SOA Pattern: Event-Driven Messaging

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lean • enterprise • middleware

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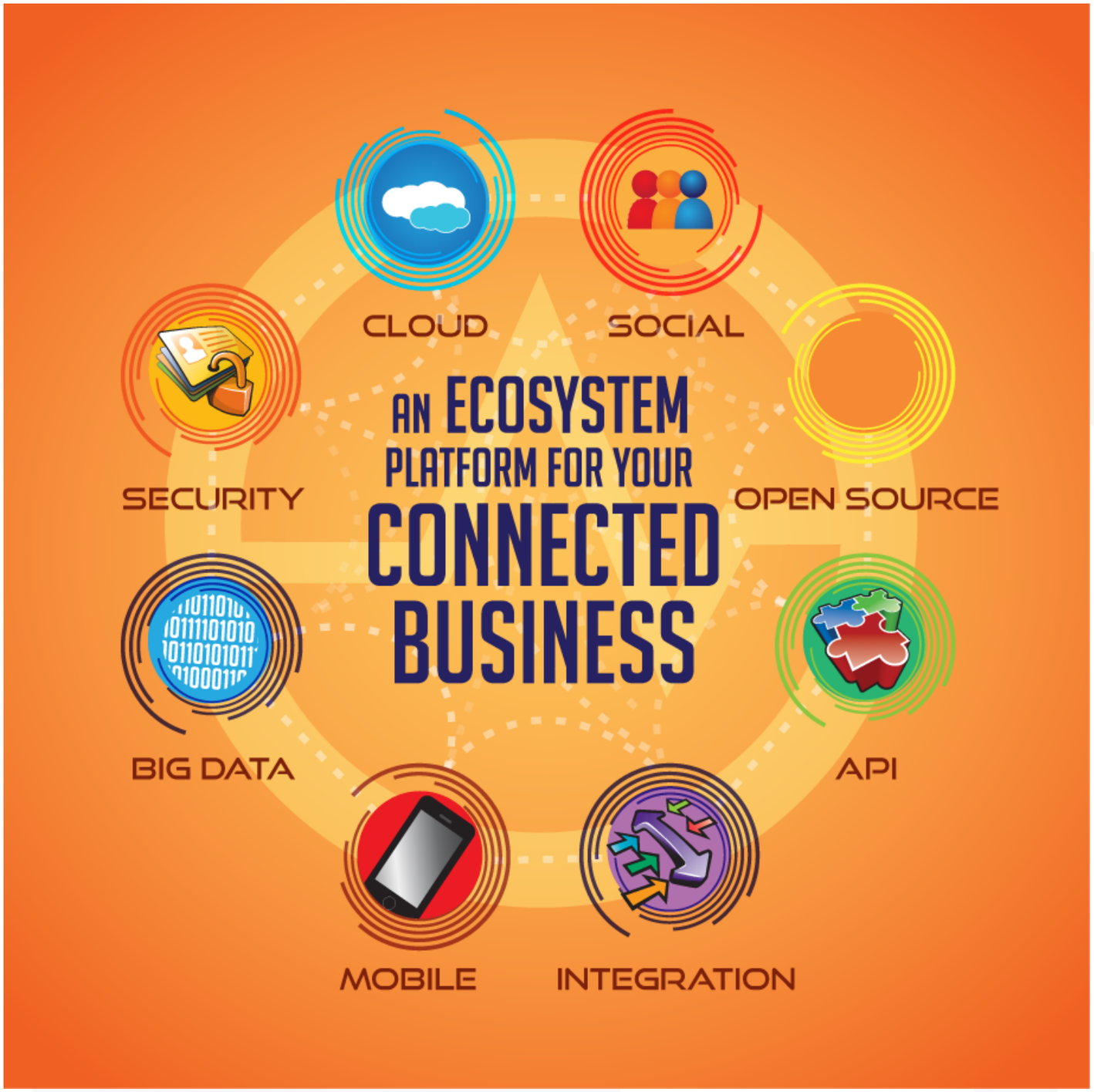
About the Presenter(s)

- Dakshitha Ratnayake
- Associate Technical Lead – Technical Sales
- Experience with Java/J2EE technologies in the fields of health-care information systems and content management systems for telecommunications providers prior to her employment at WSO2.
- Prior to joining the Solutions Architecture team she worked with the WSO2 Developer Studio team.
- Chathura Kulasinghe
- Solutions Engineer
- Experience with Java/J2EE, .net based enterprise (banking) applications design and development prior to his employment at WSO2.
- UX design and iOS app development.
- He has also contributed to the developments of the WSO2 App Factory.

About WSO2

- Global enterprise, founded in 2005 by acknowledged leaders in XML, web services technologies, standards and open source
- Provides only open source platform-as-a-service for private, public and hybrid cloud deployments
- All WSO2 products are 100% open source and released under the Apache License Version 2.0.
- Is an Active Member of OASIS, Cloud Security Alliance, OSGi Alliance, AMQP Working Group, OpenID Foundation and W3C.

- Driven by Innovation
  - Launched first open source API Management solution in 2012
  - Launched App Factory in 2Q 2013
  - Launched Enterprise Store and first open source Mobile solution in 4Q 2013



What WSO2 delivers

Overall Presentation Goals

- Understand Event-Driven Architecture (EDA) and Messaging
- Understand the benefits of EDA and how it fits into SOA
- How CEP extends EDA
- Introduce how EDA and CEP concepts are supported through the WSO2 platform
- Demonstration of an event-driven messaging scenario

What is an Event?

Image Source - http://www.flamemedia.com.vn/images/slide/ticketing-header.jpg

Definition of an Event in Event Architecture

- A set of information (properties) about an object (or objects) at a given time
- Usually encapsulated as a message

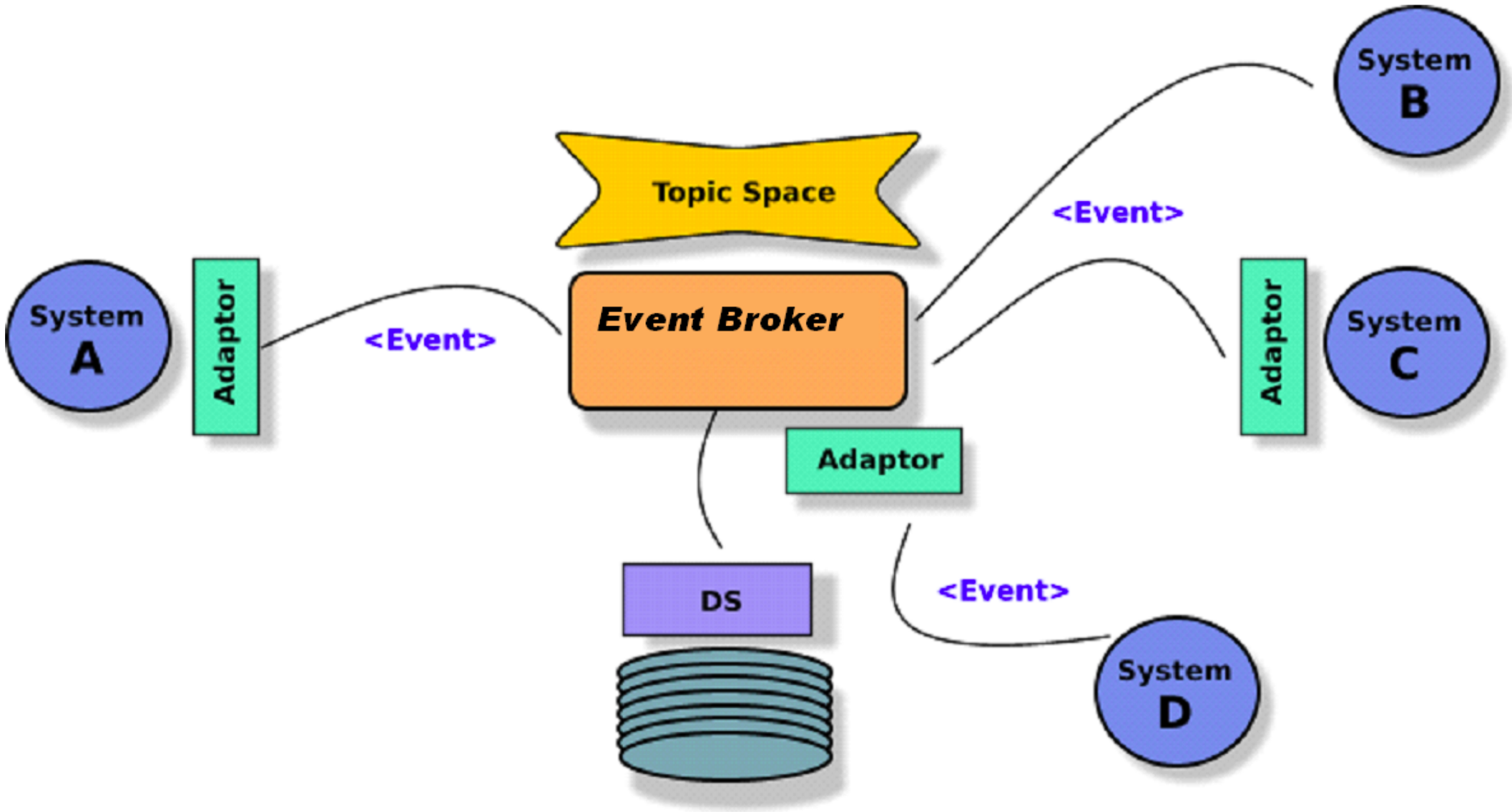
Event Characteristics

- Represents a change in state
- Self-contained
  - A pure and complete representation of a specific event
  - No references to other data sources
  - Reduces dependencies, loosens coupling
- Uniquely Identifiable
  - Enables idempotent handling of events
  - Allows correlation with related events
- Time relevant, not time sensitive
- Sourced using messaging
- Observable
  - Published events can be observed by multiple subscribers
  - Event stream processing

Event Driven Architecture (EDA)

- A method of building enterprise systems in which events flow between decoupled components and services
- A maintainable, sustainable, and extensible model for building complex, distributed applications
- Well suited for asynchronous, unpredictable environments

Event Driven Architecture



Publish / Subscribe

- A distribution model for events
- Events are tied to some logical model - “Event Streams” / “**Topic**” **(the most used model)**
- A Topic is a tree-based model or namespace that makes it easy to organize Events

Event Producers and Consumers

Event Producers/Generators/ Sources

- Publish messages representing an event
- Often oblivious to the consequences of the generated event

Event Consumers/Subscribers/ Sinks

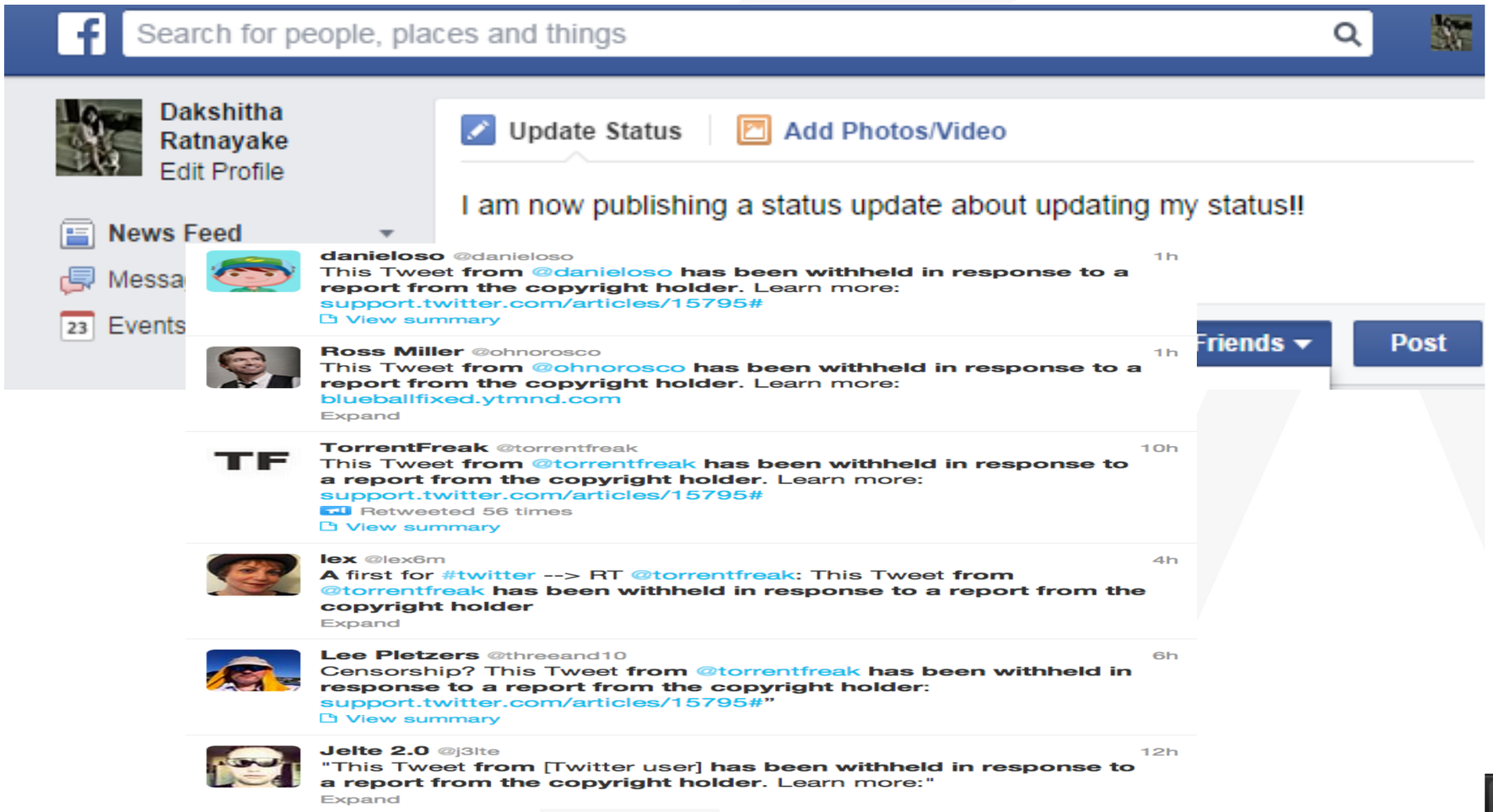
- Subscribe to events by topic/type/ selector
- Handle events asynchronously
- No performance penalty for additional consumers

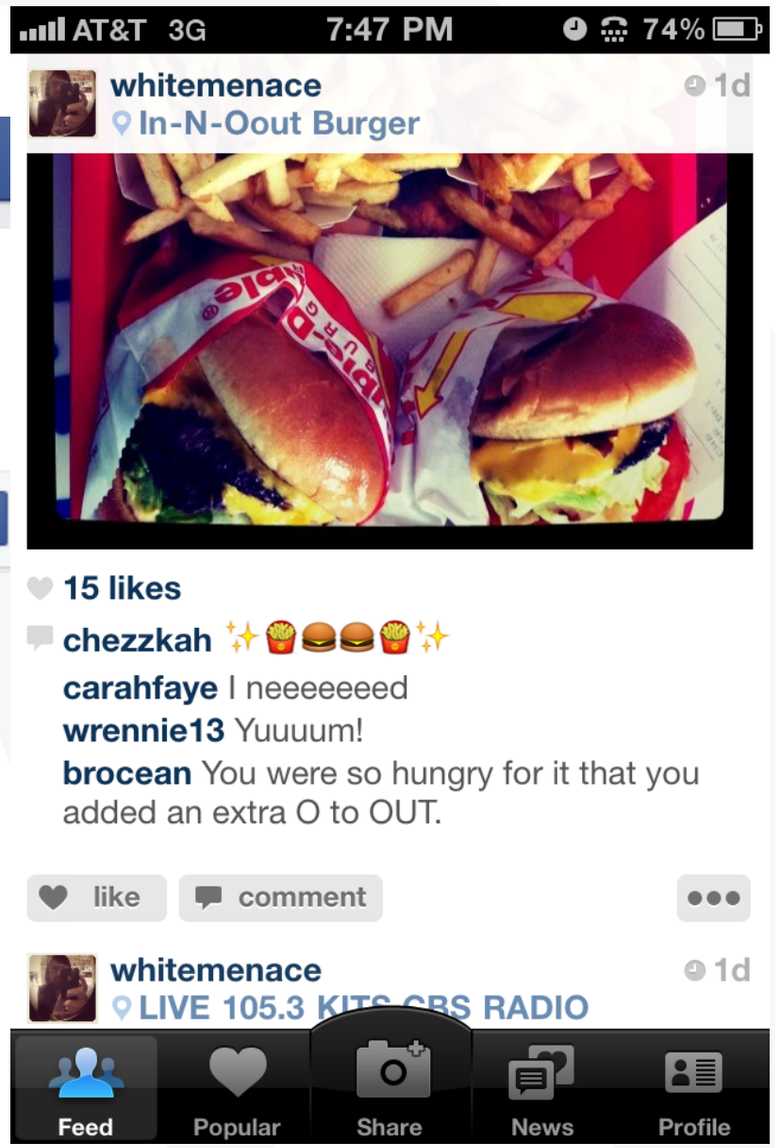
Why is EDA attractive?

- Incredibly loosely coupled
  - The sensor doesn't need to be aware of the actuator
  - The actuator doesn't need to be aware of the sensor
- Events can be re-distributed
  - The topology can change
- New actuators or sensors can be added seamlessly
- Topic or Event Streams give the ability to self-organize

Examples: Event Based Models

- Publisher updates Facebook status -> Subscribers' Facebook walls display Publisher's status update
- Same goes with Twitter, Instagram etc.





- Older models: nntp, irc, mailing lists

How is EDA different from SOA?

Another Architecture?!!!?

Service Oriented Architecture

- Applications are composed at design-time
- Linear flow between services
- Predictable behavior
- Request/Response is common, overused

Event Driven Architecture

- Applications are composed at run-time
- Asynchronous components
- Reactive behavior
- Natural fit for distributed systems

EDA Complements SOA!

SOA Pattern: Event-Driven Messaging

EDA Complements SOA!

- **Problem:** *How can service consumers be automatically notified of runtime service events?*

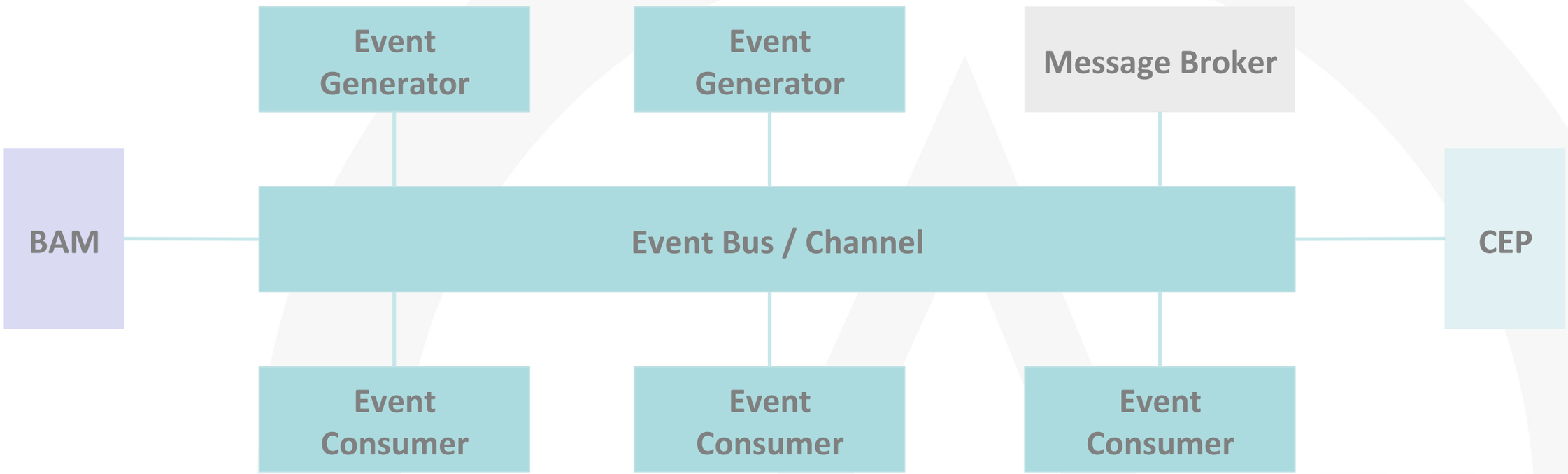
- **Solution:** *The consumer establishes itself as a subscriber of the service. The service, in turn, automatically issues notifications of relevant events to this and any of its subscribers.*

- **Application:** *A messaging framework is implemented capable of supporting the publish-and-subscribe MEP and associated complex event processing and tracking.*

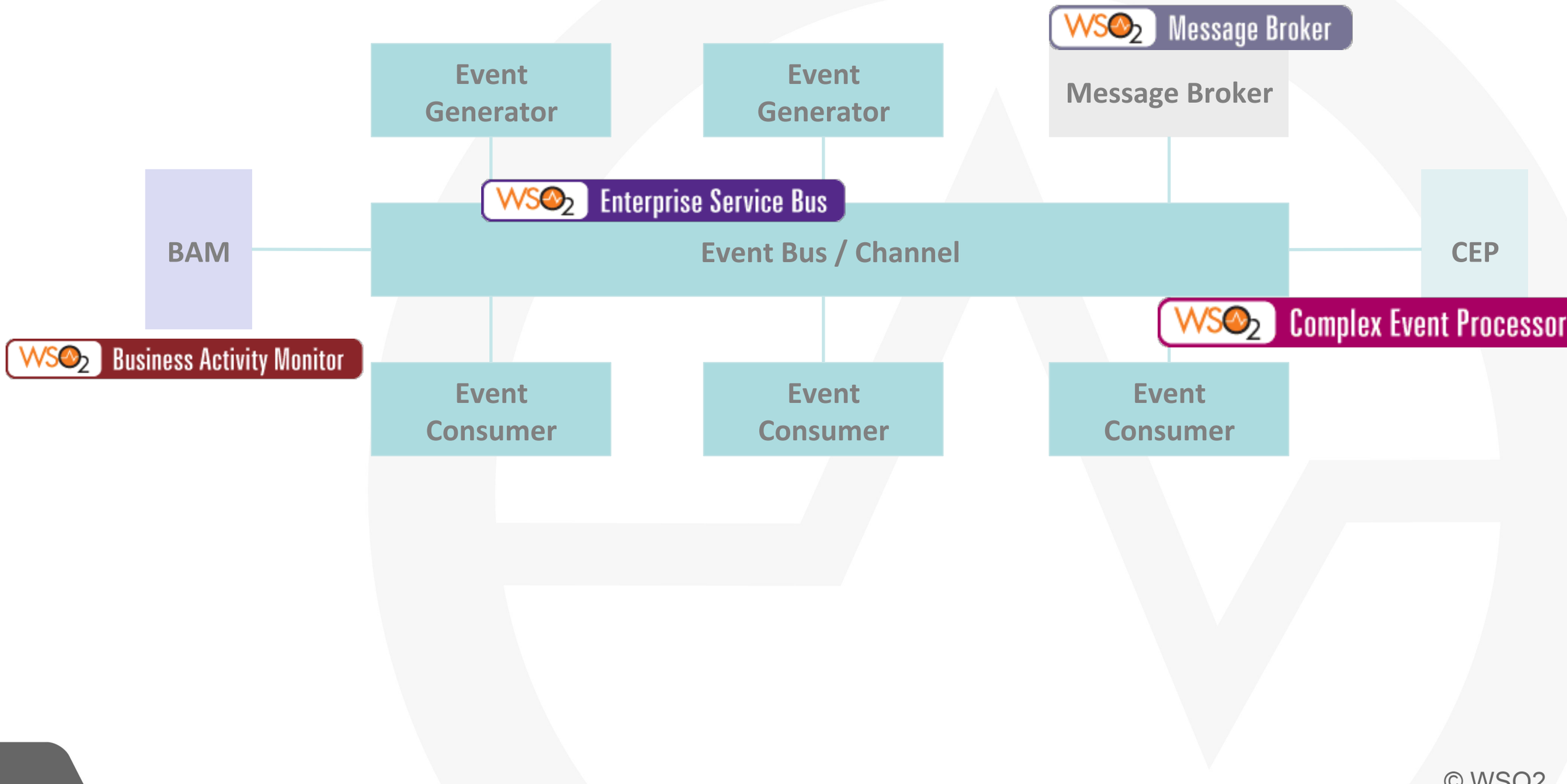
Event Transports

- JMS
- WS-Eventing / SOAP
- Stomp/…/…
- AMQP
- XMPP
- MQTT

EDA with SOA



EDA + SOA with WSO2

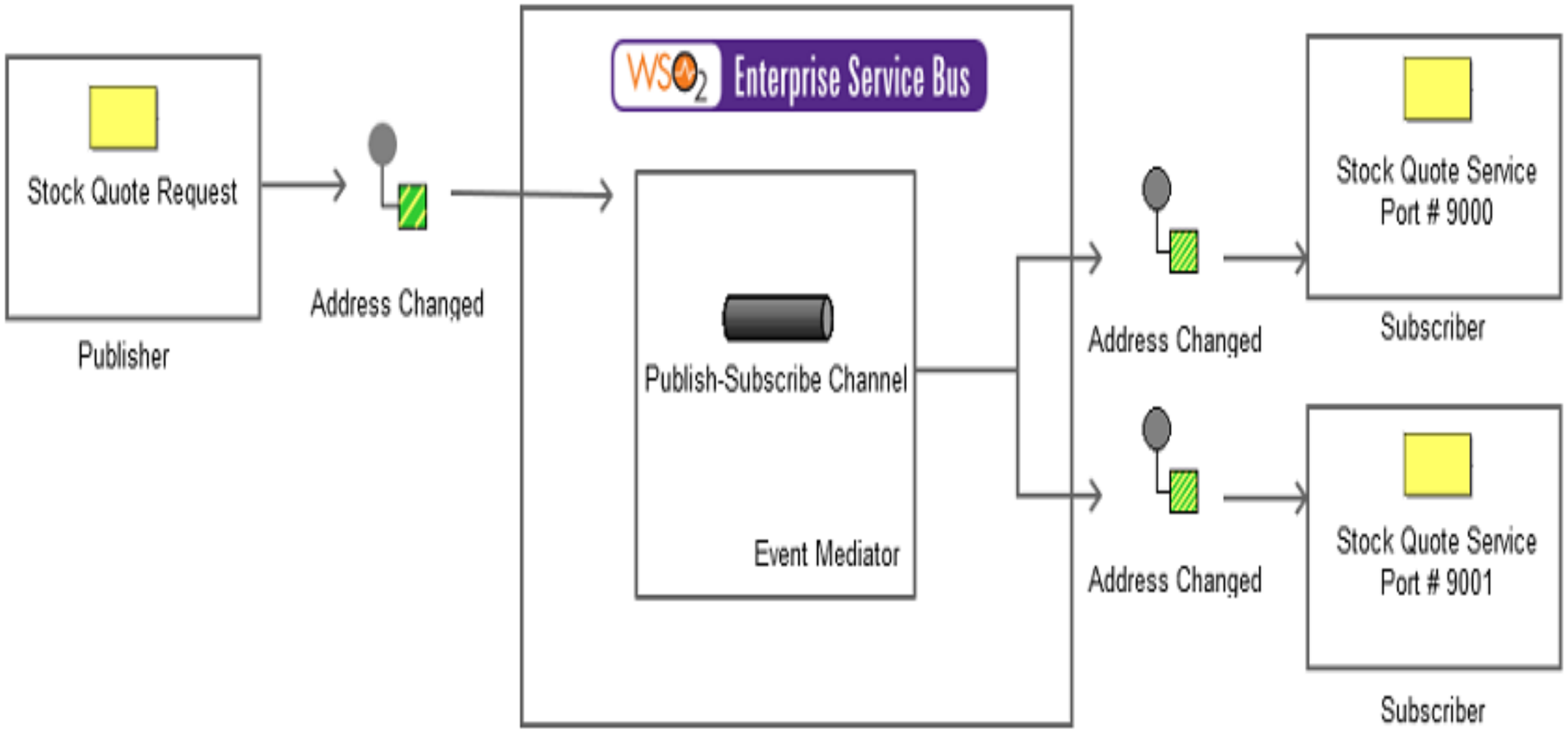


Event Bus / Channel

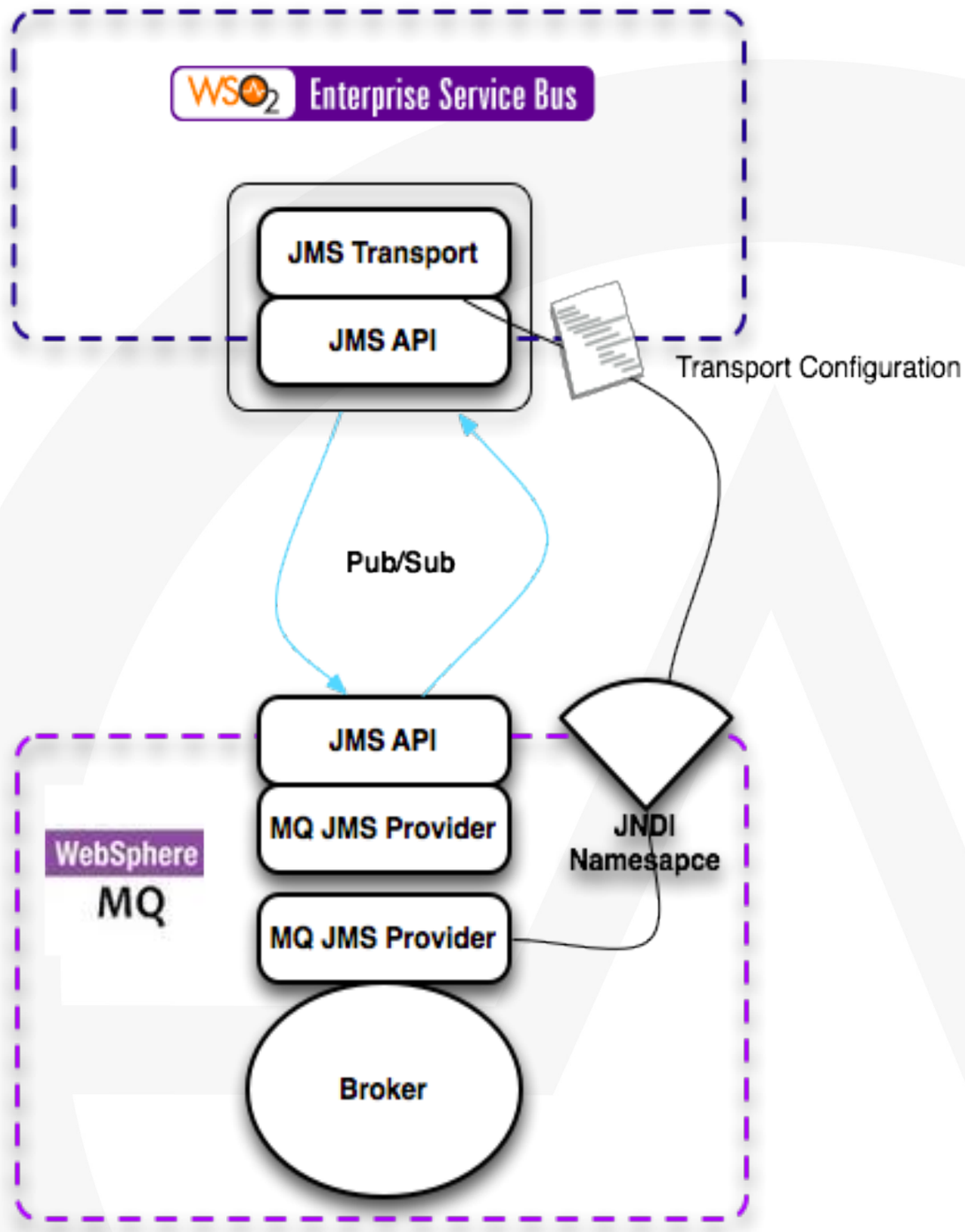
- Usually an Enterprise Service Bus
- Emitters and consumers connected through the bus
- Different interfaces / message formats
- Generating events from the bus itself
- Integrating non-event based systems

- ***WSO2 ESB***
  - *WS-Eventing based interactions / integrations*
  - *Transforming to and from WS-Events and general triggers*
  - *Reliable delivery with a JMS broker*

Pub/Sub with WS-Eventing



Pub/Sub with JMS

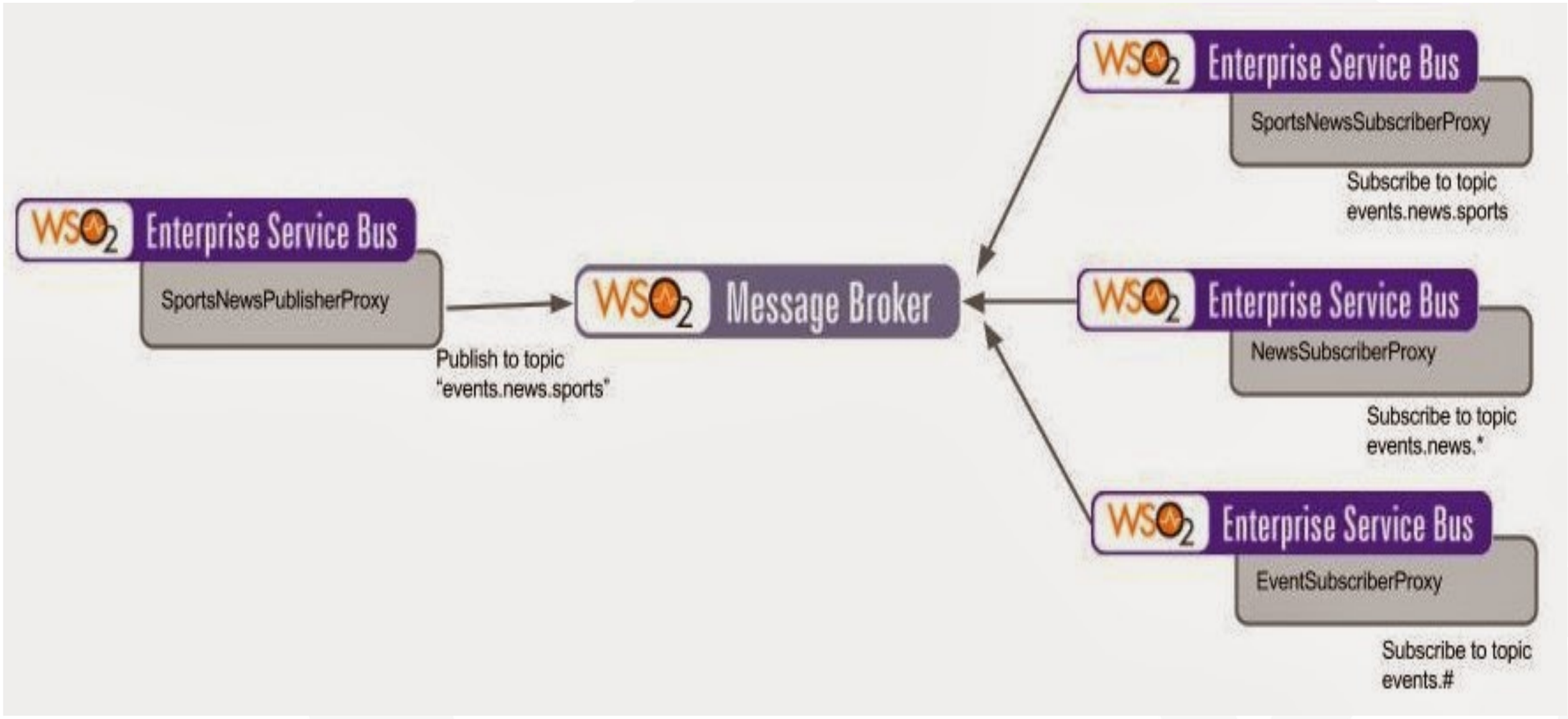


Message Broker

- Supporting different messaging patterns
- Queue based and pub/sub
- Reliable delivery of messages/events

- ***WSO2 Message Broker***
  - *Support for JMS v1.0 and v1.1 API and Advanced Message Queuing Protocol, the only industry standard protocol for interoperable reliable messaging*
  - *Interoperability with many languages / platforms via AMQP clients for Java, .Net, C, C++, PHP, Ruby and more*
  - *Support for in memory message store to improve performance.*
  - *Scalable, distributed message storage based on Cassandra*
  - *Distributed queuing*

Pub/Sub with WSO2 ESB and WSO2 MB



Event Processing

- **Simple Event Processing**
  - Acting on single events
  - e.g. a <filter> in the ESB or Is this a gold or platinum customer?
- **Event Stream Processing**
  - Looking across multiple events
  - Finding patterns – e.g. the CPU utilization has been more than 90% for the last 10 minutes
- **Complex Event Processing**
  - Looking across multiple event streams
  - e.g There has been a significant increase in overall trading activity AND the average price of commodities has fallen 2% in the last 4 hours

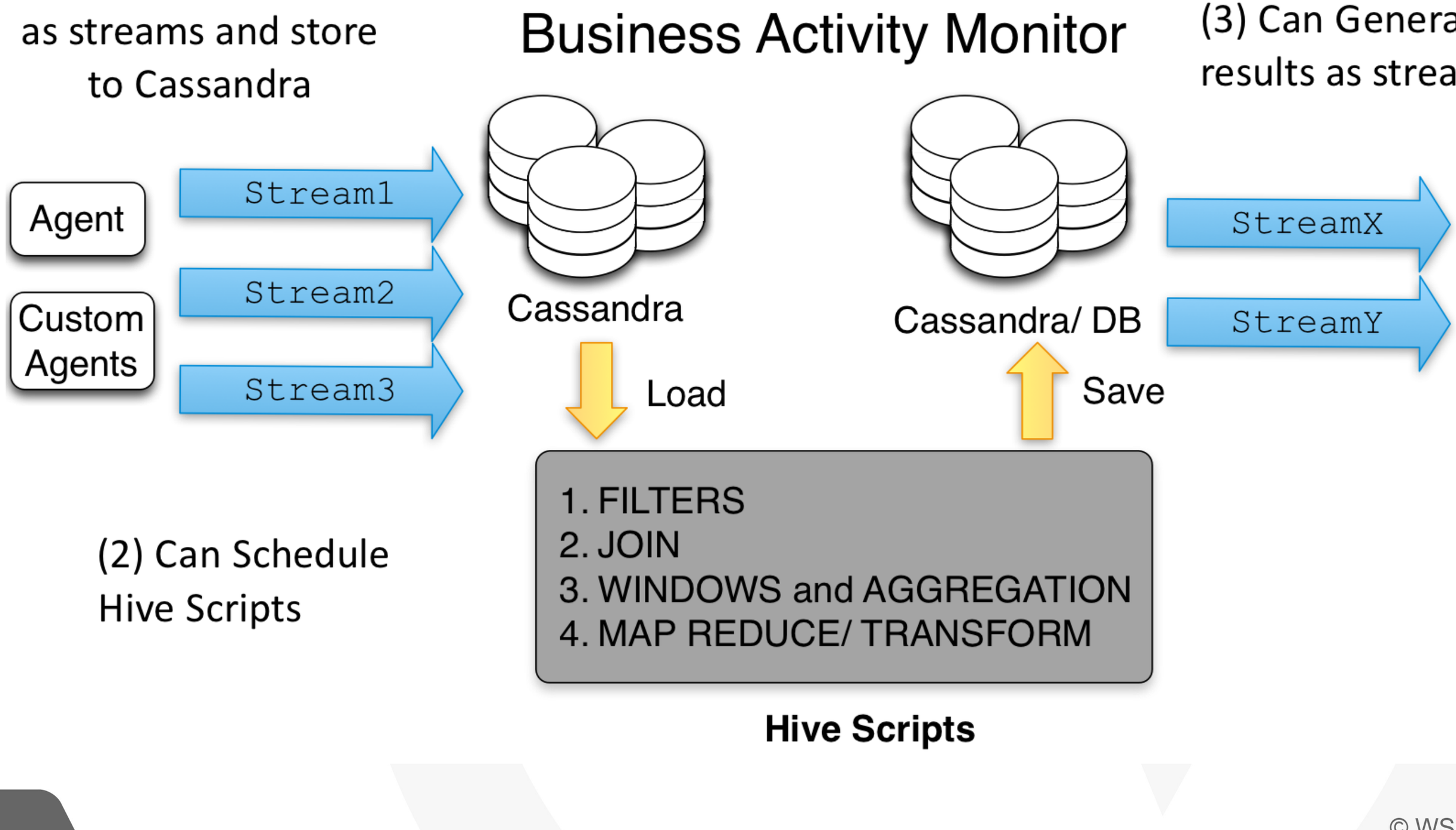
Business Activity Monitoring

- Monitoring end-to-end business message flow
- Identifying/collecting/tracing business transactions

- *WSO2 BAM*
  - *Scalable analytics using Hadoop*
  - *Scalable data storage model, Cassandra*
  - *Flexible deployment model (external Hadoop cluster and external Cassandra ring)*
  - *Intuitive and powerful dashboards*

WSO2 Business Activity Monitor

(1) Receive events as streams and store to Cassandra



(3) Can Generate results as streams

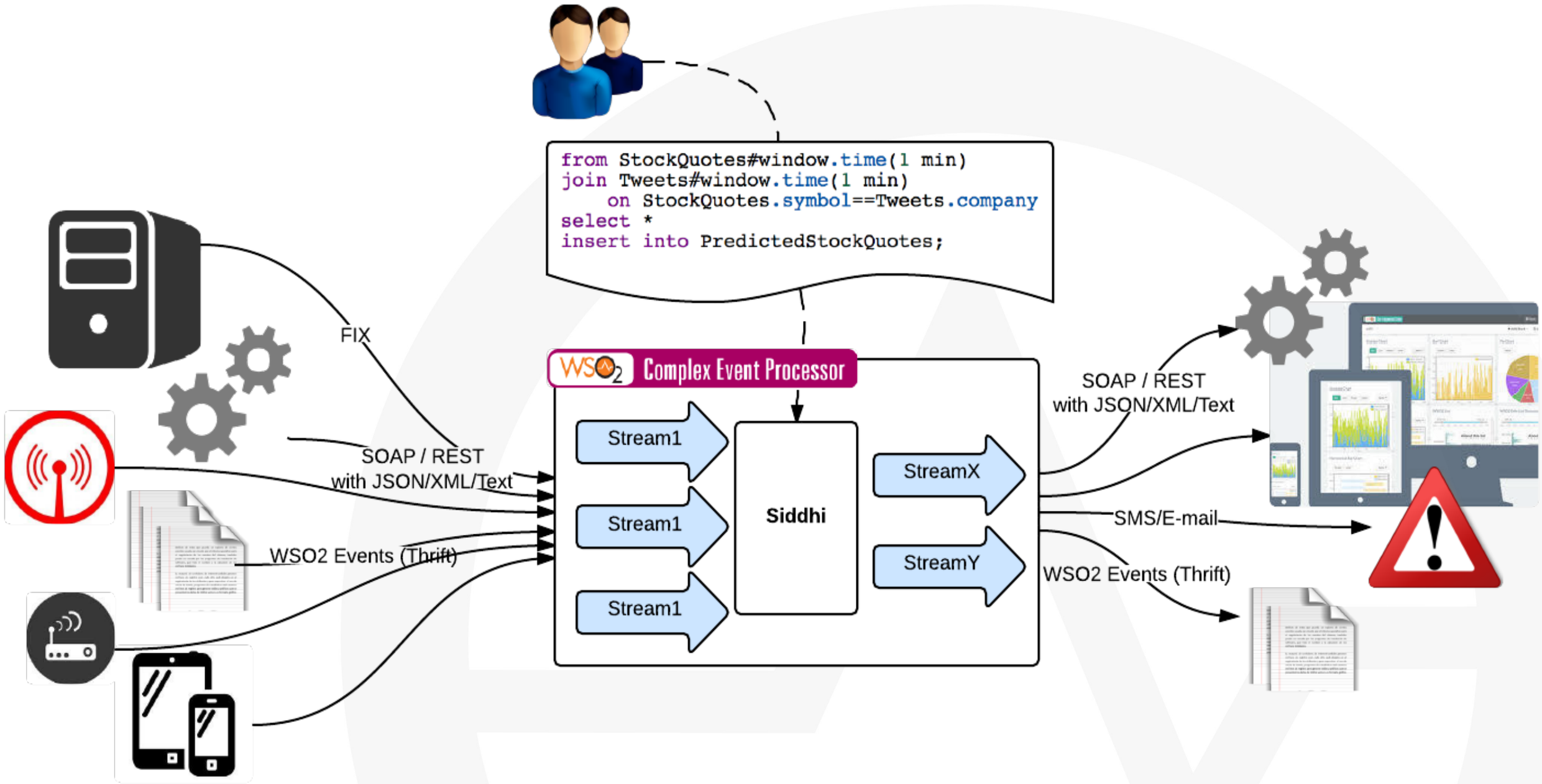
(2) Can Schedule Hive Scripts

Complex Event Processing

- Reading multiple continuous event streams real-time
- Identify different patterns from these events

- ***WSO2 CEP***
  - *Extremely High Performant Processing Engine*
  - *Processes more than 2.5M events/sec on single server commodity hardware.*
  - *Powered by WSO2 Siddhi Query Language.*
  - *Filter events by conditions.*
  - *Join event streams and create new streams.*
  - *Execute temporal queries using various windows.*
  - *Detect and respond to various event patterns and sequences.*
  - *Process historical data in RDBMS in real-time.*

WSO2 Complex Event Processor

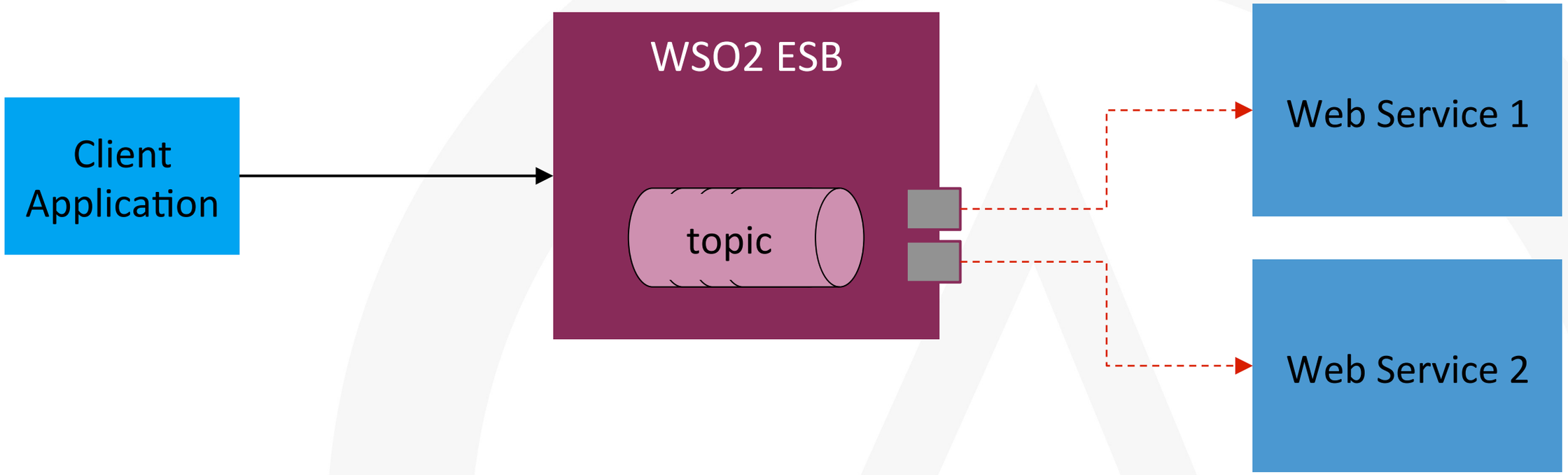


Demo Outline

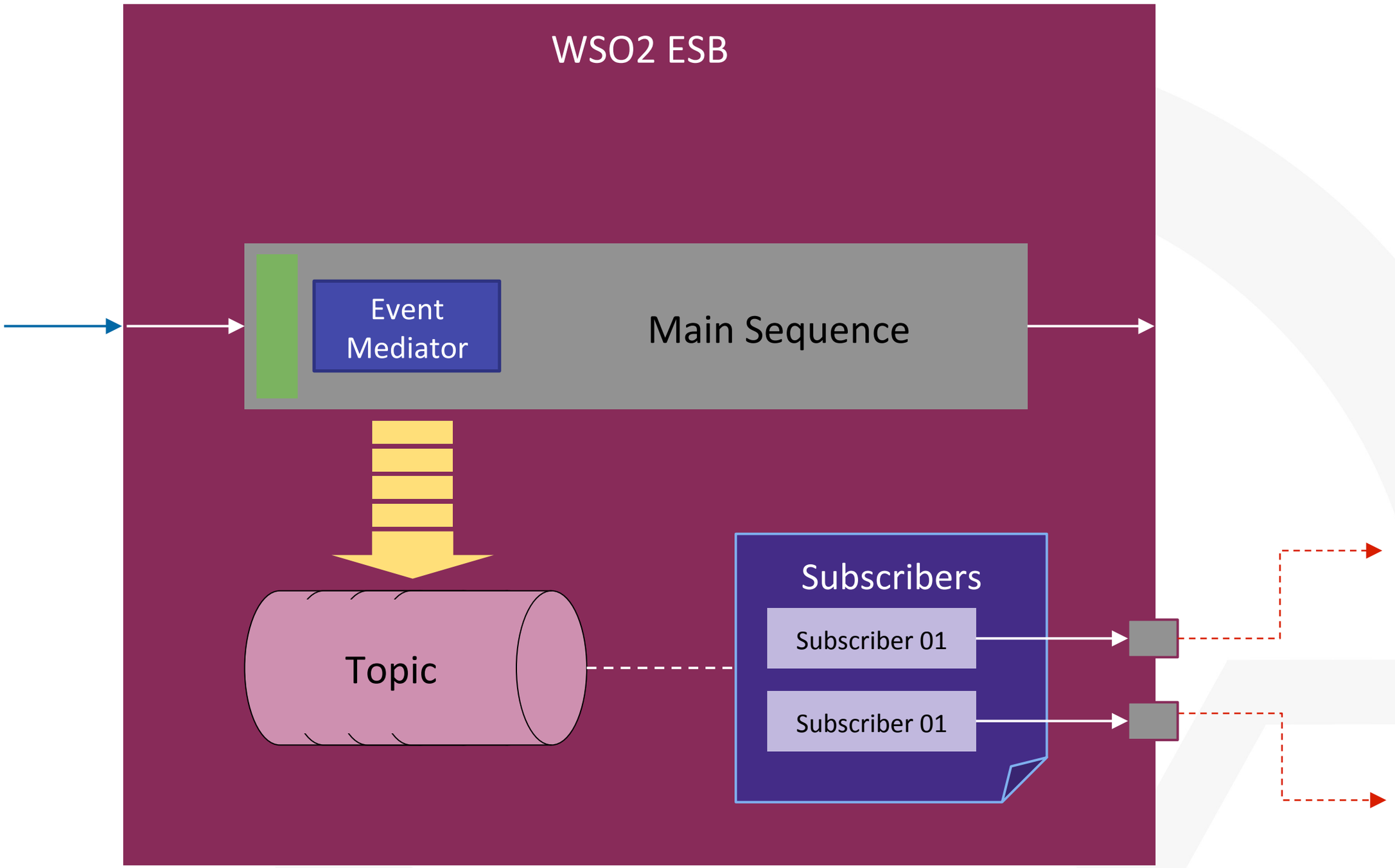
- Publisher-Subscriber with WSO2 ESB
  - WSO2 ESB as the Event Publisher
  - Topic
  - Web service instances as the Subscribers

- Complex Event Processing with WSO2 CEP
  - Delayed flights detection

WSO2 ESB as Event Publisher



WSO2 ESB as Event Publisher



Demo

Delayed Flight Alerting System

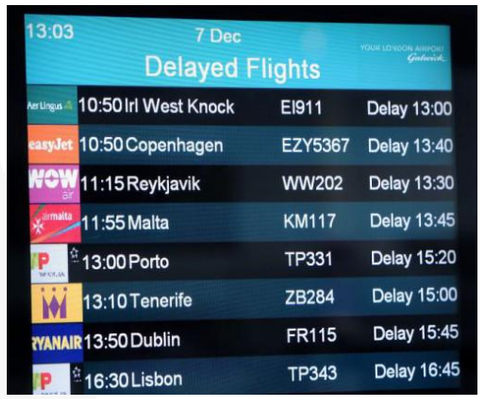
Flights information system

Data Stream

WSO2 CEP

Processing events when a delayed flight is detected.

External Systems/Devices



Demo Sample Setup

Data Stream publisher

Data Stream

Processing events when a delayed flight is detected.

WSO2 CEP

JMS Queue

JMS Consumer

Complex Event Processing

flightStatsStream

Flight 01 - Delayed

Flight 02 - On-time

Flight 03 - On-time

from

flightStatsStream

[status != 'On-Time']

select

flightName, flightId, flightType,

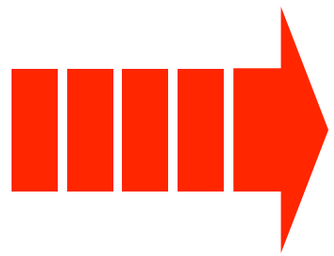
arrivalTime, trackNo

insert into

delayedFlightStream

WSO2 CEP

Detects one Delayed Flights



delayedFlightStream

Flight 01

(Information)

Demo

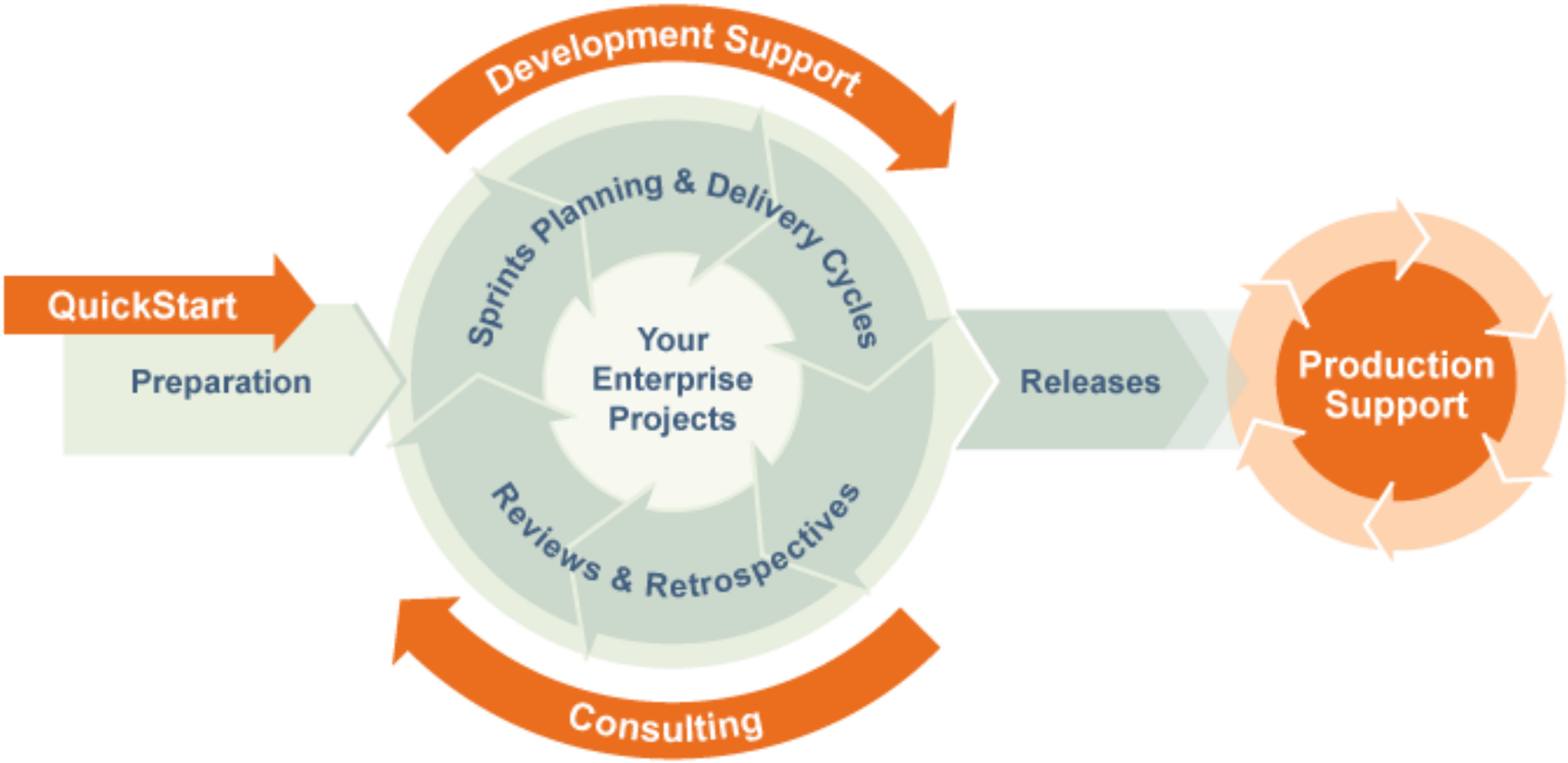
Summary

- Event Driven Architecture is a good thing
- Adding Complex Event Processing can significantly add value
- WSO2 Supports Event Driven Architecture and Messaging through various products. i.e. ESB, Message Broker, Business Activity Monitor and Complex Event Processor

Resources

- http://rangasiriwardena.blogspot.com/2014/03/pubsub-with-wso2-mb-and-wso2-esb-using.html
- http://soapatterns.org/design_patterns/event_driven_messaging
- https://docs.wso2.com/display/ESB481/Working+with+Topics+and+Events
- http://www.informit.com/articles/article.aspx?p=1577450

Business Model



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