SERENA BUSINESS MASHUPS
SCALING FOR THE ENTERPRISE

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SERENA™

WHO SHOULD READ THIS PAPER?

This paper provides information on scaling Serena Business Mashups to meet the performance and scalability needs of the enterprise. This includes a brief overview of the components and architecture followed by a description of the scalability options.

INTRODUCTION

IT organizations are being challenged by a growing backlog of requests from lines of business. They are faced with tighter budgets and limited resources. The startup cost of IT projects is high. Consequently, projects that the IT organization can work on must demonstrate a high return on investment. This leaves many requests from the business unattended.

Serena makes it simple to deliver collaborative process-based applications inexpensively so you can drive productivity and reduce costs. Serena Business Mashups empowers business users to collaborate with IT in building out applications to solve business problems. It includes key new capabilities for creating workflows, orchestrations, and forms as well as Mashup Manager for streamlined management of Mashup staging and deployment.

Serena Business Mashups allow the creation of a new breed of business applications which are

- Visually composed and assembled by business developers
- Combines content and services from multiple applications and services
- Delivered on-premise or on-demand
- Process-centric and data-enabled
- Delivered through multiple channels such as email, browser, IM, PDA
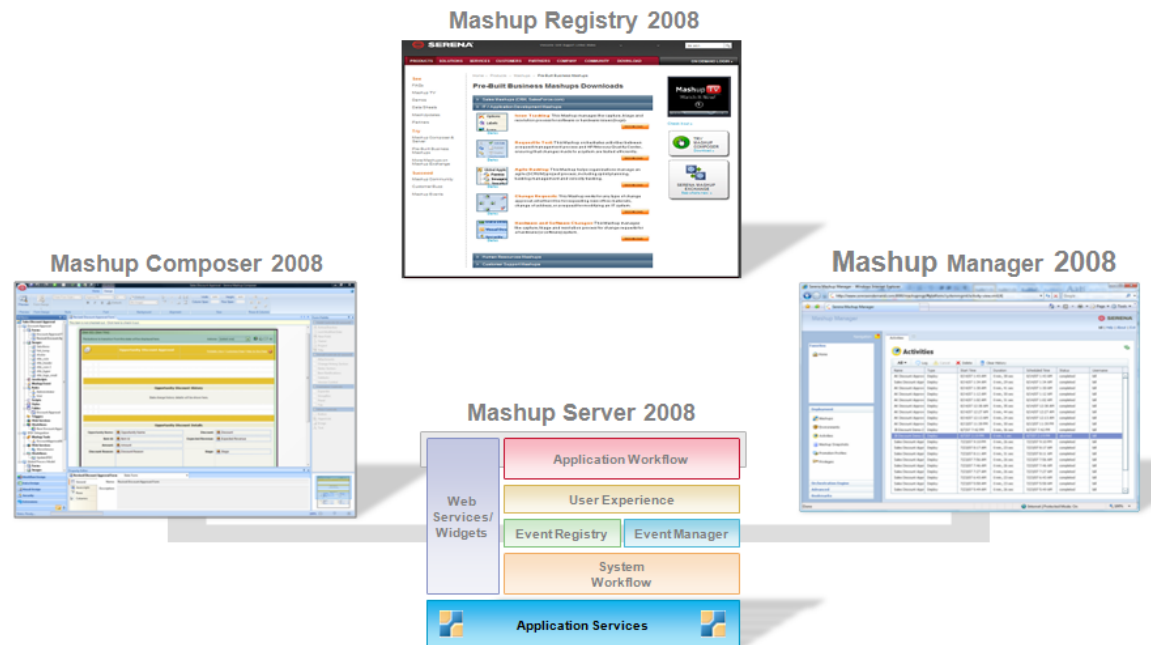
Serena Business Mashups promotes a process-focused approach to productivity. It coordinates processes across teams and systems and provides repeatability, traceability, and auditability. Serena Business Mashups 2008 includes several components, including:

- **Mashup Composer** - Fully integrated visual environment targeted at Business Developers for creating and publishing process-driven web applications.

- **Mashup Manager** – Designed for IT and Mashup Administrators, Mashup Manager is an Interactive web-based governance application for streamlined management of application versioning, deployment, promotion, and granular permission grants. Mashup Manager provides a single point of control and visibility for IT Administrators.

- **Mashup Server**, a collection of application services for runtime execution of Business Mashups.

- **Mashup Registry** for cataloging and access to a corporate-wide repository of Business Mashups. Mashup Registry will be extended in 2009 R2 release of Business Mashups to contain other business artifacts including process fragments, user interfaces, web services, UI gadgets, and so on.

To meet varying configuration, performance and scalability needs of the enterprise, Serena Business Mashups employs several techniques including

- N-Tier Architecture
- Mashup Development Lifecycle
- Security
- Deployment Configurations
- Scalability

N-TIER ARCHITECTURE

Serena Business Mashups employs a three tier configuration – the Mashup Browser, Composer and Administrator on the Client, Mashup Server and Database Server. End-users interact with Business Mashups using the Microsoft Internet Explorer or Mozilla Firefox Web browser by entering the URL of the virtual directory into which the Mashup Server is installed.

The Mashup Browser is a zero-footprint client from which users can access Mashups. The interface is completely implemented using HTML and JavaScript, and requires no client installation. This enables any client with a standard web browser to render the Mashup Browser. The Mashup Browser uses AJAX (Asynchronous JavaScript and XML) to deliver a rich user experience.

Mashup Composer is a modern smart-client application built using the Microsoft .NET platform. It provides an extremely rich interface with features such as ribbon bars, drag and drop, zoom and unlimited undo/redo. Mashup Composer is the design environment from which business users can find, customize and create Mashups. Mashup Composer uses web services to interact with the Mashup Server.
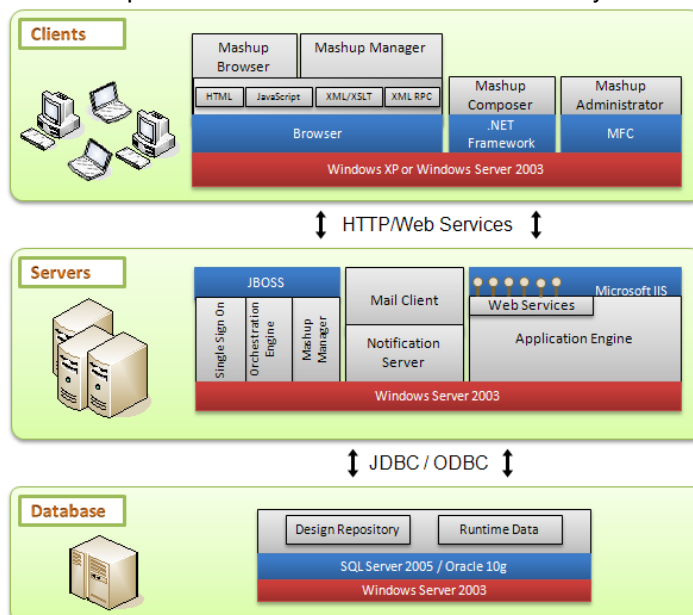
Mashup Manager is a zero-footprint browser client from which system administrators can control deployment of Mashups into multiple environments. The interface uses advanced AJAX techniques and a single page interface to deliver a rich internet application.

Mashup Administrator is a Windows based application built using Microsoft Foundation Classes (MFC). Administrators use this application to manage configurations for the Mashup Server. Mashup Administrator can use ODBC or HTTP protocol to interact with the Mashup Server.

The clients can be deployed in a variety of network topologies since they interact with the Mashup Server using industry standard HTTP, web services and ODBC protocols. The Mashup Server is implemented using J2EE and ISAPI extensions. The primary components of the Mashup Server are:

- **Application Engine** – Executes as an in-process ISAPI plug-in to IIS. It receives processes and responds to HTTP and web service requests from the IIS web server. This is the entry point into the Mashup Server for Mashup Browser and Administrator clients. The Application Engine primarily coordinates human workflow activities in a Business Mashup.

- **Serena Common JBOSS** – The JBOSS server is a J2EE container for a number of services provided in Mashup Server. These services include:

  - **Mashup Manager Services** – Provides repository, deployment and promotion services. The repository service is used by Mashup Composer and Mashup Manager in storing design and deployment artifacts. Mashup Composer accesses the repository via web services. The Mashup Manager client uses deployment and promotion services to provide business users and administrators with a path to production. Once Mashups are built and versioned from Mashup Composer, they can be deployed into the server to be made available to end users. See Mashup Development Lifecycle for more information.

  - **Orchestration Service** – Receives events from applications and executes associated orchestrations as BPEL processes. These BPEL processes use web services to execute a business process across multiple tools.

  - **Single Sign-On (SSO) Service** – Provides common authentication across all components of Serena Business Mashups. The SSO service can be extended to include other applications by writing or configuring providers. This allows a user to log in once into Business Mashups and have their user context carried through orchestrations and web services into participating tools.

- **Notification Service** – Evaluates notification and escalation rules and performs specified actions such as sending reminders via email or performing specific actions.

- **Mail Client Service** – Provides inbound services so that items can be submitted by sending an email to the Mail Client. The Mail Client communicates with mail servers using POP5 or IMAP protocols.
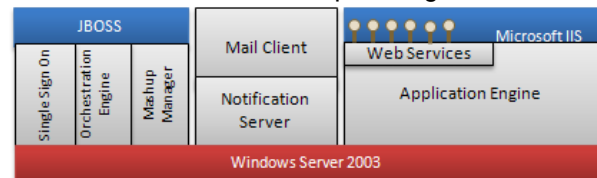
The Business Mashup database resides in a relational database. Data design includes storage of system metadata information along with user data. Users can access data using web services, APIs or direct SQL access.

SUMMARY CONFIGURATION REQUIREMENTS

Tier	Operating System(s)	Software
Mashup Browser	Microsoft Windows XP Professional SP2 or later, Microsoft Vista, Mac OS X	Internet Explorer 6.0 or later, Firefox 2.0, Safari
Mashup Composer	Microsoft Windows XP Professional SP2 or later, Microsoft Vista	Microsoft .NET Framework 2.0
Mashup Manager	Microsoft Windows XP Professional SP2 or later, Microsoft Vista, Mac OS X	Internet Explorer 6.0 or later, Firefox 2.0, Safari
Mashup Administrator	Microsoft Windows XP Professional SP2 or later	
Mashup Server	Windows 2003 Server	Microsoft IIS 5.0+
Mashup Database	Windows 2000 Server SP3, Windows 2003 Server	SQL Server 2000 SP3, SQL Server 2005, Oracle 10g, Oracle 11g

MASHUP DEVELOPMENT LIFECYCLE

Serena Business Mashups supports a full-fledged development process including parallel development. Business users use Mashup Composer to create Mashups. Features such as check-out, check-in and versioning are provided within Mashup Composer and allow for parallel development. Once designs are finalized, the Mashup is published and available for deployment from Mashup Manager. Once the Mashup is deployed into the Mashup Server, administrators can use Mashup Administrator to configure the Mashup and make it available to users.
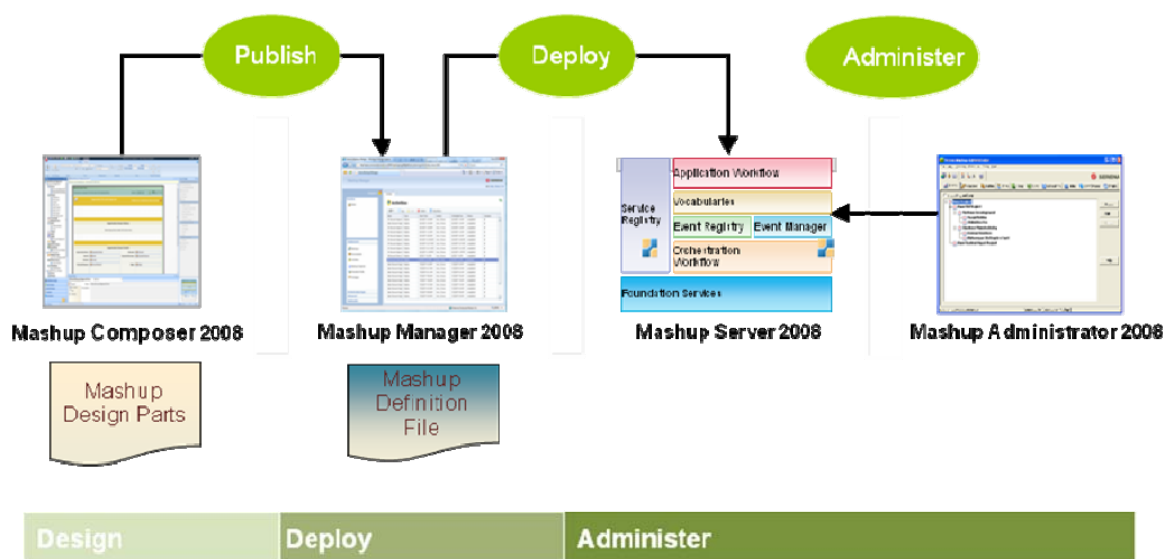
Mashup Manager uses web services to perform deployments. As such, it is capable of deploying to any number of Mashup Servers in varying network topologies. Deployments can also be rolled back and prior versions of a Mashup can be redeployed. Users can also open prior versions of a Mashup in Mashup Composer in case patching of the production Mashup Server is required.

PATH TO PRODUCTION

Best practices in software management advocate multiple environments for development, testing, staging and production where changes are propagated from one environment to another in an automated manner. Mashup Server provides full fidelity promotion of a Mashup and all related configuration data, called a snapshot, from one environment to another. These snapshots can also be exported and imported into the Mashup Server in case there is a firewall in between environments.

SECURITY

Serena Business Mashups provides authenticated users with appropriate access to data. This is accomplished via authentication and a highly flexible privileges system.

- **Network Security** – Clients can use HTTP over Secure Sockets Layer (SSL) encryption to communicate with the Mashup Server. With SSL, all data transmitted between Mashup Server and the clients is encrypted.

- **User Authentication** – Every request to the Mashup Server is authenticated using one of the following schemes.

    o **Serena Business Mashup** – User credentials can be validated against those stored within Serena Business Mashups. Passwords within the Mashup Server are stored using a hashing algorithm (SHA-256 – http://csrc.nist.gov/publications/fips/fips180-2/fips180-2withchangenotice.pdf).

    o **NT Challenge/Response** – The Windows security system integrated into IIS can be used to authenticate user access. In this case, IIS verifies login names and passwords against Windows user accounts.

    o **LDAP** – Mashup Server can be configured to use LDAP systems for authentication. The system can be configured to use LDAP authentication alone or LDAP followed by Serena Business Mashup authentication.

- **Data and Function Security** – Business Mashups provides granular control over privileges for all logical components within the Mashup Server. Users may be granted varying roles which allow them access to particular areas of the system. The scope of a particular privilege may be limited to one or more projects within a Mashup. The system provides exceptional configurability to control authorization down to the field level.

The Mashup Server also provides a complete audit trail and logging for all business and administrative events. Users may view the change history for all items and field values. Business data is retained indefinitely and may be archived as needed by the System Administrator.

SCALABILITY

Applications need to scale well in order to be successfully deployed in enterprise environments. This is a complex task since many factors including network hardware and software, WAN latencies, server hardware and software, network load, server load and data volume. In addition, each type of application activity utilizes resources in a unique way. For example, a Mashup with many human workflow interactions will consume more resources in the Application Engine. A Mashup with complex orchestrations will require more resources to be allocated to Serena Common JBOSS. These factors must be carefully considered by IT professionals along with Serena Software Professional Services when planning a scalable deployment.

- **Network Configuration/Topology** – Serena Business Mashups is distributed across clients, servers, and database server. Consequently, network hardware and software configuration and capabilities have a significant impact on the performance characteristics. The closer in proximity on the network these pieces are the better the

performance. As a general rule of thumb, the Mashup Server and Mashup Database should be located on the same network segment.

- **CPU speed** – Server and database transactions are CPU intensive. Faster CPUs translate directly to improved server performance. Do not under invest in the quality and speed of the server CPUs. The more processes that are running on a single machine, the more the CPU demand will be once additional load is applied.

- **Software Configuration** – Serena Business Mashups configurability, while being one of the products greatest advantages, can lead to performance issues if not implemented in accordance with best practices. Serena Support and Serena Professional Services are well versed in these best practices and should be engaged to review implementations and help diagnose performance issues.

- **Usage Model** - The addition of Mashup Composer and the Orchestration Engine has provided users with the ability to create a variety of Mashups. Serena Business Mashups is used by each customer to solve different types of business problems. There are many possible usage models and each one will utilize systems resources in a unique way. Understanding the usage model for the user base will help in determining how to best scale the servers.

We utilize standard Microsoft and J2EE technologies and approaches for building and deploying a scalable enterprise solution. The Windows 2003 Server and Windows 2000 Server platforms provide industry-leading capabilities to manage and grow enterprise application performance and availability in an economical way. The price and performance of Microsoft SQL Server and Windows 2003/2000-based servers are consistently among the best as measured by the Transaction Processing Performance Council (TPC; reference www.tpc.org).

VERTICAL SCALING

Scaling up involves applying higher powered hardware on the Serena Business Mashups server. This can involve faster CPUs, multiple CPUs, more memory, faster network cards, or more likely, some combination of all of these.

- **Processors** – The Mashup Server will take advantage of additional processors and improve the performance of Serena Business Mashups. More processors will allow you to scale your system vertically provided your system has the capability to upgrade or expand processors. If you have all components installed on a single system, you will find more processors will handle additional load.

- **Memory** – Serena Business Mashups currently supports 32-bit versions of the MS operating systems and the amount of memory that can be utilized by as single process is limited to 2GB by the operating system. The amount of memory your system is able to address is partially dependent on the version of Windows 2003 server you are using. You may find it necessary to upgrade your version of Windows 2003 server if you wish to scale the system memory beyond 4GB (see following chart). Having 2GB of memory per processor is a good general rule of thumb.
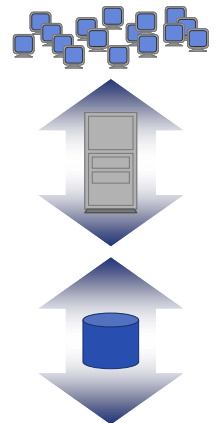
  Customers wishing to expand the Application Engine memory utilization beyond 2GB of RAM can set an IIS switch (http://technet.microsoft.com/en-us/library/bb124810.aspx). This setting will allow the Application Engine to utilize up to 3GB of RAM. Serena Common JBOSS server can also take advantage of additional memory up to 2GB by changing configuration settings. The Mashup Database server will also benefit from additional memory. Please consult your database documentation for further details.

  Serena Mashup Server can also take advantage of additional RAM on a system by using multiple processes to run the Application Engine. This can be done by creating multiple instances of virtual web sites and configuring application pools. Each virtual web site will

run in a process and be able to utilize 2GB of RAM without interfering with other processes.

WINDOWS 2003 SCALABILITY PARAMETERS

Parameter	Standard	Enterprise	Data Center
Memory	4GB	32GB	64GB
Processors	4	8	64
Web Farms	✓	✓	✓
Clustering		✓	✓

- **Networking** – System networking is an important aspect of scaling. If the network card is saturated with network traffic in your configuration, an additional network card can be used to help scale the application. It is extremely desirable to place the Mashup Server and Mashup Database on the same subnet with low latency.

- **Disk Subsystem** – The disk subsystem in a single system configuration can also be used to get additional scalability. The faster the disk drive speed the faster disk I/O activity. Separating database data and logs onto separate physical drives (or spindles) will allow the system to operate more efficiently. If possible, the operating system should be placed on a drive of its own. Reducing contention for data access from the physical disk drive will improve the scalability of the system.

HORIZONTAL SCALING

When it comes to achieving the highest levels of concurrency, scaling out horizontally becomes necessary. Simply moving some components to separate machines is a great start when attempting to scale horizontally. Since the Mashup Database and Mashup Server processes will most likely be contending for CPU and disk I/O, it is recommended that these pieces be separated first.

Furthermore, testing has shown that the Application Engine can be scaled further with the use of a Web Farm. The Application Engine will be able to take advantage of a Web Farm that contains multiple IIS servers. The farm of IIS servers can be implemented using either hardware or software. Hardware Web Farms require specialized hardware and skills to implement and tend to be more costly. Software Web Farms can be implemented completely using Microsoft Windows 2003/2000 Server. The network load balancing capabilities of Windows 2003 and Windows 2000 Server automatically distribute the load across servers in
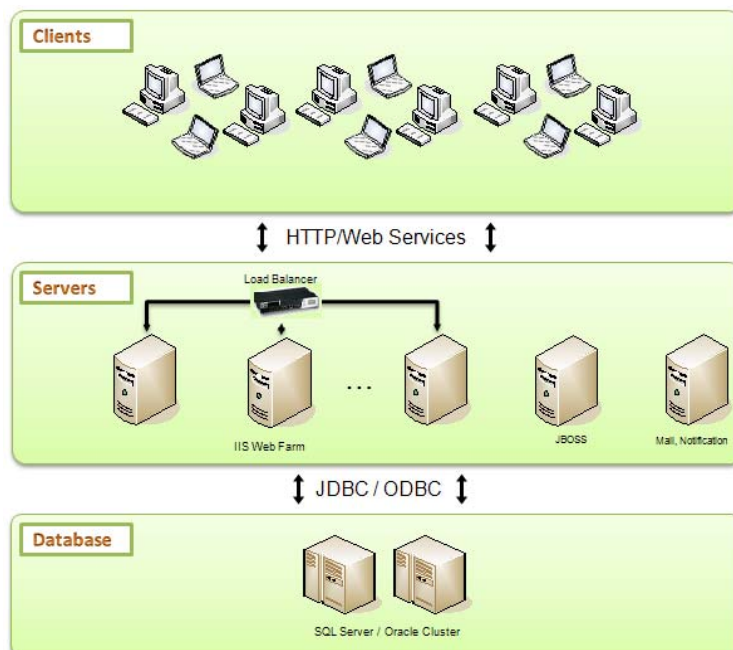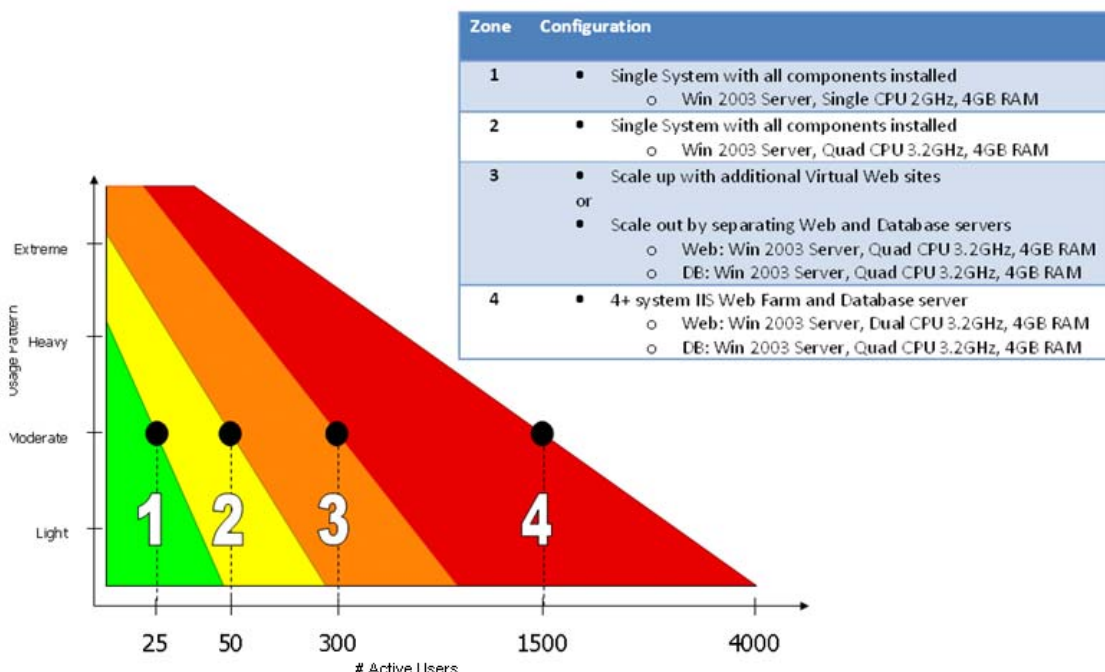
the farm. The end user continues to access the system via a single URL and is completely unaware of the Web Farm implementation.

For deployments with complex or high volume orchestration activity, additional Serena Common JBOSS severs can be configured. By specifying particular end-points during the Mashup deployment process, the amount of activity that is directed to any one JBOSS server can be controlled.

The Notification and Mail Client services can run on separate hardware as well to separate the processing overhead of these services to another system. There can be at most one Notification and Mail Client in a Serena Business Mashups installation.

GENERAL APPROACH FOR SCALABILITY

When optimizing performance, focus first on getting servers with the fastest possible CPUs. Second, look closely at memory utilization and ensure there is enough. Then, consider multiple processor configurations. These principles should be applied to servers when both scaling vertically and scaling horizontally. In the end, any single Serena Business Mashups operation happens fastest when CPU speed, network bandwidth, and available memory are high. Using the fastest possible CPU at the client, server, and database tiers result in the best end user experience. The following chart illustrates scalability zones for Serena Business Mashups.

Zone	Configuration
1	• Single System with all components installed o Win 2003 Server, Single CPU 2GHz, 4GB RAM
2	• Single System with all components installed o Win 2003 Server, Quad CPU 3.2GHz, 4GB RAM
3	• Scale up with additional Virtual Web sites or • Scale out by separating Web and Database servers o Web: Win 2003 Server, Quad CPU 3.2GHz, 4GB RAM o DB: Win 2003 Server, Quad CPU 3.2GHz, 4GB RAM
4	• 4+ system IIS Web Farm and Database server o Web: Win 2003 Server, Dual CPU 3.2GHz, 4GB RAM o DB: Win 2003 Server, Quad CPU 3.2GHz, 4GB RAM

In this chart there are four zones. Zone 1 represents low activity and simple configuration and usage patterns. Zone 4 is at the highest end of the spectrum. It represents high user load and complex data and usage patterns.

This table can be used to determine appropriate server configurations based on usage patterns and expected number of active users. The configuration recommendations are the result of analysis of data collected as part of the rigorous Serena Business Mashups acceptance and certification process.   The data set used was of Enterprise size and reflected configurations common to many of our customers.

An active user is defined by a user in the system who is actively performing work (e.g., two users running a report at the same time). More users can be logged into the system but are not

considered active until they are performing some activity. With this definition you can determine your usage pattern and the number of processes that you anticipate to consider a hardware configuration that might fit your needs. If for example, if you want to support a population of 250 users and you believe at any one time you will have 25 users performing moderate operations (submitting new requests, updating records, reporting, querying for a record, etc.) then Zone 1 would be the starting point for the hardware you might consider. If you had a 20,000 user population to support, Zone 3 at 300 concurrent users might be appropriate for you.

SUMMARY

Serena Business Mashups has been architected, implemented and tested to meet the complexity and scalability challenges of the enterprise. Its modern architecture provides secure and highly scalable solutions. By leveraging state-of-the-art technology, Serena Business Mashups provides a platform for innovation that will grow to meet the ever expanding needs of the enterprise.

CASE STUDY: SERENA BUSINESS MASHUPS SAAS DEPLOYMENT

Serena offers Business Mashups in Software as a Service (SaaS) model. In this section we will describe the deployment architecture that we use to host Serena Business Mashups in a way that can scale to support hundreds of distinct customers, each having hundreds of users on a single deployment of the mashup server.

The SaaS model requires that the system be highly fault tolerant, secure and ensure good performance under high concurrent load while supporting a large number of customers and users. Also, since Serena Business mashups is a platform, customers can choose to create and deploy large and complex mashups that may require significant memory and CPU resources.

Serena Business Mashups is designed to operate as a multi-tenant server. This means that a single deployment of the mashup server can be used to serve many different customers who would all be isolated from each other. Using many of the scaling techniques described in this paper, including clustering, vertical scaling and load balancing, we host a highly scaled and secure deployment of our software that simultaneously supports all our on demand customers including trials and paid accounts. The initial configuration described below is designed to support 10,000 users belonging to multiple customers.

Here are the main characteristics of our SaaS deployment.

SECURITY

- **Network Security** – The hosted deployment is firewalled with access permitted only through specified SSL enabled ports on specified external Virtual IP addresses. All communication between components inside the firewall happens over internal Virtual IPs.

- **SSO** – We have Single Sign On enabled on the hosted infrastructure. This allows users to centrally log in once to all of the SBM components (Mashup Manager, Browser UI). As a part of the login process, the user's namespace (customer account that he/she belongs to) and access levels are determined and all access is governed by those access rules.

- **Physical Security** – The hosted infrastructure is fully SaaS 70 level 2 certified. All physical access to machines is restricted by physical isolation. Network access to the machines is restricted through firewalls and authenticated access. Users can access SBM web pages and web services API only through secured HTTPS ports.

SCALABILITY AND RELIABILITY

Multiple instances of Application Engine and Orchestration Engine have been deployed in clustered configurations. The configuration allows for each of the components to be

independently scaled by adding additional server instances as needed. Each server instance is serviced by a separate network card.

- JBOSS Server instances (that host all java based components in SBM: Orchestration Engine, Mashup Manager, Event Manager) are deployed as nodes in a load balanced java cluster that allows for load to be distributed and to ensure reliability if any of the nodes fail.

- Multiple IIS Server instances (that serve Application Engine and the browser UI) are hosted in a load balanced configuration to distribute load and ensure high transaction speed. Clustered configurations for each of the components above are hosted on multiple physical machines to allow the system to remain functional if any of the physical machines goes down.

- The database server is hosted on a separate SQL cluster configuration (consisting of 2 physical machines) ensuring performance and reliability.

- The hosted infrastructure also includes additional components that enable automated creation of customer accounts and assignment of DNS addresses (C-Names). These components are not shown in the deployment diagram below.

The diagram below describes the configuration of Business Mashup components in Serena's SaaS deployment.
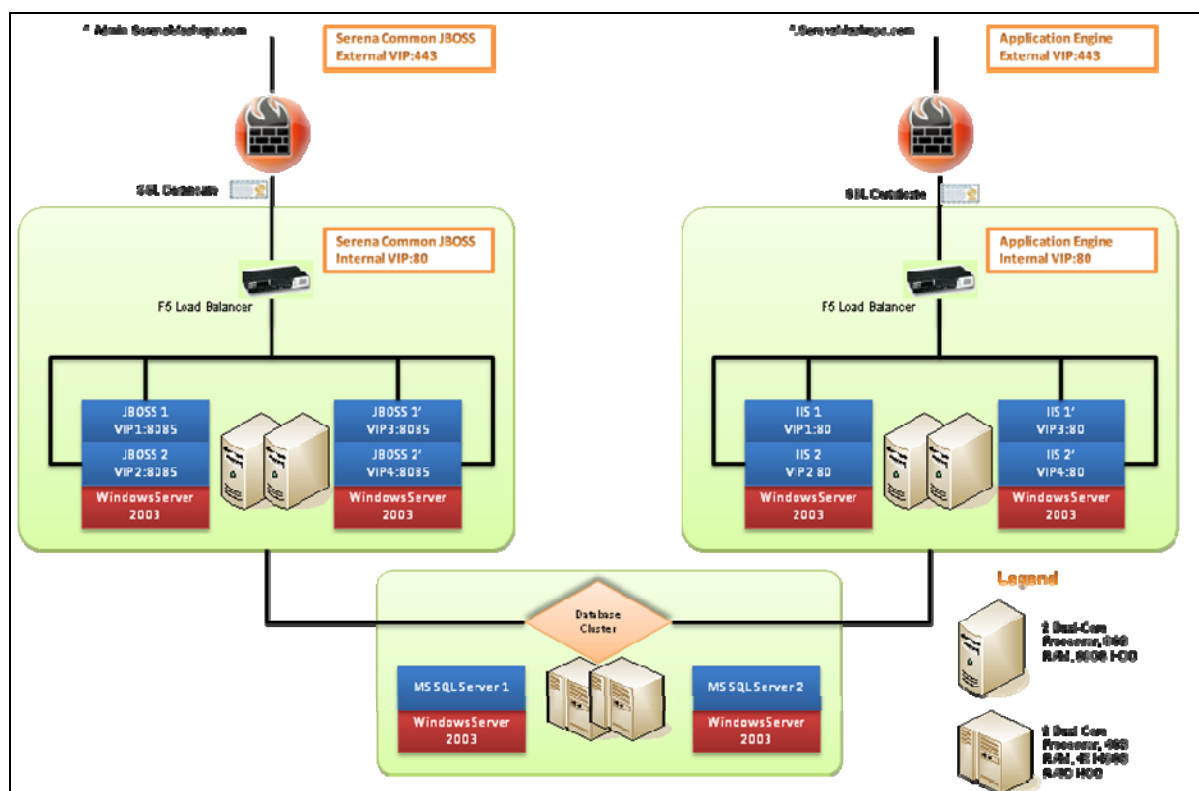
ABOUT SERENA

Serena Software, Inc. provides services to make Enterprises and the business people within them more productive. More than 15,000 organizations around the world, including 96 of the Fortune 100, rely on Serena solutions delivered either on premise or on demand, to provide visibility and efficiency to the application development process. The company provides software services such as Serena Mariner (Project & Portfolio Management), Serena Business Mashups, Serena Dimensions (Change & Requirements Management) and will be providing Agile Lifecycle Management tools in the near future. Serena is headquartered in Redwood City, California, and has offices throughout the U.S., Europe, and Asia Pacific. For more information on Serena solutions and services, visit www.serena.com.

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