Carbon: Towards a Server Building Framework for SOA Platform

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WSO2 The open source SOA company

Outline

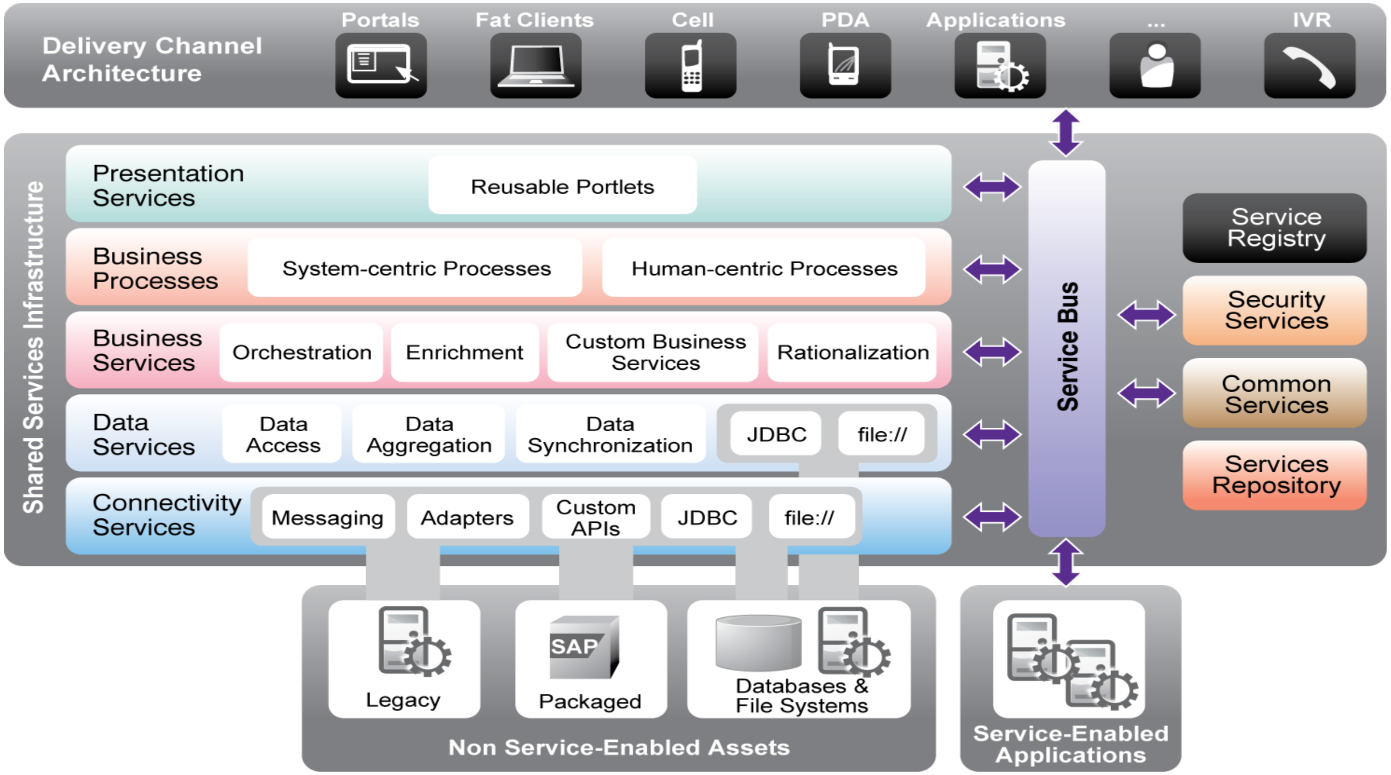
- Challenges of building a Next Generation SOA platform
- A Recipe for a Solution
- Carbon Platform Architecture
- How does it make a difference?
- Conclusion

Building Next Generation SOA Platform

AXIS2 Apache ODE shindig synapse Qpid

- At Year 2005, several contributors to Apache Web Services Project at WSO2 started an effort to build a next generation SOA platform by integrating, and extending Apache WS projects to a one platform.
- After 5 years, 3 major releases, and few thousand man months, we have more than 10 products that covers most of the SOA platform.
- Apart from SOA challenges, we faced major Software Engineering and Middleware challenges, and this is our story.

SOA Platform



- We are taking about a one platform that handles the breadth of SOA that includes a Application Server, ESB, workflow Engine, Gadget Server …
- They have to work as a one unit, not as 10 different projects, with single security model, governance model, look and feel etc..
- It is a single system that takes hours to download, hours to build!

Composition of SOA Platform

- SOA Platform should support many SOA and related concepts: Service, Workflow, Mediation, Mashup, Rules, CEP, Registry, Governance, Monitoring ...
- Also there are many cross cutting concepts like security, UI, logging, clustering, caching ..
- We typically handle platform as collection of servers, where each service supports some of the concepts.

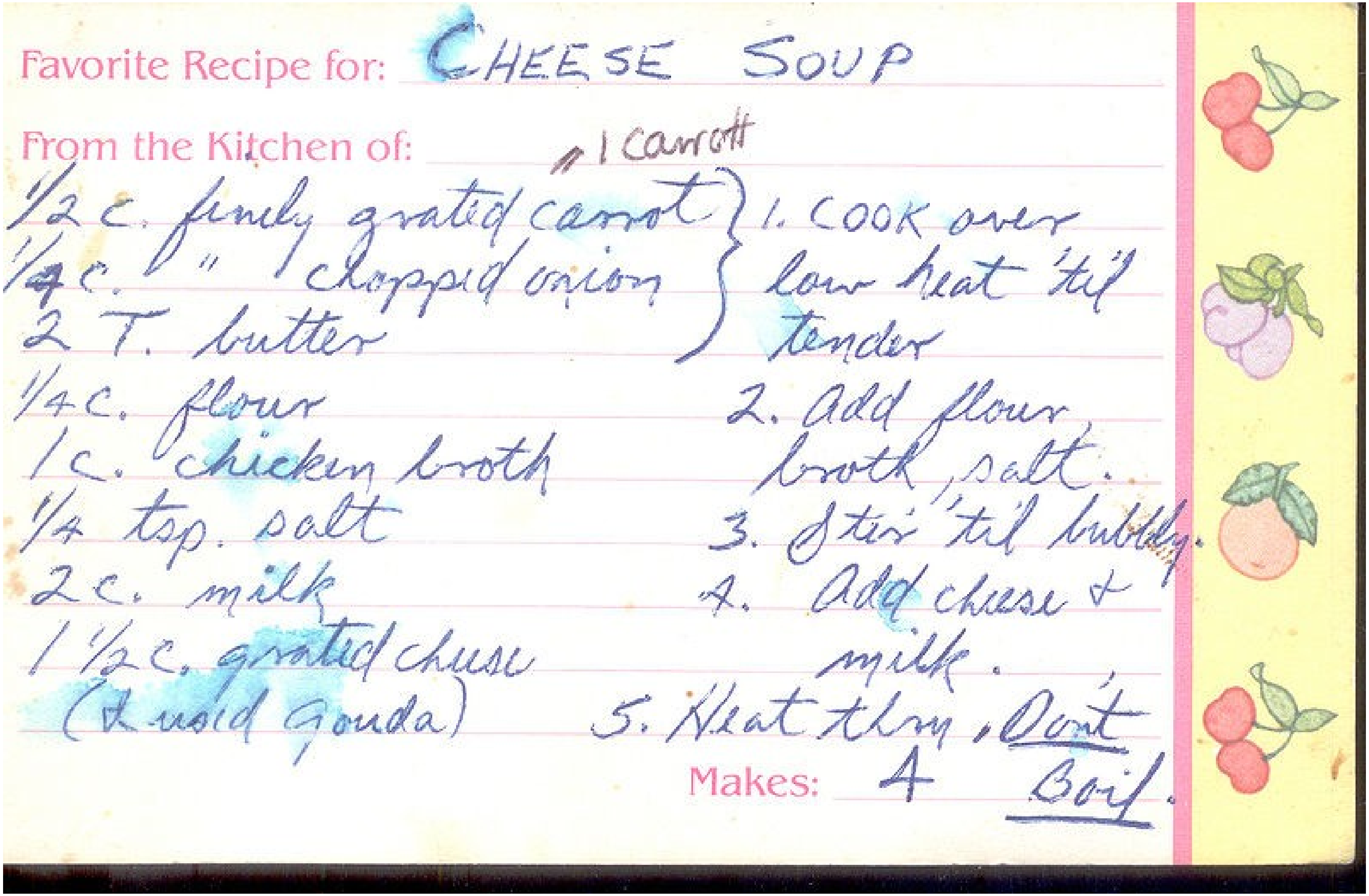
Challenges

- Avoid duplicates and maximize sharing
  - Sharing cross cutting aspects like security, storage, UIs etc.
  - Maximize sharing across different features.
- Reduce the coupling between different parts, and enable composition of features
- Make the platform extensible
- When writing a new extension, reduce the work need to be done to enable cross cutting aspects and to integrate with rest of the platform.
- Do all above with first class support to SOA

Challenges: Pizza Parlor Example

- Customization vs. few sizes fit all solutions
- With software it forces solution architecture to be conformed to available products.

Recipe for a Solution



Favorite Recipe for: CHEESE SOUP

From the Kitchen of:

1 carrott

1/2 c. finely grated carrot
1/4 c. " chopped onion
2 T. butter
1/4 c. flour
1 c. chicken broth
1/4 tsp. salt
2 c. milk
1 1/2 c. grated cheese
(I used Gouda)

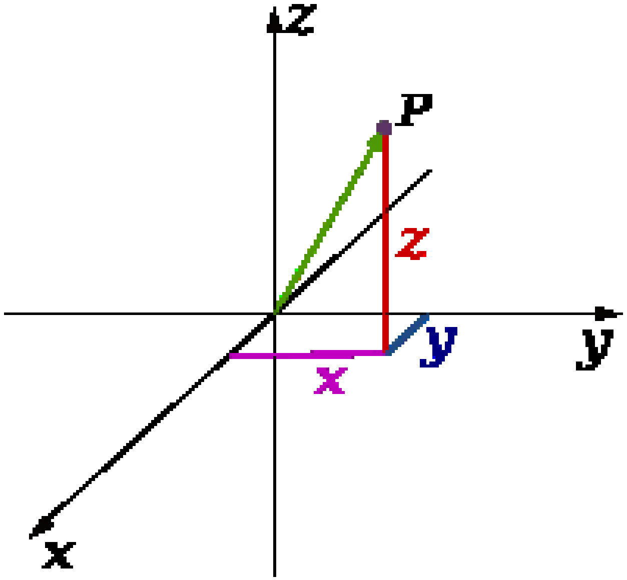
1. COOK over low heat 'til tender
2. Add flour, broth, salt.
3. Stir 'til bubbly.
4. Add cheese & milk.
5. Heat thru, Don't Boil.

Makes: 4

CBSE and Complex Systems

- CBSE (Component based Software Engineering) is used to handle complex systems in a loosely coupled manner.
- Define a component
  - Unit of deployment, versioning, and replacement
  - provide interfaces, support introspection, reflection
  - Have a deploable archive format
  - Include Metadata about itself
  - Define dependancies and often support IOC (Inversion of Control)
  - Can be composed at deployment or runtime

Kernel of the Platform



- As mentioned with challenges, servers, as well as different features shares many things, like security and execution
- Building an kernel which holds the main functionality is often use to handle such situations.
- Idea can be best explained through kernel of vector spaces, which provide a orthonormal basis for the vector space.

A Server Building Framework?

- Since SOA platform includes many servers that have different functionality, we argue that we should try to build a server building framework for SOA platform
- One potential approach is to define different functionality as components and compose them to build servers.
- IOC (Inversion of Control) based component framework

Carbon Platform

Goal

- Mostly what we discussed as challenges
- We look to build a Server Building framework
  - On top of a Component model that support IOC
  - Support first class support to SOA
  - And support building servers through composition of components

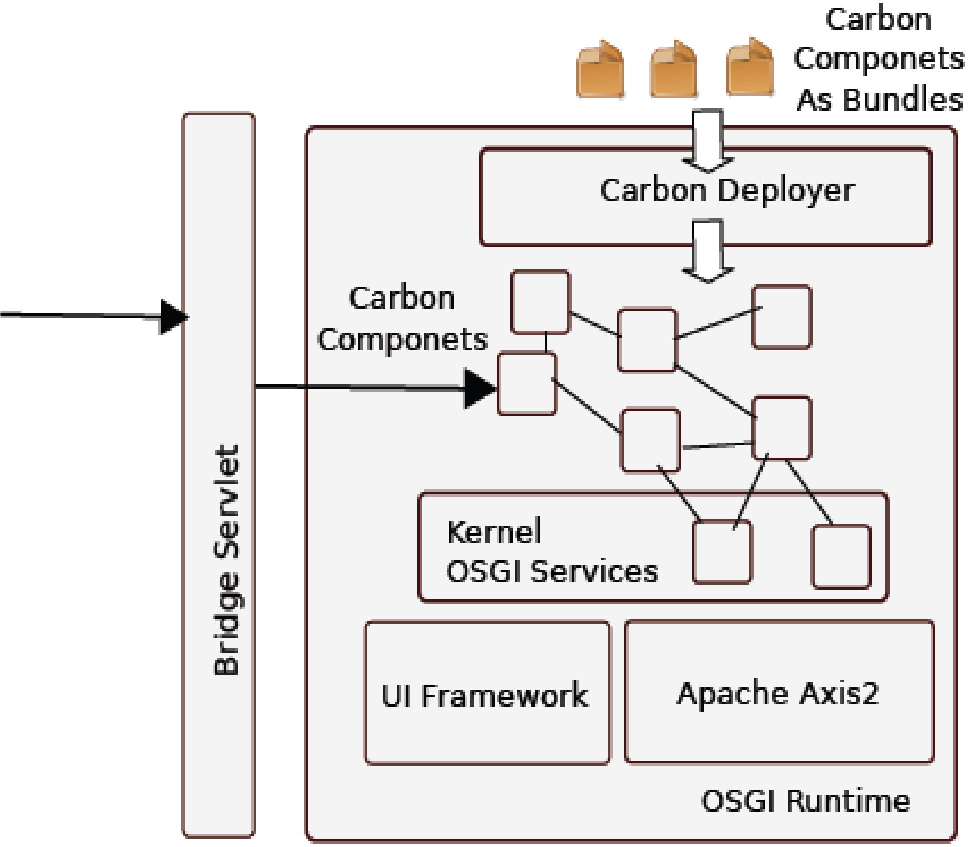
High Level Architecture

- High level architecture includes three parts
  - Carbon component framework which extends OSGi to support SOA artifacts
  - Carbon runtime that integrates Axis2 with OSGi and support security and UI support.
  - Kernel Services
- These are supported within the Carbon Core, and other components are built on top of the Carbon Core.

Carbon Components

- Carbon is built on OSGi (Eclipse Equinox)
  - Using Components, IOC support, and P2 support from OSGi
- Extends the OSGi components to support SOA artifacts as first class.
- Carbon integrates Axis2 with OSGi and supports SOA specific metadata within Carbon components
  - E.g. Component can include service definitions which are identified and deployed by Carbon.

Runtime Architecture



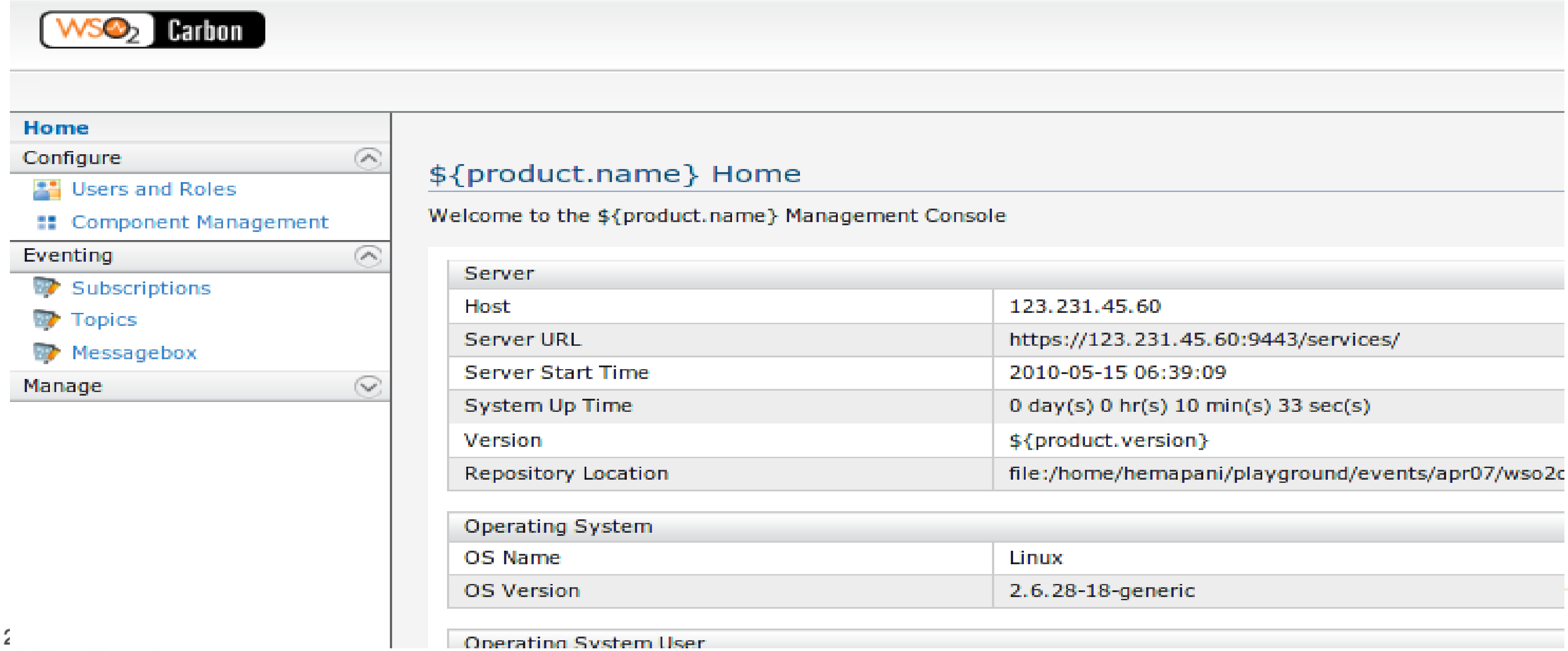
- Integrates Axis2 to OSGi
- Detect, process, and support SOA specific metadata from Carbon bundles.
- Intercept all requests through “Bridge Servelt” and support
  - Security model
  - UI support

Kernel of the Platform

- We support following as kernel services through Carbon core (Available as OSGi services through IOC)
  - Execution (supporting services and workflows)
  - Data Storage
  - Security (user management, authentication, authorization)
  - User Interfaces
  - Other Services (monitoring, caching, clustering etc.)
- They are used by most components and simplify development of new components.

Event Server as a Example

- Components
  - A Service
  - Admin UI
  - Admin Services
- All Implemented as components and composed with Carbon.



${product.name} Home

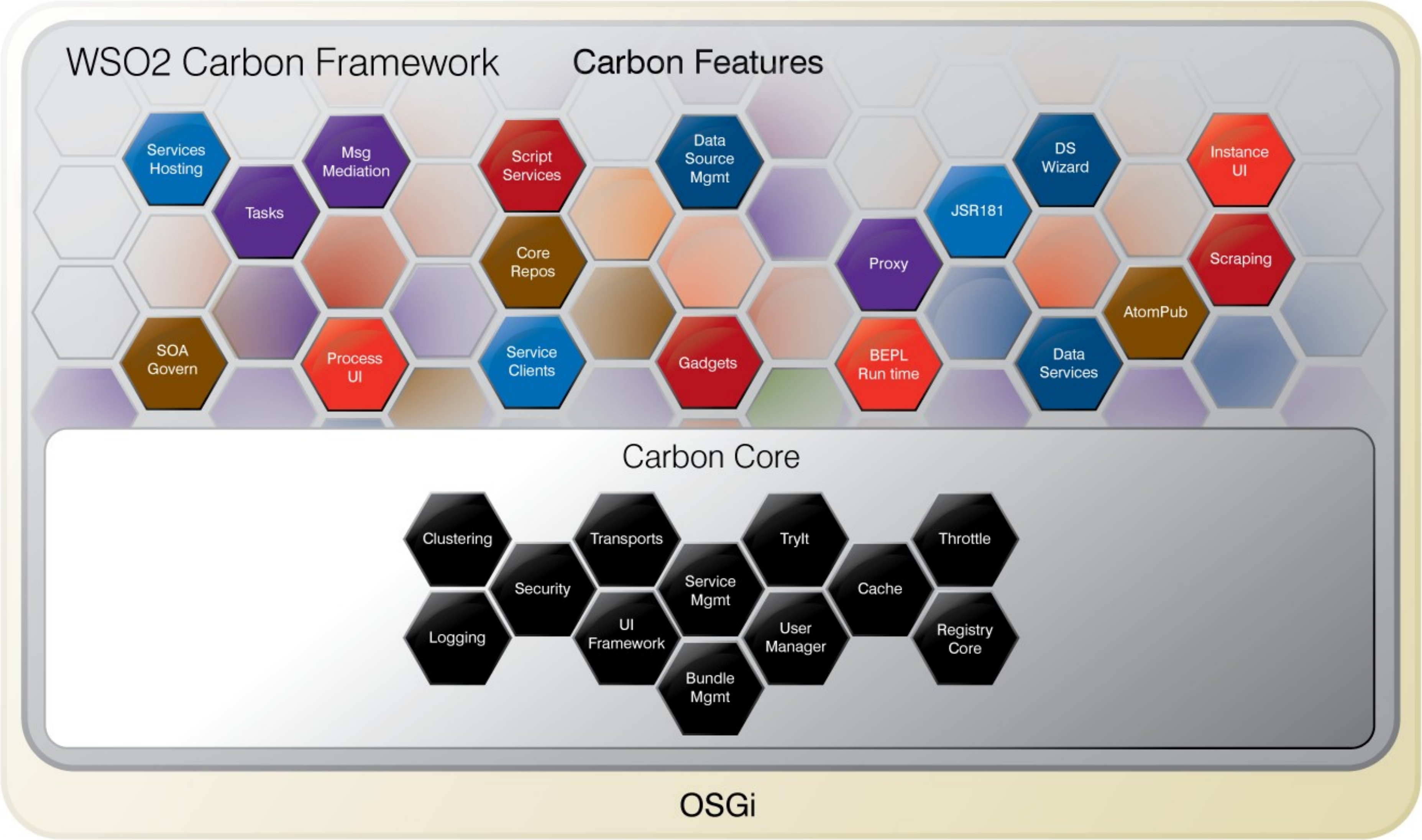
Welcome to the ${product.name} Management Console

Server	
Host	123.231.45.60
Server URL	https://123.231.45.60:9443/services/
Server Start Time	2010-05-15 06:39:09
System Up Time	0 day(s) 0 hr(s) 10 min(s) 33 sec(s)
Version	${product.version}
Repository Location	file:/home/hemapani/playground/events/apr07/wso2c

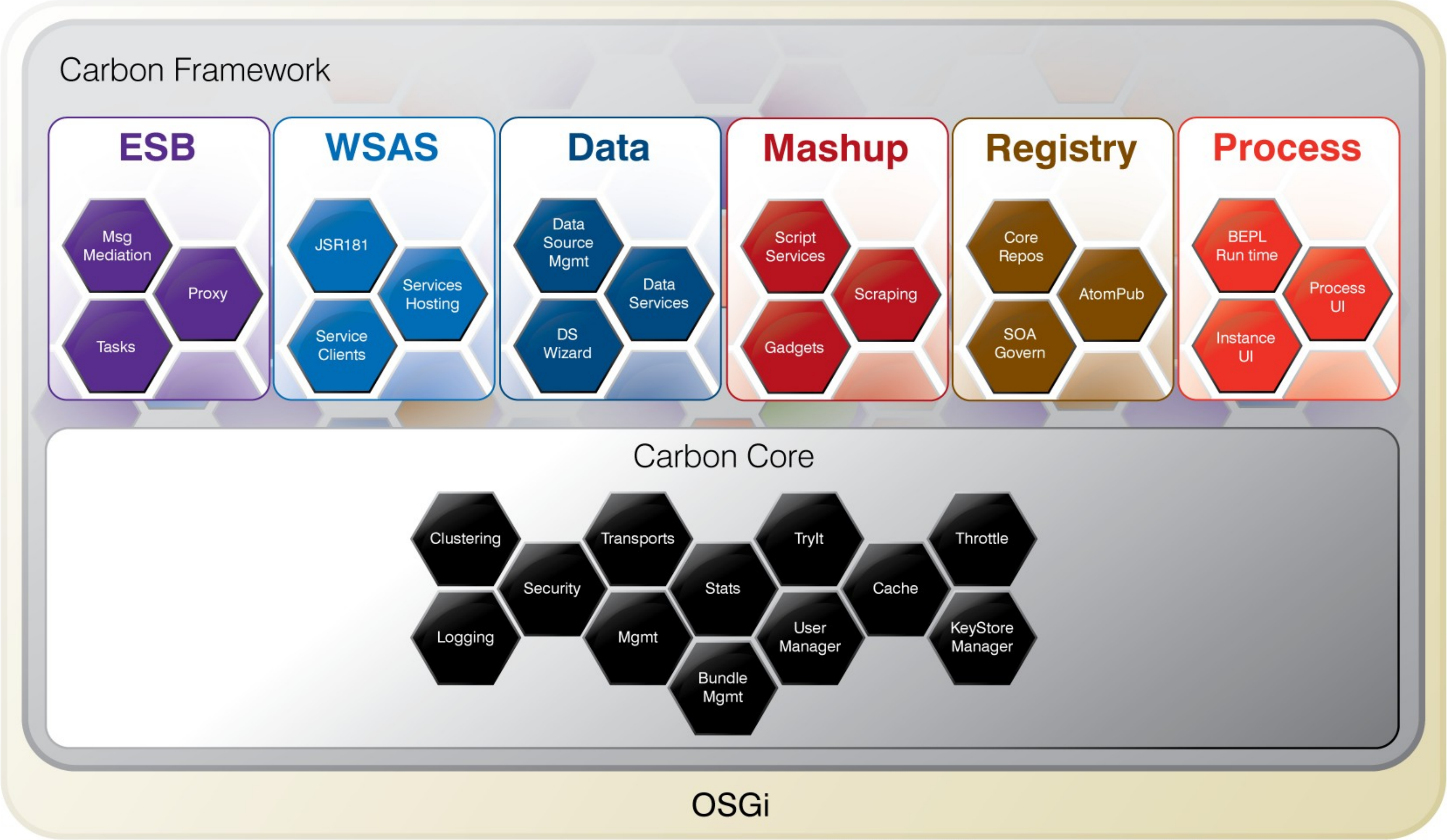
Operating System	
OS Name	Linux
OS Version	2.6.28-18-generic

Operating System User

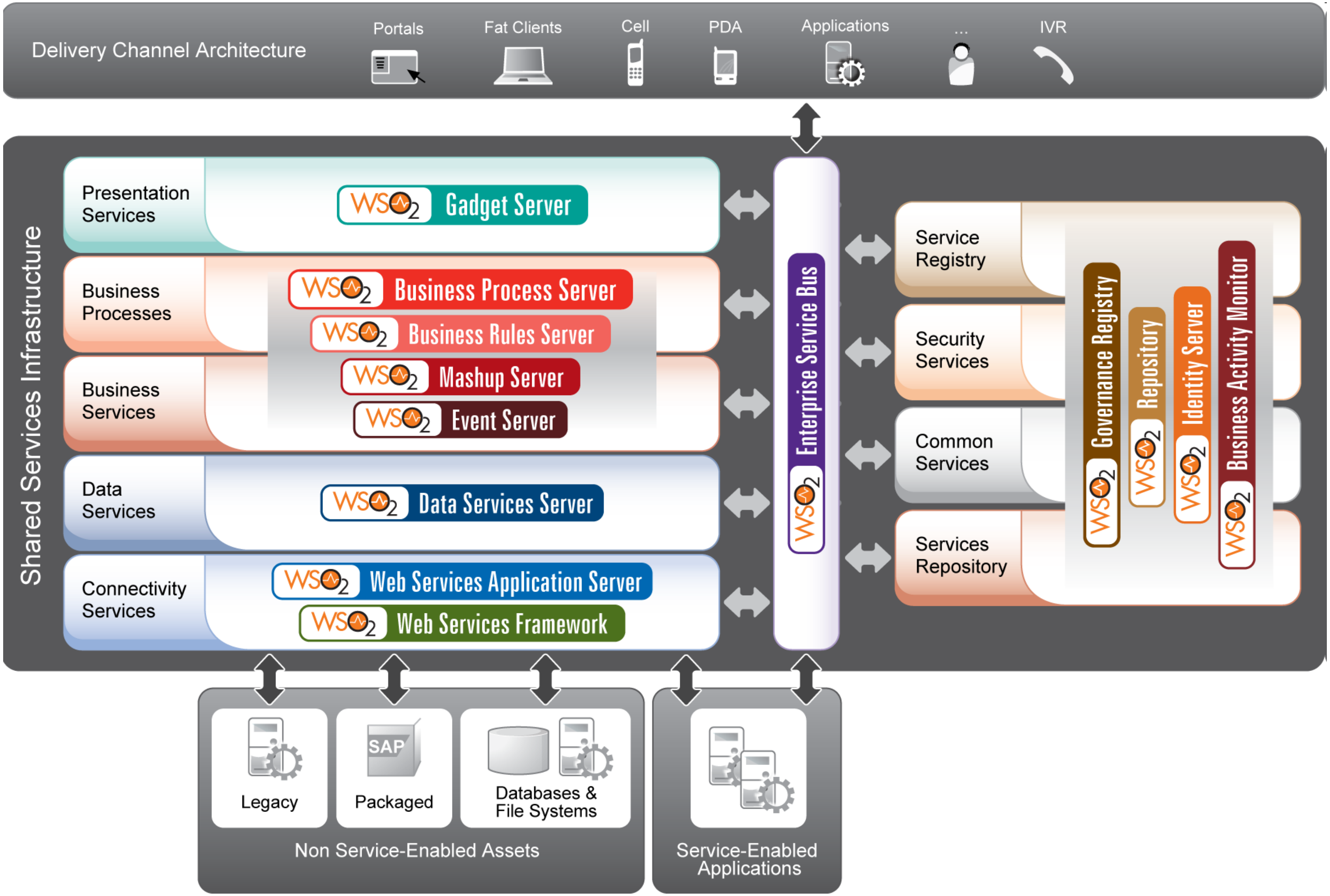
Carbon Components



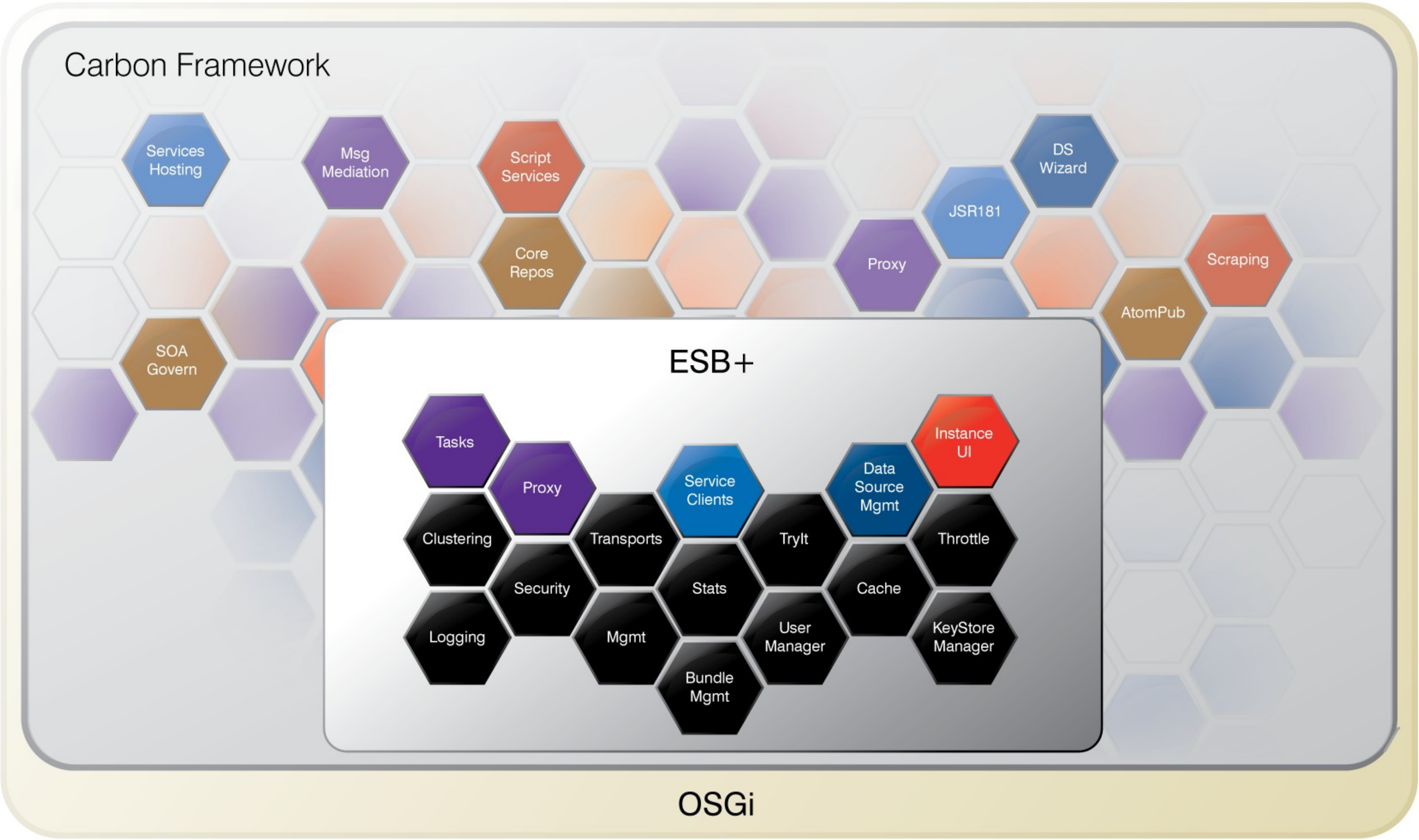
How Products are Built?



WSO2 Carbon Platform



Building Custom Products



How to Handle Conflicts?

- Can components clash when they are composed in different combinations?
- Mainly through conventions
  - All inter-component communication is through OSGI components
  - Store all configurations in its own space
  - OSGI ensure all dependancies are available
- Resulting system has the same characteristics as a loosely coupled SOA system where users pick and choose services and create applications using them.

How does Carbon make a Difference?

How does it make a difference?

- Enable architects to draw server boundaries according to the problem at hand by defining their custom servers.
- Just like eclipse, Carbon enables users to customize servers by adding or removing features at runtime.
- Through the kernel, components get support for cross cutting concerns (e.g. security) with minimal work, thus let users focus on main features of his component.
- First class support for User Interfaces as a part of components. (Written as JSP + Metadata)

How does it make a difference? (Contd.)

- Uniformity across the platform: same look and feel, startup, configurations, programming model etc. Hence if a user knows one server, he knows others.
- Kernel and components enable reuse, avoid repetition, and promote composition.
- Support platform wide aspects like a logging, governance, monitoring etc. And those aspects work consistently across the platform out of the box.
- As most features are drawn from the component repository, Carbon simplifies the development of new servers.
- Provides an OSGI based component framework for SOA developers

Few Further Steps

- Carbon supports multi- tenancy: Discussed in “Afkham Azeez, Srinath Perera, et. al., "Multi-Tenant SOA Middleware for Cloud Computing" 3rd International Conference on Cloud Computing, Florida, 2010”
- Complete Carbon platform is now available as a Service: (Stratos, see http://wso2.com/cloud/stratos/). Discussed in “Afkham Azeez, Srinath Perera, et. al., WSO2 Stratos: An Industrial Stack to Support Cloud Computing”, submitted to IT: Methods and Applications of Informatics and Information Technology Journal.

Open Questions/Challenges

- Investigate in to “Kernel” of the SOA platform, add remove features to get the right mix.
- UI Framework and integration with components (e.g. Single Sign on Support)
- Optimizing Carbon programming model
- CApp – Carbon archive format, which enable users to write a one archive that will include many SOA artifacts like Web Services, Workflows etc. (like EAR for J2EE)
- Carbon Studio – an integrated development environment for Carbon.

Few Places Where Carbon is in Use

Deutsche Bank
Alcatel·Lucent
Prudential
ca Transforming IT Management.
ebay
Chapdelaine & Co. Leadership has its advantages
Trimble
LOCKHEED MARTIN
National IT and Telecom Agency
Ministry of Science Technology and Innovation
software AG
Mercedes-Benz
BRITISH AIRWAYS
KAISER PERMANENTE
hp
concur TECHNOLOGIES
Intermountain Healthcare
FOX MOBILE

Conclusion

- We discussed Carbon Server Building Framework
  - Motivation
  - How it is build?
  - How does it make a difference?
- Currently Carbon is the core of WSO2 platform which includes 10+ servers and hundreds of deployments (70+ customers) .
- Everything is available under Apache open source license. All discussions public! We welcome your comments as well as contributions.

More Info

- Corporate website: http://wso2.com
- Developer portal: http://wso2.org

WSO2 OXYGENTANK

OXYGEN FOR WEB SERVICE DEVELOPERS

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