SOA Management and Business Transaction Assurance with SAP and Progress Actional
A report from SAP Co-Innovation Lab

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1 Introduction

Today's enterprise IT environment is being fundamentally reshaped to better address the needs of the business. Now more than ever IT is being asked to manage complex, distributed business transactions that span SAP® systems, third-party systems, and partner systems. The success of an enterprise increasingly depends on how well they are integrated with their business networks, which may include hundreds of partners and thousands of customers. SOA and web-service technologies now play a critical role in the evolution of enterprise IT infrastructure offering flexibility, agility, and lower cost, standards-based integrations. While these new technologies are allowing businesses to build new applications that offer clear competitive advantage, there is also a clear need to manage and secure them for appropriate governance, risk and compliance management.

From an IT perspective, and as the usage of web services and SOA technology increases, more and more sensitive business data is becoming easy to access internally and may even be flowing beyond the edges of the enterprise as a result of business partner interactions. This means that securing web services and enforcing data privacy policies are key requirements. Monitoring and managing distributed business transactions are equally important. Without the proper tools it is difficult to gain visibility into the entire distributed business transaction and to ensure the reliability and performance of transactions as they flow through heterogeneous IT landscapes that include SAP applications, non-SAP applications and external business partner systems.

SAP has embraced SOA and offers its customers the very best in both SOA capabilities and management solutions. With thousands of packaged, high-quality enterprise services delivered by SAP, customers can immediately reap the benefits of SAP's proven design-time governance, which focuses on building alignment between SOA infrastructure and key business processes. Once customers decided to put these enterprise services into production in their own SOA landscape, they can immediately take advantage of the SAP Solution Manager application management solution and SAP NetWeaver Administrator tool as the cornerstones for runtime management of these enterprise services.

In addition to the SOA management capabilities provided by SAP Solution Manager and SAP NetWeaver Administrator, SAP works closely with industry-leading SOA management vendors, like Progress Actional®, to offer integrated management solutions that can effectively secure, manage, and monitor the many third-party applications found in today's heterogeneous enterprise environments. In support of this objective SAP Co-Innovation Lab works directly with partners like Progress Actional to develop robust integrations with SAP products and to identify deployment patterns, best practices, and performance characteristics. This cooperation between SAP and leading SOA management vendors gives SAP customers the added flexibility and insight needed to effectively manage their heterogeneous infrastructure.

This paper offers a summary of the integrated SOA management solution developed and validated in the SAP Co-Innovation Lab by SAP and Progress Actional. Headquartered in Bedford, Massachusetts, USA, Progress Software has a history of more than two decades of innovation in the database, integration and SOA management space. The Actional product line was designed specifically to address the challenges of managing SOA environments and distributed business transactions. It provides visibility into a wide variety of SAP and third-party applications, and provides enforcement of service-level agreements (SLAs) and business policies throughout the enterprise. Its advanced root-cause analysis capabilities provide IT staff with flow maps for problem transactions that quickly pinpoint the source of performance problems and failures, saving IT cost and reducing application down-time. Actional also offers a wide range of mediation and advanced SOA security capabilities ideally suited to the effective deployment of SOA assets.

While Actional offers visibility, policy enforcement, and advanced SOA security features for a wide array of third-party applications, the testing in the SAP Co-Innovation Lab focused on how Actional can easily be deployed into an SAP landscape in order to manage, secure, and optimize SAP enterprise services without changing the SAP components.
2 Integration of Actional into the SAP Landscape

While not impossible it is certainly less than pragmatic to test the wide variety of deployment topologies used by our customers. Therefore, the SAP Co-Innovation Lab team chose to deploy a simplified SAP landscape that includes the key elements found in many modern data centers. The test configurations used in the SAP Co-Innovation Lab provide a common pattern for SOA management solution integration that should relate well to the challenges seen in most enterprise IT environments. Complexity of the landscape may be increased in future phases of SAP Co-Innovation Lab testing with Actional.

2.1 The Baseline SAP Co-Innovation Lab Landscape

The SAP Co-Innovation Lab landscape is described in the following figure and has the following characteristics:

- An SAP NetWeaver Portal 7.0 server, an SAP NetWeaver® Composition Environment (SAP NetWeaver CE) 7.10 SP3 Server, and an emulated SAP ECC 6.0 back end that provides simulated SAP enterprise services with SAP NetWeaver CE 7.10.
- All application instances are deployed inside VMware virtual machines.
- All applications are deployed in two instances to demonstrate high availability (HA) and scalability.
- A commercial application delivery (AD) appliance is added, which provides the following services:
  - A virtual server proxy endpoint for the two instance of an application component and load-balanced routing of network traffic to the component instances
  - Termination of incoming SSL connection and decryption of related traffic
  - Optional application of content-based routing rules and transformation operations
  - Connection multiplexing of many incoming TCP/IP connections to fewer connections towards the server side
  - Optional re-encryption of traffic towards the application components

![Figure 1: SAP Co-Innovation Lab Baseline Landscape](image)

As part of the simulated production landscape, SAP Co-Innovation Lab also provides a simple test application that leverages all the key components described. As shown in the screenshots below, the application addresses a customer fact sheet (CFS) scenario. It allows a sales person to log in to the portal and look up customers. Clicking on a customer record displays a quote and an order history for that customer. Behind the scenes, web service calls from the portal to a composite application running on SAP NetWeaver CE are triggered, and in turn the composite triggers further web-service calls to a backend system in which the customer data is persisted.

In the first step, the user enters a customer name to search for a customer, and a list of matching customers is returned. Clicking on a line item in the returned customer list reveals more details about the customer and the history of quotes and orders submitted by the selected customer.
The whole scenario can be simulated using load-testing tools. In SAP Co-Innovation Lab, we use SAP LoadRunner application by HP for performance testing.

2.2 SOA Management Solution from Actional

The Progress Actional family of products provides complete business transaction assurance, end-to-end visibility, security, and control from design-time to runtime. Actional provides operational and business visibility, root cause analysis, policy-based security and control of services in a heterogeneous environment. It can be used early in the lifecycle to enable pre-production teams to address service quality prior to deployment, and Actional’s comprehensive visibility and management tools can be quickly and easily applied to production applications.

Actional has several key advantages:

- Automatic discovery of services, consumers and interactions
- Broad application platform and protocol support
- Advanced root cause analysis
- Scalability and performance
- Business transaction management
- Advanced security features
- Development testing and diagnostic tools

This section provides a broad overview of the Actional SOA management solution. Please note that not all the features described in this section were fully tested at SAP Co-Innovation Lab due to...
to time and resources constraints. Section 2.3.2 and section 3 provide more details regarding what has been tested in SAP Co-Innovation Lab.

2.2.1 Automatic Discovery of Services, Consumers, and Interactions

Actional’s automatic discovery feature provides SAP customers with visibility into consumers of services, producers of services, and the dependency chains between them. Actional uniquely tracks, in near real time, the actual service usage and reports it through the network overview (screenshot below) so that managers get a holistic, end-to-end view of the message traffic and patterns flowing across the network.

![Network Overview](image)

Figure 3: Network Overview Showing Traffic, Consumers, Services, and Statistics

Most management tools require IT staff to manually update the services and systems configuration. As a result, they are labor intensive, and the configurations are often stale or inaccurate. With Actional’s automatic discovery capabilities the topology is dynamically updated, reducing IT effort. Actional also provides a more accurate view of the runtime environment that administrators can rely on.

Automatic discovery helps SAP administrators to understand dependencies between SAP systems and non-SAP applications, identify rogue consumers, and isolate performance problems that may be caused by third-party applications.

2.2.2 Broad Application Platform and Protocol Support

Most SAP customer IT landscapes are heterogeneous and include non-SAP applications hosted on legacy systems, application servers, .NET, ESBs and web service technologies. Additionally, these non-SAP platforms might be using a variety of protocols and transports such as RMI, JDBC, EJB, SOAP, HTTP, JMS, and their Microsoft counterparts. Actional gives you visibility into the end-to-end transaction across a broad array of application platforms and transports.

SAP customers are interested in understanding the root cause of problems, regardless of whether they are in third-party applications or SAP applications or happen to use one or more of the transports listed in the aforementioned. Most customers find Actional significantly reduces break-to-fix times, improves their ability to manage SLAs, and reduces the IT cost/effort associated with diagnosing and resolving problems.
2.2.3 Advanced Root Cause Analysis

One of the biggest challenges with today's complex, interconnected applications is determining what is causing a problem. Often the source of the problem is several systems away from where the symptoms are seen by application business users. As a result, IT departments are spending more time/effort trying to find the source of problems, which increases the break-to-fix times and drives up IT costs. Fast, effective root cause analysis for SOA is one of the primary strengths of Actional. Forrester Research case studies have found that Actional customers see up to an 80% reduction in the time IT staff spends searching for the root cause of problems and as much as 4 times improvement in the break-to-fix time for distributed business transactions monitored by Actional.

Actional makes finding the root cause of exceptions and violations of business policies such as SLAs easy. When violations occur, along with sending an alert, Actional's Flow Mapping™ technology creates an end-to-end flow map of the problem transaction. The screen below is a typical example of a flow map for a problem transaction.

The flow map shows only the systems/applications involved in the transaction that caused the policy violation. The red line indicates where in the enterprise the policy violation was detected, and, since it was an SLA performance violation, the line thicknesses reflect the time spent in each section of the distributed business transaction. In this case it looks like the problem is in the third-party application ordermgmt.

You can also drill down to a Path Explorer view (below) to see which services/operations were called and how much time was spent within each service/application.
A quick glance at the Path Explorer view shows that too much time (762ms) was spent in the EnterOrder operation on the order management application. It also shows that the downstream services/applications, including the SAP application, are performing well. With these graphical interfaces and transaction-specific details the IT staff now knows exactly where the problem is and can quickly get to work fixing the problem in the order management application.
2.2.4 Actional Architecture and Integration

SOA requirements range from keeping the SOA network up and running, to optimizing it for the business, to ensuring security and business policies are being enforced. To achieve these objectives Actional offers both lightweight agents and intermediaries (advanced proxies) that allow you to tailor your SOA runtime governance to your needs. Actional Management Server collects information from the agents/intermediaries, stores it in an underlying relational data store, and hosts the web consoles used by the various business and IT stakeholders. Actional also integrates with a variety of identity, registry, and management products.

2.2.4.1 Actional Management Server

Actional Management Server is a software product that manages the collection of information (metrics, data, alerts) from Actional agents and intermediaries. It acts as the central store for this information. It also hosts the web-based management console that provides a comprehensive
view into SOA environments, displaying services, flows through services, consumers, metrics, alerts, and root-cause analysis for problem transactions. Actional Management Server is designed to be highly scalable, supporting more than 1000 agents/intermediaries per server. It achieves this through a unique architecture where it acts as an aggregator and a central point of control. It does not participate directly in the processing of transactions: that is delegated to the intermediaries and agents to allow maximum performance and scalability while eliminating bottlenecks and single points of failure.

### 2.2.4.2 Actional Intermediary

Actional Intermediary is an advanced, software-based proxy that is commonly used to virtualize services in order to provide critical features such as advanced SOA security, message transformation, content-based routing, SLA monitoring, and business policy enforcement. As a server-side intermediary it can be used to expose multiple services as a single service or to expose individual services with multiple interfaces tailored to client needs. It can also be used as a client-side intermediary to secure weak clients and arbitrate client interactions.

### 2.2.4.3 Actional Agent

Actional agents are lightweight, software-based agents that monitor SOA traffic in/out of services/applications. They differ from the Actional Intermediary in several key ways. Actional agents do not support the security, transformation, or routing features found in the intermediary. The agents instead focus on visibility, auto-discovery of services, auto-discovery of dependencies, SLA enforcement, and business policy enforcement. They run co-resident with the service/application and are extremely high performance. Actional agents can instrument a broad range of third-party products and support a wide variety of protocols and interfaces (e.g., Axis, SOAP, EJB, JMS, Servlets (HTTP), Jakarta HTTP client, ADO.Net, RMI, JDBC, and Kerberos).

### 2.2.4.4 Actional Team Server

Actional Team Server is the result of the Progress acquisition of Mindreef in 2008. It is a collaborative platform that enables architects, developers, testers, and business analysts to work together to drive quality, trust, and confidence throughout the service lifecycle—from development to application support, and beyond. Actional Team Server features include load testing, WSDL compliance testing, and a pseudo-code view of XML so that service behavior can be easily understood without deep knowledge of XML.

### 2.2.5 Scalability and Performance

Actional was designed from the ground up for high performance and deployment at enterprise scale. Actional agents are lightweight, low latency, and highly efficient. Although not tested in the SAP Co-Innovation Lab, Actional indicates that agents typically consume 2-to-3% of CPU capacity and latency is typically under 50 microseconds (microseconds, not milliseconds). Actional Intermediary is an advanced proxy-style agent that offers all the features of a standard Actional agent plus advanced security, transformation, and content-based routing. The Actional Management Server is also designed for enterprise scale. While the configuration tested in the SAP Co-Innovation Lab included a modest number of intermediaries, Actional indicates that a single Actional Management Server can support over 1,000 agents and intermediaries with 50,000 or more service interdependency mappings.
2.3 Network Integration

Given the strong SAP interest in Actional’s security and proxy capabilities, the first round of SAP Co-Innovation Lab testing focused on Actional Intermediary, the advanced agent with security, policy enforcement, and mediation capabilities. It offered an easy way to integrate Actional into an existing SAP deployment without changing the footprint or configuration of the existing SAP components. Actional Management Server was also tested in conjunction with Actional Intermediary. Testing with Actional agents was deferred to a later round.

2.3.1 Recommended Deployment Patterns

As a software-based proxy, the Actional Intermediary supports a number of deployment alternatives. The most common deployment profiles are:

- Pure proxy
- Server-side proxy
- Client-side proxy

2.3.1.1 Actional Intermediary as a Pure Proxy

Deploying Actional Intermediary as a pure proxy allows the user to expose backend services through virtual service interfaces and to supplement the capabilities of the backend services with advanced security, transformation, and policy enforcement. In a pure proxy configuration the user gains the advantage of having dedicated resources for Actional Intermediary’s security, transformation, routing, and policy enforcement tasks. You can also use a single pure proxy instance of Actional Intermediary to proxy numerous backend applications running on one or more servers.

2.3.1.2 Actional Intermediary as a Server-side Proxy

Actional Intermediary can be deployed as a server-side proxy that runs on the same server as the backend application (in its own operating system process). Deploying Actional Intermediary as a server-side proxy can simplify HA support. If the application is configured for HA using HA hardware or multiple instances, then Actional Intermediary leverages that configuration without the need for additional hardware or load balancers. A server-side proxy can also eliminate potential security challenges associated with communication between the proxy and the backend application. You do, however, need to ensure that both the application and the Actional Intermediary have sufficient resources to prevent contention.
2.3.1.3 Actional Intermediary as a Client-side Proxy

Actional Intermediary can be deployed as a client-side proxy in order to augment the capabilities of the client. Users will often use this configuration to gain support for advanced security features that the underlying client application does not support. It can also be used to change the protocol from one that the client supports to one that the server side requires. In some cases it is also used to transform the outbound request into a form that the server side requires. This can be useful in scenarios in which the client application cannot be changed or is prohibitively expensive to change.

2.3.1.4 The Advantages of Software-based Proxies

For customers considering deployment of proxies throughout their enterprise Actional Intermediary offers several advantages. In addition to the broad set of features, software-based proxies are easier to deploy than proxies that require custom hardware (e.g., XML appliances, load balancers) and can easily be reconfigured/repurposed as the enterprise changes and often cost significantly less. Actional’s user interfaces and tools also make it easy to manage large numbers of Actional Intermediaries and share configuration across large deployments. Also note that with today’s new generation of servers that include built-in crypto accelerators Actional’s security performance is on a par with more expensive solutions using dedicated hardware.

2.3.1.5 Typical Production Deployment Profile

The most common production deployment profile is to deploy two or more Actional Intermediaries as a logical cluster and to front-end them with a load balancer:

With this approach you gain high availability and can also increase capacity by adding additional Actional Intermediaries to the cluster. The Intermediary can also offload the expensive cryptographic operations to the load balancer. In this deployment, the load balancer does the SSL ter-
mination and sends the data in the clear to the downstream intermediary instances. More details regarding high availability are discussed in later sections.

### 2.3.2 The Integrated Landscape

Multiple configurations were deployed in the SAP Co-Innovation Lab in order to demonstrate the breadth and depth of Actional’s features. Among the features confirmed were automatic discovery of services, security profiles (e.g., SAML, WS-Security), performance/SLA monitoring, business policy enforcement, content transformation, content-based routing, business metrics collection, applying policies based on content, and high availability.

For performance and stress testing a typical production deployment profile was deployed in the SAP Co-Innovation Lab. Two instances of Actional Intermediary were deployed as proxies to the two backend SAP ERP applications. A load balancer was placed in front of the Actional Intermediaries to distribute the load and redirect traffic to the remaining Actional Intermediary should one of the two fail (an HA feature). Actional Management Server is also included in the configuration as a central point of policy authoring and propagation. It also acts as the statistics store and hosts the web-browser-based console.

![Figure 11: SAP Co-Innovation Lab Landscape with Actional Intermediary as a Proxy to ERP Systems](image-url)
3 Performance and Stress Testing Results

This section documents the findings from the final tests with Actional Intermediary acting as a smart proxy sitting in between SAP NetWeaver CE and SAP ERP Central Component (SAP ECC).

3.1 Response-time Impact

![Figure 12 - WS. Size Ramp-up: Green=SAP-only Reference, purple=SAP+Actional Intermediary](image)

Shown are the response times of continuously occurring web-service calls, in which the data size is increased from call to call until a preset limit is hit and then the cycle is repeated. Policies included some XML parsing and the traffic protocol was https. For the SAP-only case the SAP server terminated SSL; for the Actional case the Actional Intermediary terminated SSL and then routed messages via http unencrypted to the SAP servers.

The response times are slightly higher (about 13%) with the Actional Intermediary than without Actional, seen best from the longer cycle times. This seems to be reasonable for a software proxy, as complex policies were in use that inspected the XML content when this measurement was made. Response-time fluctuations seem to be slightly increased with the Actional proxy in place.

3.2 Stress Testing Results

A few runs of multi-user stress tests were done with the following key parameters:

- Https termination in the Actional Intermediary
- Heavy XML parsing policies deployed
- Constant message sizes of 100 line items, largest web-service call about 300KB
Below are more details from the 40 concurrent user tests in which each test client submits requests every 10 seconds.

Figure 13: Average Transaction Response Times

Average transaction response times with Actional were very good. In figure 13 the SAP-only response time is in purple while the response time with Actional included is in green. Note that the response times with Actional were only slightly slower than those of SAP software without Actional. It should also be noted that the response time only increased by a small amount as the user load increased during the first hour of testing. Actional also performed well over time under constant load; there was no noticeable degradation in response time.

Figure 14: Average Transaction Response Times under Load (after Ramp-up)
Figure 14 shows the same response-time measurement with the first hour of information removed. This gives the user a good feel for the average response time under load. SAP without Actional averaged 0.4 seconds while SAP with Actional averaged 0.6 seconds (rounded). Both measurements show that response time fluctuates significantly with standard deviations of 0.26 seconds for SAP-only and 0.33 seconds for SAP with Actonal.

In figure 15 you can see transaction request rates for SAP-only (purple) and SAP with Actional (green). The transaction request rates to the composite application were almost identical, with an average of 3.8 transactions per second. Each transaction caused three web-service calls of different sizes between SAP NetWeaver CE and the backend system. Only one of these web-service calls was larger in size (about 300KB).
Figure 16 documents the CPU usage for the Actional Intermediary (yellow) and the Actional Management Server (pink). During initial user ramp-up, CPU usage increases linearly with the number of users. Linear increases in resource consumption typically indicate that a product is designed to scale efficiently.

Figure 17 shows the CPU utilization under load with the ramp-up phase removed. The above information provides useful estimates for hardware capacity planning exercises for the Actional product. The CPU measurements above are taken from the Windows operating system perform-
ance monitor. The Windows system itself was running inside a VMware virtual machine, which had one CPU core assigned to it from a four-core server blade that has 5000 SAPs (SAP’s invented capacity metric). This leads to the following calculations:

- Intermediary CPU usage inside VMware averaged 32.5% while under load, with an average of four large web-service calls (300KB size) per second.
- Dividing by four to normalize for 4 core machine yields an 8.1% average CPU utilization.
- Similarly, for the Actional server there is 4.3% CPU usage inside VM and 1.1% CPU utilization when normalized for the whole 5000 SAPs blade.

In general, the resource consumption for Actional Intermediary and Actional Management Server was modest and stable under load.
4 Conclusion

For SAP customers who are expanding their use of SOA technologies and those who want more effective tools to manage business transactions flowing through their heterogeneous environment, The SAP Co-Innovation Lab team recommends taking a look at Actional.

Actional Intermediary is a very competent, software-based proxy that can be used to virtualize services in order to provide critical features such as advanced SOA security, message transformation, content-based routing, SLA monitoring, and business policy enforcement. As a server-side intermediary it can be used to expose multiple services as a single service or to expose individual services with multiple interfaces tailored to client needs. It can also be used as a client-side intermediary to secure weak clients and arbitrate client interactions.

Actional agents were not tested in this phase of SAP Co-Innovation Lab testing but are known to provide visibility and performance SLA monitoring across a wide array of non-SAP applications and protocols. For SAP customers struggling with isolating problems in third-party applications interacting with SAP applications Actional can offer significant value.

Actional Management Server provides a central point of control for policy authoring, a data store for statistics, and a rich, browser-based management console. The management console provides insight into the enterprise IT landscape, views of distributed business transactions flowing through it, and strong root cause analysis tools that can be used to quickly isolate the cause of problems across a variety of application platforms and protocols.

The joint testing of Actional in SAP Co-Innovation Lab was successful and demonstrated the value SAP customers can gain when using Actional to secure services, provide advanced proxy capabilities, and enforce runtime policies. The test results for the landscape specific to SAP Co-Innovation Lab and the Actional components showed good results:

- The response time increase associated with Actional Intermediary (software proxy) was minimal.
- Performance under load was very good.
- Resource usage scaled linearly with the applied load.
- Resource consumption remained flat over time under constant load (with no leaks).
- Adding security handling into the configuration had a minor impact on performance.
- As expected, complex policies that included extensive XML data parsing and XPath activity provided excellent value to the customer but did have a modest impact on performance.

5 References

For additional Information:
SAP Co-Innovation Lab: https://www.sdn.sap.com/irj/sdn/coil
Progress Actional: http://www.actional.com
Forrester Research report "The Total Economic Impact™ of Progress Actional Management for Today's Interconnected Applications" can be found at: