Son of SOA
Resource-Oriented Computing
Event-Driven Architecture

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pr3d4t0r @ irc://irc.freenode.net ##java, #esb, #awk, #security

About Eugene

- **15+ years of experience building mission-critical, high-availability systems infrastructure**
- **12+ years of Java work**
- **Open-source evangelist**
  - **Official adoption of open-source / Linux at Wal-Mart Stores**
  - **State-of-the-art tech for main-line of business roll-outs**
- **Engaged by the largest companies in the world**
  - **Retail**
  - **Finance**
  - **Oil industry**

What You Will Learn...

- **How to develop complex apps within very tight deadlines**
- **Formalize integration around a resource-oriented model**
- **Develop event-driven apps based on existing production tech and services**
- **Turn SOA-based systems into callbacks as an evolution of the provider/consumer model**
- **Define application processing in terms of compositions and asynchronous sequences of resource requests**

So... What is the Problem?

- **Very tight deadlines**
  - **Typical 12-month project rolled out in 90 days**
- **Development team built at the same time as application design work**
- **No history of developing Web applications**
- **Rigid IT infrastructure and policies**
  - **SOX and other compliance issues**
  - **IT guys used to rule the world**
- **Integration with financial and other legacy systems is a must**

Advantages

- **Very tight deadlines!**
  - **We gotta do what we gotta do...**
- **Dev team grows at the same time as design work proceeds**
  - **Technology adoption driven by team member selection and viceversa**
- **Very few legacy issues to deal with in Web applications**
  - **Adoption of best-of-breed technology from open-source community**
- **IT doesn't do Web systems**
  - **Technology adoption policy evolves along with design and development**
- **No need to reinvent the wheel for existing systems**
  - **Financial, CRM model, etc.**

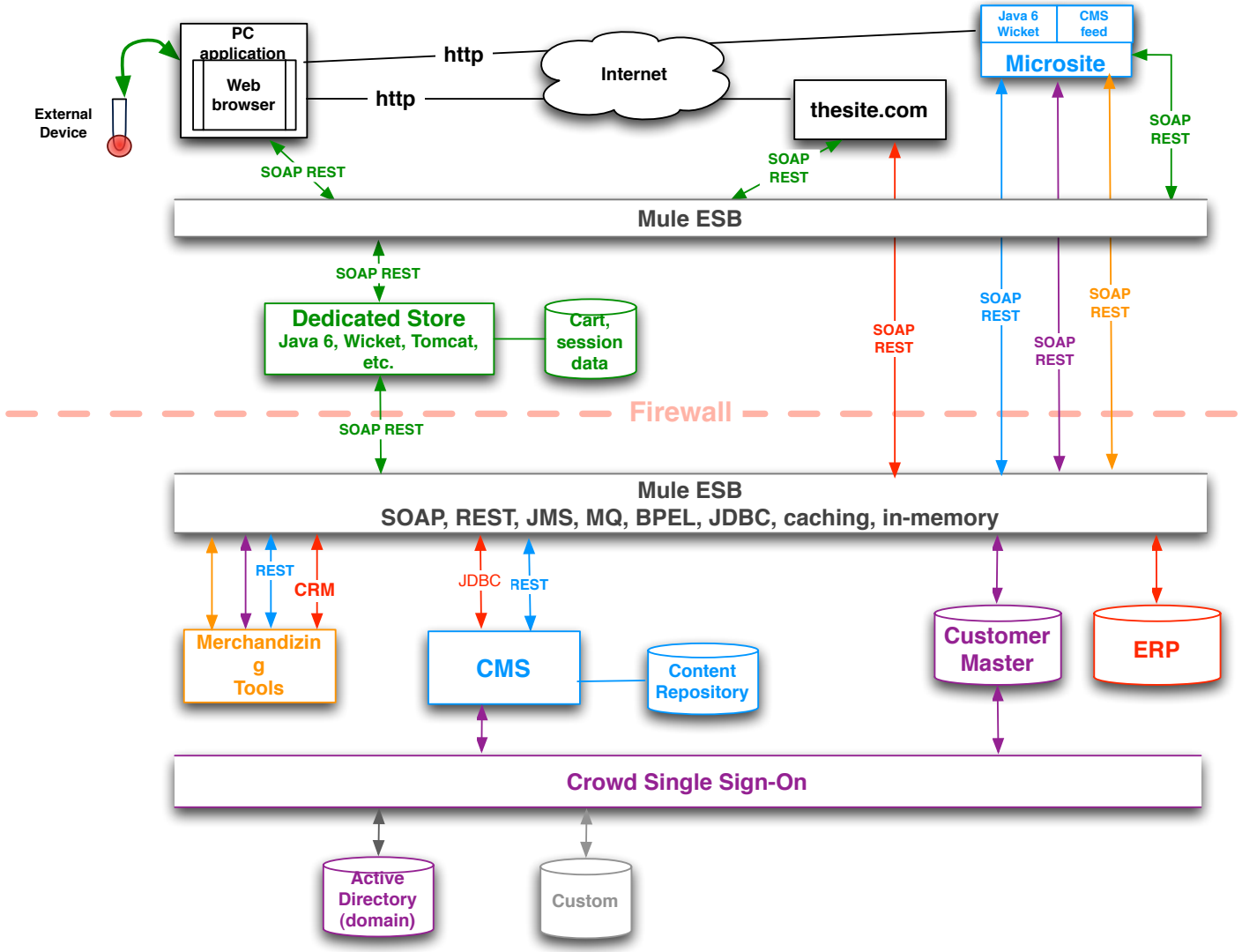
Integration Through Services

- **SOA = Services-Oriented Architecture**
- **Collection of services that communicate with one another**
  - **No dependencies on other services**
  - **Self-contained**
- **Messaging: mechanism for communication between two or more services**
- **Real-time, asynchronous, synchronous**
  - **May occur over different transports**
    - **HTTP, FTP, JMS, RMI, CORBA, etc.**

SOA Limitations

- **Not all systems can be mapped as services**
- **Workflow issues**
- **Development team coordination**
- **Programmer skill levels**
  - **Do your programmers grok SOA?**
- **System coupling**
  - **System dependencies**
  - **Organizational dependencies**

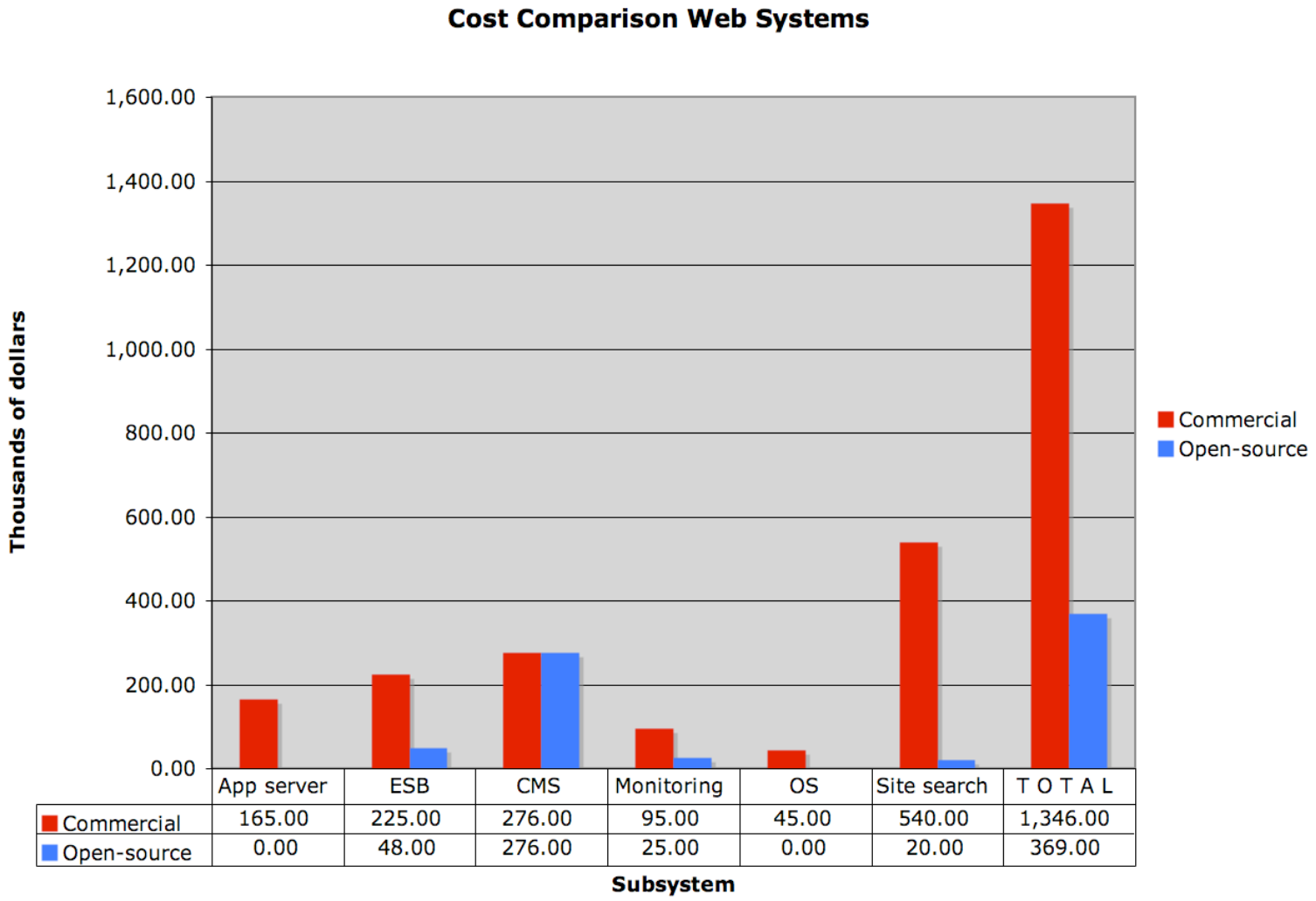
Environment - First Iteration



Technologies Deployed

- **Best of Breed**
- **Mule ESB - the backbone**
- **Crowd Single Sign-on**
- **GWT for front end AJAXy stuff**
- **Wicket for Web applications**
- **Day Communiqué / CRX for CMS**
- **All open-source development tools**
- **Java 5 and Java 6**

How Well Did This Work?



	App server	ESB	CMS	Monitoring	OS	Site search	T O T A L
Commercial	165.00	225.00	276.00	95.00	45.00	540.00	1,346.00
Open-source	0.00	48.00	276.00	25.00	0.00	20.00	369.00

What's Next?

- **Integration of third-party systems**
  - **2007 - two**
  - **2008 - ten or more**
- **International sites**
- **Real-time device data processing**
- **Multiple data sources**
  - **Databases**
  - **Financial systems**
  - **CRM**
- **Support for millions of devices "in the wild"**

Shift Toward Consuming Resources

- **Conscious decision to blur the distinction between "services" and "data sources"**
- **Everything is a resource**
  - **SOAP, REST, JMS, files**
  - **Web apps back-end**
  - **Computational data**
- **Resources are available through a well-defined protocol**
- **Resources are always available through a common transport to simplify development and deployment**

What is Resource-Oriented Computing?

- **All components of a system are viewed as resources to be consumed synchronously or asynchronously**
- **There is no distinction between “data”, “objects” or “services”**
- **There is no dependency on a programming language or framework**
  - **Mix and match is the reason why you want to move toward ROC**
- **Resources are located through URIs**
- **Software identifies resources through logical rather than physical mappings**

What is Resource-Oriented Computing?

- **Programs map logical and physical locations through identifiers in traditional computing models**
  - **String resource = “I am some useful, non-trivial text.”;**
- **ROC defines resources through verbs and logical identifiers**
  - **Yes, it sounds like REST**
- **An identifier ALWAYS returns the CURRENT representation of a resource**
- **Each logical identifier is resolved for every request**
  - **Resource implementations can change dynamically, resource consumers need not care about where or how a resource is implemented**

Java vs. REST vs. ROC

	Java	REST	ROC
Identifier	private int nX;	URI	URI
Fetch	out.printf("nX = %d\n", nX);	Method GET URI	Protocol fetch + URI
Resolve	Compiler, reflection	DNS + app server	ROC kernel or backbone
Compute	Java Virtual Machine	App server	Endpoint and service object
Low-level operation	JVM, method, initializer	HTTP method + URI	Verb + URI pair

Defining Resources

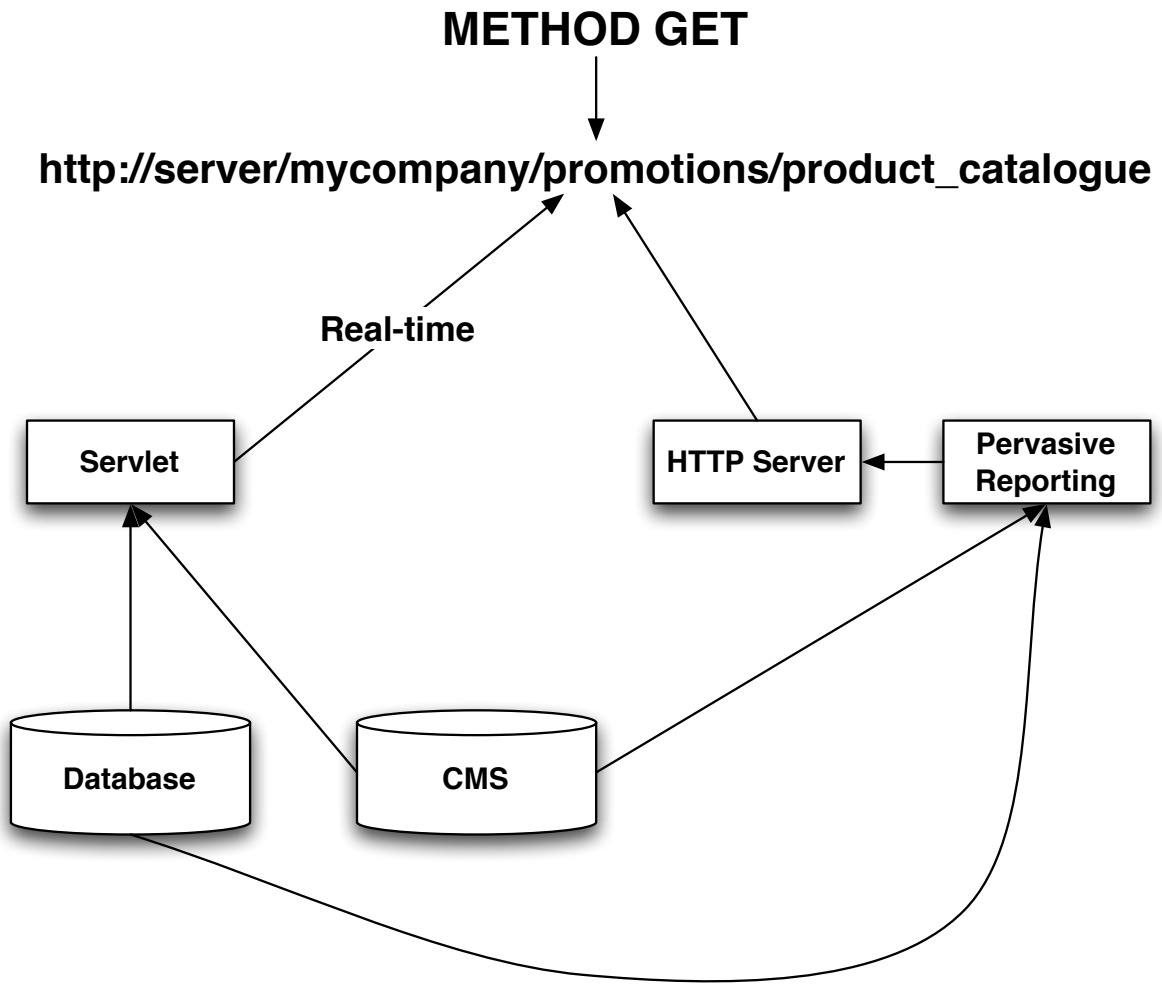
- **Resources don't exist in the context of an application until they are requested**
- **Resources lack typing**
  - **Typing is relevant only to the consumer**
- **Endpoint URIs may convert types for individual data elements or complex data structures**
- **URIs may encode the desired operation to perform on the data**
  - **protocol://servername/subsystem/operation/resource**

Resource Abstractions

http://server/mycompany/promotions/product_catalogue

- The promotions resources may be generated...
  - cron periodically
  - On-demand
  - Aggregated
- The promotions system of record is independent of the ROC platform or the consumer
- The “verb” here is “promotions”, when combined with a GET
- There may be two or more aggregators that produce the resource

Resource Abstractions



ROC Platforms

- **Full ROC platform by 1060 Research**
  - **Custom distributed kernel**
- **GridGain, GigaSpaces**
  - **Distributed Computing**
- **Homebrew ROC**
  - **Are you in the business of building one from scratch?**
- **Off-the-shelf integration**
  - **Best-of-breed strategy: find the best components and integrate them**

ROC Platforms

- VENDOR LOCK-IN!!!!
- **Homebrew ROC**
  - **Are you in the business of building one from scratch?**
- **Off-the-shelf integration**
  - **Best-of-breed strategy: find the best components and integrate them**

ROC Architecture

- The systems are built around a backbone that provides resources via URI
- The backbone acts as an resource container or as a conduit between resources or resources and consumers
- URI mapping is done by the backbone
- Resource containers can exist in the same memory space as the backbone or in a separate system
- Resource providers may be written in any programming language
- Resource providers are stateless

ROC Architecture

- **Modularity is attained through logical separation of resources**
  - **Resource providers as .jar, .war, or other entity**
  - **Localized backbones**
  - **Localized resource providers**
- **Logical separation may obey organizational policy, technology policy, or both**
- **Implementation can be done with off-the-shelf components in any combination that makes sense, as long as the backbone is protocol-, language-, and vendor-independent**

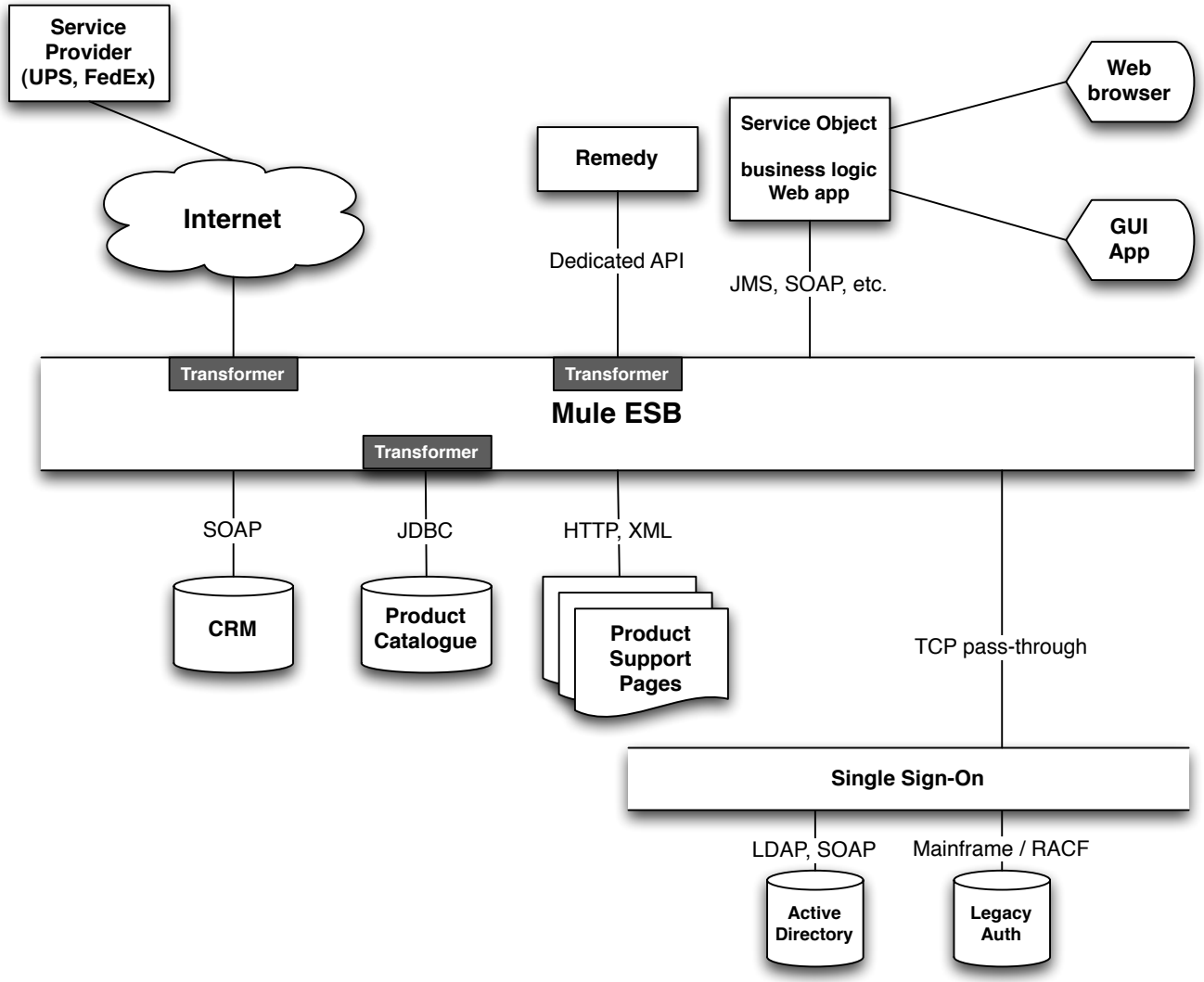
ROC Architecture

- **Backbone: Mule ESB**
  - Provides full independence from the kind of crap that vendors like to create lock-in for
  - Open-source
  - Workflow, transactions, transformations, logging, routing
- **Resource container: Mule ESB**
  - UMOs (service objects) implement business logic independently of protocol or data formats by design
  - Transactional, app server and workflow logic built-in
  - UMOs are just POJOs
- **Synchronization**
  - In-memory endpoints

ROC Architecture

- **Original architecture had lots of best-of-breed software**
  - **Tomcat**
  - **Dedicated application/service providers**
  - **Web servers**
- **ROC architecture only has two basic building blocks**
  - **Mule acting as a resource service provider (i.e. Mule is the application container)**
  - **UMOs as computationally active entities**
- **Existing and off-the-shelf systems plug into the architecture through SOAP, REST, JMS, etc.**
- **Mule allows us to define our own protocols, if necessary!**

ROC Architecture



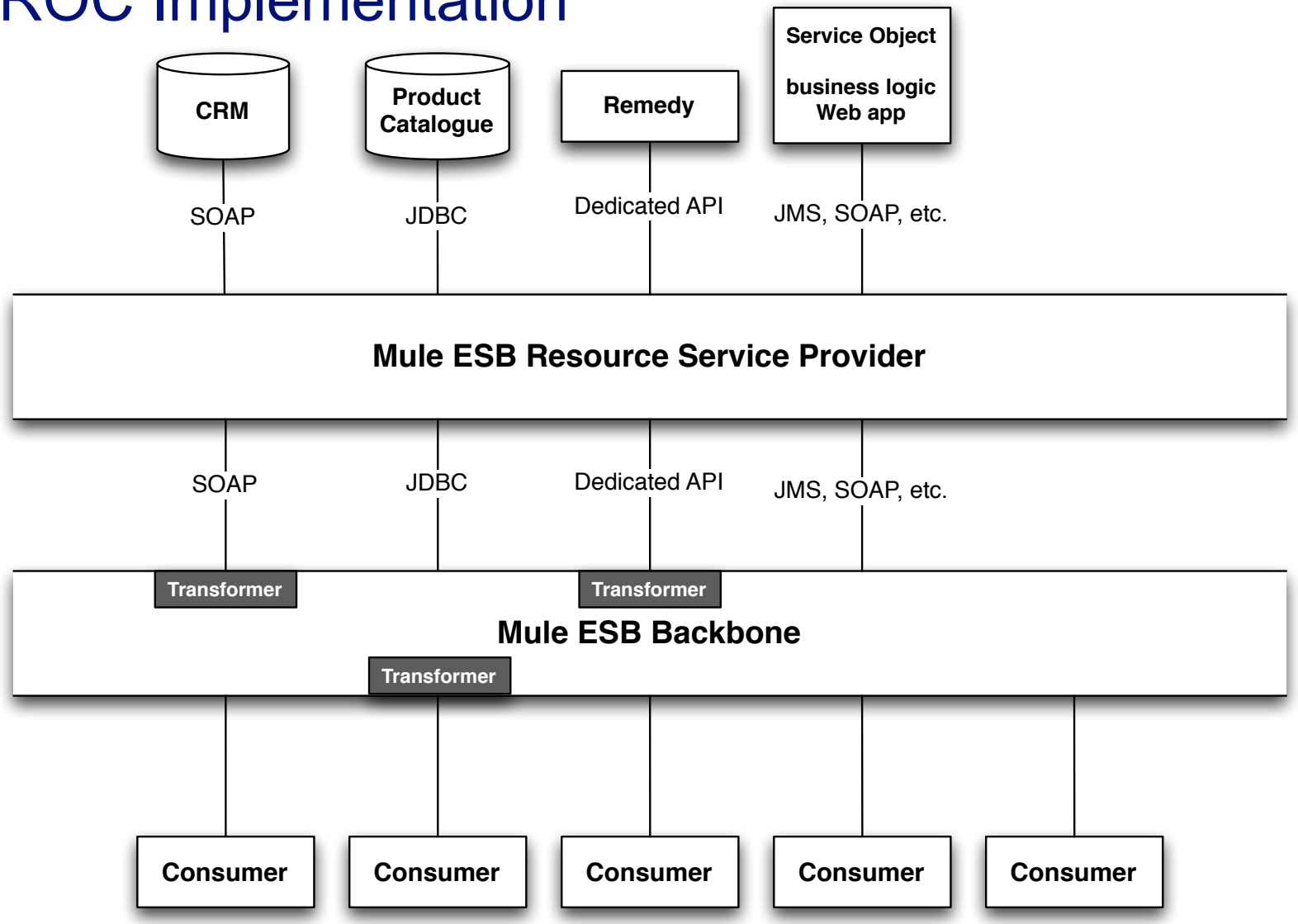
ROC Implementation

- **Dedicated protocols**
  - **vm://mycompany/subsystem/resource_name**
  - **http://mycompany/subsystem/resource_name**
- **Easy to extend to handle ROC:**

verb:protocol://mycompany:port/organization/subsystem/resource_name

- **Easy to implement!**

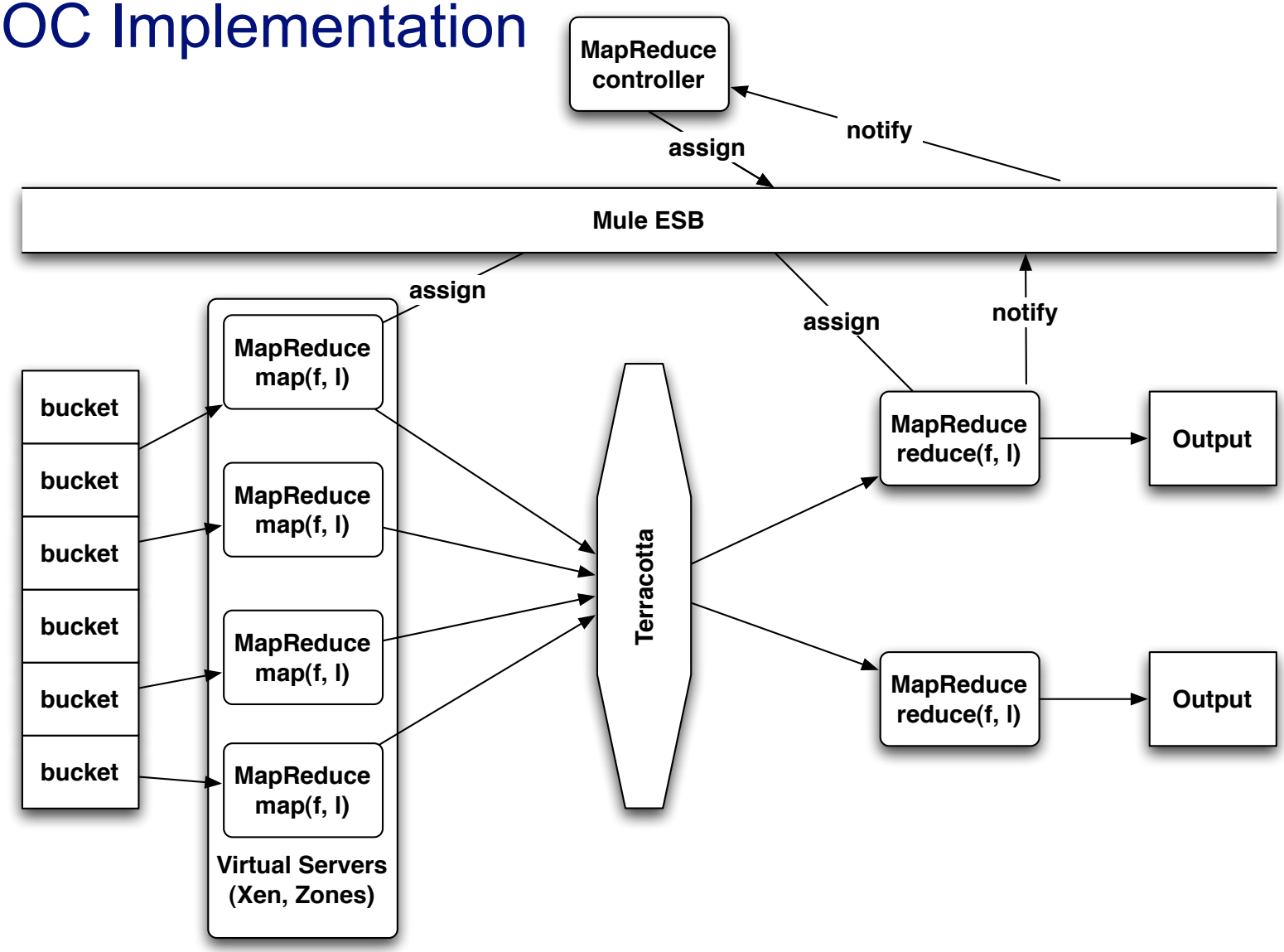
ROC Implementation



ROC Implementation

- **Resource providers**
  - **SOAP API to CRM**
  - **JMS API to transactional pieces**
  - **Download app repository**
  - **OpenLaszlo dynamic rich Internet application provider**
- **Interfaces to existing systems**
  - **Epsilon direct mail interfaces**
  - **FTP, sftp, other data transfer**
- **Computational resources for ad hoc new functionality**
  - **MapReducers (2008, 2009)**

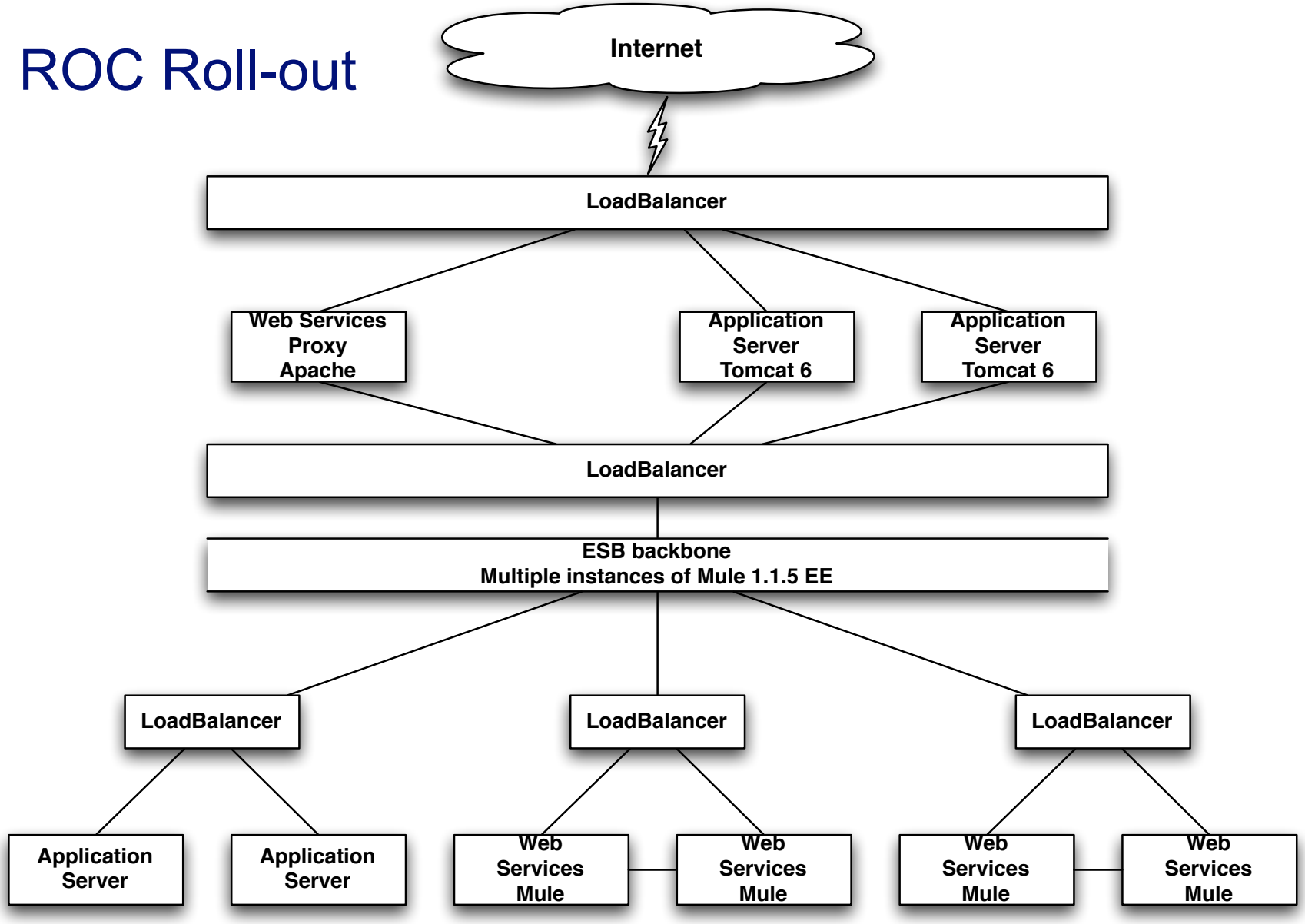
ROC Implementation



ROC Roll-out

- **Quick, turnkey roll-out**
- **The fewer systems to maintain, the better**
- **Use Java or JVM-hosted languages wherever possible**
- **Integrate with third-party or non-Java systems over standard or custom protocols with as quick a turnaround as possible**
- **EASY TO SCALE QUICKLY!!!!**

ROC Roll-out


Internet
LoadBalancer
Web Services Proxy Apache
Application Server Tomcat 6
Application Server Tomcat 6
LoadBalancer
ESB backbone
Multiple instances of Mule 1.1.5 EE
LoadBalancer
LoadBalancer
LoadBalancer
Application Server
Application Server
Web Services Mule
Web Services Mule
Web Services Mule
Web Services Mule

Conclusions

- **Complex systems are easier to code and maintain if implemented as small blocks**
- **Small blocks can be mapped as resources that can be consumed in a stateless fashion**
- **Applications can be built as an aggregation of resources**
- **ROC techniques improve time-to-market**
- **ROC techniques combined with open-source offerings can reduce deployment costs by 70%, and ongoing maintenance by 30-40%**
- **Complex systems can be integrated as a combination of best-of-breed software whether commercial, open-source, or homebrew**
- **ROC is the logical evolution of applied SOA**

Q&A

Thanks for coming!

This presentation is at:
http://eugeneciurana.com/TSSJS2008/ROC.pdf

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