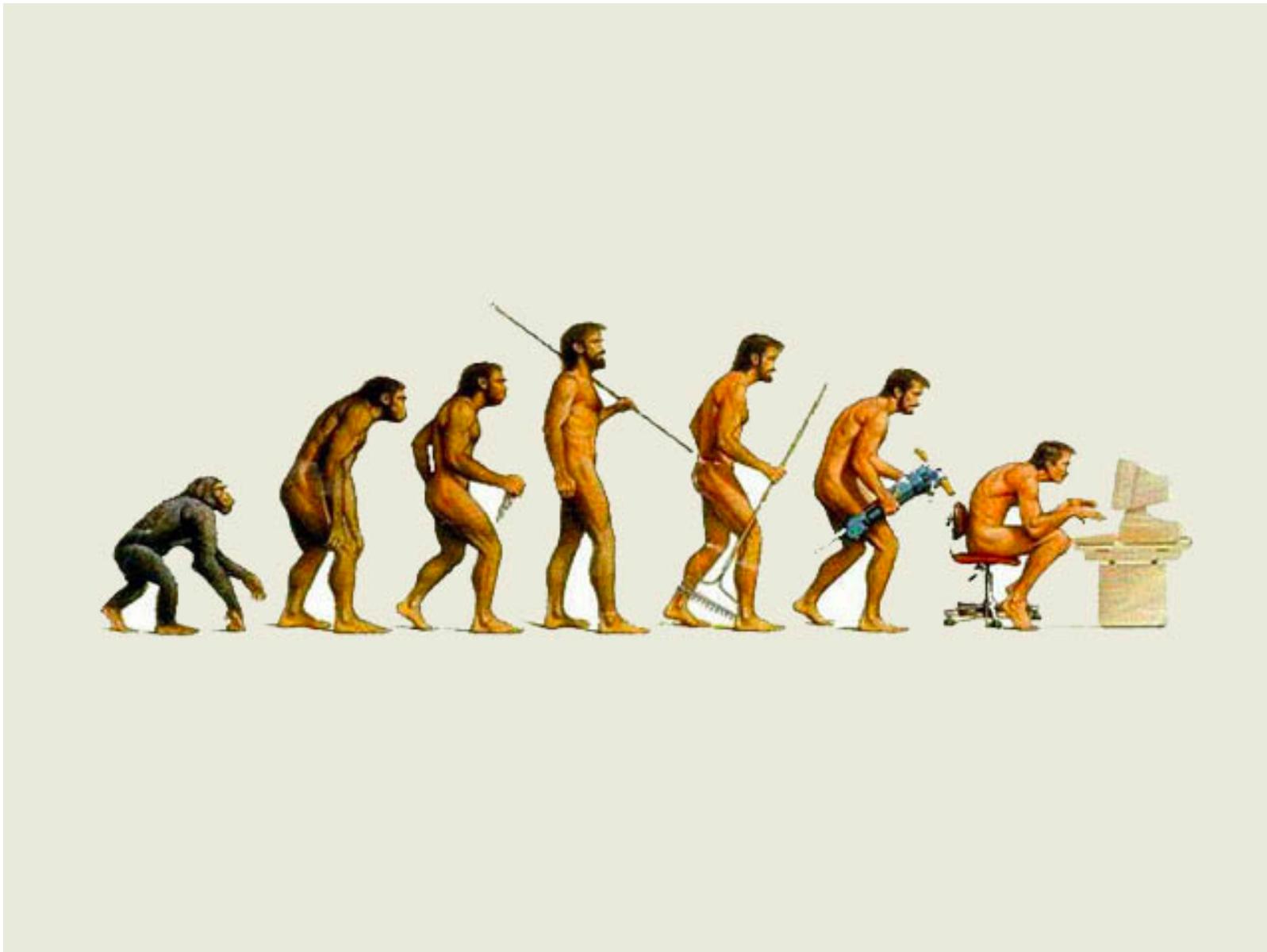


The Evolution of Distributed Computing and Integration

Oxford University
Software Engineering Programme
Dec 2012



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Distributed Computing



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DCE

- Standardized remote procedure call model proposed in the 90s by the Open Software Foundation (OSF)
- Didn't succeed widely, except as part of Microsoft's DCOM

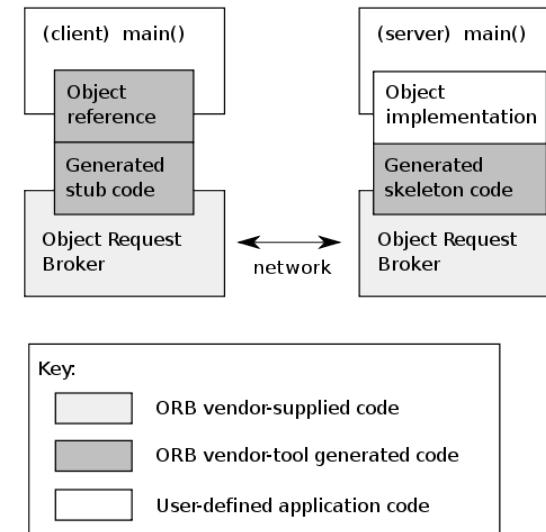


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CORBA

Common Object Request Broker Architecture

- An attempt to move DCE like distributed computing into the OO world
- Object Management Group (OMG)
- Still in some use today
- Stagnated/Deprecated



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SOAP

- XML approach to replace CORBA/DCE, etc
- Theoretically built to be transport independent and message oriented
- 97% of the time used over HTTP in RPC model
- We will cover in much more detail later



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REST

- Representational State Transfer
 - A model that influenced and was based on HTTP 1.1
- Web approach to distributed computing and integration
- We will cover in much more detail later



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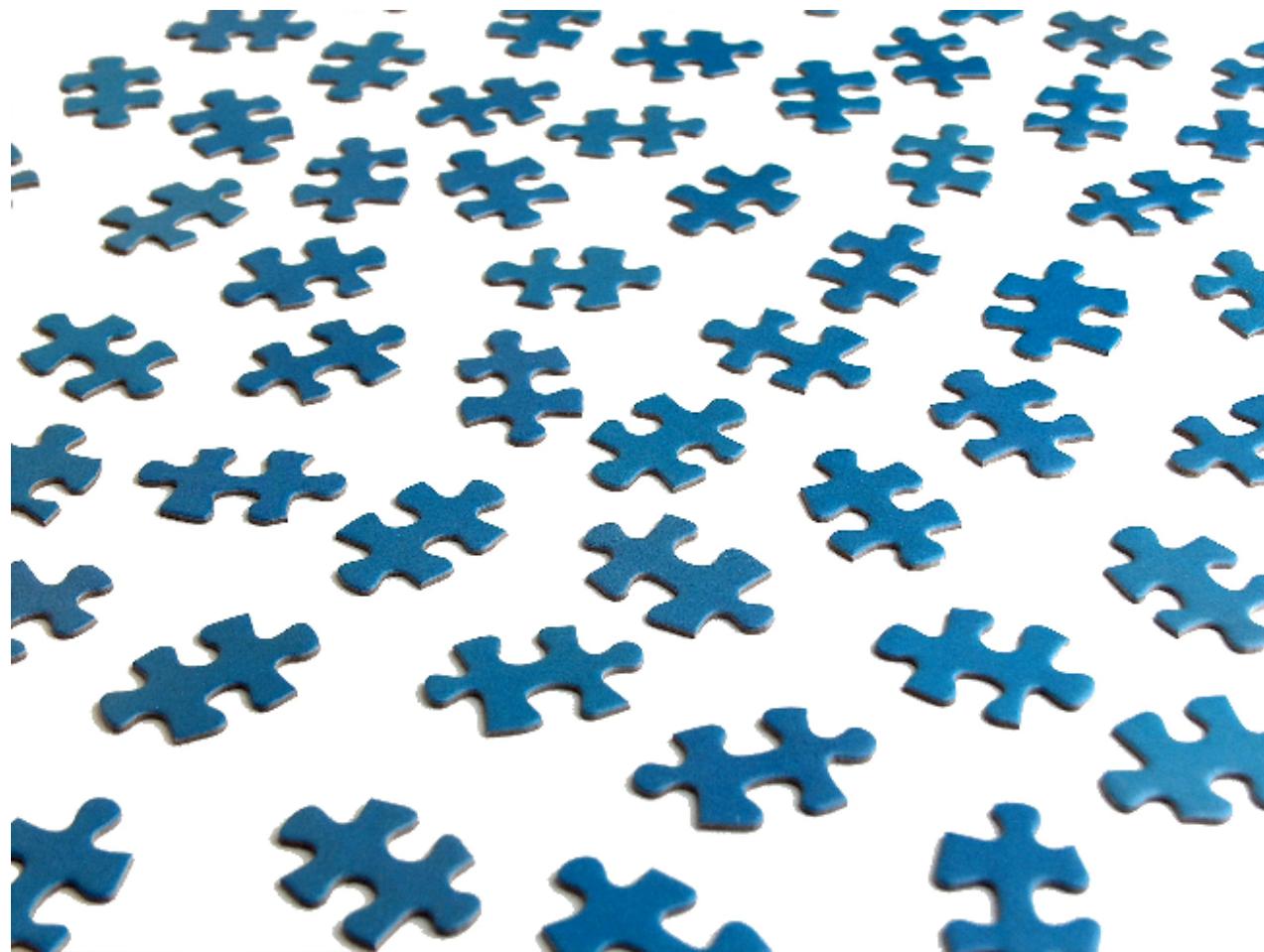
Next generation RPC

- Java RMI (Remote Method Invocation)
- Google Protocol Buffers
- Apache Thrift
- Apache Avro
- Kryo etc
- We will cover these in a later lecture



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Integration



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Integration

- It is unhelpful to consider Distributed Computing and SOA without considering Integration
- Integration is the problem of creating applications that incorporate existing as well as new logic
- Almost no system is standalone and does not need to evolve!
- Even embedded systems are now moving to incorporate Internet and Messaging



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Integration points

- Data
 - Integration in the database layer
- Application
 - Inter-application integration
- Web tier
 - Portal based integration
- On-the-glass
 - Cut and paste



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Tightly coupled

- Tightly coupled systems have significant problems:
 - Errors, delays and downtime spread through the system
 - The resilience of the whole system is based on the weakest part
 - Cost of upgrading or migrating spreads
 - Hard to evaluate the useful parts from the dead weight

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Loose coupling



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“6 Degrees of Separation”

- Location
- Access
- Programming Language
- Stack/Vendor
- Time
- Scalability

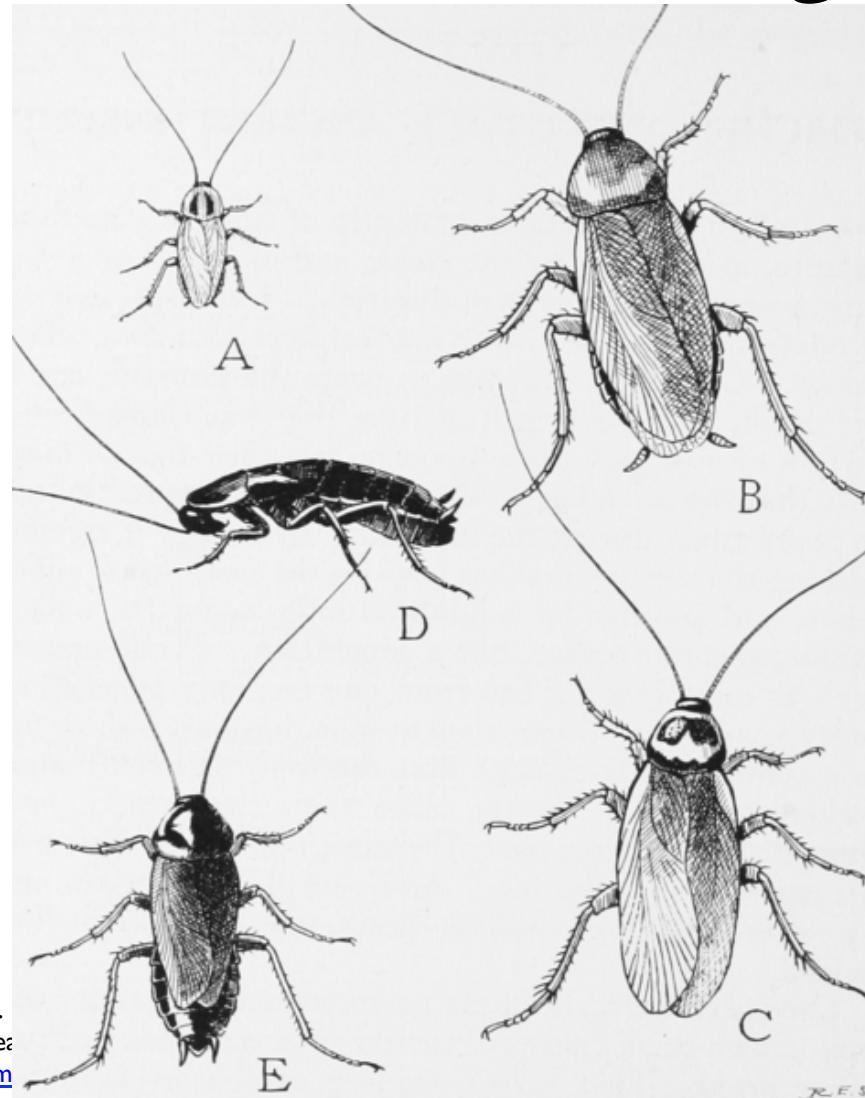


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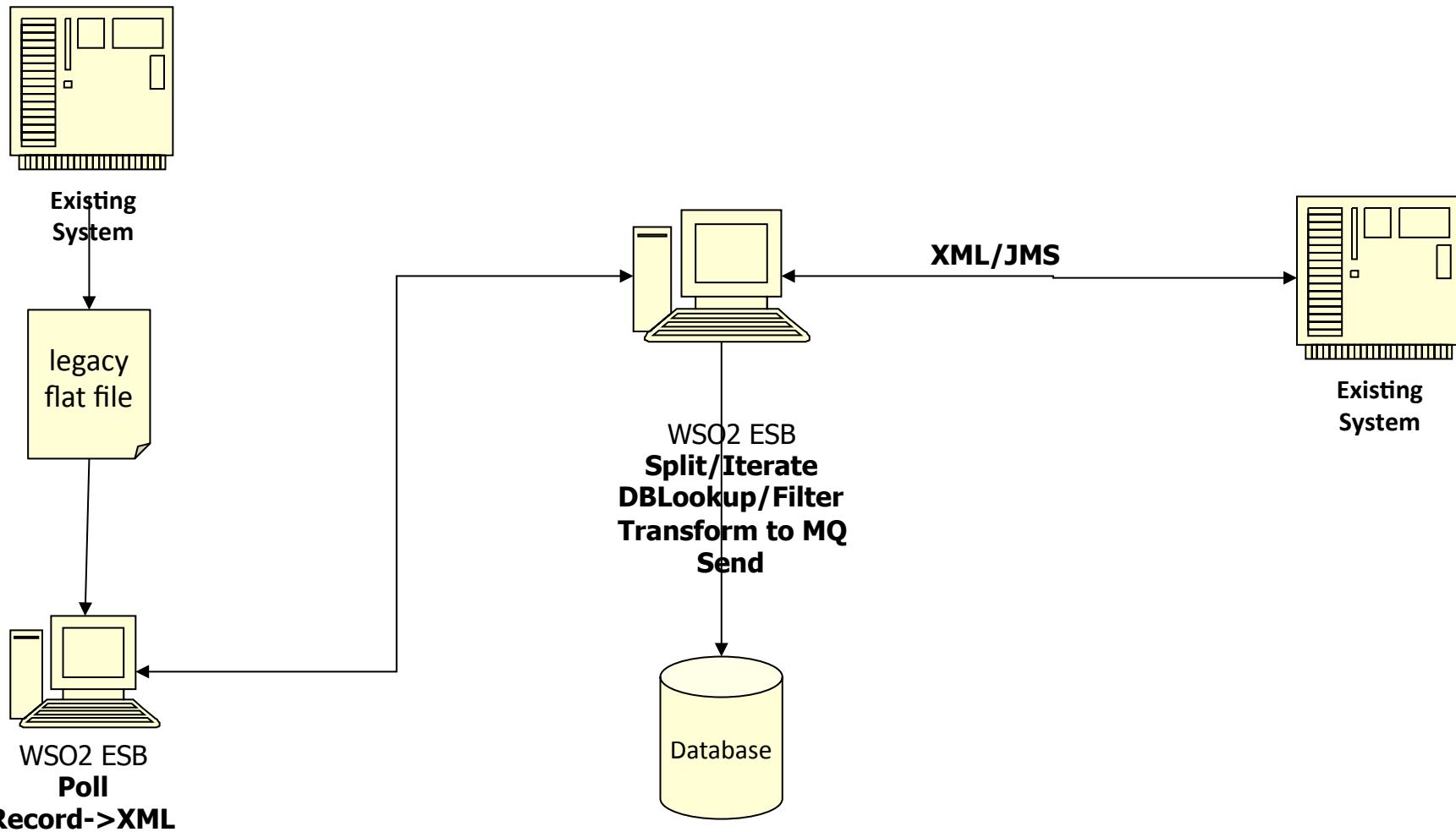
Batch file transfer - the cockroach of integration



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File transfer lives on



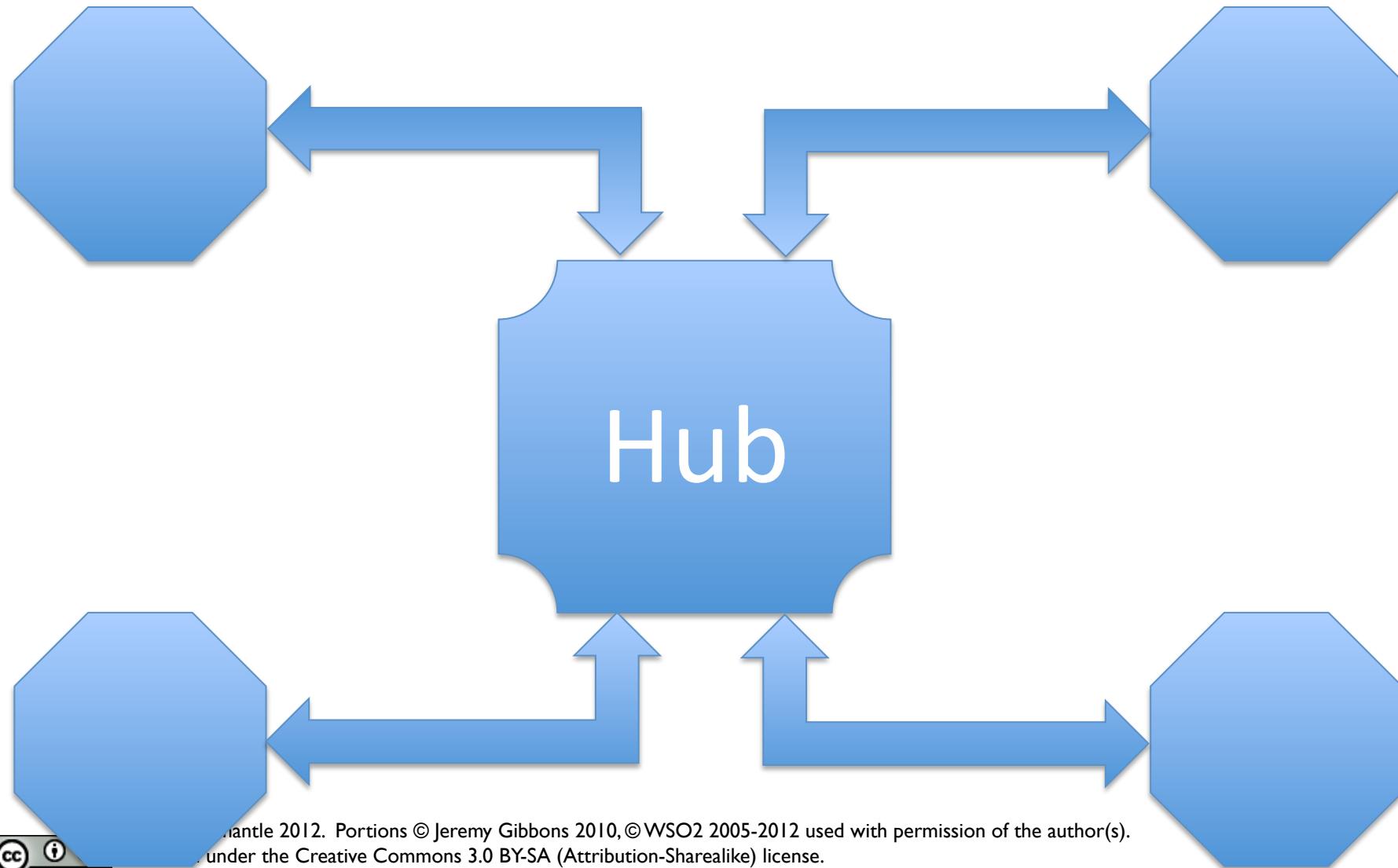
XML->XML Paul Fremantle 2012. Portions © Jeremy Gibbons 2010, © WSO2 2005-2012 used with permission of the author(s).
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NEW YORK

LONDON

EAI



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EAI hub

- Many integration models still uses the “hub model” today (even with an ESB)
 - Most vendors renamed their hub to ESB
- Why?
 - Well understood pattern
 - Easy to manage
- Why not?
 - Too many meetings with the “EAI Hub Team”
 - MQSI experiences

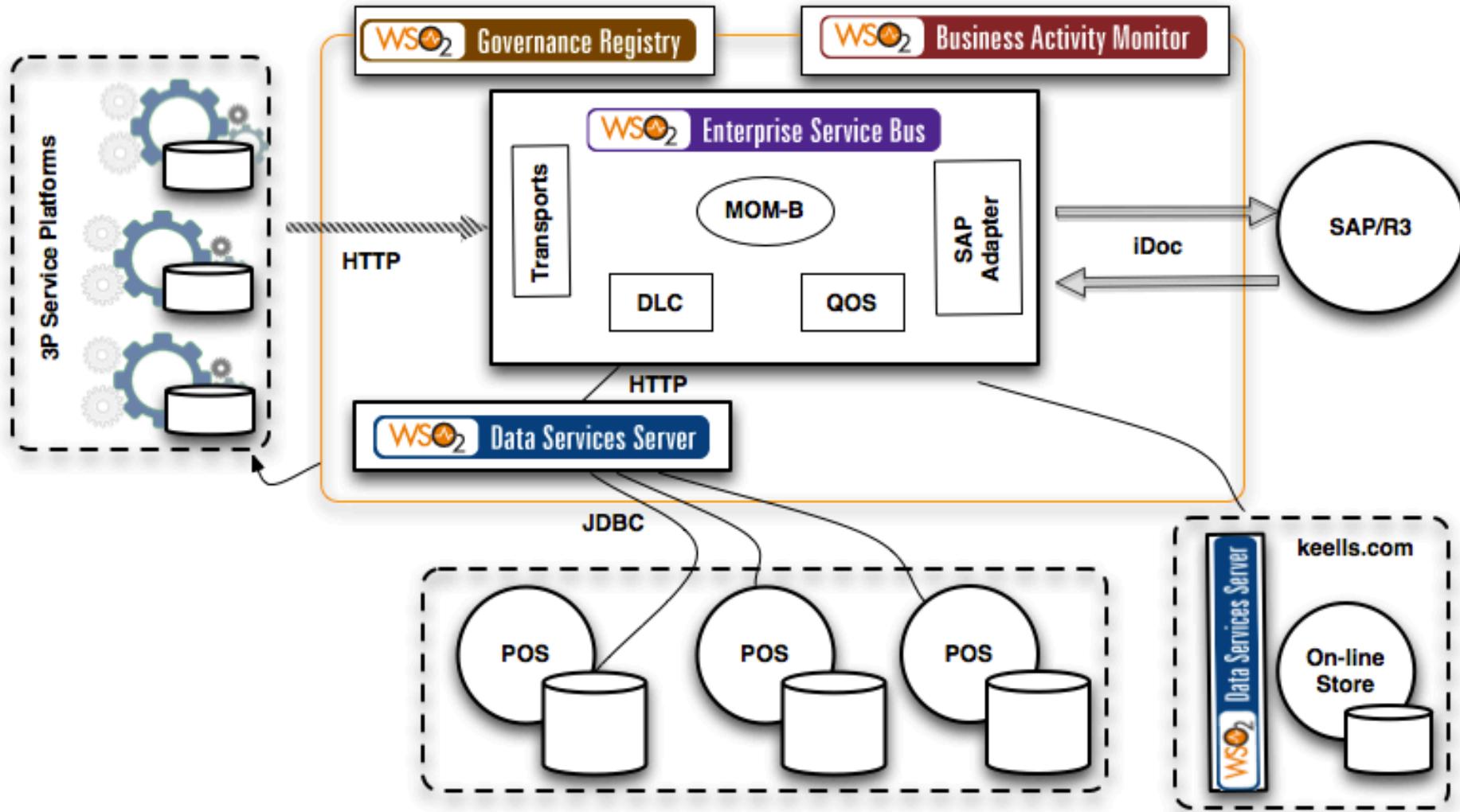


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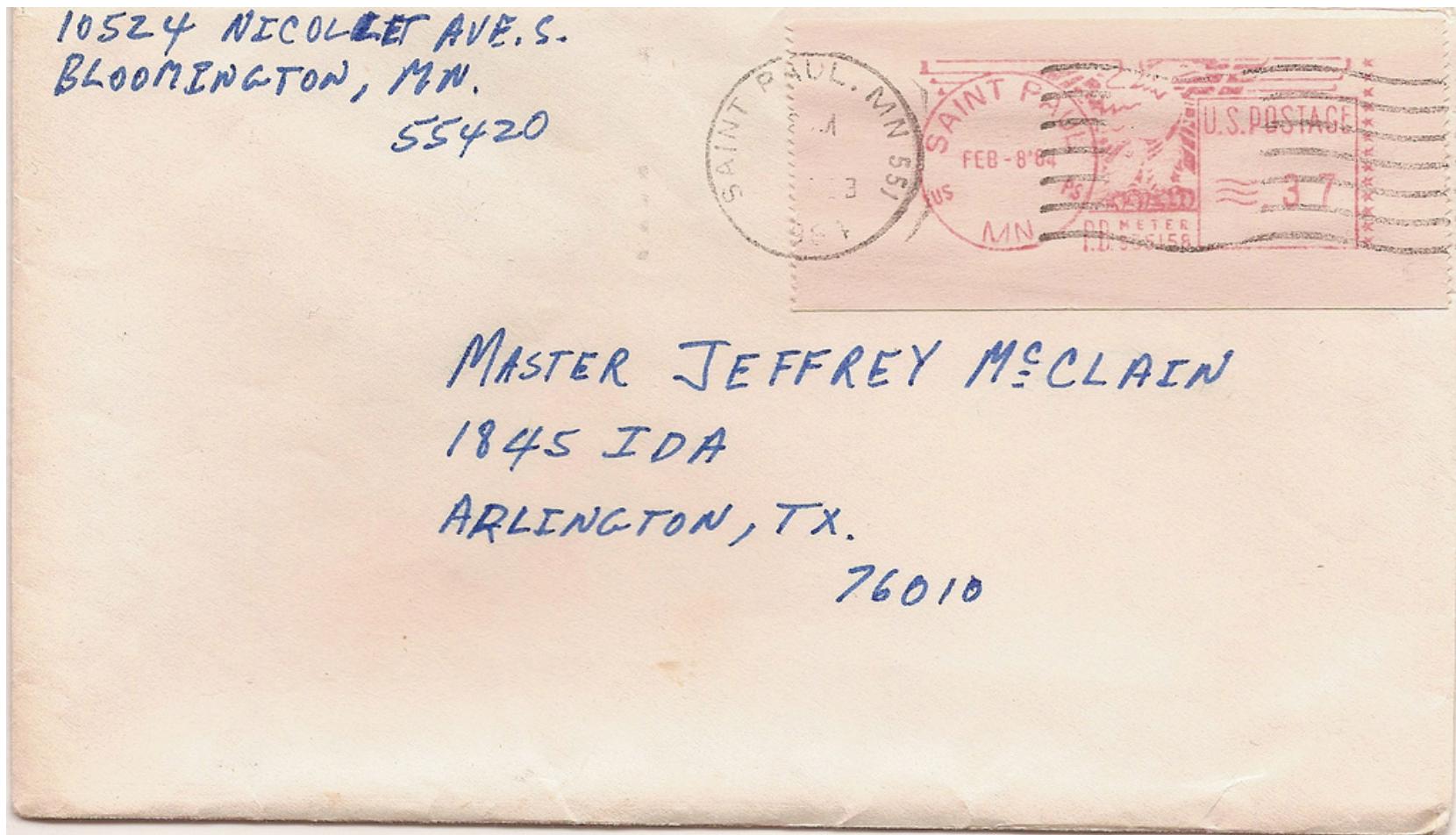
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Hub approach with an ESB



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“Message Oriented Middleware”



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<http://www.flickr.com/photos/robeast/>

MOM model

- Decouple message producers from consumers
 - Decoupled in addressing *and* in time
- Not inherently decoupled in message format
 - Though in many cases that too
- One-way asynchronous messages
 - But request-reply possible using “Reply Queues”
- Usually used with reliable delivery

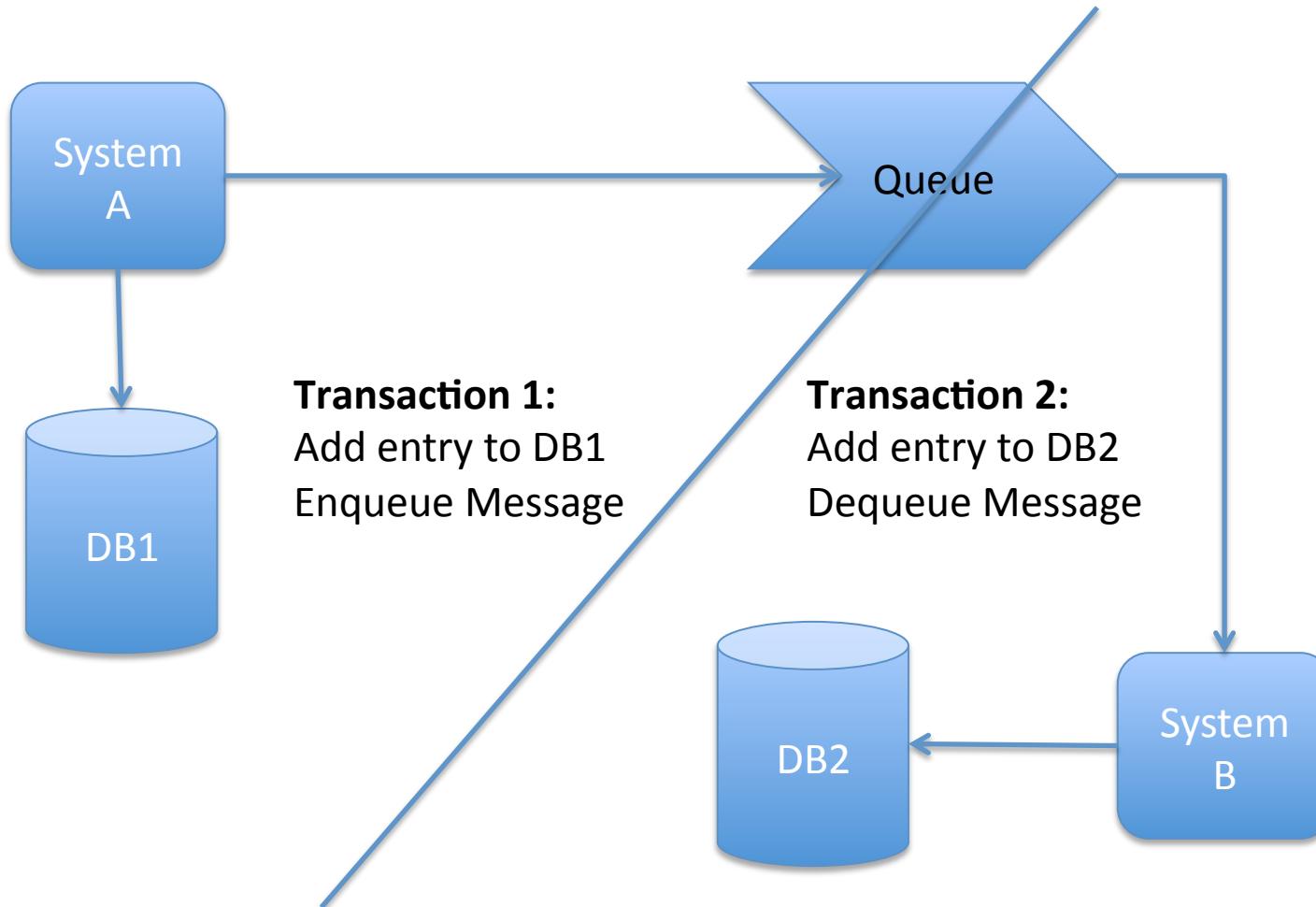


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Queued Transaction Processing



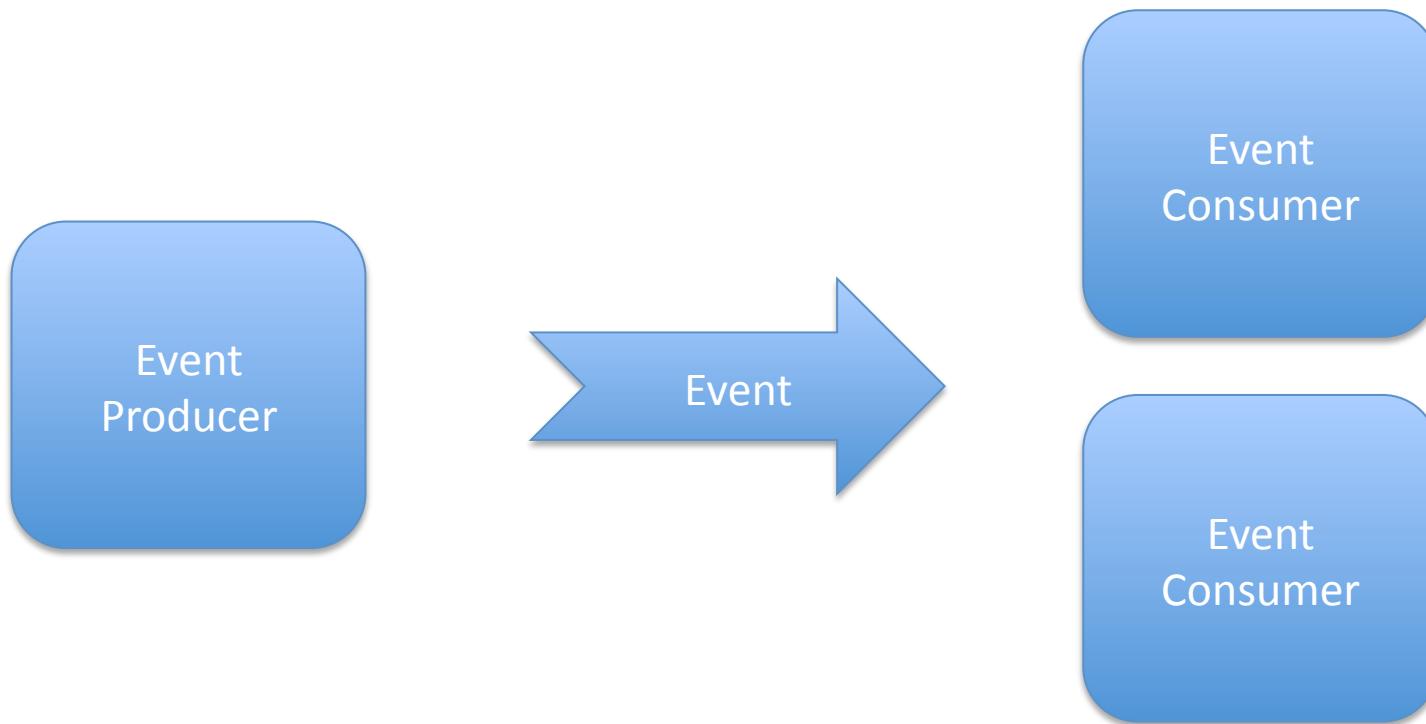
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AMQP



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Event Driven Architecture



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“Event Driven Architecture”

- Actually how Apache (and WSO2) work(s)
 - Mailing lists = topics
- Can be layered with reliable delivery
- Used a lot in high-volume logging, trading environments, fraud detection, etc
- *Requires a very different mindset*



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EDA

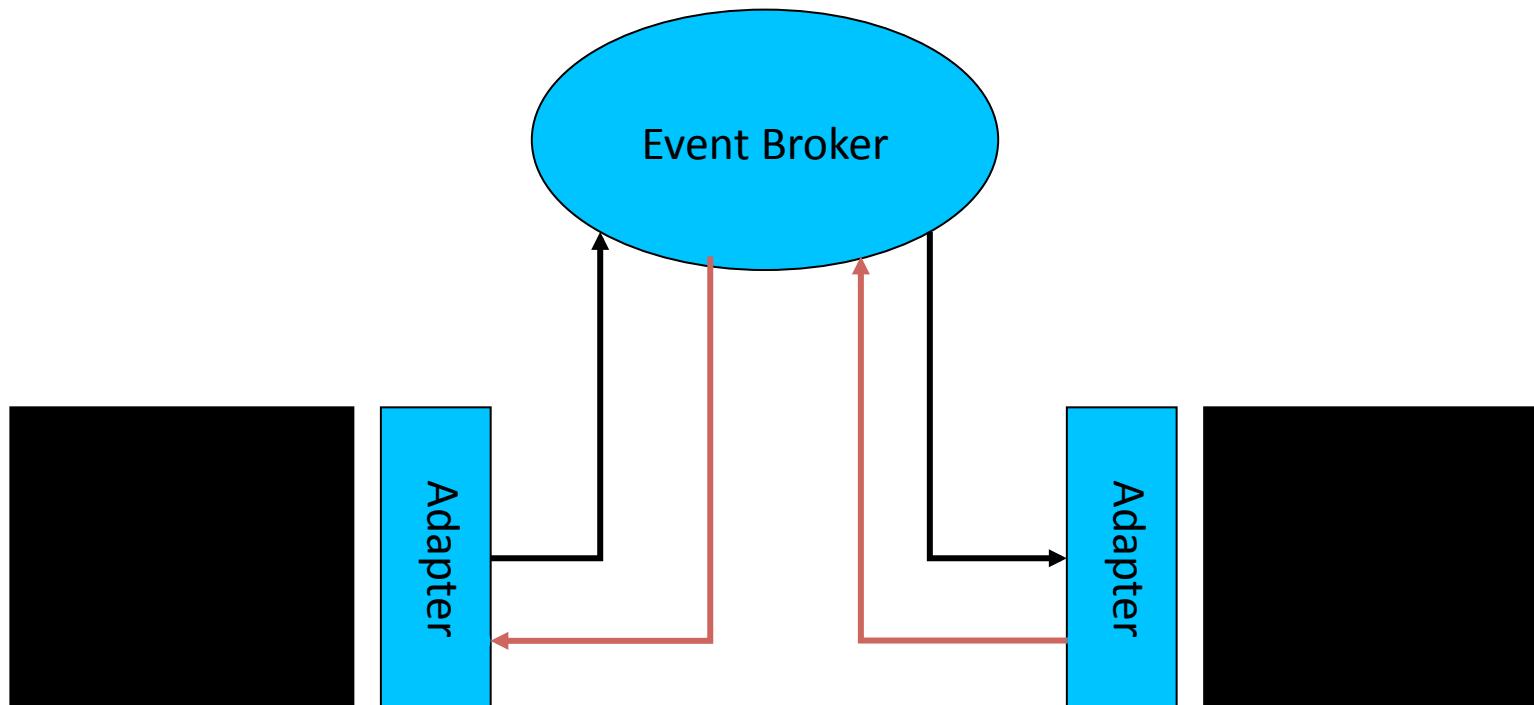


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Feedback loops

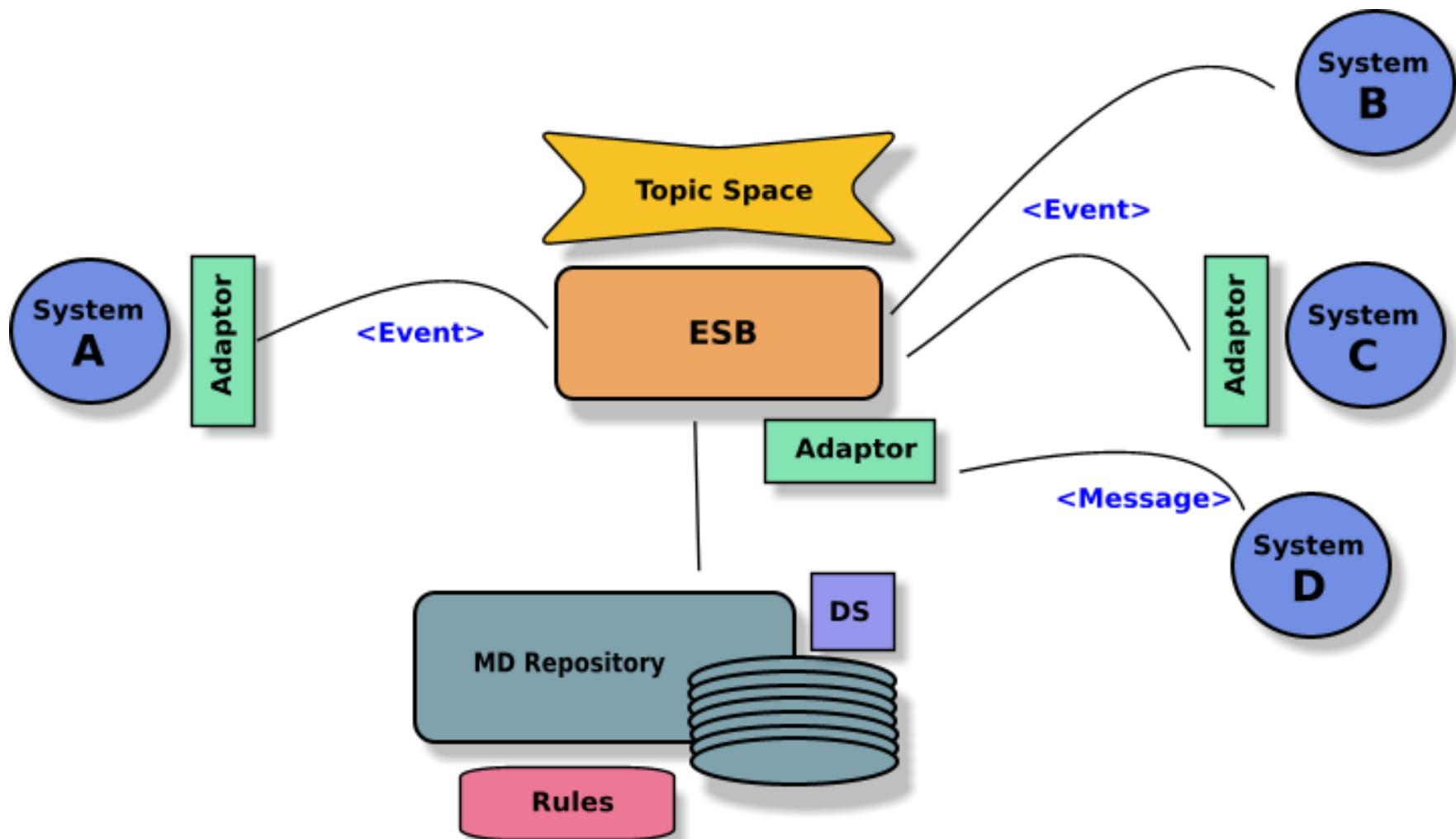


<http://pzf.fremantle.org/2008/09/interesting-problem-in-event-driven.html>



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Solution



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Why did SOA evolve?

- Directly came out of XML
 - Understanding the schema and structure of messages
 - Especially within the “fabric” not just at the endpoints
- What’s different?
 - Metadata
 - Policies
 - Security



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Service



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SOA failures

One consumer per service



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SOA failures

“Just buy an ESB from me”



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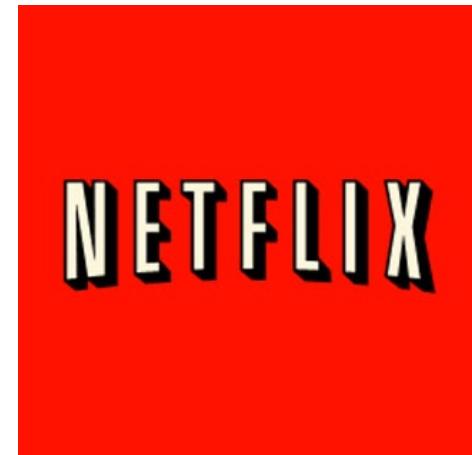
SOA failures

Vendor Driven Architecture



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“soa” successes



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Turmeric

What is Turmeric?

Turmeric is a comprehensive, policy-driven SOA platform that you can use to develop, deploy, secure, run and monitor SOA services and consumers. It is a Java based platform, follows the standards (SOAP, XML, JSON, XACML, etc.), and supports WSDL (SOAP style - Doc Lit wrapped mode and REST style). It supports a variety of protocols and data formats. Eclipse plugins help with the development of services and consumers. Other important features include:

- Various Quality of Service (QoS) features such as authentication, authorization, and rate limiting, which you control by defining respective policies.
- Monitoring capabilities.



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Why ESB/SOA model isn't just EAI

- Policy based
 - XACML, Throttling Policy, etc
 - eBay's Internal Service Router
- Independent management
 - Loose coupling of configuration
 - Hot deploy / re-deploy / continuous delivery
- Governance
 - Lifecycle and Dependency management
 - Analysis and reporting on the meta-model
- Non-blocking asynchronous routing
- Distributed architecture

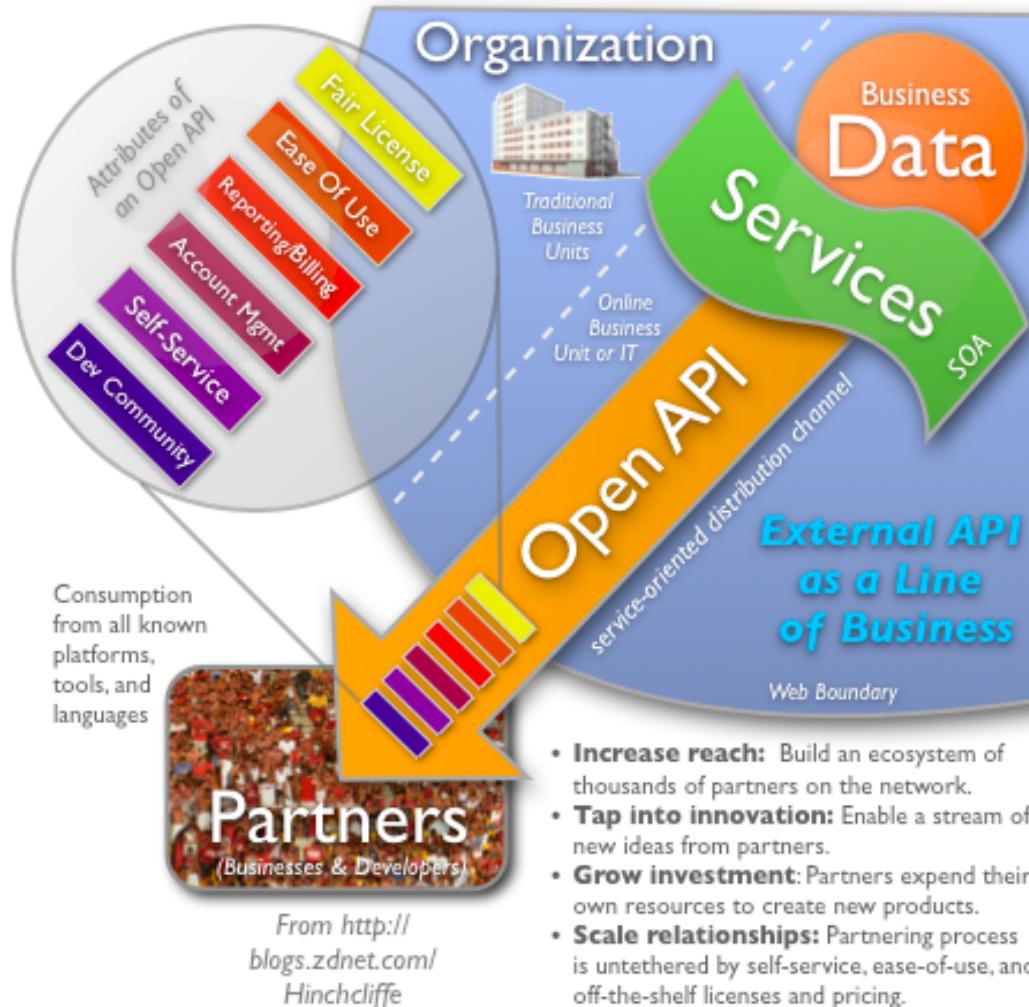


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Running your SOA like a Web startup



- **Increase reach:** Build an ecosystem of thousands of partners on the network.
- **Tap into innovation:** Enable a stream of new ideas from partners.
- **Grow investment:** Partners expend their own resources to create new products.
- **Scale relationships:** Partnering process is untethered by self-service, ease-of-use, and off-the-shelf licenses and pricing.



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<http://www.zdnet.com/blog/hinchcliffe/running-your-soa-like-a-web-startup/525>

API

- **An API** is a business capability delivered over the Internet to internal or external consumers
 - Network accessible function
 - Available using standard web protocols
 - With well-defined interfaces
 - Designed for access by third-parties



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What is different from an API and a Service?

- Publishing your API in a Portal
- Expecting people to use it without them having to meet with you
- Making it easy to consume (JSON? Ready built clients in Github?)
- Governance
 - Caring who uses it
 - Letting them know when you version it
 - Meeting an SLA



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Key API technologies

- json / rest
- OAuth / OAuth2 keys
- SLA management
- API portal / API Store
 - Catalogue, subscription/purchase
 - Monetization
 - Forum, Ratings, Social
- Analytics



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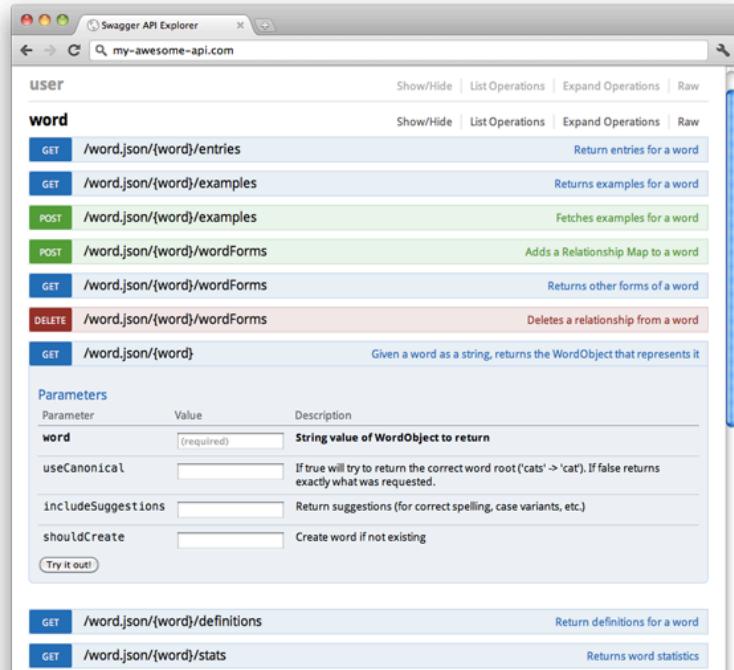
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REST description



The screenshot shows a web browser window displaying the Swagger API Explorer. The URL in the address bar is `my-awesome-api.com`. The main content area is titled "USER" and lists several REST operations for a "word" resource:

- word**
 - GET /word.json/{word}/entries** Returns entries for a word
 - GET /word.json/{word}/examples** Returns examples for a word
 - POST /word.json/{word}/examples** Fetches examples for a word
 - POST /word.json/{word}/wordForms** Adds a Relationship Map to a word
 - GET /word.json/{word}/wordForms** Returns other forms of a word
 - DELETE /word.json/{word}/wordForms** Deletes a relationship from a word
 - GET /word.json/{word}** Given a word as a string, returns the WordObject that represents it

Below the operations, there is a table for "Parameters":

Parameter	Value	Description
word	(required)	String value of WordObject to return
useCanonical		If true will try to return the correct word root ('cats' -> 'cat'). If false returns exactly what was requested.
includeSuggestions		Return suggestions (for correct spelling, case variants, etc.)
shouldCreate		Create word if not existing

At the bottom of the interface, there are two more operations:

- GET /word.json/{word}/definitions** Returns definitions for a word
- GET /word.json/{word}/stats** Returns word statistics

Document your API with Style

Swagger is a specification and complete framework implementation for describing, producing, consuming, and visualizing RESTful web services. The overarching goal of Swagger is to enable client and documentation systems to update at the same pace as the server. The documentation of methods, parameters and models are tightly integrated into the server code, allowing APIs to always stay in sync. With Swagger, deploying, managing, and using powerful APIs has never been easier.

Who is responsible for Swagger?

Both the specification and framework implementation are initiatives from Wordnik. Swagger was developed for Wordnik's own use during the development of [developer.wordnik.com](#) and the underlying system. Swagger development began in early 2010—the framework being released is currently used by Wordnik's APIs, which power both internal and external API clients.

Why is Swagger useful?

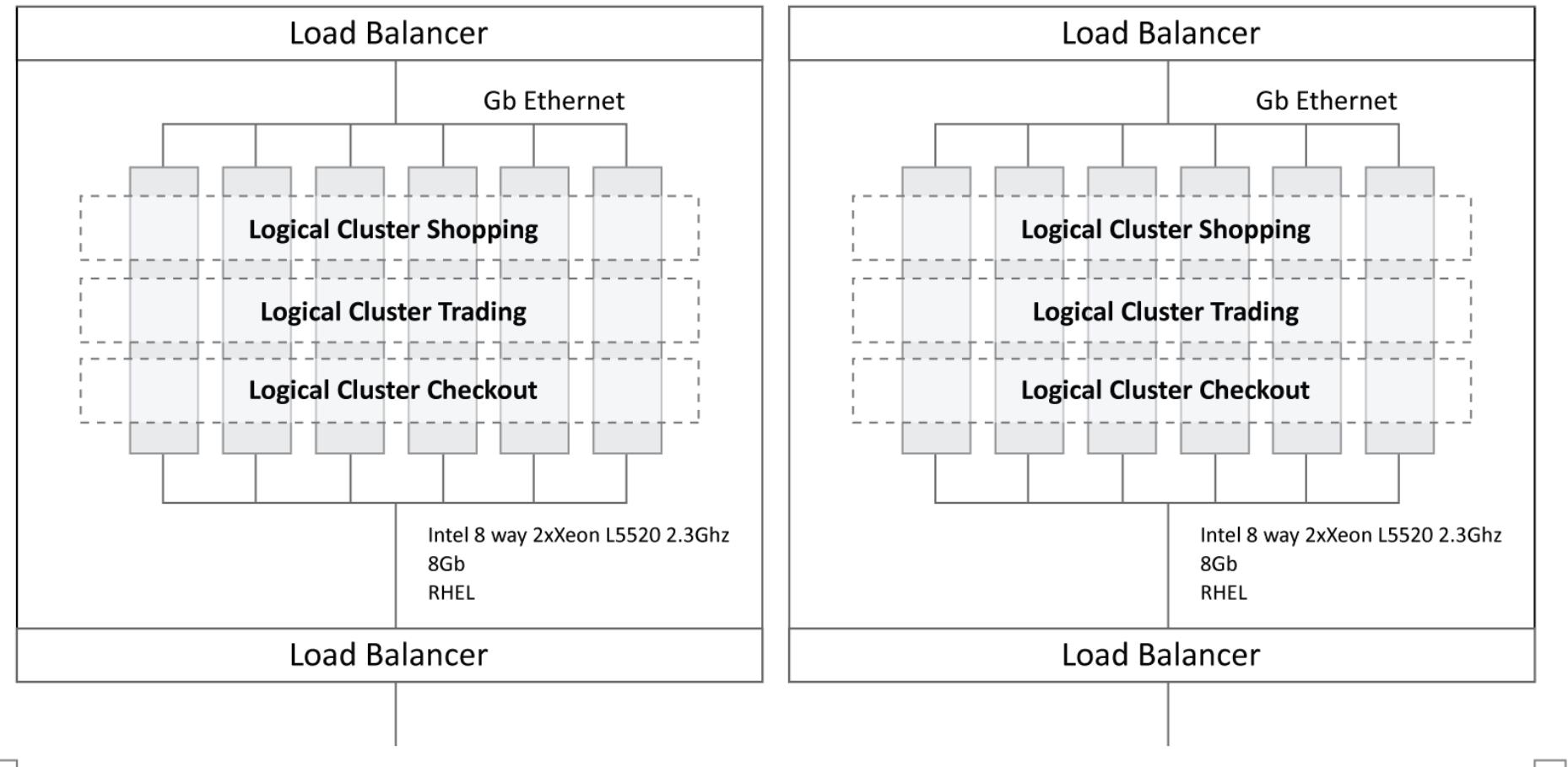
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High volume integration @ eBay



100's of service instances
Tomcat + Axis2

Change in focus

- Security, tokens, access control/entitlement
- Throttling, caching
- Latency and CPU usage
- Monitoring, BAM and CEP



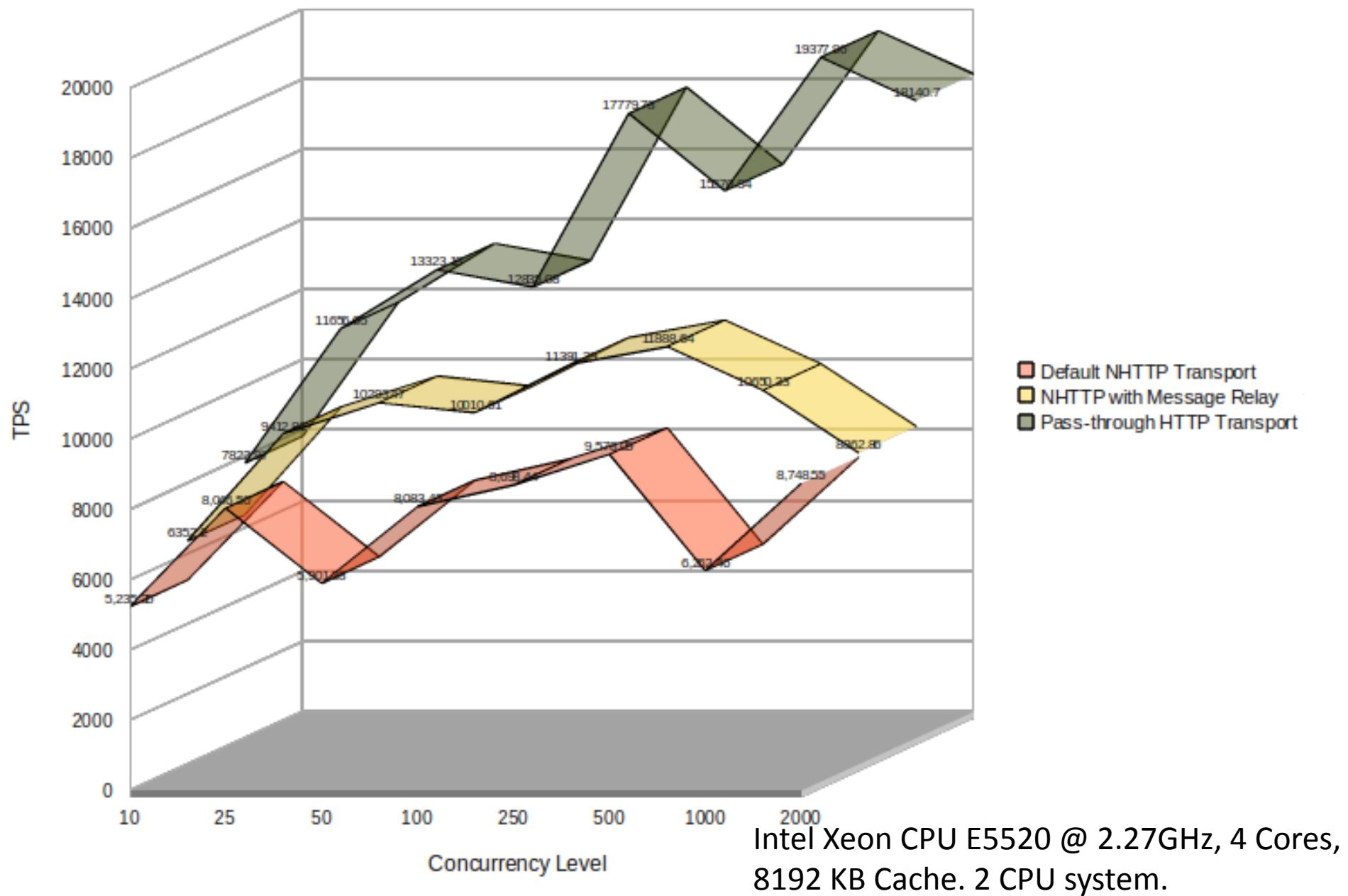
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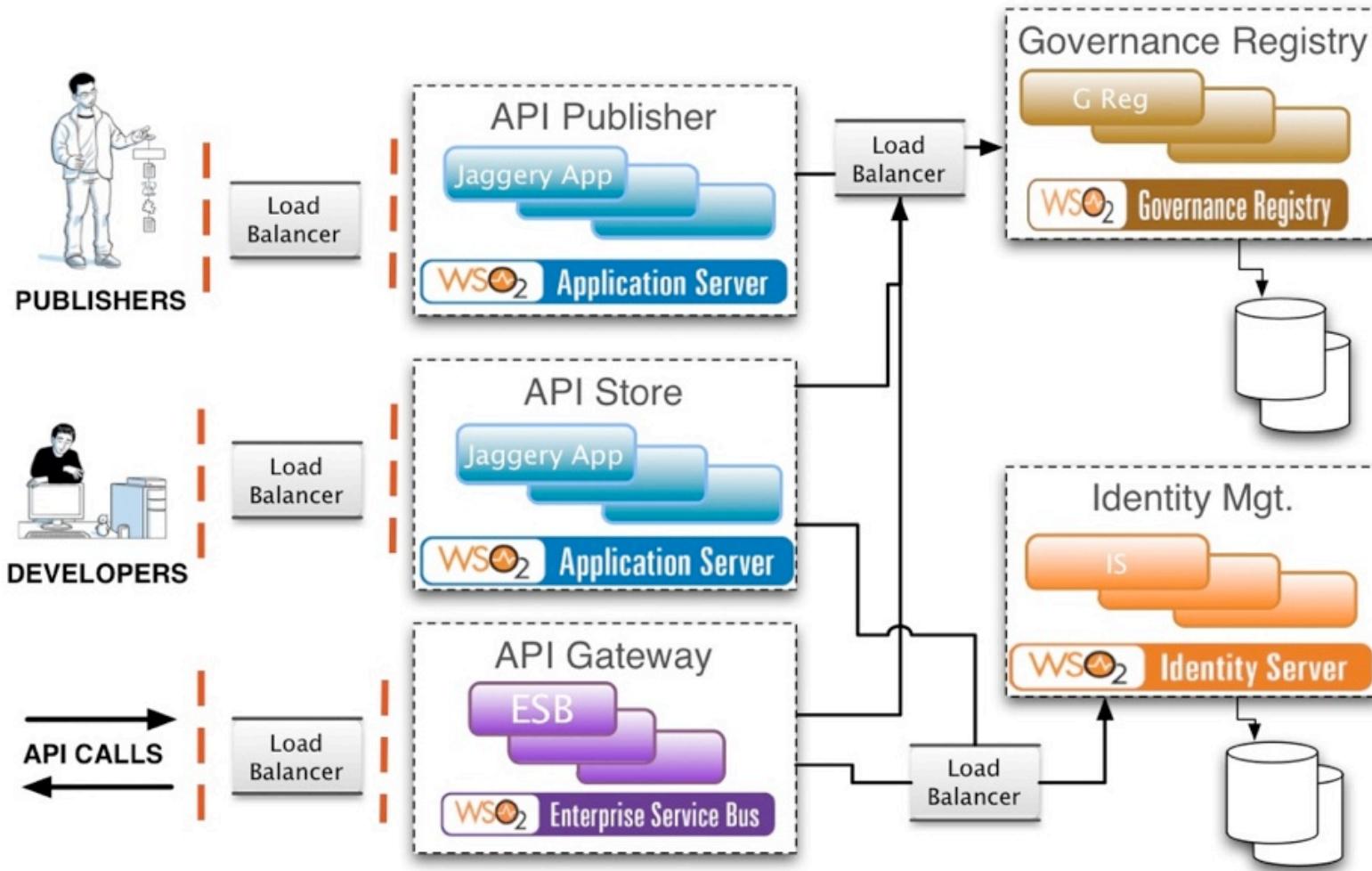
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Pass-through Proxying

Message Size 0.5K



API management



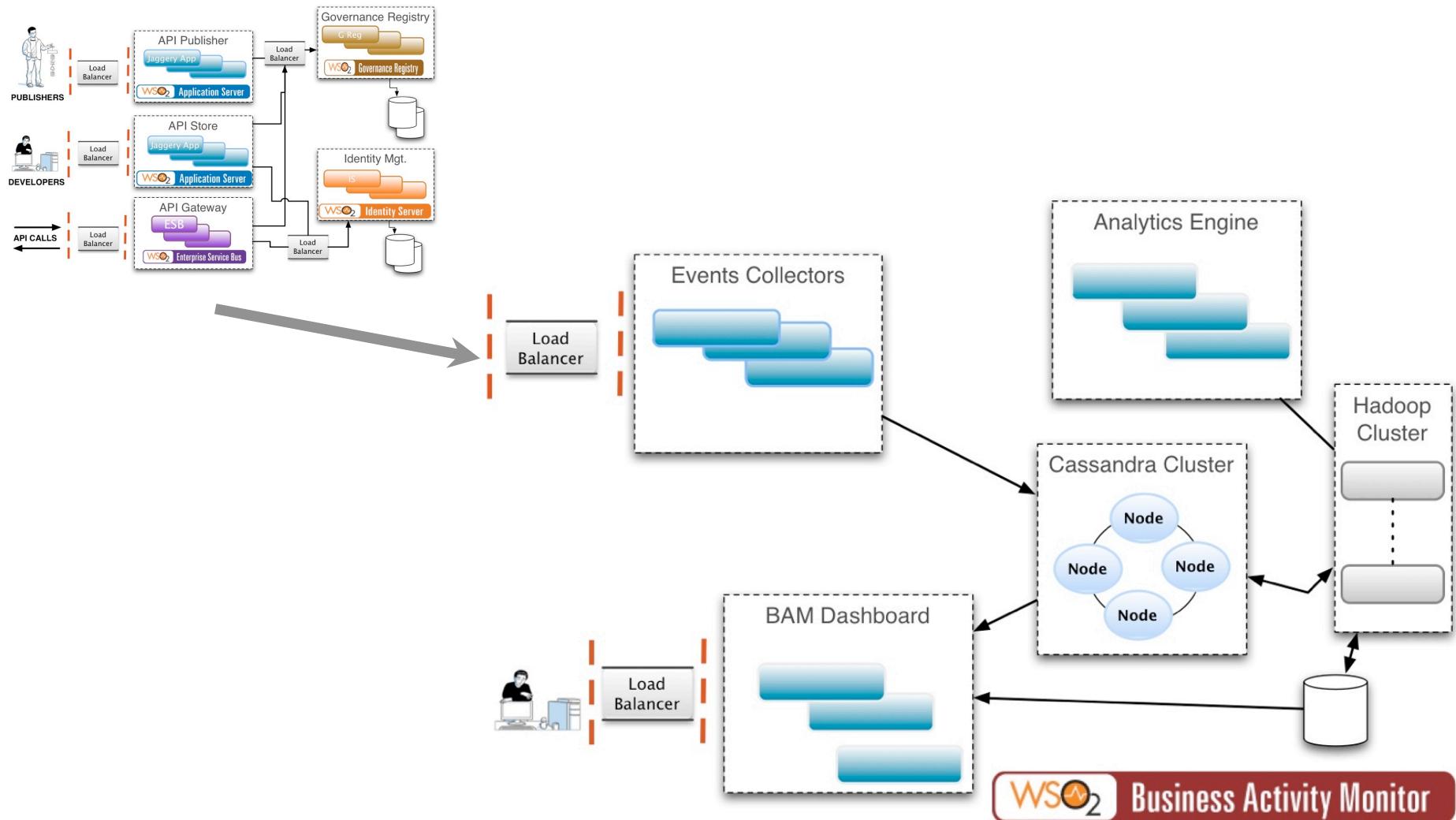
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Scalable analytics



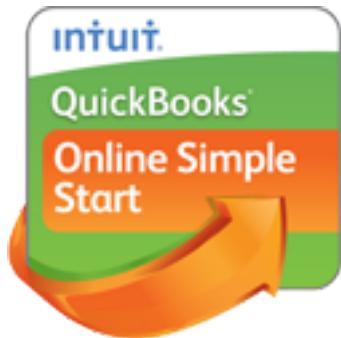
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Cloud integration



salesforce.com



Google™ Docs

ESB-as-a-Service



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Cloud integration

- APIs are the right approach
 - Use a “cloud gateway” to bridge into internal systems
- “Push-me pull-you” pattern
 - Use an active ESB in the cloud
- Analytics
 - See what is happening



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What's next?

- Still a long way from canonical models
- Successful systems are using “soa” and “rest” at scale
 - Architecture is more important than dogma
- Governance sounds boring but is key
- Applying monetization approaches and “API Store” models
- Analytics and feedback loops



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Summary

- Integration has evolved in some interesting ways
 - Async messaging, EDA, APIs, High Volume
- Evolution isn't monotonic
- Doing APIs right is about the mindset as much as the technology



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