

# PushT↓Test™

## A Soft-Appliance Solution to SOA Performance and Scalability

An Executive Summary for Primary Research Commissioned by Intel.

This paper introduces a new soft-appliance approach to building Service Oriented Architecture (SOA) services, and provides a methodology to evaluate the Intel® SOA Expressway runtime for developer productivity, performance, and scalability.



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World Wide Web: <http://www.intel.com/software/soae>

**Abridged Edition**

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## Revision History

Revision Number	Description	Revision Date
DRAFT V12	Completed Executive Summary and Performance Research Results including all 4 use cases	July 2008

# 1 **About this Document**

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This paper introduces a new soft-appliance approach for Service Oriented Architecture (SOA) enablement, and provides a methodology to evaluate the Intel SOA Expressway runtime for developer productivity, performance, and scalability

The audience for this document includes analysts, SOA architects and developers, and potential customers for the SOA Expressway product.

**Abridged Edition**

***This printed Abridged Edition is a partial printing of the full report. The full report from the PushToTest assessment of Intel SOA Expressway can be requested and retrieved on-line at <http://www.intel.com/software/soae>***

## 2 Executive Summary

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### 2.1 Summary Findings

PushToTest, the open-source test automation company, provides test tools, platforms, and methodology to medium and large enterprises needing to surface functional, load and performance, and business performance issues in Service Oriented Architecture (SOA), Web service, AJAX, and Web application environments. In 2007 PushToTest observed a trend among the 160,000 people in our open-source community. Software developers, QA testers, and IT managers are looking for a better way to develop, orchestrate, deploy, and manage services.

In his book, *FastSOA, the way to use native XML technology to achieve SOA governance, scalability and performance* (Morgan Kaufmann 2007), Frank Cohen of PushToTest writes:

Huge performance and scalability gains are possible when using service intermediaries that offer mid-tier service acceleration through caching, transformation, federation of data from multiple services, and intelligent service request routing.

The Intel SOA Expressway product is the first of a new category of SOA soft-appliance platforms to deliver service acceleration. A soft-appliance differs from a hardware appliance in that it offers XML and workflow acceleration using software alone, without specific hardware assist. To learn how this new entrant fairs in the real-world, Intel commissioned PushToTest to apply the PushToTest SOA performance and scalability test methodology to surface performance metrics possible with services built on the Intel SOA Expressway software product.

PushToTest observed Intel SOA Expressway performance above 5,000 transactions per second (TPS) in a variety of demanding use cases. This is on par with published reports of competing enterprise-grade SOA transformation and routing appliances.

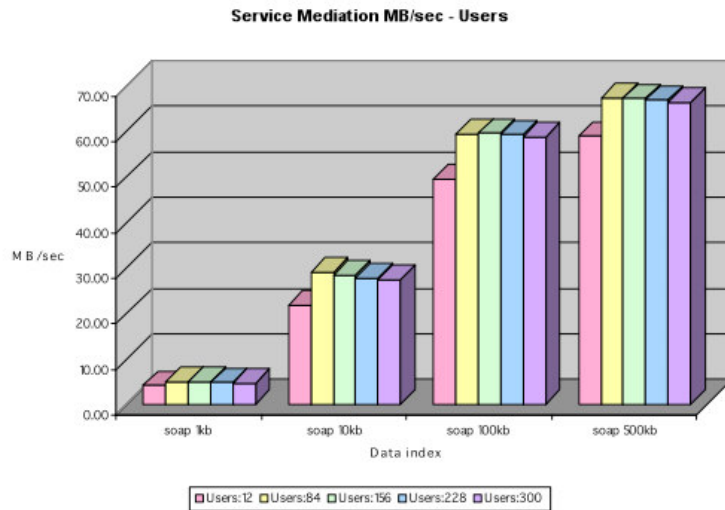
Upon reviewing the performance and scalability results delivered by the Intel SOA Expressway product, Cohen wrote in his blog:

The Intel SOA Expressway provides organizations with a good mix of features and performance for an enterprise-grade SOA development, transformation, and processing application. Architecturally the SOA Expressway platform is a good choice as it provides efficient native XML processing, offloads data transformation to a soft-appliance, and improves in performance from Intel's continued upgrade of the platform (both in software and multi-processor CPU improvements.)

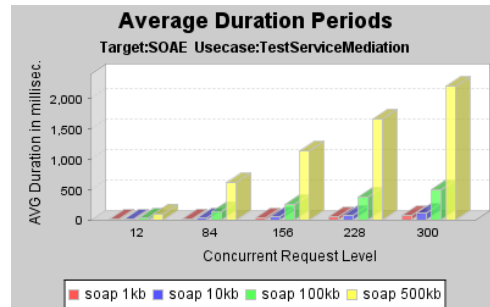
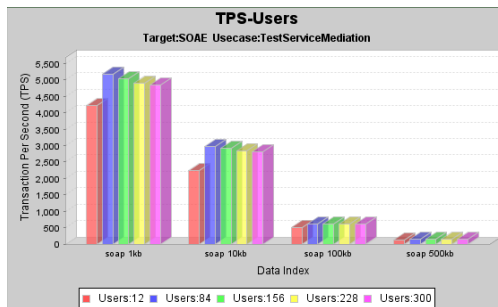
PushToTest operated tests of four scenario implementations. The following chart summarizes the scenario description and the best performance PushToTest observed on the establish hardware configuration for this test.

Scenario	Description	Best Performance Observed
Scenario 1	Mediation use case. Includes XSD validation, an XSL transformation, another XSD validation, a SOAP message generation, and payload driven content-based routing to the final service endpoint.	Maximum TPS: 5,184 Message Size: 1 K bytes (D0) Concurrent Request Level: 84
Scenario 2	Legacy-To-SOA Integration Use Case. Passes data through a HL7/EDI transformation, an XSL transformation with a XSD validation. Generates SOAP response and reply using MLLP.	Maximum TPS: 980 Message Size: 0.42K (D1) Concurrent Request Level: 84
Scenario 3	Security Policies. Decrypts and verifies a message, applies an XACML policy and use conditionals to send to different SOAP services.	Maximum TPS: 1,050 Message Size: 7.64 K (D0) Concurrent Request Level: 84
Scenario 4	Complex Asynchronous Workflow Use Case. The messages are delivered either using a JMS queue to understand the impact of a JMS store and forward queue on an asynchronous application.	Maximum TPS: 528 Message Quantity: 60,000 Message Size: 1 K bytes (D0)

The performance test surfaced scalability characteristics that are unique to Intel SOA Expressway. The following chart shows the MB/Sec behavior. This is calculated as the MB/Sec transmitted as part of the request in the test elapsed time. Throughput at the MB/Sec level improved as message size increased.



With its high throughput, SOA Expressway is a good fit for high performance enterprise processing requirements. The same research shows that the Expressway product throughput and performance varies with message size and number of concurrent requests. The following charts present the performance characteristic graphically.



The left chart is a measurement of Transactions Per Second (TPS) as measured at the client. The TPS measurements are grouped by message size (Data Index) from 1,000 bytes to 500,000 bytes. Within each group are TPS measurements at several concurrent simulated user levels from 12 to 300 users.

As expected from PushToTest research on similar products, we observe a steady decline in TPS levels as concurrent user levels and message sizes increase. This is a scalability pattern we observe in most SOA development platforms today. This is mostly caused by the SOA Expressway platform taking longer to process requests as user level and message sizes increase, as demonstrated in the above right-hand side chart.

Although communication I/O was not an issue, the actual message processing impacted the results. The use cases PushToTest implemented require manipulation of the XML message payload (transformation, mapping to XML, decrypting, and digital security signature verification) that are CPU intensive tasks. In these cases the tests operated at 75% or higher available CPU bandwidth. PushToTest observed that while communication and workflow execution may be highly optimized, the overall impact in transaction time (responsiveness) is bound to the CPU-intensive data manipulation processes.

The complex asynchronous workflow use case the SOA Expressway maintained good consistency in throughput. We measured 488 to 528 messages per second. Throughput is limited by the performance of the JMS store. In this study PushToTest used the Sun MQ product. PushToTest recommends careful study of JMS optimization to determine the results for your own environment. Recommendations about how to optimize a JMS deployment are available as a blog entry at the PushToTest web site.

PushToTest observes an architectural advantage to enterprise adoption of a soft-appliance. Intel SOA Expressway's packaging as a soft-appliance enables medium and large enterprises to standardize SOA development today and benefit from on-going improvements to Intel Multi-Core processors over time. Moreover, the soft-appliance form factor combines software flexibility and extensibility with appliance performance and management, a rare combination. Intel SOA Expressway is a unique way to put Moore's law to work to improve SOA performance and scalability.

## 2.2 Methodology, Use Cases, Tools

PushToTest's methodology for an SOA evaluation defines a use case with the following mandatory criteria:

- It is an orchestration of services,
- It is a long running process,
- The use case requires connectivity to JMS, SOAP services and others
- It uses medium to large payload sizes defined by complex schemata,
- It must be able to be instrumented as a scalability test,
- It uses services mediation action, including transformation and conditionals,
- It uses document-oriented container architecture.

The use cases defined in this project document show a technical team the performance characteristics of SOA Expressway in a modest hardware configuration. PushToTest analysts used PushToTest TestMaker 5.2 to conduct the performance tests and resulting analysis for this report.

PushToTest constructed use case implementations against the following scenarios:

- Scenario 1: Mediation use case. Includes XSD validation, an XSL transformation, another XSD validation, a SOAP message generation, content-based router (conditional end point addressing and invocation.)
- Scenario 2: Legacy-To-SOA Integration Use Case. Passes data through a CDE (complex data exchange) HL7/EDI transformation, an XSL transformation with a XSD validation. Generates SOAP response and reply using MLLP.
- Scenario 3: Security Policies. Decrypts and verifies a message, applies an XACML policy and uses conditional end point addressing to send to different SOAP services.
- Scenario 4: Complex Asynchronous Workflow Use Case. The messages are delivered either using a JMS queue to understand the impact of a JMS store and forward queue on an asynchronous application processed by SOAE.

PushToTest observed the following while constructing the use cases and working with the Intel SOA Expressway tools.

1. The use cases test different features supported in Intel SOA Expressway, including normal mediation and security, and special features like HL7 mapping and JMS support.
2. Intel SOA Expressway contains some configuration controls over connections and requests. This required special considerations when configuring tests with several users. One of the notable parameters is the number open connections and the limit of requests per connection (a great tool to stop Denial-Of-Service, DOS, attacks). Adjusting the clients and those parameters allowed the tests to run correctly.
3. Although communication was not an issue, the actual processing of messages impacted the results. Most of the features required manipulation of the message payload (transformation, mapping to XML, decrypting, sign verification, etc) and that those processing requirements were shown in the actual CPU consumption. This indicates that, even though the communication and workflow execution may be highly optimized, the overall impact in transaction time (responsiveness) is bound to those manipulation processes.
4. The most CPU consuming process may be the HL7 processing (complex data exchange transform) in test scenario 3. PushToTest observed performance numbers lower than a regular XML formatted message, even when those XML payloads were larger than the HL7 ones.

## 3 *For More Information*

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PushToTest is a software publishing and global services company specializing in business optimization and information systems test automation. Our expertise is put to work for enterprises needing to understand and solve scalability and performance problems in complex information systems, especially Web Services. PushToTest provides open-source SOA test automation tools for software developers, information architects, and CIOs. Details are found at <http://www.pushtotest.com>.

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Intel® SOA Expressway is a complete high-performance software runtime for Service-Oriented Architecture (SOA) enablement.

Intel SOA Expressway combines a high performance workflow engine and native XML acceleration with appliance manageability and codeless design for high volume, high throughput SOA integration and deployment scenarios

The unique soft-appliance form factor is optimized for Intel® Multi-Core processors such as the Intel® Xeon® 5000 Sequence as well as native support for Intel® I/OAT. For more details on Intel® SOA Expressway go to [www.intel.com/software/soae](http://www.intel.com/software/soae)