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Using REST and WS-* for SOA

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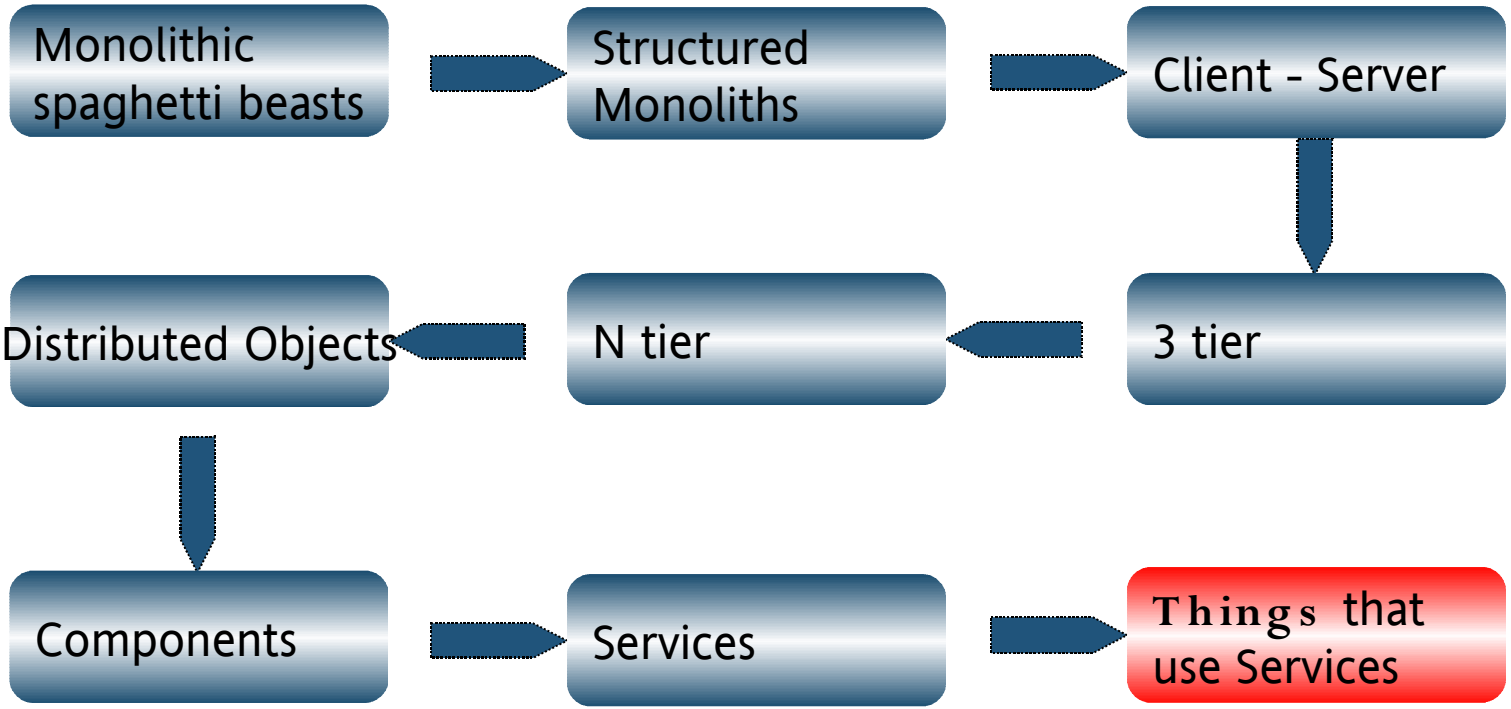
Background

- Research into fault-tolerant distributed systems since 1986
  - Arjuna, Argus, Isis/Horus, Emerald, Xerox, …
  - DCE, DCOM, CORBA, JavaRMI, HTTP, Web Services, …
- Active in OMG, OASIS, W3C, JCP, GGF and others
- Involved with Web Services since 1999
  - Co-author of a number of WS-* specifications and standards
- Involved with REST/HTTP since at least 2000
  - W3Objects

Overview

- SOA in a nutshell
- WS-* and REST
- Where should you start?
  - Don’t panic!
- One size does not fit all
  - Don’t believe everything you read
- Bridging the divide
  - Can REST be used with WS-*?

Back to the future?



The debate

- Actually more about WS-* and RESTful HTTP (REST/HTTP)
  - REST is a valid approach to SOA
- No REST bashing
  - REST is a valid architectural approach
  - HTTP is one way of implementing it
- No WS-* bashing
  - And specifically no WSDL bashing please
- These types of debate have raged throughout history
  - BetaMax vs VHS
- Hybrid systems are the norm
  - Very few places can afford to rip-n-replace

SOA in a nutshell

- **SOA is an architectural style to achieve *loose coupling***
  - **A service is a unit of work done by a service provider to achieve desired end results for a consumer**
- **SOA is deliberately not prescriptive about what happens behind service endpoints**
  - **We are only concerned with the transfer of structured data between parties**
- **SOA turns business functions into services that can be reused and accessed through standard interfaces.**
  - **Should be accessible through different applications over a variety of channels**

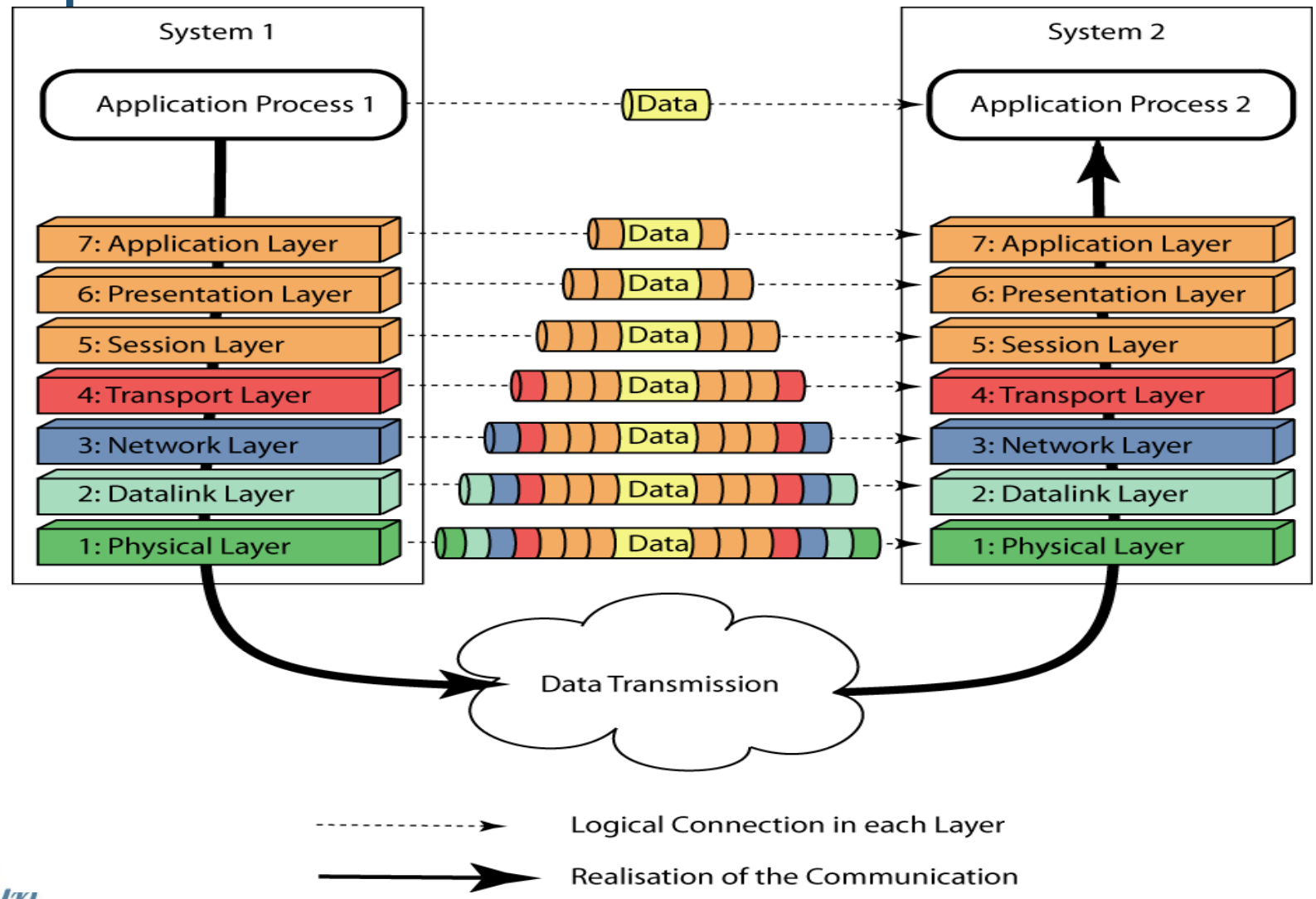
Achieving loose coupling

- SOA employs a few architectural constraints
  - A small set of simple and ubiquitous interfaces to all participating software agents.
  - Only generic semantics are encoded at the interfaces.
    - The interfaces should be universally available for all providers and consumers
    - Yes, it's often based on specific interfaces for each service
      - But does not need to be
  - Descriptive messages constrained by an extensible schema delivered through the interfaces.
  - No, or only minimal, system behavior is prescribed by messages.
    - A schema limits the vocabulary and structure of messages.
    - An extensible schema allows new versions of services to be introduced without breaking existing services

Implementing SOA

- Many different possible approaches to SOA
  - CORBA
  - JEE
    - JMS
- Two most popular approaches are
  - WS-*
  - REST
    - Actually an architecture in its own right (not tied to HTTP)
    - Much more solidly defined than SOA
- Which is the right approach?
  - Why should there be only one?

The protocol stack



Distributed Systems

- Same fundamental laws
  - Develop “entity”
    - Define the UOW it supports
  - Search for “entity”
    - Agree “entity” offers the desired capability or UOW
  - Request “entity” to perform UOW
    - Create a network-transferable message
    - Send the message
  - Maybe try to make the remote interaction appear local
  - Maybe do some “enterprise” work as well
    - Security, transactions, replication etc.
      - Contextualization of messages

The most popular (by demand)

- **Client and server technologies based on RPC**
  - **Hide distribution**
  - **Make remote service invocation look the same as local component invocation**
  - **In use since the 1970's**
- **Unfortunately this leads to *tightly coupled* applications**
  - **Changes to the IDL require re-generation of stubs**
    - **And dissemination of new code**
    - **Or errors will occur during interactions**
  - **Such applications can be brittle**
    - Hard to control the infrastructure as needed
    - No quiescent period

Degrees of coupling

- At the one extreme
  - Defining specific service interfaces, akin to IDL
    - Easier to reason about the service
    - Limits the amount of freedom in changing the implementation
- At the other extreme
  - Single operation (e.g., doWork)
    - More flexibility is changing the implementation
      - Well, almost …
    - More difficult to determine service functionality a priori
      - Need more service metadata
- There are degrees of coupling and you should choose the level that is right for you
  - Not specific to distributed systems

Distributed Systems 101

- The same requirements are present throughout the stack
  - Split differently between the infrastructure and the “application”
- Uniform interface allows for generic infrastructural support
  - Caching, extremely loose coupling
  - Can push more requirements on to the “developer”
  - Requires more from external contract meta-data
- Specific interface allows for more limited generic support
  - Targeted caching, application semantics
  - Impacts less on the “developer” but may cost in terms of flexibility

Different approaches to distribution

- Event Driven Architectures
  - Pub/Sub
- Service Oriented Architectures
- Resource Oriented Architectures
- Message Oriented Architectures
  - MOM
  - Pub/Sub
- Tuple Spaces
  - E.g., Linda, Jini
- RPC based
- Group communication based
  - Reliable or unreliable

- There is no such thing as a global panacea!

So what do we need for SOA?

- An architectural approach that supports
  - Loose coupling
  - Enterprise capabilities
    - Security, reliable messaging, fault tolerance
  - Different invocation mechanisms
    - UDP, TCP, HTTP, JMS, IIOP
  - Integration with back-end “legacy” systems
  - Standards based
- Things that would be nice (not architecture)
  - Easy to use and administer
  - Good tooling

REST

- Defined by Roy Fielding in his PhD
  - One of a range of approaches
- Core set of architectural principles
  - Identify all resources/entities
  - Link resource together
    - Hypermedia as the engine of application state
  - Use standard methods for interacting with resources
  - Multiple resource representation
  - Stateless communication
- Not tied to HTTP

REST/HTTP in a nutshell

- Original HTTP specification talked about adding new commands
  - GET only in 0.9
  - GET, HEAD, POST, extension-method in 1.0
  - Now we have up to 8 different verbs
    - Changes to “interface” occur but users aren’t affected
- Many good distributed systems approaches
  - Dynamic content negotiation
  - Caching
  - Scalability
- It is NOT a transport
- Network specific architecture

Not machine driven?

- Often stated that REST/HTTP is only suitable for hypertext
  - "Because that's the way the majority of the Web works"
- Weak argument
  - It's still a distributed system based on resources
  - OK, humans fill in the "gaps" in contract definition
  - Extra infrastructure support could help
    - Anyone remember URN name servers (1994/1995)?
    - Google anyone?
- Not enough "application" standards
  - Good point
- Lack of good tooling
  - JAX-RS, WCF, …

Standards

- The Web is a series of standards
  - URIs
  - HTTP
  - HTML
- Universal adoption has to count for something!
- REST/HTTP is ubiquitous
  - Communication interoperability, which is a good start
    - Also why WS-* standardised on HTTP
  - But application semantic interoperability is not there (yet)
    - Take a minimum of 5 years to do
- But …

Enterprise ready?

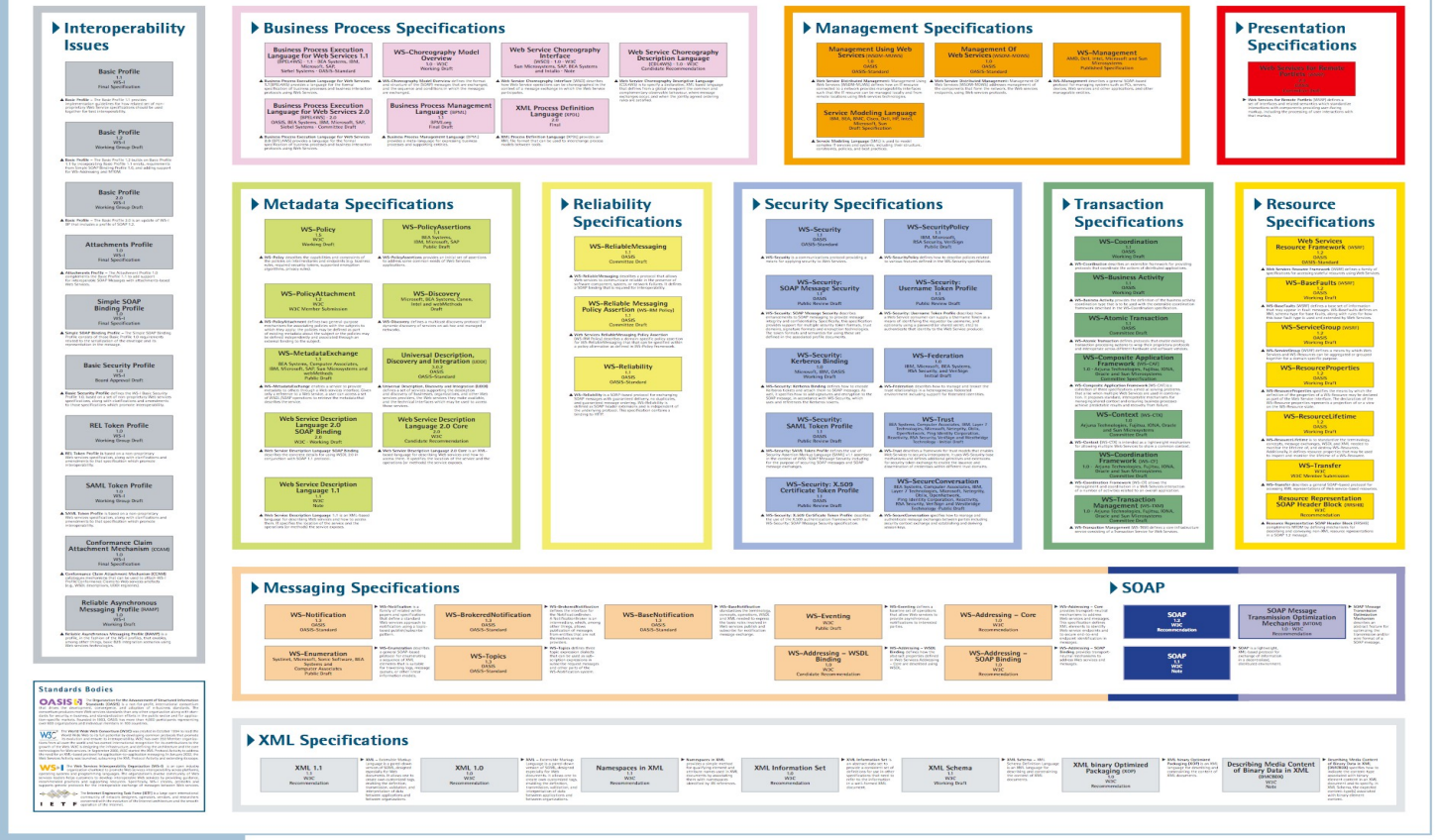
- D'Oh!
  - Take a look at the world!
- Enterprise capabilities
  - Reliable messaging
  - Some fault tolerance
    - No transactions
    - Workflow
    - 404 rules!
    - Stale links
- Components are there, just not necessarily used
- But … it's not that easy!
  - Human interaction style can sometimes confuse

What about Web Services?

- Popular integration approach
  - XML
  - HTTP
    - Other transport bindings are possible
- Developed with machine-to-machine interactions in mind
- Not specific to SOA
  - Web Services began life as CORBA-over-HTTP
  - XML-RPC
  - WS-RF and WS-Addressing
- Web Services+SOA gives benefits
  - Loose coupling
  - Interoperability
  - Enterprise capabilities, e.g., security and transactions

WS-* Architecture

Web Services Standards Overview



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However …

- WS-* has driven protocol interoperability
  - More so than CORBA, DCE, Java
- Native data and protocol bridging
- Clearly defined semantics for transactions, security, reliable messaging
  - Not specific to HTTP

Enterprise realities

- Customers want interoperability of heterogeneous systems
- They want guaranteed delivery of messages
  - Even in the presence of failures such as network partitions
- They want transactions
  - NOT ACID transactions!
- They need audit trails
  - Sarbanes-Oxley anyone?
- They need bullet-proof security
- They need machine-readable contracts with SLAs

WS-* backlash?

- "It's too complex"
  - Complicated problems often require complex solutions
- "It's using HTTP as a transport!"
  - Get over it! Mistakes happen.
- "It doesn't offer anything better than REST/HTTP"
  - Short-sightedness works in both directions
- "It doesn't leverage the Web"
  - Valid point for Web deployments
  - Not so valid for every other type of deployment

REST or WS-*?

- SOAP/HTTP
  - WS-* vendors have spent a lot of time ensuring it integrates with legacy systems
    - How many people remember that WS-* is supposed to also be about Internet scale computing?
  - That's important for out-of-the-box and interoperable deployments
  - But REST as a general architectural approach has merits even in SOA
- REST/HTTP has "simplicity" and (relative) ease of use
  - No vendor-lockin at the infrastructure level
  - Is precisely for Internet scale computing as well
  - Remember that a lot of cool Web applications aren't RESTful

What can REST learn from WS-*?

- Uniform interface isn't enough for complex application requirements
  - Standardise on the application protocol semantics
  - Ad hoc approach does not scale and leads to interoperability nightmares
- Popularise using HTTP outside of the browser
  - Yes, there are examples and implementations, but they are the exception to the rule
- Just because the Web "works" is not sufficient reason to assume it's right for everything

What can WS-* learn from REST?

- Don’t abuse transports, they don’t like it!
- Adopt SOA principles
  - No more WS-RF please!
  - Adopt WS-Context in favour of WS-Addressing “extensions”
- Late binding is good
  - But extremely late binding can be a burden
- KISS and make up
  - Occams Razor
- Infrastructure support for common services/resources simplifies development
- The Web uses HTTP for a reason

What should you use?

- If it needs to be on the Web
  - REST/HTTP
- If it needs to be interoperable with arbitrary vendors
  - WS-* for standards
  - Or persuade vendors to work on standards for REST
- If you must use HTTP
  - Consider REST before WS-*
    - But understand all of the implications
- If integrating with back-end systems out-of-the-box
  - WS-* has a lot of out-of-the-box solutions

The combination

- WS-* used within the firewall
  - REST principles could still help
  - SOAP is not fast!
- REST/HTTP for between firewalls
  - HTTP is not for performance either
  - Improved application protocol standards
- Get the bridging between WS-* and REST/HTTP right
  - Leverage all of HTTP where possible
  - Definitely not easy to do, but …
- WS-* between firewalls?
  - Unlikely to see massive adoption

Conclusions

- What have we learnt from the last 40 years?
  - One size does not fit all!
  - Use the right tool for the right job
    - If all you've got is a hammer then of course everything looks like a nail!
  - REST versus WS-* was a useful debate
    - Ignore the extremes!
  - REST and WS-* will be more useful
    - But remember the trade-offs!

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Thank You

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