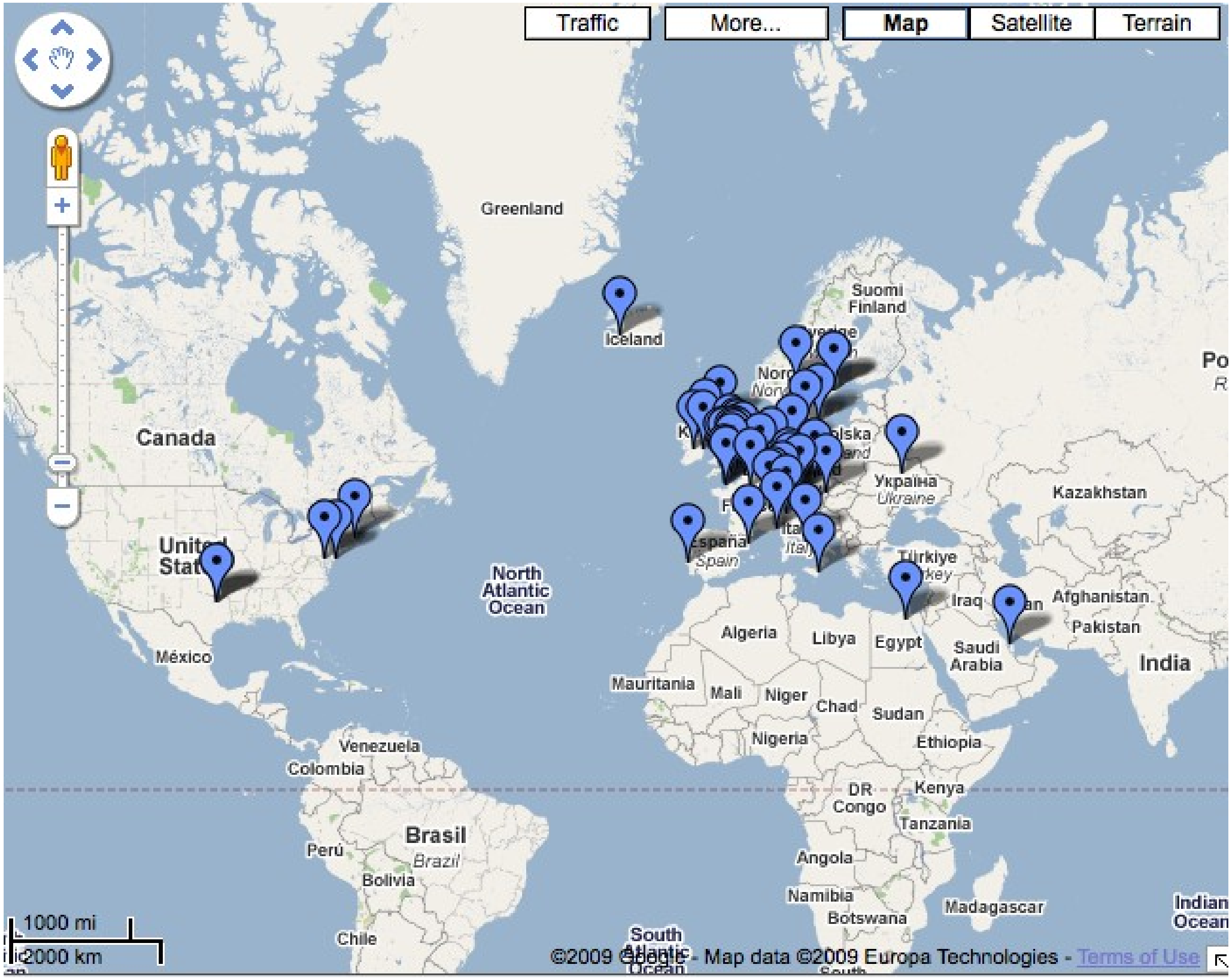
PROGRESS
SOFTWARE

Tales from the front line: how ActiveMQ, ServiceMix and Camel are used to solve real world problems

Adrian Trenaman
Distinguished Consultant
http://trenaman.blogspot.com

FUSE

Ade's consultancy map...



Agenda

- Brief introduction to Apache CXF, ServiceMix and ActiveMQ
  - From a functional and deployment perspective.
- Use cases and stories
  - Health-care: PDA-enable a government health system
  - Retail Pharmacy: warehouse / distribution management solution.
  - Document Storage: built on ActiveMQ
  - Telco Web Services: BSS systems
- This stuff works!
  - Highly available, clustered, flexible, extendible, ...
  - Focussed on enterprise integration & service enablement

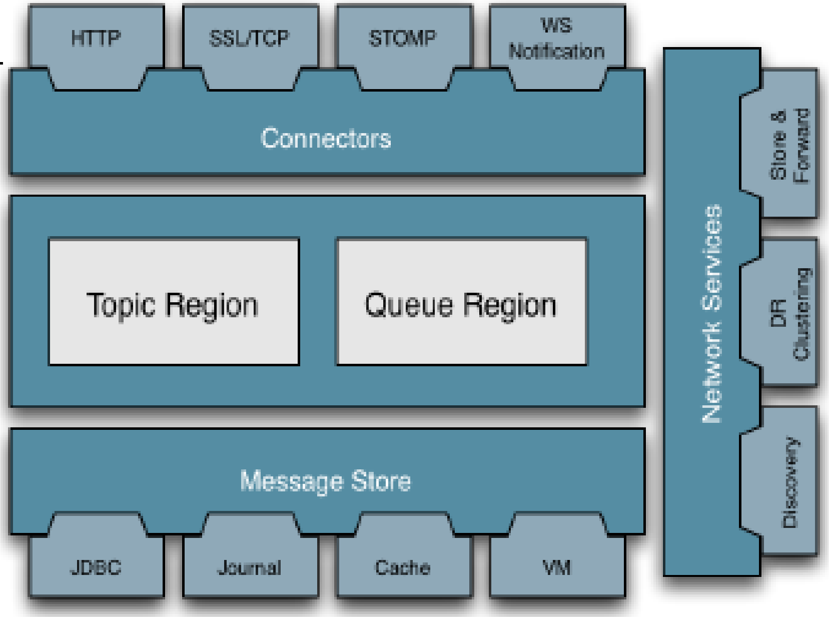
ActiveMQ, ServiceMix, CXF & Camel

ActiveMQ

- A high performance, reliable messaging fabric, supporting JMS, C, .Net, and other frameworks.

Clients connect to the broker using connectors with simple URIs

Topics and queues created dynamically.□



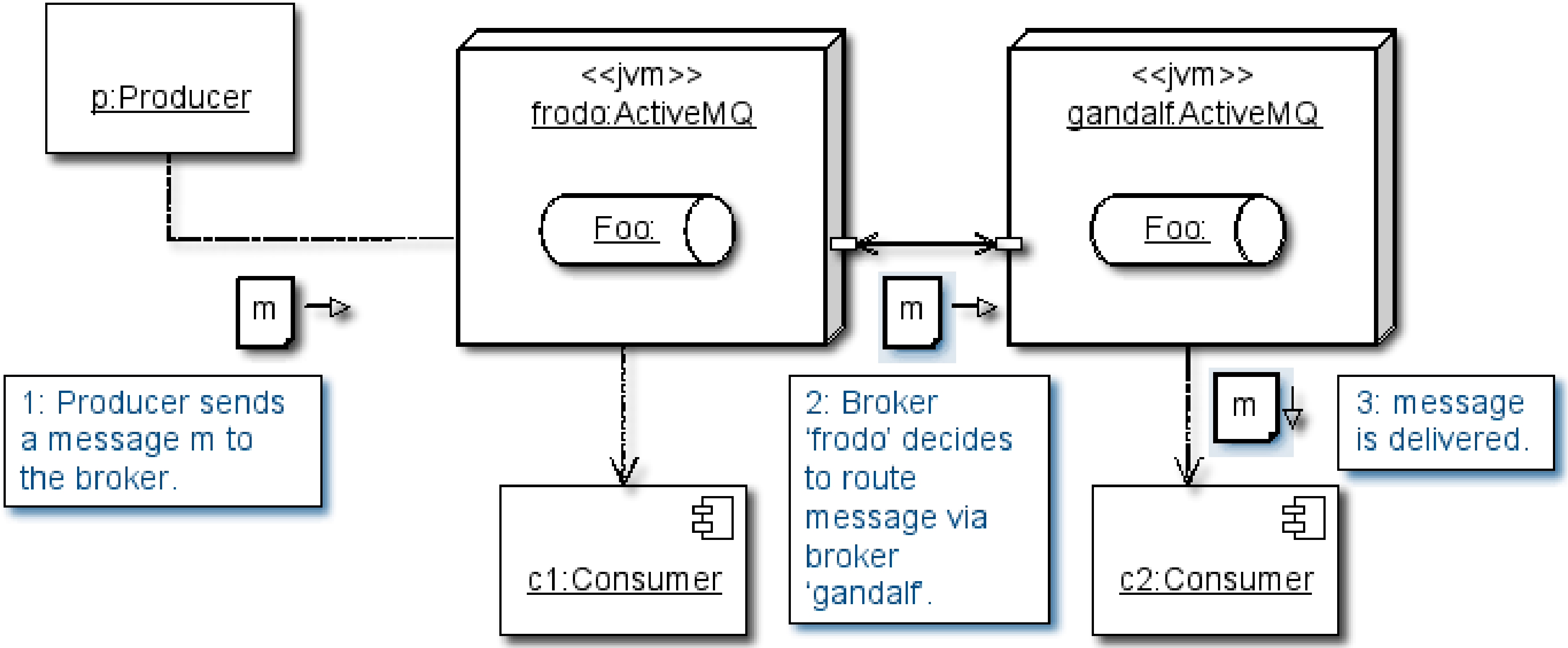
Network connectors control how the broker interacts with other brokers for discovery, replication, failover, clustering and store & forward.

File & JDBC-based message stores supported.

… all based on a flexible Spring-based core.

Networked brokers & distributed queues

- Brokers use network connectors to share consumer information and make routing decisions using “store-and-forward”
  - JMS clients use failover URLs or auto-discovery to connect to a live broker.



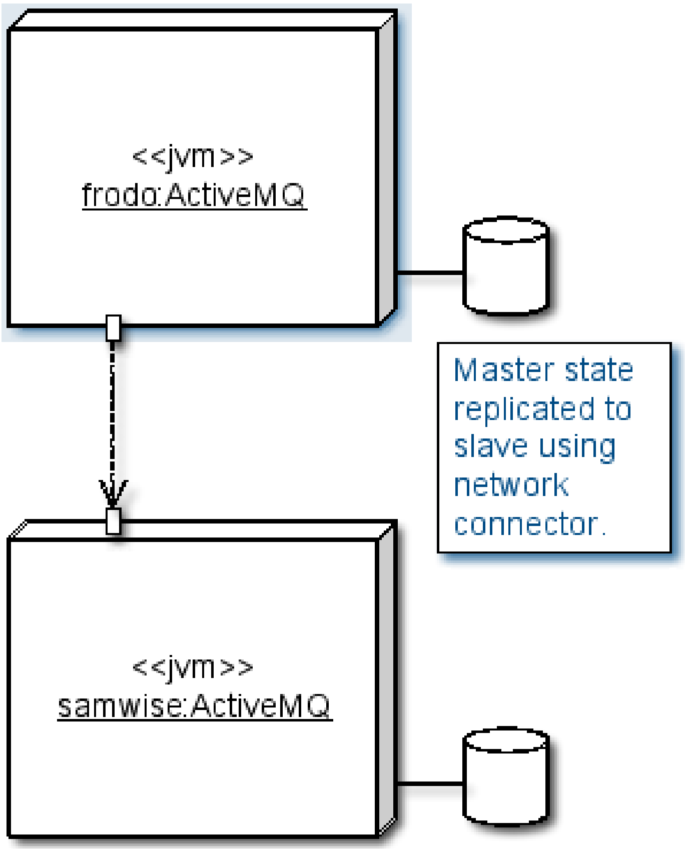
1: Producer sends a message m to the broker.

2: Broker 'frodo' decides to route message via broker 'gandalf'.

3: message is delivered.

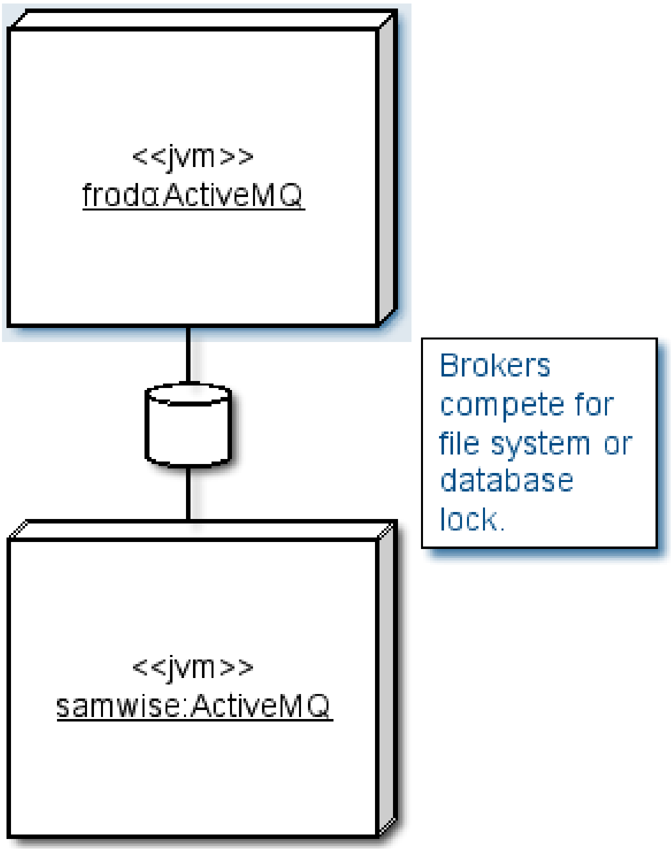
ActiveMQ replication, clustering and failover

Broker replication



Master state replicated to slave using network connector.

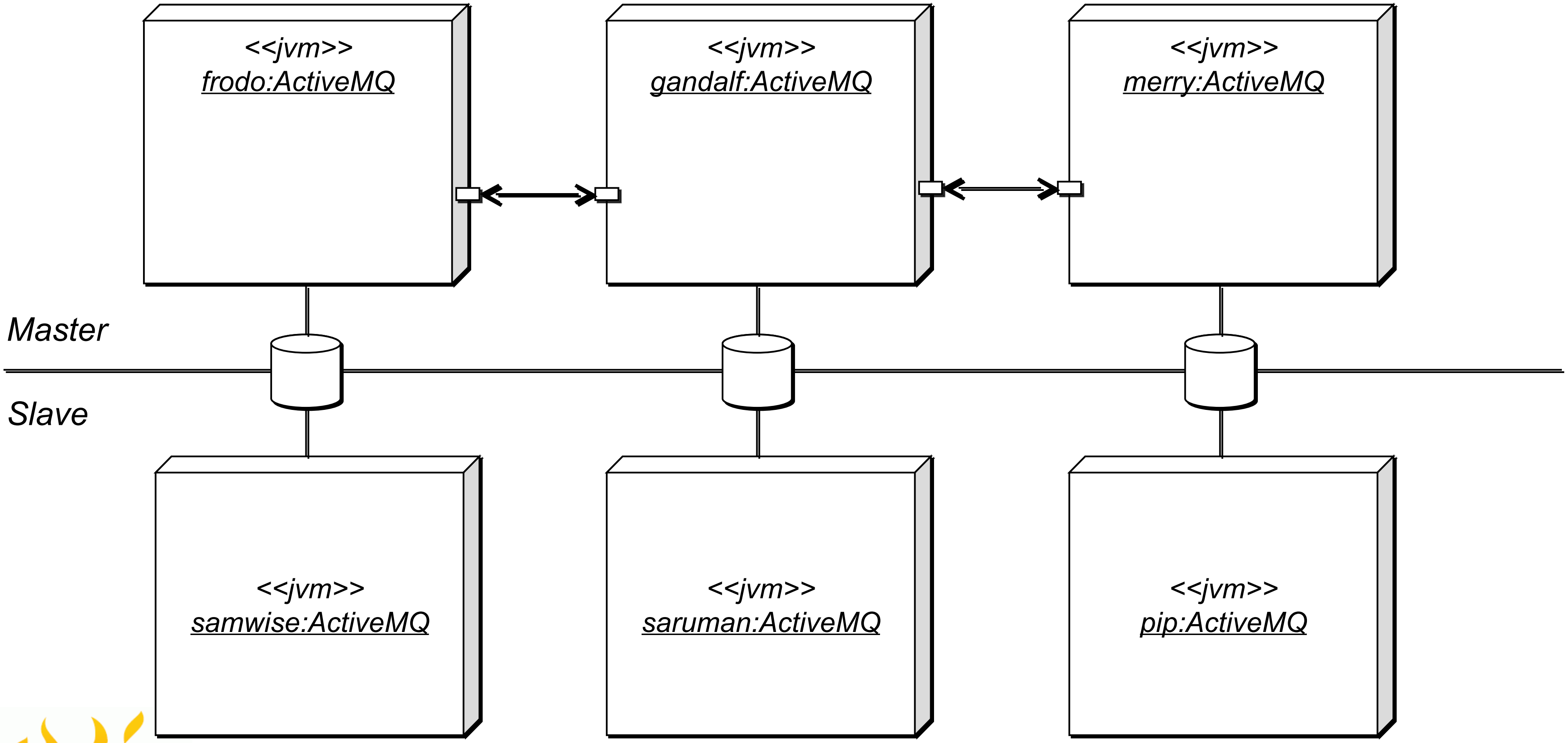
Shared message store



Brokers compete for file system or database lock.

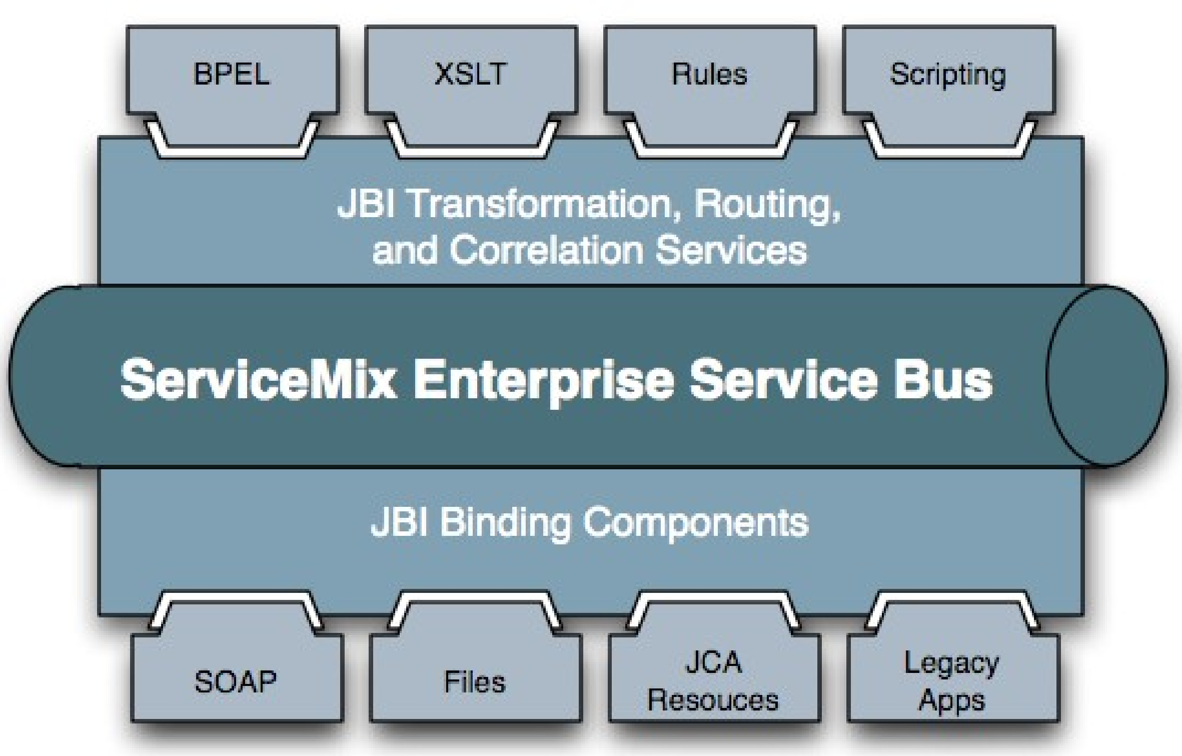
Networks of master-slave pairs

- A highly available, clustered approach.

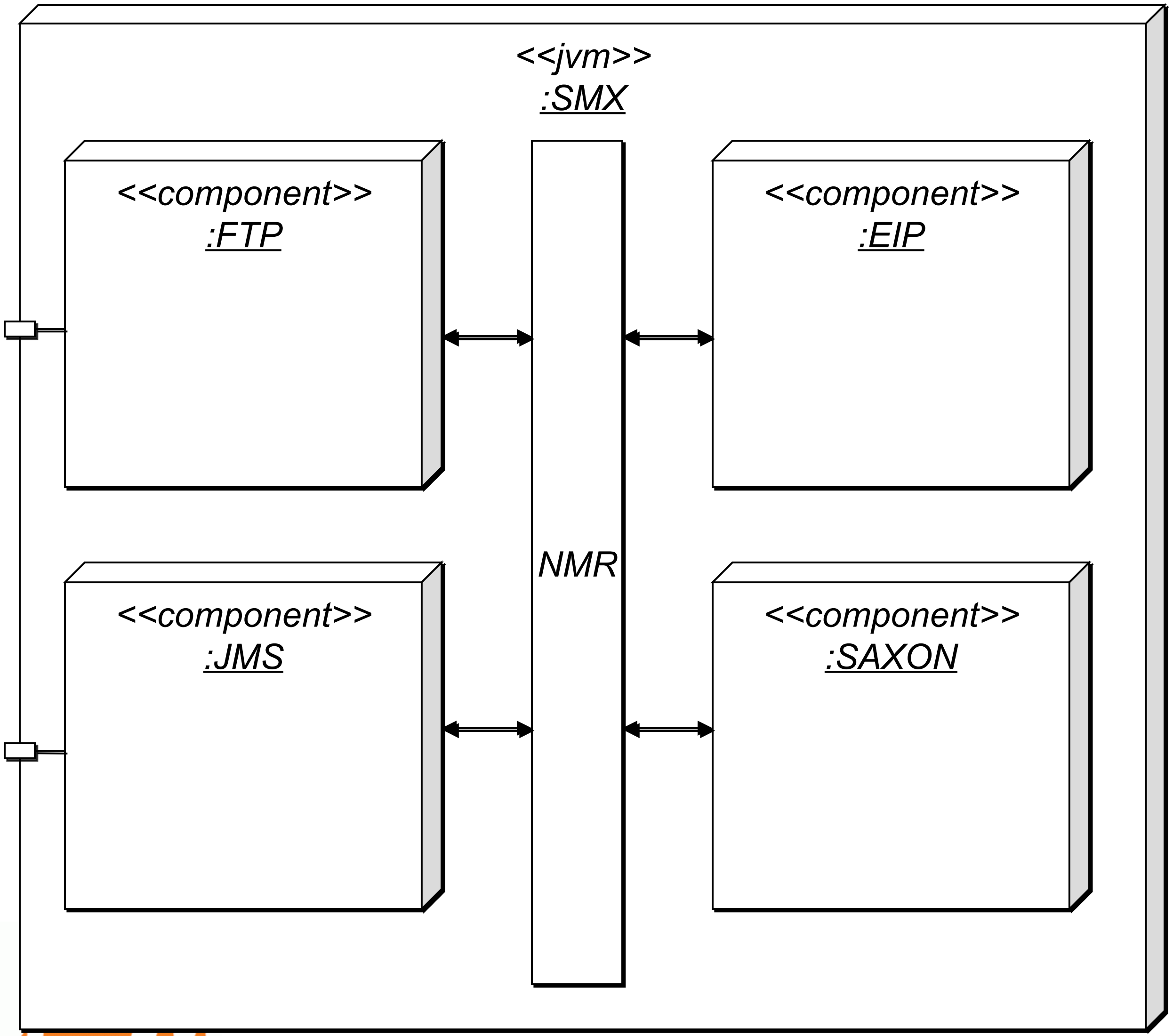


Apache ServiceMix – JBI-based integration

- A standards-based framework for deploying integration solutions.
  - Solutions are deployed as service assemblies (SAs), containing service units (SUs) that initialize servce endpoints.


BPEL
XSLT
Rules
Scripting
JBI Transformation, Routing, and Correlation Services
ServiceMix Enterprise Service Bus
JBI Binding Components
SOAP
Files
JCA Resouces
Legacy Apps

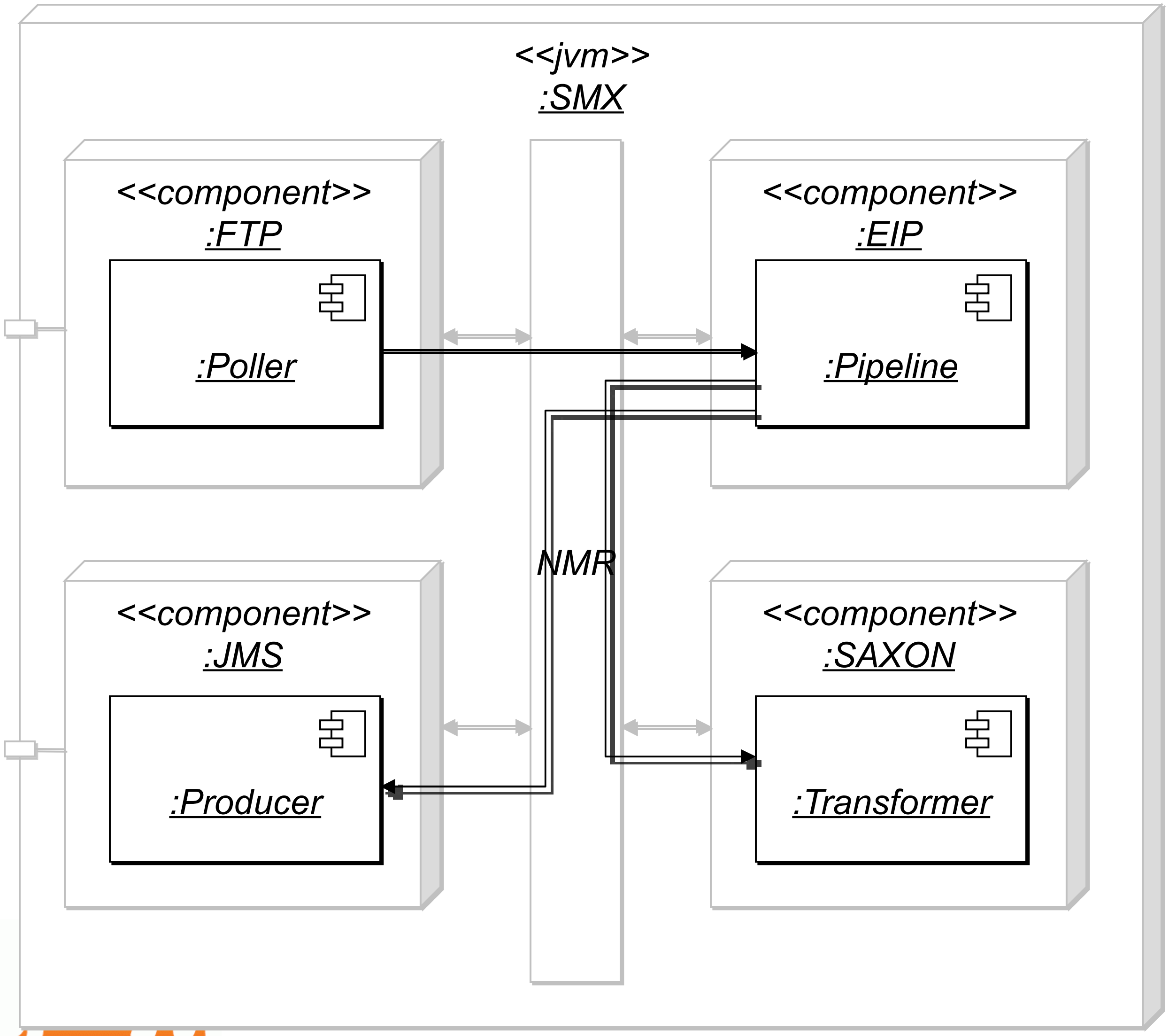
JBI component-based architecture



ServiceMix acts as a container for “components”, communicating with each other using the XML-based Normalized Message Router.

Use well-known components like JMS, HTTP, CXF, Bean, FTP, FILE, or write your own.

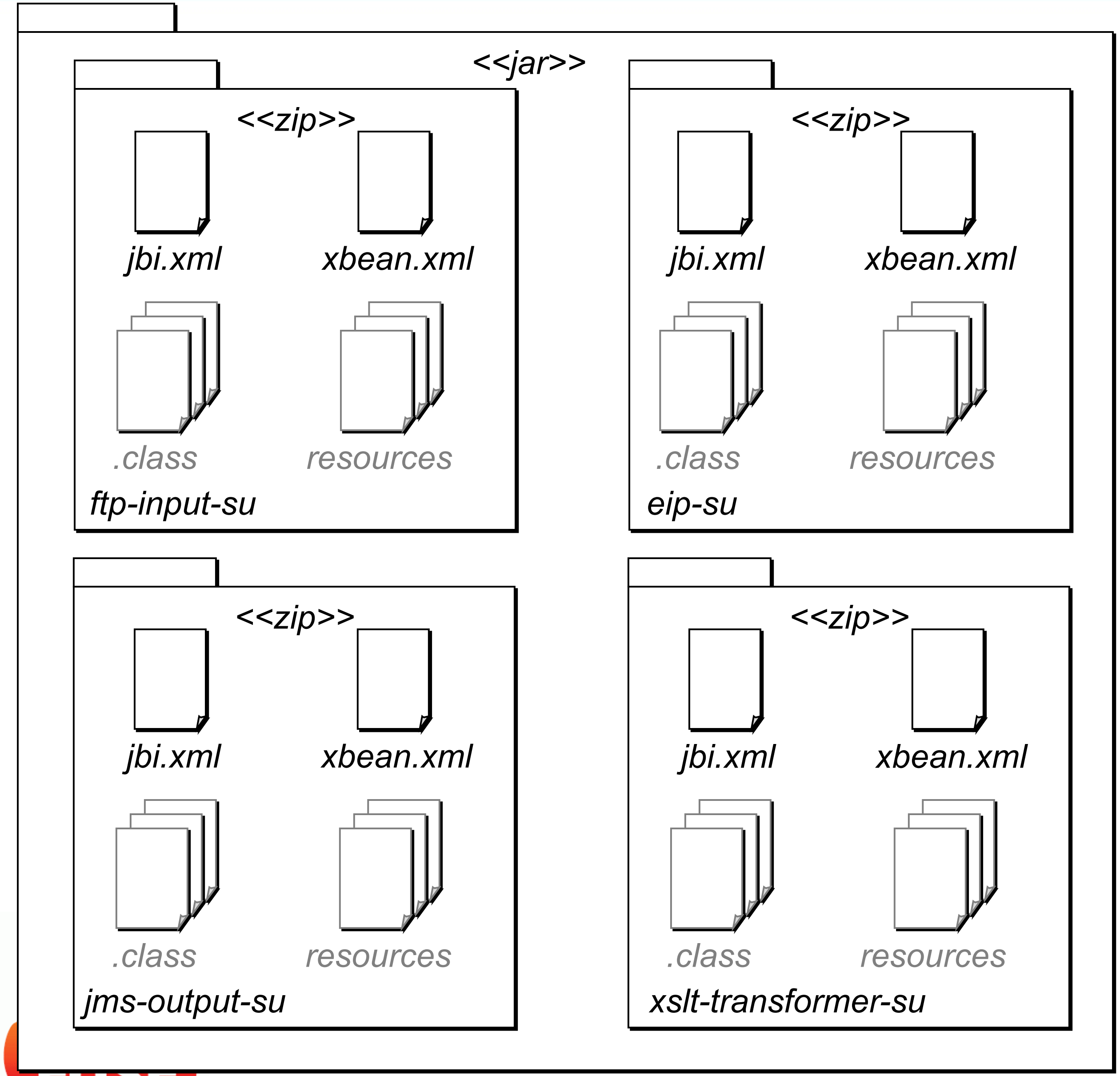
JBI component-based architecture



Build an application by configuring and wiring endpoints as SUs, combining them into SAs that can be deployed atomically.

Endpoints are configured using xbean (Spring) configuration; deployment artifacts are created using maven plugins.

JBI packaging



Each component is specialized using a SU.

In ServiceMix, the endpoint(s) are defined in an xbean.xml file.

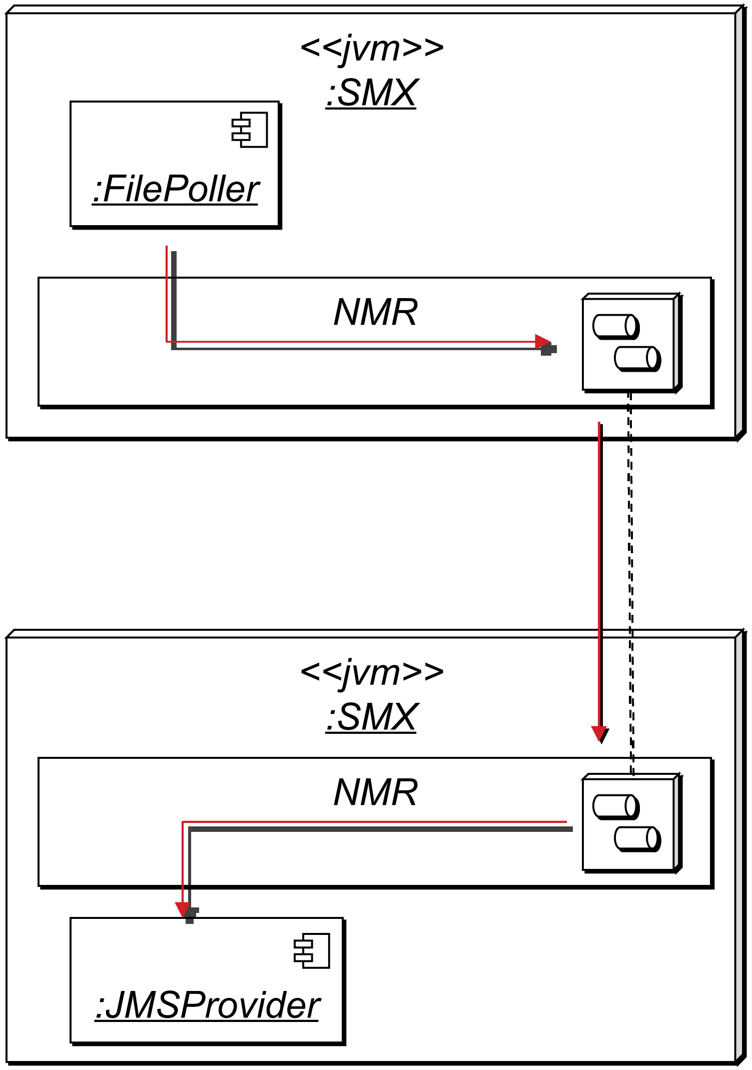
Maven plugins are used to generate jbi.xml file

SUs can optionally contain support classes and resources such as WSDL & XSD

SUs are bundled together into an SA to be deployed atomically.

Hidden gem: “message flows”

- Internally, the NMR uses different approaches (“flows”) to deliver messages between components
  - ST - straight through on the same thread
  - SEDA - intermediary in memory queue
  - JMS - using ActiveMQ
  - JCA - using XA-transactional queues with ActiveMQ
- The flow is chosen dynamically at runtime
  - ServiceMix chooses the flow according to the quality of service of the message exchange.

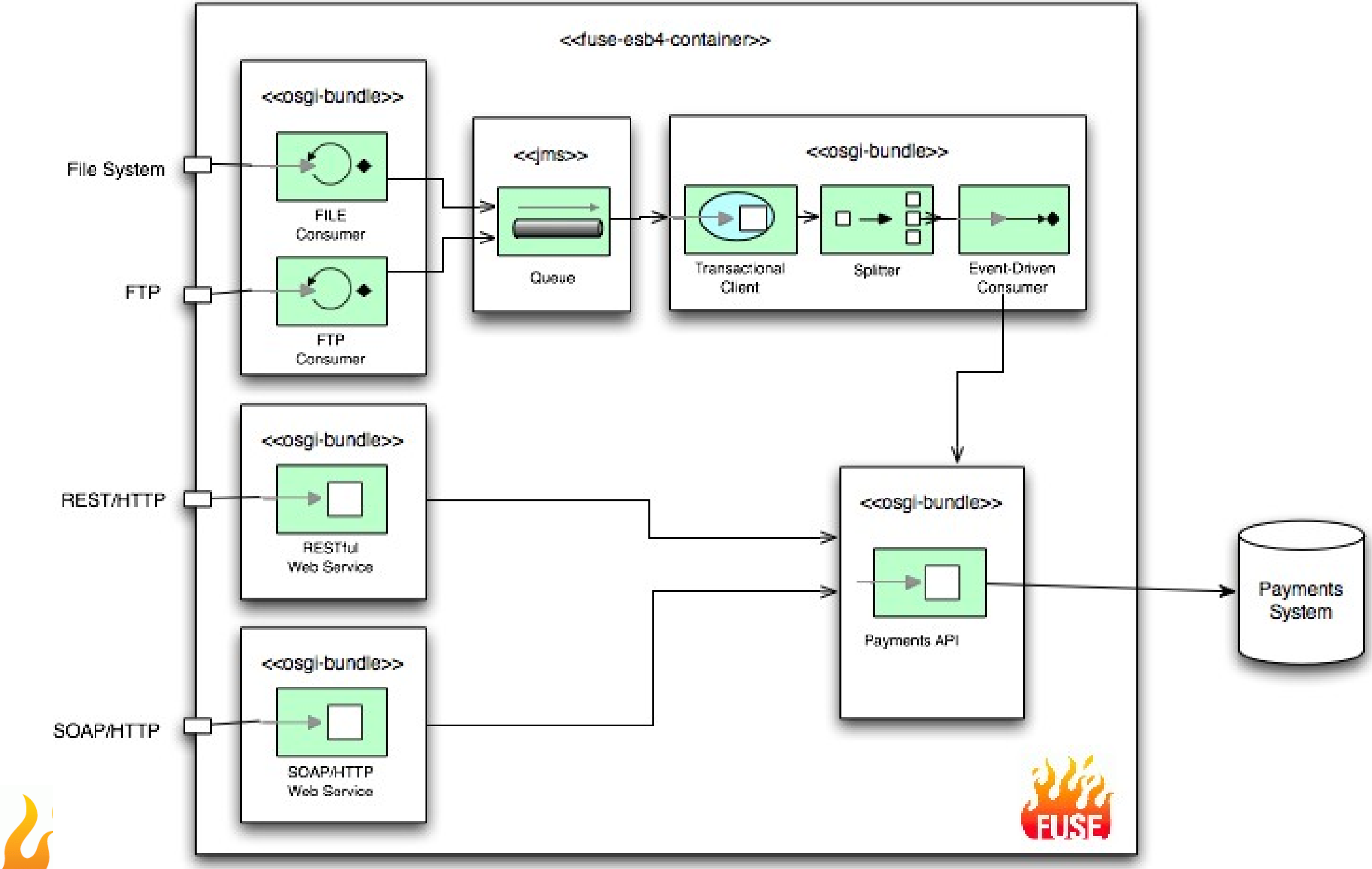


Apache ServiceMix 4.0 - OSGi

- ServiceMix 4.0 provides a new OSGi-based core
  - OSGi provides a simpler deployment artifact - the bundle - with versioning, class-path isolation & service life-cycle.
  - JBI functionality is implemented as a plug-in 'feature'

- Easily deploy CXF services, Camel routes, ActiveMQ, JBI components, Spring configuration, bundles, …

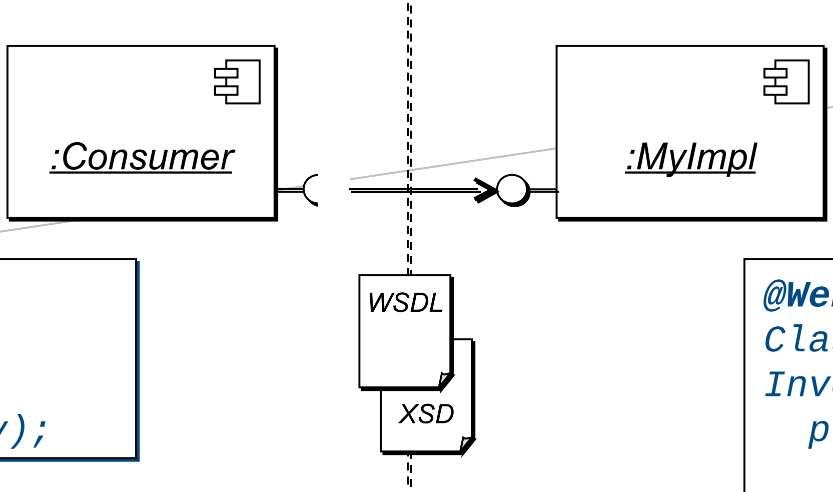
ServiceMix4: OSGi-based integration



FUSE Services Framework (Apache CXF)

- Flexibly create & deploy code-first or WSDL-first Java web services.

Choose the payload (XML, SOAP, JSON) or transport (HTTP, JMS) declaratively with no impact on code.



Separation of concerns

Implement services using JAX-WS or JAX-RS

```
Invoice inv
  = new Invoice();

invoiceSvc.process(inv);
```

```
@WebService
Class MyImpl implements
Invoicing {
  public void process(
      Invoice inv)
  {
  }
}
```

Cool things about FUSE Service Framework

- Code RESTful services using JAX-RS

- Generate client-side JavaScript code on the fly for browser-based WS clients:
  - http://localhost:9000/InvoicingService?js

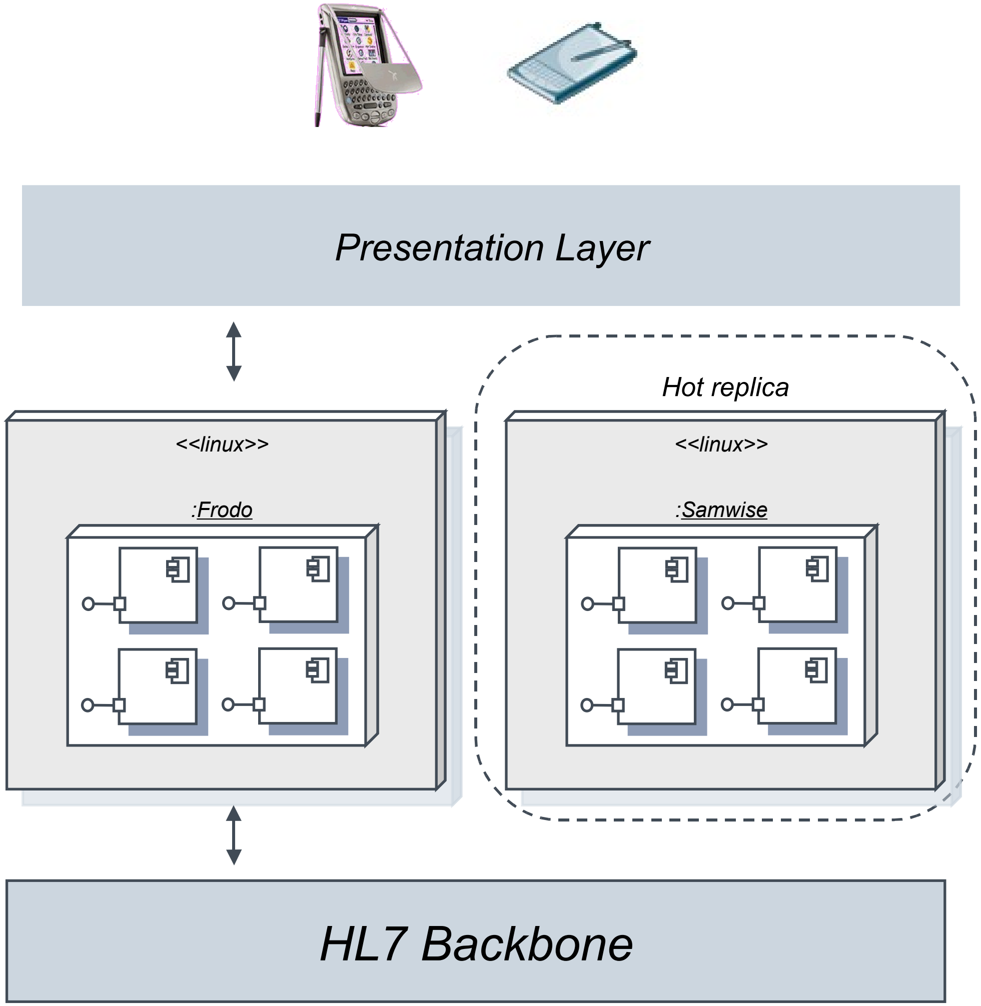
- Deploy anywhere:
  - J2EE: WebLogic, WebSphere, Tomcat, Jboss
  - OSGi: Servicemix 4
  - JBI: ServiceMix 3
  - SpringFramework
  - Lightweight FUSE Spring Container
  - Standalone: `public static void main(…) { }`

Integration for Mobile Healthcare

- Aim: expose patient care data from the national healthcare systems to health professionals using PDAs.
- Key points:
  - Four month project.
  - Integration using SOAP/HTTP and the healthcare HL7 XML schema library.
- Solution built using ServiceMix (Fuse ESB).
  - Architecture: SEDA based; use embedded transactional queues to achieve synchronous, synchronous reliable, and asynchronous reliable flows.
  - Standards: SOAP, JBI, HL7, XML, XSD, XSLT
  - Tools: JDK, Eclipse, Maven, Subversion, Fuse ESB, CXF
- Methodology: agile methods, war room, stand-ups, XP metrics, all in the context of a highly formal project methodology

Architecture

- Integration bridge between national health-care system and mobile devices
  - Providing patient care data to medical professionals on PDA.
  - Supporting synchronous, asynchronous and reliable asynchronous message exchange patterns.



Presentation Layer

Hot replica

<<linux>>

:Frodo

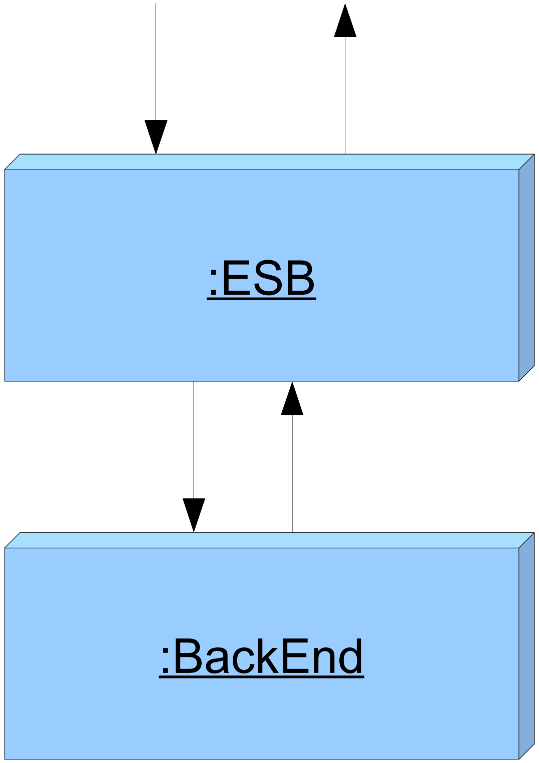
<<linux>>

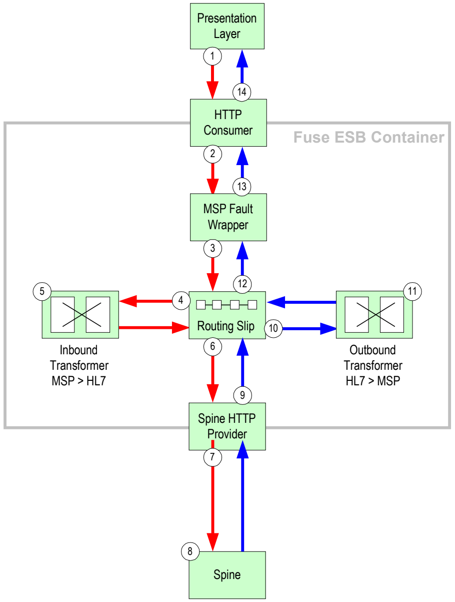
:Samwise

HL7 Backbone

Architecture notes: synchronous flow

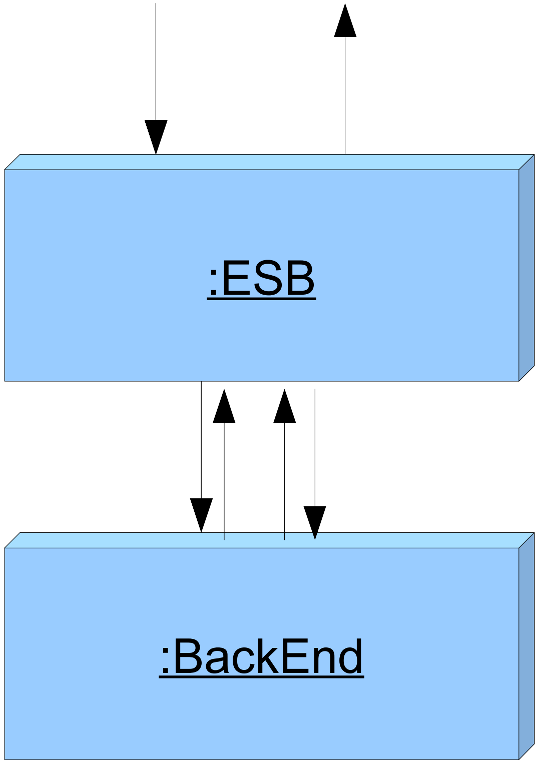
- Presentation layer makes a blocking call on the integration service, which in turn blocks as it accesses the back-end.
  - ... with some transformation to/from HL7 XSD using XSLT stylesheets.
  - Easy peasy, lemon squeezy.

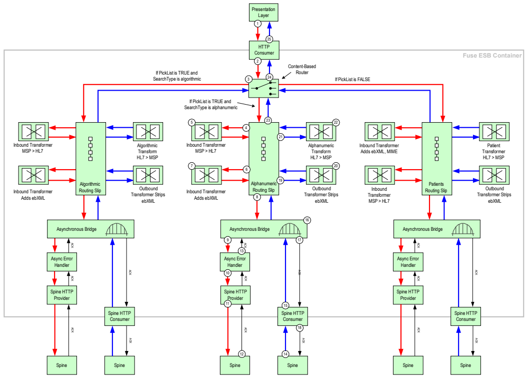




Architecture notes: synchronous unreliable flow

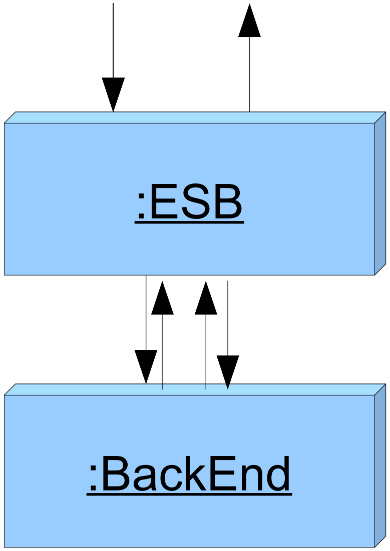
- Presentation layer makes a blocking call on the ESB
  - Which uses an 'asynch bridge' pattern to send a message to the back-end...
  - And correlate a subsequent message from the back-end as a the response.




Presentation Layer
HTTP Consumer
Fuse ESB Container
Content-Based Router
If PickList is TRUE and SearchType is algorithmic
If PickList is FALSE
If PickList is TRUE and SearchType is alphanumeric
Inbound Transformer MSP > HL7
Algorithmic Transform HL7 > MSP
Inbound Transformer Adds ebXML
Algorithmic Routing Slip
Outbound Transformer Strips ebXML
Inbound Transformer MSP > HL7
Alphanumeric Transform HL7 > MSP
Inbound Transformer Adds ebXML
Alphanumeric Routing Slip
Outbound Transformer Strips ebXML
Inbound Transformer Adds ebXML, MIME
Patient Transformer HL7 > MSP
Inbound Transformer MSP > HL7
Patients Routing Slip
Outbound Transformer Strips ebXML
Asynchronous Bridge
Asynchronous Bridge
Asynchronous Bridge
Async Error Handler
Spine HTTP Provider
Spine HTTP Consumer
ACK
Spine
Spine

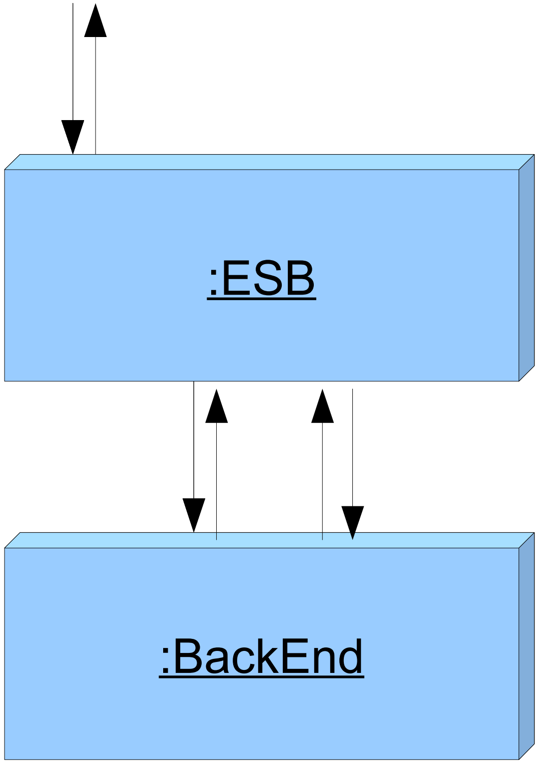
Architecture notes: synchronous unreliable flow (cont')

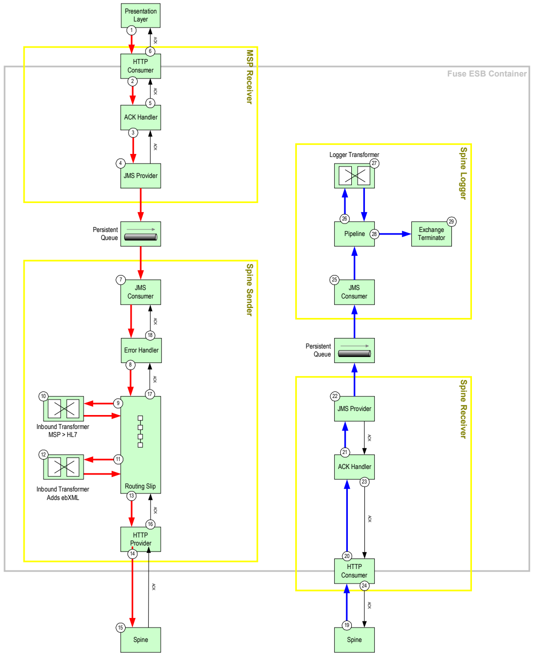
- Unreliable? What do you mean, UNRELIABLE?
- The client is blocking for a response, so
  - If there's an error in the flow, then the client will receive an exception or timeout...
  - ... so they can retry.
  - ... so this means there's no need to make the flows persisted or transactional.
  - ... hence, the term 'unreliable'
- Use reliability *when you need it*.



Architecture notes: asynchronous reliable flow

- Presentation layer submits a request to the integration service.
  - Message is placed on persisted queue; ACK is returned.
  - Message read off queue, request is submitted to HL7 back-end.
  - Later a 'useless ACK' response is received from back-end and placed on a queue; this is logged for audit.





Lessons learnt

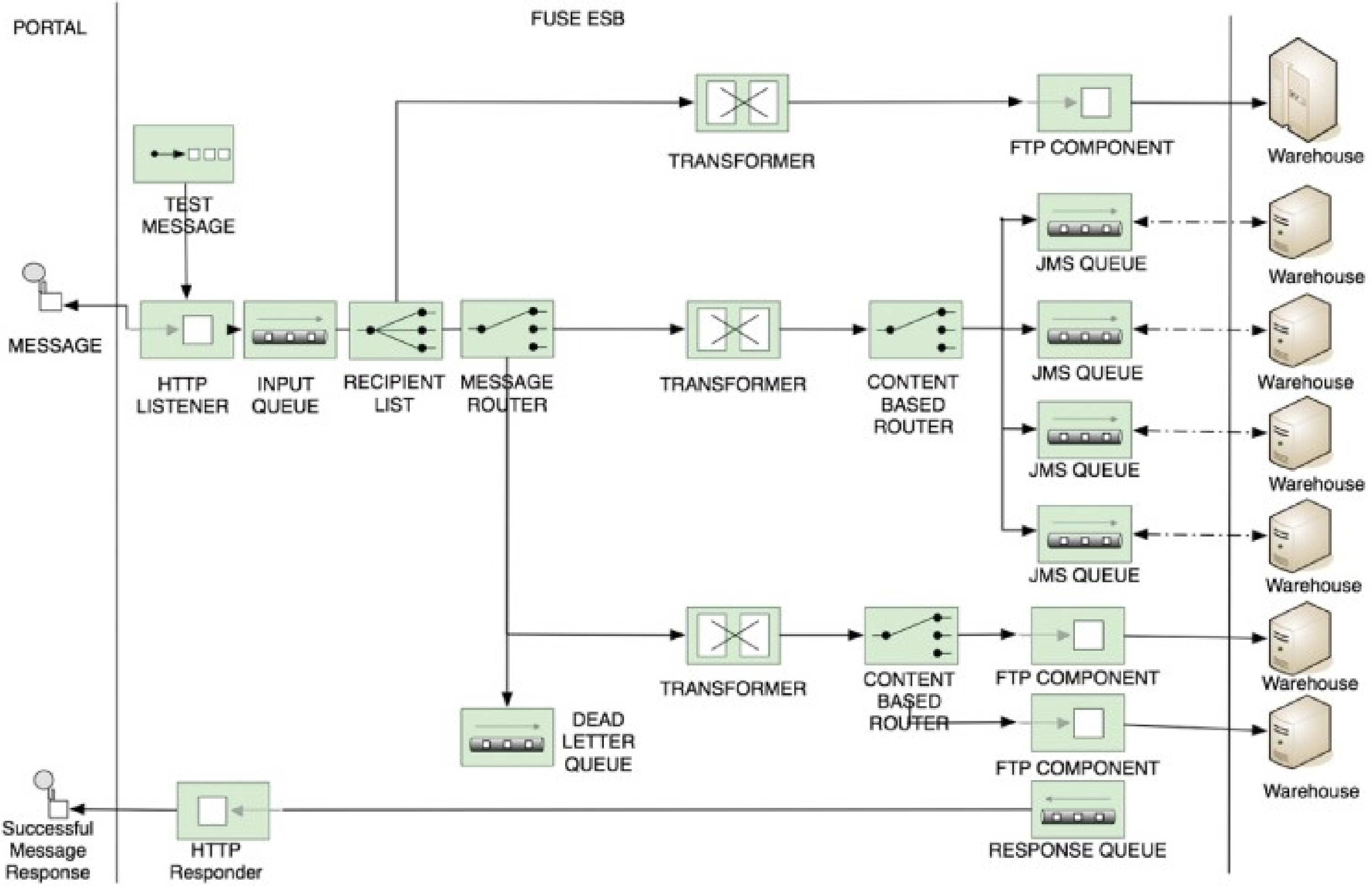
- Open source is geared for partnership
  - Java/XML/Maven/Spring skills readily available.
  - We had some great externals on this project.
- Agile can work well in a formal project environment
  - Need a good project manager to act as a “spring”.
- ServiceMix is *solid*.
  - Great performance in non-functional test: the 72 hour *flat-line of joy*.
- ServiceMix is not a silver bullet.
  - Some of those flows were tricky.
- Community contact is good
  - IRC, direct email
  - Problem analysis: *Use the source, Luke*.
  - Don’t get distracted by the *dark side of the source*.

Retail Pharmacy

... actually, a warehouse scheduling problem

- How to schedule trucks and payload to increase turnaround and save on penalties.
- Application manager at warehouse sketched his design using gregor-grams on Visio.
  - ... and discovered he could implement them using ServiceMix.
- End solution was declarative configuration of EIPs.
  - No code, just config.
  - Maven, xbean, ...

The EIP solution



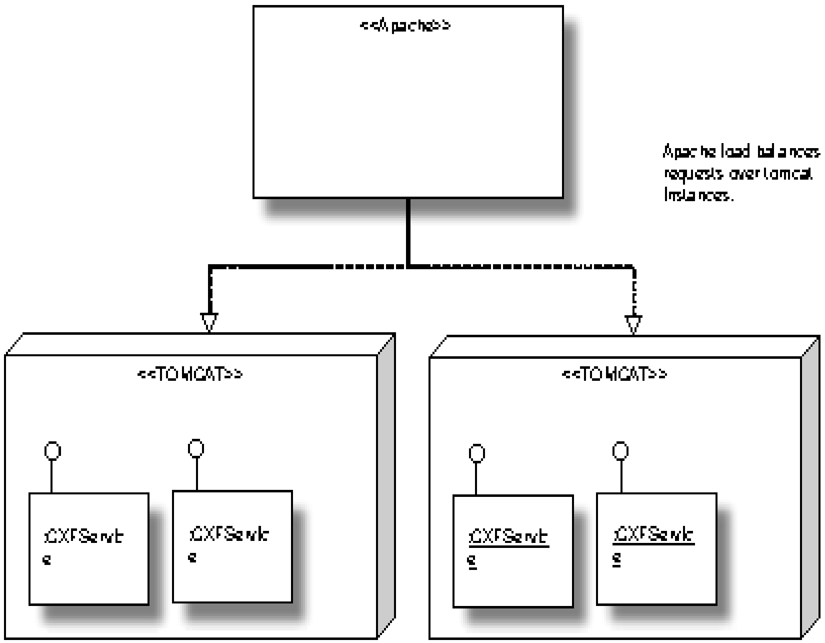
Aside

- We've seen Apache middleware adopted numerous times in retail sector.
  - No million-dollar budget.
  - Pragmatic, bottom-line approach.
  - Real results, real-time.

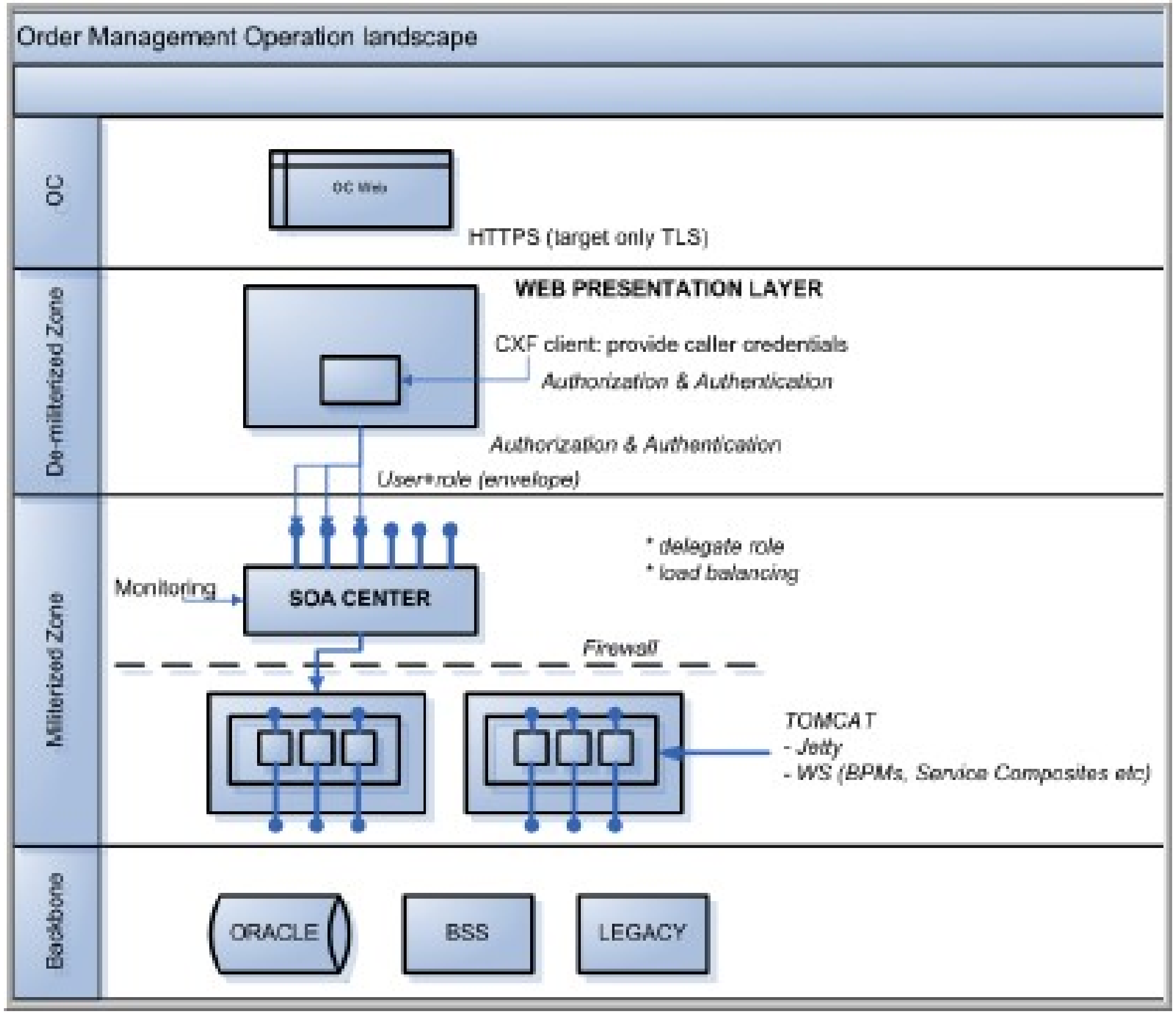
Telco

Web Services for BSS

- Mobile operator with a growing suite of web services around customer care and provisioning.
  - CXF used for Web Services
  - Deployed in Tomcat
  - Load-balanced via Apache Proxy
- >50 services:
  - Needed more control over provisioning and better security.

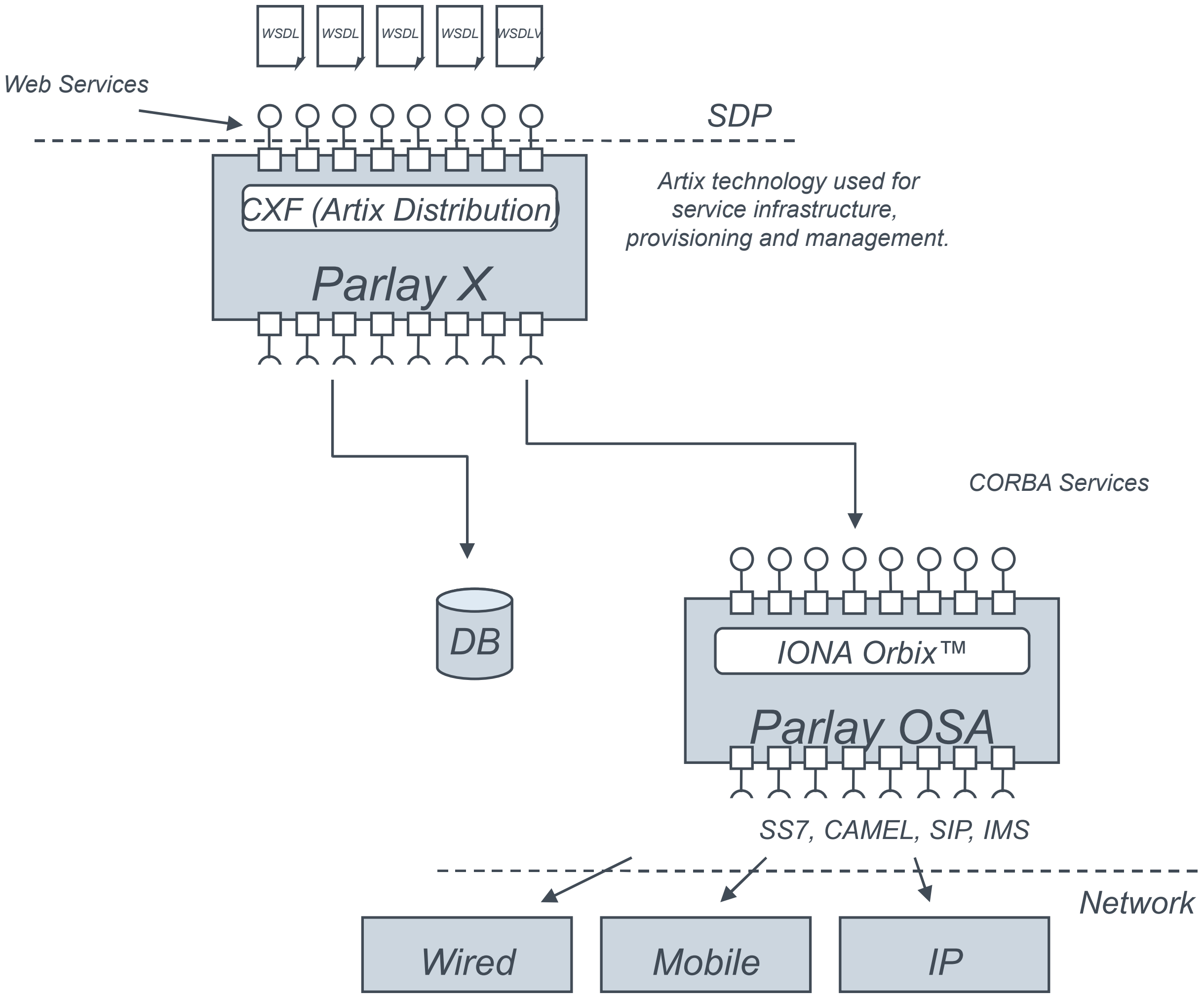


Proposed Architecture



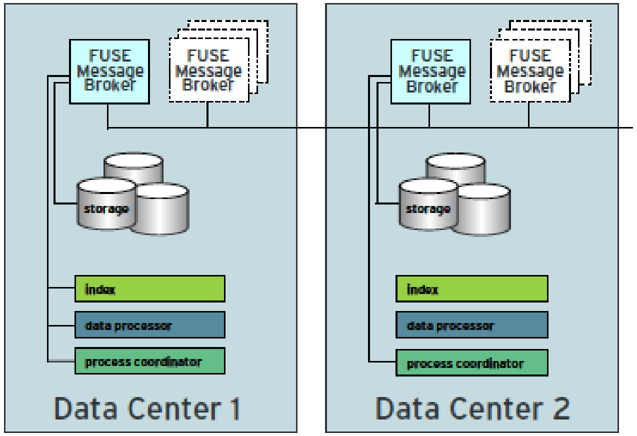
Another telco use-case

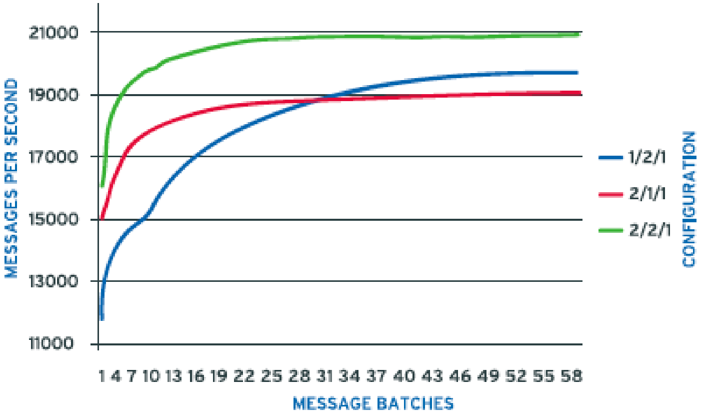
- Implementation of Parlay-X
  - Allowing Telcos to provide services such as MMS, SMS, ALM to partners.
    - For example, how does my SMS vote for X-Factor get counted?
  - Integrates heavily with CORBA Parlay infrastructure
    - Makes use of CXF CORBA binding.
- Services deployed using OSGi framework.


WSDL
WSDL
WSDL
WSDL
WSDLV
Web Services
SDP
CXF (Artix Distribution)
Parlay X
Artix technology used for service infrastructure, provisioning and management.
CORBA Services
DB
IONA Orbix™
Parlay OSA
SS7, CAMEL, SIP, IMS
Network
Wired
Mobile
IP

Documents Storage

- Document storage company; terabytes of data per day.
  - Moving from an closed-source solution to ActiveMQ.
    - It'll scale in price, but will it scale in deployment??
  - ActiveMQ put through rigorous performance tests.
    - And was selected for next generation system :)
    - Get the results from the white paper at fusesource.com.





Summary

- ActiveMQ, CXF, ServiceMix, Camel:
  - Focussed on messaging, integration, SOA enablement
  - Reliable, clustered, highly-available infrastructure
- The Apache Software License is *scalable*.
  - This is a major attraction for many adopters.
- Futures
  - Movement to OSGi runtime in SMX4
  - Supporting “SOA” & “REST” architectures