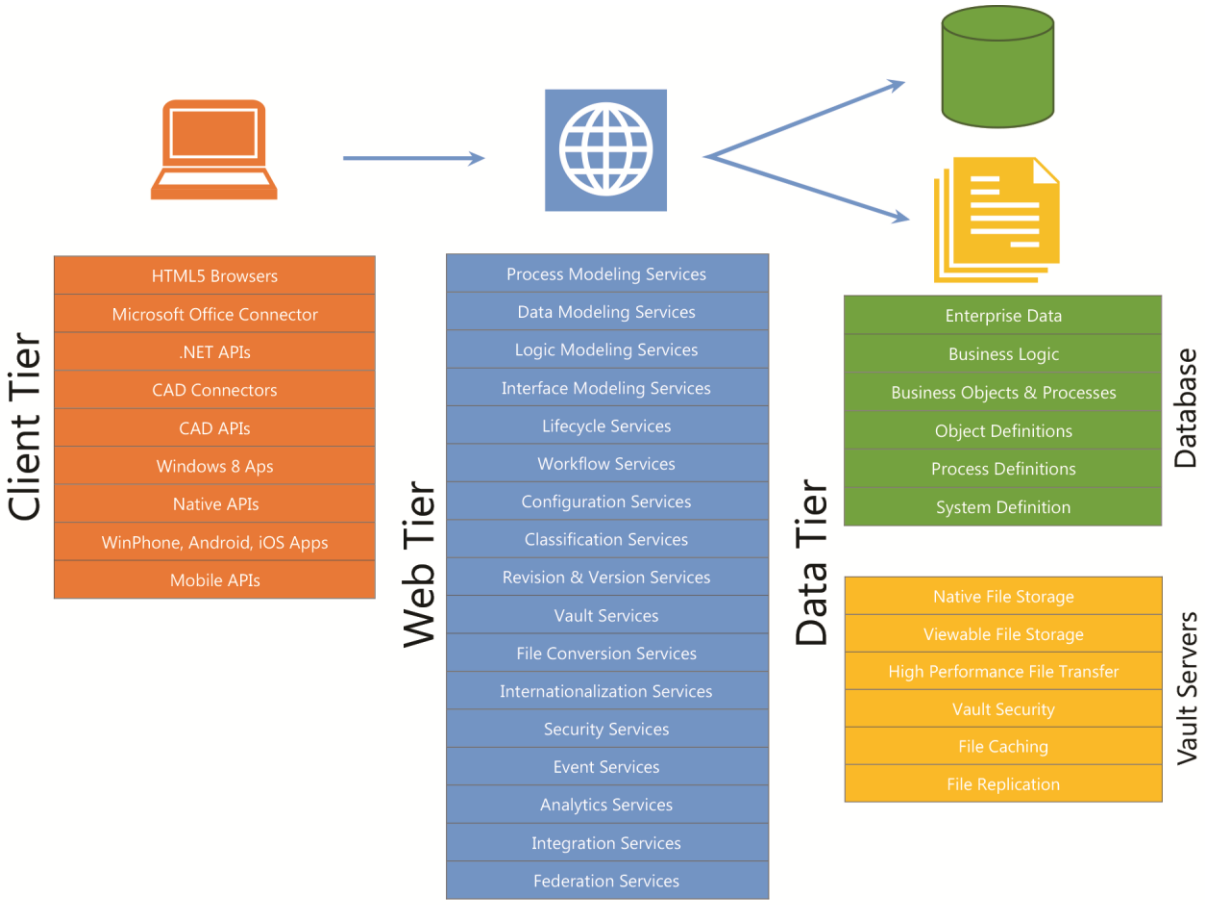
SQL Server 2012 Enterprise Edition

Aras Innovator 10 runs on the Microsoft SQL Server 2012 Enterprise Edition database for persistent metadata storage. SQL Server 2012 Enterprise Edition is designed to deliver comprehensive, high-end data center capabilities for mission-critical applications.

SQL Server 2012 Enterprise Edition has introduced a wide range of performance and scalability enhancements into the database engine to enable a new level of support for the largest workloads including greater processing and memory capacity, increased partition support, and xVelocity in-memory technologies which enable sub-second query responses and rapid column-oriented processing. Together, these capabilities along with other improvements help SQL Server 2012 deliver predictable performance at scale.

Aras Innovator Application Architecture

The following diagram provides a high level illustration of the application layers that make up the Aras Innovator 10 architecture.[1] The data tier is divided into a series of vault servers which can scale out and a database server which is designed to scale up.

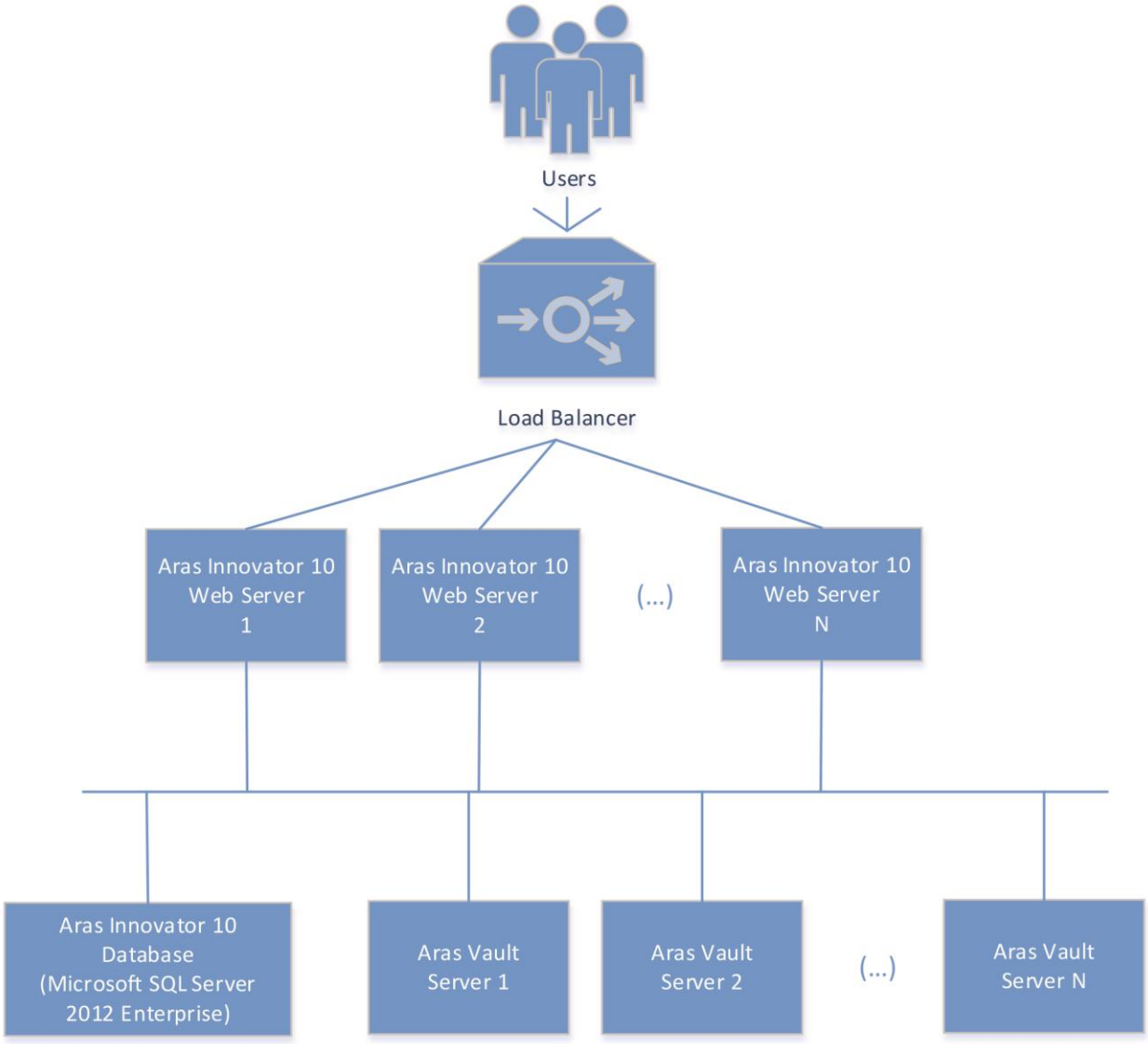


[1] Additional information about the Aras Innovator Architecture can be found at PLM alpha

Aras Innovator Enterprise Deployment

The Aras Innovator 10 architecture employs a scale-out and scale-up approach. Application services are hosted on scale-out web servers. File containers (CAD models and drawings, documents, and other files) are stored in scale-out vault servers with replication. The Aras Innovator 10 database is used to host metadata which is ideal for storage in a relational database server and leads to excellent scale-up capabilities.

This diagram illustrates the way Aras Innovator 10 can be deployed to scale out and scale up for large enterprise deployments of 100,000 concurrent users or more.[2]



[2] Aras Innovator 10 Scalability Benchmark Methodology and Performance Results

Database Server Hardware Recommendations

In order to achieve performance with large data sets and concurrent user loads, the database server should be hosted on a data center class server that has been designed to handle enterprise environments, including high availability, disaster recovery, and versioning. To illustrate what this means, we will present two server configurations which can meet some of the most demanding, large scale Aras Innovator 10 workloads.

Enterprise Deployment

For enterprise deployments with up to 75,000 concurrent users, we recommend the HP ProLiant DL585G7.[3] This flexible four-socket multi-core rack-mount server with expansion capabilities is well-suited for enterprise applications.

Configuration details:

- 32 core AMD Opteron 6386 SE, 2.7GHz
- 128 gigabytes (GB) RAM
- I/O subsystem options by load:
    - Up to 25,000 concurrent users:
        - Eight SSDs in the DL585 chassis.
    - Between 25,000 and 50,000 concurrent users:
        - One HP StorageWorks Disk Enclosure D2700 with 20 drives.
    - Between 50,000 and 75,000 concurrent users:
        - Two HP StorageWorks Disk Enclosure D2700s, with 25 drives each to spread out I/O load. This will require a second smart array controller.
        - For complete in-chassis storage at this level of usage, we recommend a pair of Fusion-io 2 DUO cards.
        - For high availability, we recommend using a shared storage cluster solution such as: MSA 2040 or HP 3Par 7200 directly attached to a DL580 cluster.
- One 1/10 gigabit (Gb) NIC with four ports, or a comparable network interface that matches this level of performance.
    - In general, we recommend using one 1Gb NIC per 30,000 concurrent users, and to not exceed 15,000 packets per second on a single Gb link.

[3] Source: HP ProLiant 585 Overview/Specs

Large Enterprise Deployment

For large enterprise deployments with over 75,000 concurrent users, we recommend the HP ProLiant DL980G7.[4] HP's PREMA Architecture is an ideal solution for the balanced scaling and self-healing resiliency required by today's most demanding compute environments.

Configuration details:

- 40 core Intel Xeon E7-4870, 2.4 GHz
- 256 GB RAM
- I/O subsystem options by load:
    - Between 75,000 and 125,000 concurrent users:
        - Two HP StorageWorks Disk Enclosure D2700s, with 25 drives each to spread out I/O load. This will require a second smart array controller.
        - For complete in-chassis storage at this level of usage we recommend a pair of Fusion-io 2 DUO cards.
        - For high availability, we recommend using a shared storage cluster solution such as: MSA 2040 or HP 3Par 7200 directly attached to a DL980 cluster.
- One 1/10 Gb NIC with four ports, or a comparable network interface that matches this level of performance.
    - In general, we recommend using one 1Gb NIC per 30,000 concurrent users, and to not exceed 15,000 packets per second on a single Gb link.

Note: The above configurations will work for approximately 90 percent of all enterprise deployments. The configurations tested work very well out-of-the-box, and require little in the way of customization to achieve optimal performance. For further tuning recommendations we recommend consulting the Best Practices When Deploying Microsoft Windows Server on the HP ProLiant 980 and Best Practices for Tuning Microsoft SQL Server on the HP ProLiant DL980 guides.

[4] Source: HP ProLiant 980 Overview/Specs

Installation Overview

Windows Server 2012 Operating System Configuration

For Aras Innovator 10 installations the recommended operating system is Windows Server 2012 Enterprise Edition. Aras Innovator 10 should be installed on a 64-bit operating system to handle accessing large blocks of data. For most installations, the default operating system configuration will be sufficient. Always consult the server vendor's best practices to determine if the manufacturer's recommendations match your environment and workload.

I/O Subsystem Configuration

The configuration of the I/O subsystem is critical for top performance of any online transaction processing (OLTP) system, such as Aras Innovator 10. Enterprises with performance-critical applications should consider logical and physical partitions, as opposed to using a single pool of disks on a storage array. Even logical partitions help the array controller direct traffic, manage pools better, and aid in resource monitoring. For instance, having a logical partition means that resources can be monitored easily from PerfMon. The following is our recommended setup of logical disk partitions in a disk array:

Disk 1: Operating system and SQL Binaries

Disk 2: System databases (aside from TempDB)

Disk 3: TempDB

Disk 4: Data files

Disk 5: Transaction logs

Note on TempDB: Since the servers in this paper are 32 cores and more, we recommend starting with eight files for TempDB, and then adding four more if latency is detected. For instance, if you see PAGELATCH_XX waits on TempDB causing a bottleneck, then you should consider adding four files to TempDB.

In an OLTP system such as Aras Innovator 10, the usage pattern on the I/O subsystem is typically one of small, discrete transactions comprised of many small reads and writes. Therefore, the data files follow a classic pattern of heavy random reads and writes and the log files will have heavy sequential writes, meaning that the data and log files need to be stored on separate logical RAID volumes.

Our recommendation is to deploy a RAID 1+0 configuration on both of the logical RAID volumes. Another option is RAID 1 or 10 for log, and RAID 5 for data. Format the disks to use 64 kilobyte clusters (file allocation units), using NTFS format. The data volume should have caching disabled, and the log volume should have it enabled.

SQL Server Installation

Our recommendation is that the SQL Server 2012 Enterprise SP1 CU7 instance be installed on a server that is dedicated to serving the Aras Innovator 10 database. We recommend the following settings for the SQL Server 2012 instance:

- Set AUTO_UPDATE_STATS_ASYNC to ON
- SQL Server Trace flag:
  - T834 – Use Large Pages
- Optional (use only if you see issues in your particular workload):
  - T652 – Disable Page Prefetching Scans
  - T661 – Disable Ghost Removal Processes
- Grant the account SQL Server is running under the following rights:
  - Perform Volume Maintenance
  - Lock Pages In Memory – for details see: Microsoft Knowledge Base Article 2659143

In conjunction with Lock Pages In Memory, you also need to set an upper limit on SQL Server memory. We tested with 100 GB set as the upper limit for the DL585 server, and 200 GB set as the upper limit on the DL980 server.

While the above settings will work for most scenarios, further tuning can be done to improve this setup.

NOTE: See the Best Practices for Tuning Microsoft SQL Server on the HP ProLiant DL980 guide for additional tuning information.

Conclusions

This paper has covered the best practices for setting up Aras Innovator 10 on a SQL Server 2012 Enterprise Edition server designed to scale to from under 25,000 concurrent users to over 100,000 concurrent users. We presented a set of configuration best practices that have been proven to work in most environments, as well as several I/O subsystem hardware options for various different concurrent user workload levels.

Using the database server configuration best practices in this paper, Aras Innovator 10 running on Microsoft SQL Server 2012 Enterprise Edition will give you excellent performance with these hardware configurations.

While the above configurations will work for 90 percent of deployments, these configurations can be further tuned for deployment specific workloads if you are experiencing performance issues. We recommend performing system benchmarks before undertaking additional tuning steps, both before and after any configuration changes are made. This will help to measure any differences.

When benchmarking, it is good practice to run a warm-up script to pre-load the cache before running the benchmark test. If this is not done, testing will be skewed by missed cache hits. Another recommendation is to restore the test database between tests in order to ensure that the database benchmarks are an accurate comparison.

The performance of Aras Innovator 10 is not constrained by its architecture, which makes proper hardware configuration important. Aras Innovator 10's design puts the burden of work on the hardware, so it can be scaled up and scaled out with server hardware upgrades to meet the needs of large-scale enterprise scenarios.

Additional information about Aras and Aras Innovator 10 is available at www.aras.com.

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