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Foundry Networks Application Delivery Solutions for Enterprise Service-Oriented Architecture

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April 2008	1.0	

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1 Global Business Support by Applications and Networks

CIOs and IT experts are facing ever increasing new requirements from the business experts for extending their services to be available everywhere around the world. They still need to consolidate data centers and business applications in order to lower costs, pay attention to new compliance rules and give access to business applications to new business end users. Beyond company employees, business partners and customers become all end users of IT and demand secure and low response time access to business applications from wherever they are. In addition, web-service style message traffic in between application components is very much on the rise due to the need to facilitate inter- and intra company business application integration. IT has to support the *extended enterprise* (Fig 1) which does not end any more at the doorstep of a head-quarter datacenter or any organizational boundaries of an enterprise any more. “The network” becomes the increasingly important glue in between more and more globally distributed and used business application components and end-users.

SAP addresses modern business needs through enterprise service-oriented architecture (enterprise SOA) architected solutions. So called Application Delivery (AD) technologies for the global network infrastructure complement the SAP® applications. Foundry Networks and SAP would like to present jointly in this paper how modern application and network technologies could be combined to form productive SAP business application landscapes, which perform well and securely when used globally. The work is based on the results of [Enterprise Services Community](#) and [SAP Co-Innovation Lab](#) activities where a number of leading network and test solution vendors and SAP teamed up for building a production like enterprise SOA application landscape including the simulation of remote end-users and applications.

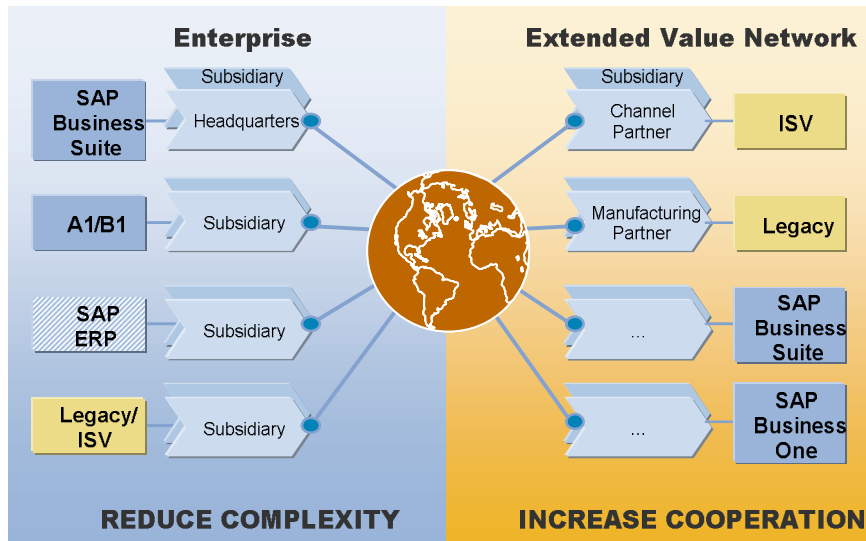


Fig 1: Extended Enterprise

Foundry's Layer 4-7 application switching and traffic management solutions from its ServerIron product family enable high-performance, always-on and secure service delivery over networks in enterprise, service provider and e-commerce data centers. The ServerIron family offers a range

of solutions that are designed to accelerate, secure and scale network traffic for Web and Business applications.

Today, web-enabled and enterprise SOA-based applications are at the heart of business operations, and these applications are used for various business-critical services that help reduce cost, increase productivity, and grow profitability. The key architectural design criterion for IT managers and architects are reliability and availability of the business critical application, security of data and communications over the network, performance of application as measured by end-user download and application execution times and last but not the least lowering the cost of operation of the IT infrastructure. End-users like employees in branch offices, suppliers and customers all over the world can access the SAP NetWeaver® Portal component, which is the central user integration point for multiple applications and services. Also, in the age of enterprise SOA, application to application web service traffic from the extended enterprise is rising. Reliability and availability ensures that business critical applications are available to a global user population 24 hours a day, 7 days a week, all year round. With increasing number of regulations, legal risk needs to be limited with data and network security technologies. The globalization of business has driven the need to ensure acceptable application delivery performance for end-users. Finally IT costs need to be driven lower to ensure maximum leverage and ROI for the business. Increased demand for application resources are net result of growing number of users, increased volume of application transactions, changes in the nature of application usage, and implementation of new services. And, there are no indications in the relaxation of these demands anytime soon. Accommodating growth and never-ending changes to applications requires flexible application and server farm infrastructure that can scale on demand. A critical component to growth is growing transparently to existing application users.

Foundry's ServerIron family of high-performance application switches ensure maximum availability of applications by intelligently distributing traffic among all available servers, and dynamically monitoring the ability of servers and applications running on the servers to deliver optimal performance. Using customizable health checks at various levels of granularity like host, port, application and transaction levels, the load balancers transparently react in real time to increases and decreases in available server capacity by redistributing client traffic. Failures of servers and applications running on the servers do not cause disruption to the end clients. The failed resources are simply set aside until they come back online, and the subsequent client connections are re-directed to other available servers. ServerIron switches can be deployed in multiple high-availability modes with stateful session synchronization (session sticky routing to application server instances) and failover to preserve client connections during catastrophic failures. Applications are transparent to the presence and failures of load balancers, and function uninterrupted.

Scaling of applications and server farms is a fundamental requirement for keeping pace with continued business growth, and is cost-effectively and transparently met by the ServerIron application switching solutions. ServerIron switches provide tremendous scalability to IP-based applications by allowing the use of multiple servers with load balancing and failover. The switches allow businesses to leverage commodity servers to build highly sophisticated and secure application infrastructure. As demand grows, simply slide in new server resources and configure the ServerIron switch to use the new resources. There is no need for forklift upgrades to the server farms and disruption to applications. With the fine-grain content switching intelligence of these switches, there is no longer the need to scale the entire server farm simultaneously. Growth can be targeted to specific application functions and content servers, which allows even higher levels of scalability. Additionally, existing resources can be more efficiently used by implementing content switching rules that maximize overall utilization.

2 Design of the Test Landscape

The goal of the test landscape design was to incorporate many of the features which customers would need to use enterprise SOA-based applications productively. In detail this meant:

- Using the SAP NetWeaver technology platform integration components (Fig. 2a) like SAP NetWeaver Portal for people integration
- Use SAP's composite application concept for building integrated business processes using enterprise SOA concepts (Fig. 2b)
- Building a production like application and network infrastructure with secure access, simulated WAN traffic and scalable multi instances deployments of all SAP NetWeaver and business application components.

The first 2 points were fulfilled by using the SAP Discovery system (<https://www.sdn.sap.com/irj/sdn/esoadiscovery>) which is a one server deployment of SAP NetWeaver, composite application, and ECC 2005 backend applications. A number of enterprise SOA business scenarios are implemented out of the box on the SAP Discovery system which greatly reduces the effort for building a test landscape.

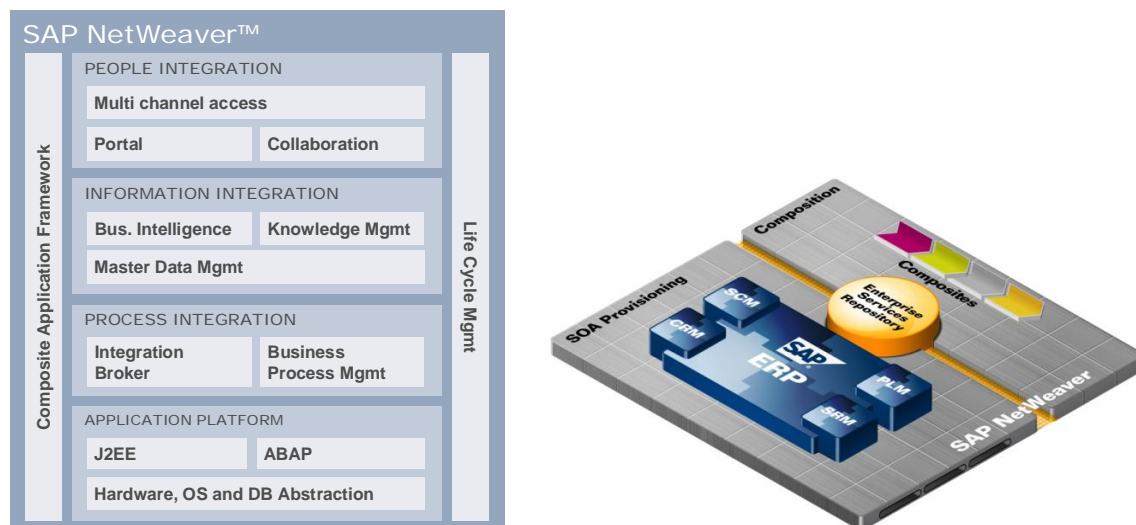


Fig 2: Building business scenarios based on the SAP NetWeaver technology platform (left) for SAP applications following enterprise SOA principles

Foundry's ServerIron family of application delivery and traffic management switch is the industry leader in high availability, acceleration, security and scalability for business-critical IP, Web and VoIP applications. The ServerIron provides a total solution for server load balancing, server health checks, advanced content (Layer 7) switching, server farm and application security, SSL acceleration, and multi-site redundancy.

In the test landscape, Foundry Networks' ServerIron application switches were deployed in front of SAP servers for two typical use cases. Case one emulated the application load from remotely located end-users far away from the edges of the data center. Users were routed through a ServerIron 850 to SAP NetWeaver Portal. ServerIron was enabled to provide SSL acceleration through offloading SSL handling from SAP NetWeaver Portal, advanced cookie switching for session persistence and server load balancing.

A second use case focused on enterprise SOA typical web-service network traffic over a Wide Area Network connection as it might happen between major data centers of a corporation or in Business to Business application scenarios where multiple different companies might be participating. Similar to the first, user focused, case ServerIron was configured to provide load balancing for SAP servers. At both locations, ServerIron switches were deployed in one-arm to the general network switches in the test infrastructure. Both cases are illustrated in Fig 3.

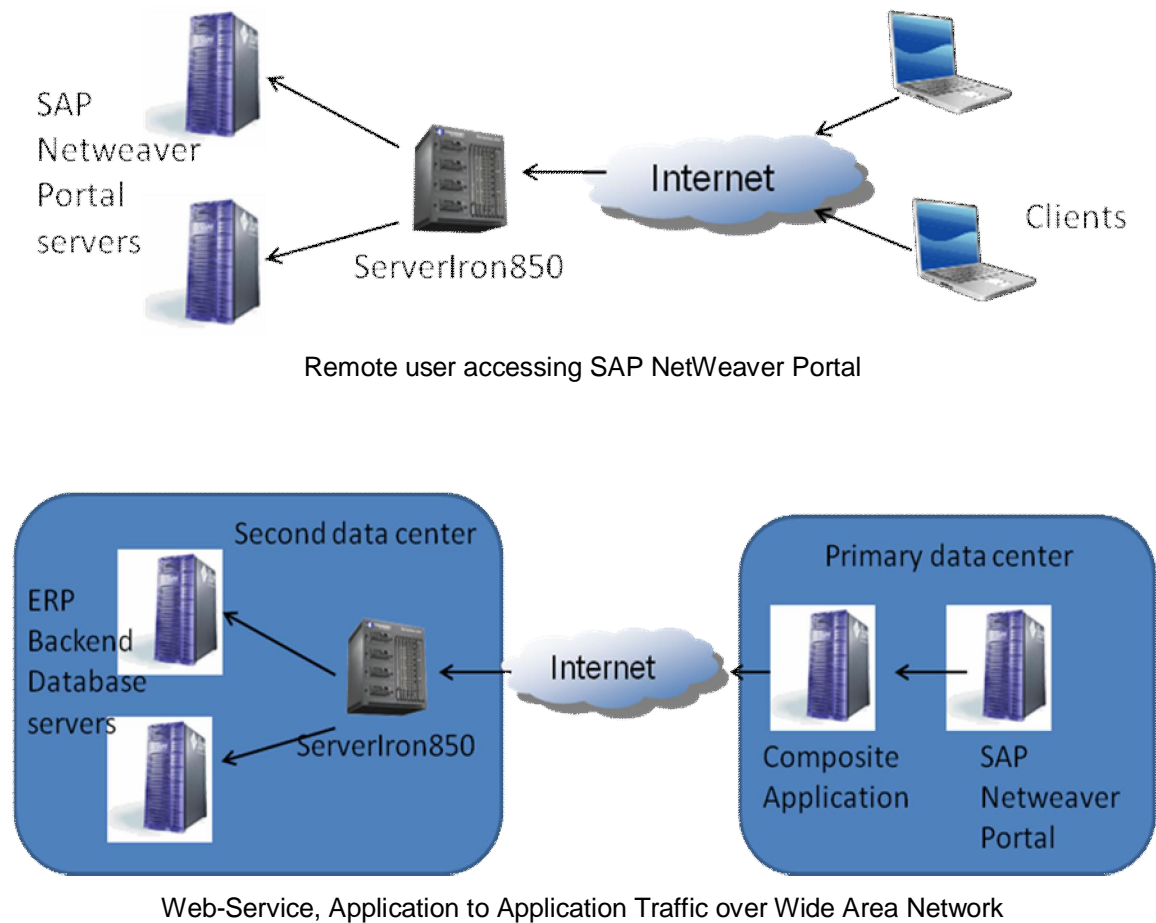


Fig 3: Enterprise SOA with Foundry Networks ServerIron test environment

End-users would access applications residing at SAP NetWeaver Portal data center locations over company Intranet or using their Internet connections. Such long distance network connections were simulated using a WAN emulation appliance from Shunra Software Limited. HP (for-

mer Mercury Interactive) LoadRunner Traffic tool was utilized for simulating SAP application end-users. For the 2nd use case, the web-service traffic, a simple servlet in a composite application middle tier application component was used to trigger web-service calls to an SAP ERP application backend system. In a real scenario the web-service calls would be triggered by user interaction in SAP NetWeaver Portal which would access the composite application. HP LoadRunner was used to call the servlet and the Shunra WAN emulator was providing the WAN link between the composite and ERP backend components.

3 User Scenarios, Test Methodology and Test Results

User scenarios

SAP NetWeaver and Foundry ServerIron integration tests were designed to verify server load balancing, high availability, security, performance scalability, and augmentation functions of the ServerIron application switches in context of enterprise SOA.

Secure login and logoff from a user portal:

This use case focuses on the important step to establish user sessions in SAP NetWeaver Portal including the efforts for user authentication and role authorization and displaying a content rich first welcome page. A remotely outside the datacenter LAN located end-user logs into his or her portal environment using secure https encrypted communication and provides user name and password in a first step. The point of interest is the login response time when receiving the welcome page after submitting user credentials. Wide Area Network latency, bandwidth and quality issues are emulated and secure communication is used to add real world conditions, which affect user experiences.

Download of a large file from a remote office:

A large 5MB file download scenario complemented the more transaction step like login scenario. The basic landscape layout, WAN conditions and security requirements as in the login test were used. However, in this test only the download time of a very large object was checked, while the login scenario downloads a large number of small web-objects.

Application to Application communication in a distributed enterprise SOA with basic data exchange:

Another use case scenario is where two applications that are deployed in separate data centers exchange application data as defined in service oriented architecture framework. This will include data exchange over the wide area network or WAN, and will require security of the exchanged data using standard protocol such as https. Two use cases were investigated.

The first one uploaded customer data from an ERP backend system into a composite application, which feeds the backend data into a webpage which could be forwarded through the NetWeaver Portal to an end-user. The second use case pushed a business document from the composite application into the ERP backend system. For both use cases web-service standard methodologies were used which could use http or https protocol and XML data format. Again, for making the use cases as real world like as possible special attention was paid to use large business objects like customer orders with more than 100 line items, resulting in large data volume web-service calls.

Test Methodology

All tests are performed over an emulated Wide Area Network (WAN) link. All test cases are designed such that traffic WAN is always encrypted (https) and hence secure. It is mandatory that any added network technology maintains secure, encrypted communication over the WAN link. However, network appliances and application components may communicate clear text within a datacenter or to an emulated end-user location.

All tests require use of an emulated WAN link or a similar connection via real global networks. At least the following 2 WAN link properties are required to be tested for all test cases:

- Within North America DSL link from a data center to home or hotel based end-users
- Intercontinental T3 WAN link to branch offices

The technical WAN properties are listed in the table below.

WAN use case	Bandwidth	Round trip latency	Packet loss rate
DSL	768 Kbps	40 milli seconds	1%
T3	43 Mbps	300 milli seconds	1%

Test Results

Foundry Networks' ServerIron application delivery controller switches successfully integrated with SAP NetWeaver application architecture and provided necessary load balancing, session persistence, security, performance and high availability and reliability for SAP application server farm. The end user experience with SAP application usage while server farm being front ended by ServerIron application delivery controllers stayed within acceptable performance boundaries..

Proven Reliability and High Availability of the infrastructure

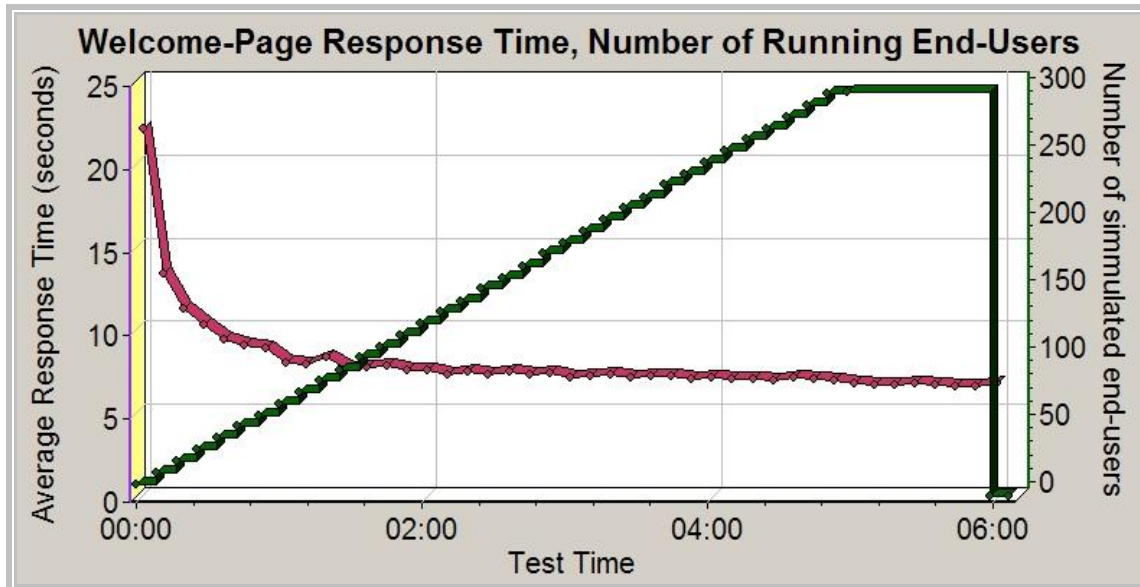


Figure shows that overall environment runs very stable over an extended period of time, here 6 hours, under increasing load of up to 300 concurrent users in this test.

Response time decline can be explained as a result of mixture of first time users logging with an empty browser cache resulting in high download volume and repeat users logging in with prefilled browser cache resulting in lower response times. Towards the end a larger portion of users is of the second type and therefore response times go down over time.

This kind of test was done for DSL and T3 case. It is not unusual to have some web-download errors under the challenging WAN conditions which were chosen for the test. Therefore, we checked the error rate. We found only 1 error in 4000 login attempts in the DSL case and no error in 12,000 login attempts in the T3 case. Therefore, the login success rate was 99.975% and better. This proves the reliability and the high availability standards of the application delivery infrastructure with Foundry Networks ServerIron.

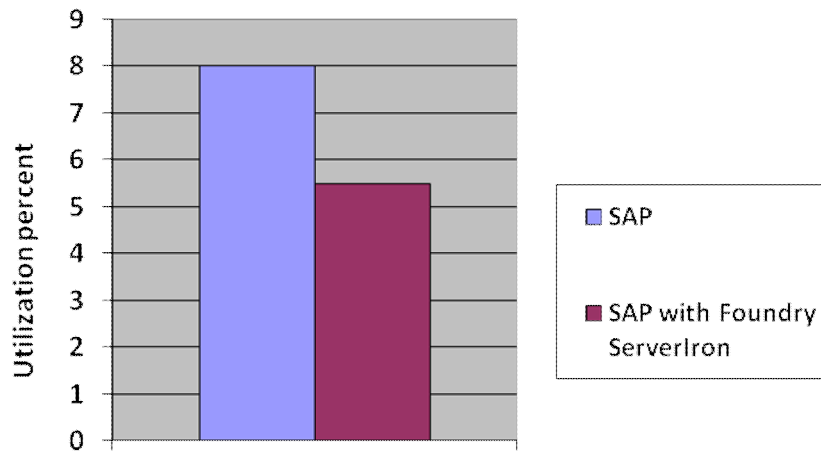
The other 3 test scenarios were done only with 1 user tests, but all of them were verified to work functionally correct under both WAN conditions and including the Foundry appliances in front of all 3 major SAP components.

Further it was verified that end-user response times in all tests were equal or better with the Foundry appliance than without.

Performance and utilization improvement with SSL offloading

The ServerIron application delivery controller switch offloaded SSL processing from SAP servers (SSL acceleration) by terminating client side SSL connections. This improved SAP application server's CPU utilization by approximately 30% as it was now freed from SSL processing overheads. In all the tests, network traffic over the WAN was encrypted, ensuring confidential business data exchange over typically non-company WAN infrastructures.

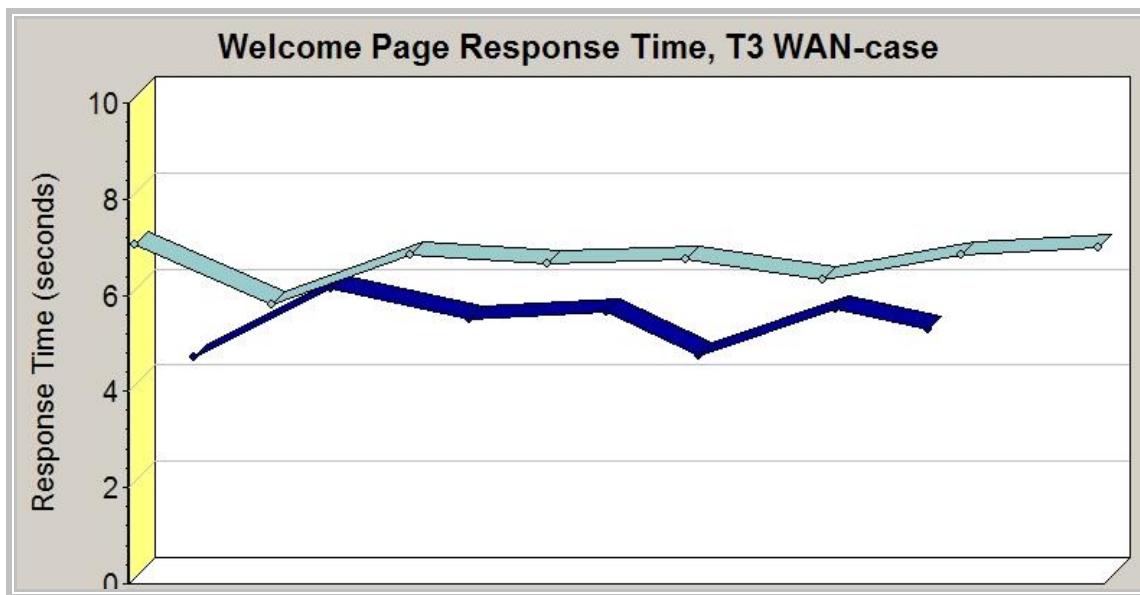
Server Utilization Improvement



Industry leading Network Security for Denial-of-Service attack

Foundry ServerIron's Denial-of-Service (DoS) attack prevention functionality was tested against SAP NetWeaver Portal. This security feature from ServerIron switches can potentially thwart up to 10 Million SYN attacks per second and defend application server farms, which could not handle such attack load at reasonable costs.

DOS attack:



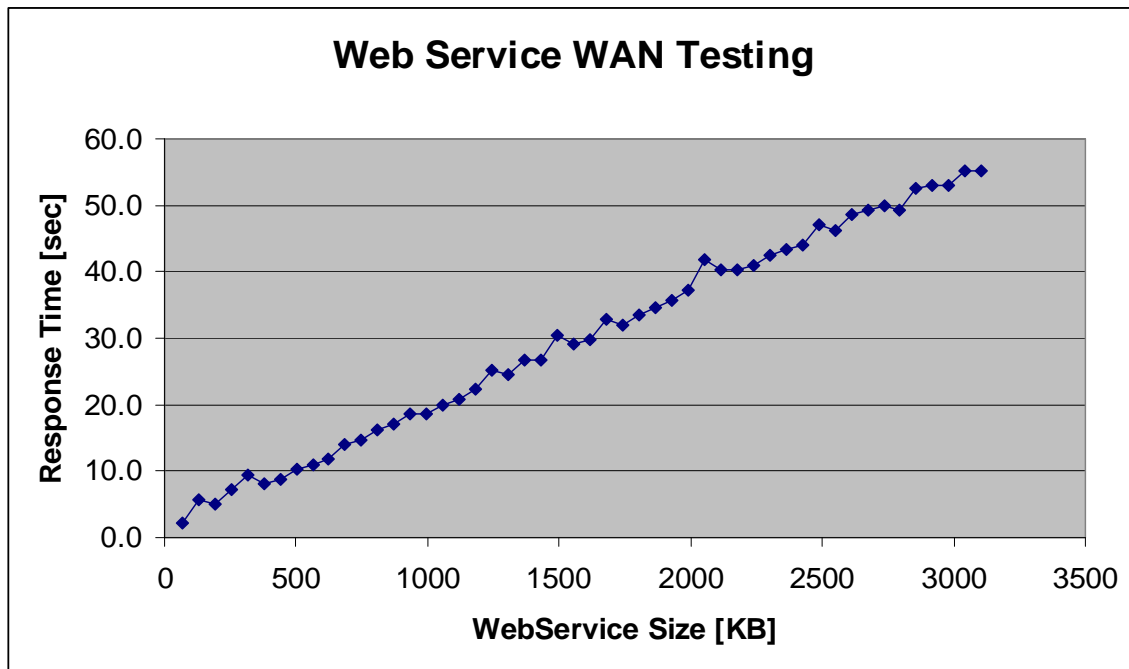
Shown are a few iterations of 1 user login in, response time of the welcome page for T3 case:

- Upper curve SAP only, no Foundry appliance, no DOS attack
- Lower curve: With Foundry under dos attack
- Not shown: SAP app under heavy dos attack w/o Foundry because that case showed 100% error rate rendering SAP NetWeaver portal unavailable to end users.

A network traffic generator from the company Ixia was used to simulate the DoS Attacks. TCP-SYN DoS attack packet flow was sent to the ServerIron proxy and slowly ramped up to about 2000 packets per second of attacks. It was verified that there was no impact to the performance to the Portal.

Ready for Enterprise SOA

Part of the testing included standard webservice traffic between an SAP NetWeaver-based composite application component and an SAP ERP backend component. The webservice call was part of a scenario where a sales representative looks up the past orders of a customer. The webservice call returned from the backend to the composite the list of such orders from a customer. In the real world such listings can be of vastly varying sizes leading to small or large size webservice calls. Therefore, such varying sizes were tested as is shown in the next chart.



The order list size was varied from 20 to 1000 orders, leading to large webservice calls up to about 3MB size. The response times shown are for the T3 WAN case. Due to at the end very large webService content sizes the WAN network transfer times can be quite large. However, with the ServerIron appliance frontending the ERP web service provider endpoint the web-service delivery was flawless without any errors, showing that this technology can also be used for enterprise SOA-based application to application component communication over Wide Area Networks.

4 Conclusion and summary

Enterprise SOA-based application systems provide high value to business end users as well as to businesses cooperating over now-a-days global network infrastructures. Thereby modern

Foundry ServerIron network appliances at the edges of the data centers support business applications with for a company's business essential values:

- The ServerIron Application Delivery Controller provides the reliability and high availability required for an enterprise SOA-based application as proven by the tests. This is a very critical requirement for the business critical application that run on the SAP platform.
- Security is very important, both from the point of view of data integrity and encryption over the network as well as immunity for the server platform from network based hacker generated attacks like Denial-of-Service at multiple layers of the network stack. The ServerIron is able to thwart complicated and massive scale DoS attacks keeping the SAP application accessible for legitimate end users.
- Performance is improved with ServerIron due to SSL offloading capabilities and also leads to improved computing resource utilization on the SAP server. Not at least this helps to reduce application server capital and operations costs.

Overall the ServerIron adds value to an SAP NetWeaver-based enterprise SOA deployment while at the same time does not degrade the application performance characteristics and user experience

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