

IBM solutions
To support your business objectives



ENTERPRISE FOUNDATION FOR SENSOR EVENT SOLUTIONS

IBM WEBSPHERE SENSOR EVENTS

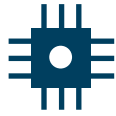




ENTERPRISE FOUNDATION FOR SENSOR EVENT SOLUTIONS

Sensor Solutions in a smarter planet

Smarter planet initiatives are central to the enormous efforts underway at IBM to create new opportunities and value for our clients. These initiatives serve both to recognize where technology is already shaping our interactions with the world — and also in a set of activities to advance those interactions by providing a new vision into the world around us. Whether we are talking about a smarter traffic system in Stockholm, smarter supply chain management at Metro Group in Düsseldorf, smarter railway systems developed at the IBM Global Rail Innovation Center in Beijing, or smarter water management for the Hudson River, the common, fundamental principle is similar. Each of these solutions is based on the observation and processing of sensor data to extract insights about the physical world, and take the appropriate action based on the business opportunity or risk. IBM Sensor Solutions provide visibility to the physical world, integrating the various types of sensor data to enable us to become more instrumented, more interconnected and more intelligent. Let's examine how IBM WebSphere® Sensor Events participates in these critical aspects of smarter planet initiatives.



WebSphere Sensor Events integrates and derives the actionable events from a range of sensor devices. This in turn supports business processes that can take advantage of the access to new types of data and deliver new sense-and-respond capabilities. There are many new opportunities to make the most of information from a broad range of sensor data. These include monitoring condition data (such as temperature, humidity, shock and vibration); location-tracking data such as fleet monitoring, hospital asset tracking, warehouse management, personnel safety and security; and finally, identification for use in physical gateway or threshold boundary tracking such as supply chain monitoring, inventory, work in process, and usage. All of this data creates an opportunity to identify new insights into the environment in which our world works, how businesses operate, and how to capitalize on these insights by optimizing the responsiveness to rapidly changing situations. WebSphere Sensor Events is an integration platform that provides the infrastructure to collect, filter, and analyze this data, and turn it into the actionable events that drive business responsiveness to real world opportunities and risks.

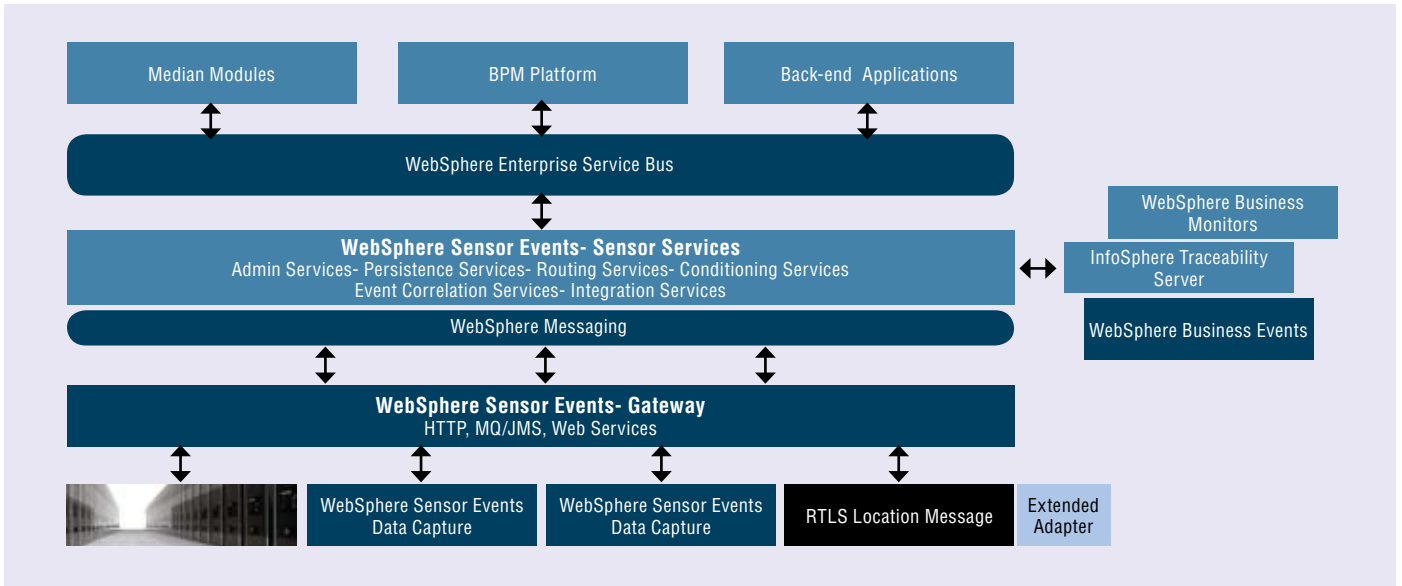


WebSphere Sensor Events is used in solutions across a spectrum of industries and smarter planet initiatives. While extending the value of an integration platform that can be used to connect to sensors to collect new data, WebSphere Sensor Events also provides the integration infrastructure to connect that data to business processes. WebSphere Sensor Events provides the framework to normalize both the sensor event data and the operations of sensor-control services. It uses industry standards where available, so that businesses can easily and reliably connect with these new sources of data. However, interconnectivity doesn't focus solely on sensor integration. Customers can use the business observations derived from these new data sources both within their enterprise or extended to trading partners across the globe.



Business solutions often make use of multiple component products and applications. WebSphere Sensor Events acts as the dissemination point for analyzed events to be integrated across multiple applications or product boundaries. Without this capability to manage data across multiple integration points, there is a risk of generating "silos of automation" within specific vertical applications.

As described, WebSphere Sensor Events links the instrumented data and provides interconnectivity services to collect and process that data. A key to deriving business value from a collection of raw event data is the process by which business-actionable observations are derived from that data. The derived intelligence are business outcomes like asset utilization of containers, freshness of food or lowering of inventory or work in process. Intelligence is the outcome of the analysis of sensor data.



High level architecture diagram for WebSphere Sensor Events showing event runtime infrastructure.

WebSphere Sensor Events is in use in deployments around the world to provide the framework on which that analysis is performed. Working closely with WebSphere Business Events, users can define and detect event patterns that allow lines-of-business personnel to establish and refine the business rules that identify business events from a continuous flow of sensor event data. Business process execution and monitoring is provided by a suite of IBM software products that can respond to these identified business events. With this intelligence, companies can sense and respond to opportunities and risks as they happen, in near real-time.

Instrumentation, interconnection and intelligence are brought together to help customers make the right decision at the right time to transform their businesses.

WebSphere Sensor Events provides the middleware platform to reach out to that sensor-based, real-time data, to provide the event analysis that derives business events from sensor events, and to integrate those business events into business processes based on a service oriented architecture (SOA).

WebSphere Sensor Events: Enterprise Foundation for Sensor Event Solutions

In an event-driven system, events are produced and published out on a common channel where interested subscribers can receive and react to them. Event processing is very loosely coupled and often distributed. Neither the event producer nor the event itself participates in the determination of any subsequent execution processing. This processing flow is strictly determined by the event consumers and the actions they take.

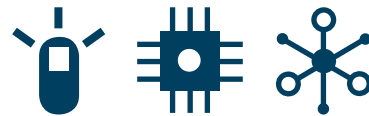
WebSphere Sensor Events supports the event-driven architecture with critical components that comprise key aspects of the event system. Let's take a look at how that occurs in the context of the high level WebSphere Sensor Events architecture shown in this diagram.

Events can be generated from a wide variety of sources including radio frequency identification (RFID) sensors, other sensors (such as temperature, shock, or humidity), health monitors, applications, services, business processes, and alert or notification systems. Events can be screened, filtered, aggregated, annotated or augmented as part of the system's simple event processing phase. In the WebSphere Sensor Events architecture, this simple event processing is typically performed at the data capture layer.

The data capture component of WebSphere Sensor Events manages the direct integration with the sensor devices and pushes the event data onto the server event processing channel. Simple event processing such as filtering, aggregation, and validation in data capture can optimize processing on event data to support highly interactive local behavior and also minimize unnecessary traffic to the server. Consistent with the event model, the event source is responsible for asynchronous delivery of event messages on a frequency that it determines.

In the diagram above, we see that the data capture environment is intended to run in a distributed model and close to the event data sources. The data capture environment provides a runtime platform based on Java™ that executes on device controllers to support critical application logic that can benefit from close physical proximity to the sensor event devices. With data capture, that application logic can be written in Java and deployed on a wide range of controller devices — while providing native communication support to an increasing number of sensor event devices and device types. One family of sensor devices is RFID readers. However, sensor devices are not limited to RFID. They can include environmental sensors, location sensors, optical sensors, acoustic sensors and many others. Data capture provides the runtime framework that can be extended to support these types of devices. With data capture, a common Java application programming interface (API) insulates the application logic from the device-specific API or protocol.

Data capture provides that native device communication and mapping to the common API. It also provides a set of common low-level services to act on that sensor data (such as event filtering and aggregation). Beyond that, it provides a reliable messaging transport of the sensor data back to WebSphere Sensor Events in a common format and protocol. Data capture runs on OSGi to support the distributed runtime environment. WebSphere Sensor Events manages the configuration definition and software loading of the distributed data-capture environments.



In event-driven systems, event sources and event listeners are generally loosely coupled. Therefore, an understanding of the format of the event data is critical to event processing. Events that are generated in non-compliant formats must be converted before being placed on the event notification channel prior to processing. In WebSphere Sensor Events, the event format is defined within a Common Base Events (CBEs) structure. CBE defines a common header with a generic payload. Payload format extensions are fully supported.

WebSphere messaging is used as the underlying messaging engine for event processing. Sources generate event messages that are ultimately published to the bus through the Sensor Events gateway. The gateway is responsible for parsing the incoming event message, converting the CBE message into an object, and publishing that object on the bus with the appropriate topic name (as dictated by specific CBE header values). Services that have been configured to listen to messages on the bus can consume those messages, deliver specific functional value, and perhaps republish messages back on the bus that have been refined or enriched. These messages may also be published with a different topic name so that they can be consumed by different message services.



Event processing occurs asynchronously and immediately when events are published to the bus. WebSphere Sensor Events provides a set of event processing services that can be invoked through a messaging interface (through Message Driven Beans, which consume messages as they are published to the bus), an Enterprise Java Bean (EJB) interface, or through a Web Services interface.

An Enterprise Service Bus (ESB), such as WebSphere Enterprise Service Bus can be used with mediation flows that can invoke the services that are delivered with Sensor Events. WebSphere Sensor Events delivers a set of event services that are available for external execution through their defined Web Services interface.

Business Event Processing (BEP) engines manage the logical processing of events in order to recognize patterns and invoke actions based on defined rules. Those actions can specify that a specific business process is invoked, that a service is called, or that derived events are generated and put back into the system for further processing. BEP engines have sophisticated techniques for event correlation. These techniques are based on pattern matching and event definitions and may be spatial or temporal. Events happen in real time and the business rules need to be flexible enough to change which patterns of events should invoke specific business processes.



WebSphere Business Events is bundled with WebSphere Sensor Events to provide the BEP capability to recognize event patterns and create an abstracted business event or directly execute a business process. Within a WebSphere Sensor Events deployment, WBE is integrated on the event messaging infrastructure and detects event patterns based on its rule definitions.

Through a defined set of rules, those events are analyzed and correlated to trigger specific actions or generate derived events. These in turn contribute to further analysis and correlation. Using this approach, analysis on low-level events can progressively generate higher-level business events; or it can invoke business processes. Similarly, high-level events can be decomposed into one or more low-level events or actions — for example, changing a pressure control valve; sounding an alarm or signaling an alert.

WebSphere Sensor Events provides a set of business-level event services that can be invoked from processing within WebSphere Sensor Events or from external business processes through their Web service interface. These include services for event data persistence, event format conversion, integration with the complex event processing engine, administrative services, and others. Business-level components integrate on the bus through the publish/subscribe model and can also be invoked from a business process. Over time, the collection of services will expand to support industry solutions as well as cross-industry generalized business services. Invocation of any given service will, in many cases, result in derived events being published out on the bus. So these services provide an explicit business function as well as providing an interaction point for generating new business events for further event-based processing.

WebSphere Sensor Events provides an integration framework into the WebSphere Business Process Management suite of products. As we have discussed, WebSphere Sensor Events provides a set of business-level Web services that can be invoked from processes within the BPM products. For example, a business process defined using BPEL and executing within WebSphere Process Server can invoke WebSphere Sensor Events services. The entire business process can be modeled and monitored using the appropriate BPM tools.

In addition to providing services to be used by business processes, WebSphere Sensor Events services can also invoke business processes. As sensor data is analyzed and correlated, business events will be identified and business processes will need to be invoked. WebSphere Sensor Events can provide this capability through the mediation capability of WebSphere Enterprise Service Bus. The details of external process invocation are mediated to insulate protocol and format differences. In addition, WebSphere Sensor Events provides integration services to integrate event messages directly with WebSphere Business Monitor, IBM InfoSphere™ Traceability Server and WebSphere Business Services.

Conclusion

An event-driven architecture supports loosely-coupled component interaction, which in turn supports an asynchronous publish-and-subscribe pattern. Smarter planet solutions using and responding to real world information require the combination of both event-driven systems and SOAs.

WebSphere Sensor Events provides a middleware platform to support enterprise integration of real-time event data. WebSphere Sensor Events takes full advantage of SOA for business process execution. It does so by integrating into process flows and exposing critical business-level capability as services with the WebSphere Sensor Events infrastructure.

This capability is critical to monitoring the physical world, integrating the various types of observed sensor data, and then deriving actionable events to support business process changes that are inherent and fundamental to Smarter Planet™ initiatives.



For more information

The WebSphere Sensor Events Web site is available at:

ibm.com/software/integration/sensor-events/index.html

For more information about WebSphere Sensor Events, see the Information Center at:

ibm.com/infocenter/pvcsensa/v6r2m0/index.jsp

Information on IBM Sensor Solutions is available at:

ibm.com/sensors

Information on Service Orient Architecture is available from IBM at:

ibm.com/software/solutions/soa/

Information on WebSphere Business Integration products can be found at:

ibm.com/software/info1/websphere/index.jsp?tab=products/businessint

Information on the WebSphere family of products can be found at:

ibm.com/software/websphere/



© Copyright IBM Corporation 2009

IBM Corporation
Software Group
Route 100
Somers, NY 10589
U.S.A.

Produced in the United States of America
09-09
All Rights Reserved

IBM, the IBM logo, ibm.com and Smart SOA are trademarks of International Business Machines Corporation in the United States, other countries, or both. If these and other IBM trademarked terms are marked on their first occurrence in this information with a trademark symbol (® or ™), these symbols indicate U.S. registered or common law trademarks owned by IBM at the time this information was published. Such trademarks may also be registered or common law trademarks in other countries. A current list of IBM trademarks is available on the Web at "Copyright and trademark information" at ibm.com/legal/copytrade.shtml.

Other company, product and service names may be trademarks or service marks of others.

IBM provides this publication "as is," without warranty of any kind, express or implied, including the implied warranties of merchantability or fitness for a particular purpose. Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions; therefore, this disclaimer may not apply to you.

IBM reserves the right to change specifications or other product information without notice. This publication could include technical inaccuracies or typographical errors.

References to IBM products and services do not imply that IBM intends to make them available in other countries.

The IBM home page can be found at ibm.com.