

ADVANCING SOA WITH AN EVENT-DRIVEN ARCHITECTURE

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Executive overview

In most organizations, events drive action. In financial services, for example, a stock dipping below a threshold price may trigger a sell order. In manufacturing, production may start when an order is received. In healthcare, an unusual increase in the number of patients registering in an emergency room could signal the start of a disease outbreak, calling for action on the part of medical staff and public health officials.

In all of these cases, a business process is started, stopped, or modified based on an event or series of events. The ability to realistically model event processing in software is a crucial capability for organizations that want to become more responsive to their customers and partners, and for achieving greater operational efficiency.

Service-oriented architecture (SOA) is a start in this direction. SOA delivers greater speed and flexibility for IT organizations that need to respond to changing business requirements. It also enables easier reuse of applications and data in multiple business processes, and greater accessibility to this information for users. And through reuse SOA helps free developers to complete more projects, reduce IT backlogs, and deliver additional value to the business. But without event-processing capabilities, an organization with service-oriented systems remains bound by the same limits as before - it can respond to a business event only as fast as its employees can discover the event, determine a course of action, and allocate resources to respond.

Adding event processing to an SOA, through an event-driven architecture (EDA), can take your organization beyond these limits. It will give your information systems the ability to sense and respond to events rapidly, either through an automated process or human interaction.

This white paper explains how InterSystems Ensemble enables you to create advanced SOA systems that include EDA, making it easier to respond quickly to significant business events, and giving you a competitive advantage.

What is EDA?

Unlike an SOA, where services must be aware of each other before interacting, the software components of an EDA do not need to interact directly. Instead, event producers and consumers interact via an intermediary – often a publish/subscribe event broker, enterprise service bus (ESB), or business process orchestration engine – without knowledge of each other. Event producers publish notification of events to the broker. Event consumers subscribe with the broker to receive events of interest as soon as they're published (or any other interval). Event consumers also may look for patterns of events, or patterns within events, and compute derived metrics that they can publish to the broker as well.

Based on event content, event-driven systems respond automatically by initiating a series of pre-defined actions. In some cases, the event-driven system will execute the entire series. In others, one of the actions may be to notify relevant personnel and wait for the result of their actions before proceeding with the next step. Users typically interact with an event-driven system through graphical dashboards or an alerting mechanism. Sophisticated event-driven systems enable drill-down into the real-time data behind dashboard notifications, and allow the user to directly affect the relevant applications.

Enhancing SOA with EDA

The move to enhancing SOA with EDA typically is a step-by-step journey. It begins with an organization's first SOA project and the implementation of a limited number of services. This enables it to start reaping the benefits of a more modular infrastructure, and encourages reuse of software assets, while it gains SOA development and deployment expertise. As more projects are completed, these organizations tend to increase the number of services deployed and build up their SOA management capabilities. In both of these stages, the SOA simply provides the functionality to coordinate a collection of loosely coupled or independent services through request/reply interactions.

Eventually, the need to identify, record, and respond faster to changes in the business environment leads the organization to include event-processing capabilities in its SOA systems. Often this is accomplished by adding the following capabilities to a basic SOA:

- Event processing with connectivity to a wide range of event sources and support for long-running business processes that can wait for the right conditions to occur before taking action. An effective event-processing engine should be able to process simple events – a single change in the state of a business process, and complex events – calculated as a pattern found in a series of events, or as a metric based on several events.
- Business Activity Monitoring (BAM) capabilities to create dashboards that report on events, business processes, and key metrics for tracking and enhancing business performance.
- Business rules featuring a high-level interface that allows analysts and other business users to define events and their associated actions.

The benefits of EDA

Event-driven systems are appropriate for handling business processes where awareness of change and rapid responses to that change are important. Responses can take a variety of forms. For example, event-driven systems can:

- Notify personnel of the event
- Take automatic (programmed) action in response
- Move on to the next step in a long-running business process
- Use the event as one input among many to determine that a “complex event” has occurred, and take action based on that value

In healthcare, for example, an event-driven bio-surveillance system might look for patterns in MRSA infection rates across a hospital. Any deviation from established goals would trigger an alert to management that action is required to prevent spread of the infection.

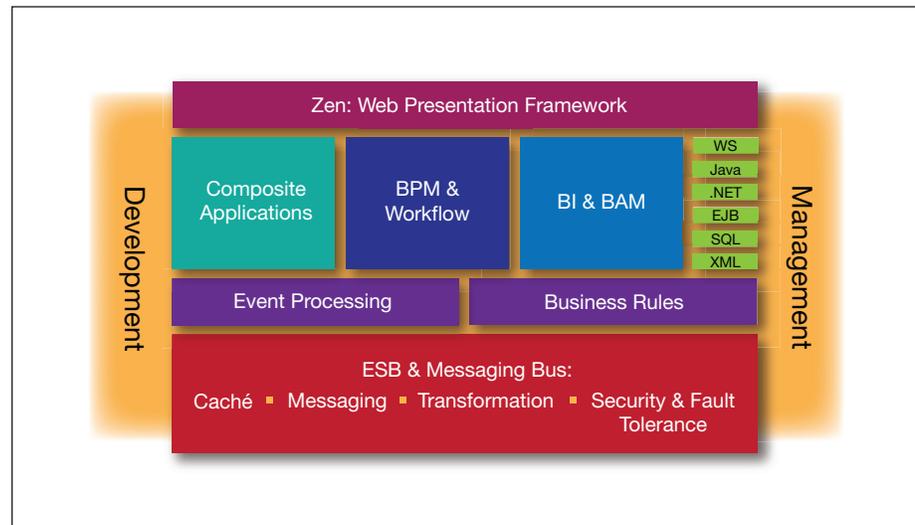
In financial services, changes in certain commodity prices might be a signal to buy or sell the stock of a company that is dependent on those commodities. An event-driven system tracking these events could make trades automatically to maximize profits before the situation changes yet again.

Another event-driven system in a hospital might look at the performance of the various laboratories the hospital uses, measured against established service-level agreements (SLAs) with those labs. Deviations from the SLAs would not only kick off alerts to hospital management, but also initiate programmatic changes in the automated business process that distributes lab orders. Orders to labs that are falling behind on test processing could be routed to labs that are on time, until the offending labs get back on schedule.

InterSystems Ensemble – the power of SOA and EDA in one cohesive package

InterSystems Ensemble takes a unique technological approach that simplifies the deployment of SOA and EDA solutions. It combines integration, SOA, and EDA capabilities in a single, coherent, and consistent platform for connecting people, processes, and applications within and between enterprises. With it, you can enhance existing service-oriented systems, or create entirely new solutions.

Ensemble has been recognized as one of the industry’s leading SOA platforms by industry experts, including Gartner, Inc. in its report, *Magic Quadrant for Application Infrastructure for SOA Composite Application Projects*.¹



Ensemble includes all the technology needed for efficient SOA and EDA development and deployment. In operation, Ensemble is a single technology stack with one consistent GUI and one rapid learning curve.

¹ *Magic Quadrant for Application Infrastructure for SOA Composite Application Projects*, Massimo Pezzini, Yefim Natis, Kimihiko Iijima, Daniel Sholler, Jess Thompson, Dale Vecchio, 19 December 2008.

Features and capabilities that make Ensemble the best foundation for making your SOA strategy even more effective with EDA include:

- **Enterprise service bus (ESB)** – At the core of Ensemble is an enterprise service bus that allows organizations to integrate and manage all of their SOA and non-SOA software assets. The Ensemble ESB includes:
 - A high-speed, highly reliable messaging and event-brokering engine
 - Message/data transformation
 - A mediation layer that allows legacy applications and services built with other technologies, such as Java and .Net, to connect to the SOA through the ESB
 - An embedded InterSystems Caché® database that automatically records all messages, events, and system interactions across the bus for easy debugging, reporting, and auditing

- **Composite application development and service creation** – Ensemble includes a rapid development environment that allows you to:
 - Create, deploy, and manage services
 - Wrap existing software assets, including legacy applications, within a Web service for control through Ensemble’s ESB and business process orchestration capabilities
 - Integrate data from multiple sources
 - Develop new, “composite” solutions that incorporate existing SOA or non-SOA applications
 - Use SOAP, XML, Web services, and other SOA technologies and standards
 - Incorporate additional technologies, standards, and enterprise applications into your solution through an extensive and extendable adapter library
 - Create rich Web user interfaces

- **Business process management (BPM)** – Ensemble provides features to monitor simple and complex processes with equal ease. The following capabilities make it possible to model, automate, and execute an event-driven business process:
 - **Business process design** – The Ensemble visual editor allows users to rapidly design and deploy business processes.
 - **Business process orchestration** – An architectural layer that is used to execute high-level business processes that span multiple external applications and ensure that each delivers its capabilities at the appropriate time. The orchestration layer transparently offers access to service-oriented applications and event processors, as well as to more traditional applications through their application programming interfaces.
 - **Workflow Engine** – Allows the seamless incorporation of human activities within automated business processes. Based on events, users can define a workflow that includes human interactions and the Ensemble Workflow Engine automates the distribution of tasks among users. In this way, Ensemble makes task assignment more efficient and task execution more accountable.

- **Business rules management** – Business rules allow non-technical users to specify and change the behavior of running business processes based on events. The logic of the rule is specified and changed using a simple forms-based interface, and changes take effect immediately. There is no need for programming or diagramming skills to change the rule, and there is no need to modify or compile production code.
- **Business activity monitoring** – Ensemble provides the ability to create Web-based corporate dashboards to display real-time information on business metrics and key performance indicators (KPIs). Dashboards can be quickly created using Ensemble's Web presentation framework and a complete set of built-in meters, such as speedometers, odometers, indicator lights, and charts.

The advantage of Ensemble's embedded database

Ensemble is a unique SOA and EDA platform because it includes an embedded InterSystems Caché high-performance object database. This database is at the heart of Ensemble's event-processing architecture. Ensemble stores all messages and events, including calculated complex events and metrics, in the database for ultrafast retrieval, display, and analysis. The high-performance database provides an efficient and common retrieval mechanism – multiple event consumers or business processes can use stored events or metrics without incurring the expense of recalculation.

The database provides additional, unparalleled EDA capabilities, including its tightly coupled execution environment and object storage. They are optimized for event-driven logic and operate in the same memory space for high-speed execution of Ensemble's messaging engine/event broker and business process orchestration engine, and for rapid response to incoming events.

Persisting huge amounts of messages and event traffic – without impacting overall system performance – clearly requires extremely high performance. The Caché database inside Ensemble has the proven capacity for terabytes of data, tens of thousands of concurrent users, and millions of database operations per second. It is installed worldwide in some of the most demanding IT environments in health-care, government, financial services, and telecommunications.

Taking the first steps toward SOA with EDA

Whichever EDA platform you choose, it should give you the ability to start small by tracking and acting on a limited number of events, while providing the performance, scalability, and reliability to support the growth that will inevitably come. The platform should provide state-of-the-art SOA, EDA, BPM, integration, and development functionality – and provide a single, cohesive technical foundation for ease of use and speed of development. This will make the creation of advanced SOA/EDA systems as natural as creating a traditional application. Composition and orchestration, business process modeling, event processing, workflow, dashboards, and user-modifiable business rules will become a regular part of your development discipline. And management's use of event dashboards and other alert mechanisms, with the ability to act immediately on this information, will become a regular and trusted part of managing, improving, and growing your business.

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