Web Services Standards and Best Practices within WebSphere

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Objective

- The following session will describe:
  - WebSphere's view on the standards industry
  - WebSphere *(IBMs)* current state in implementing web services standards
  - What WebSphere is doing to help achieve interoperability
  - Best practices customers should know for implementing interoperable web services

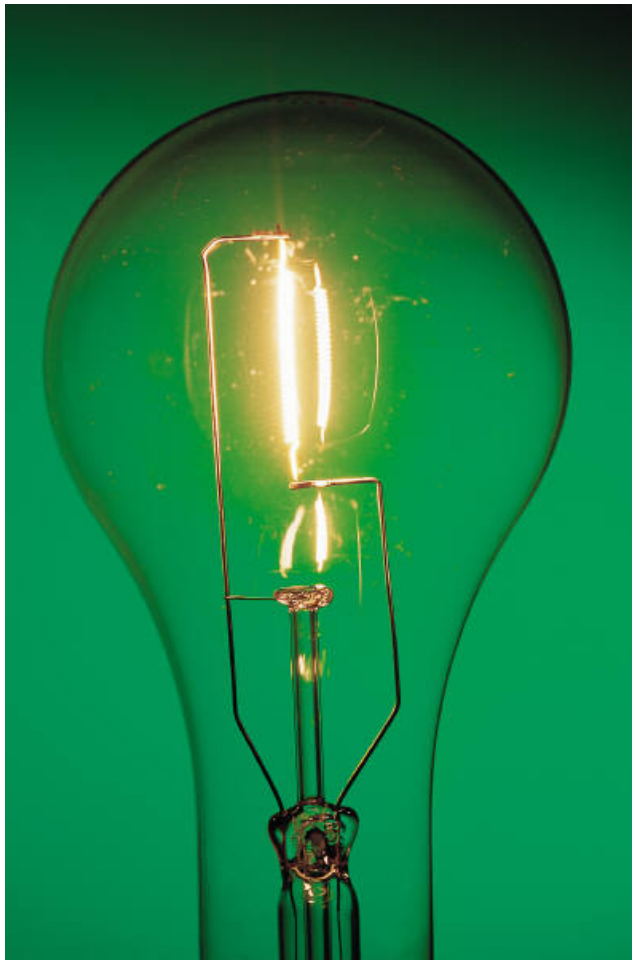
WebSphere's view on the standards industry

Differences between Specifications and Standards

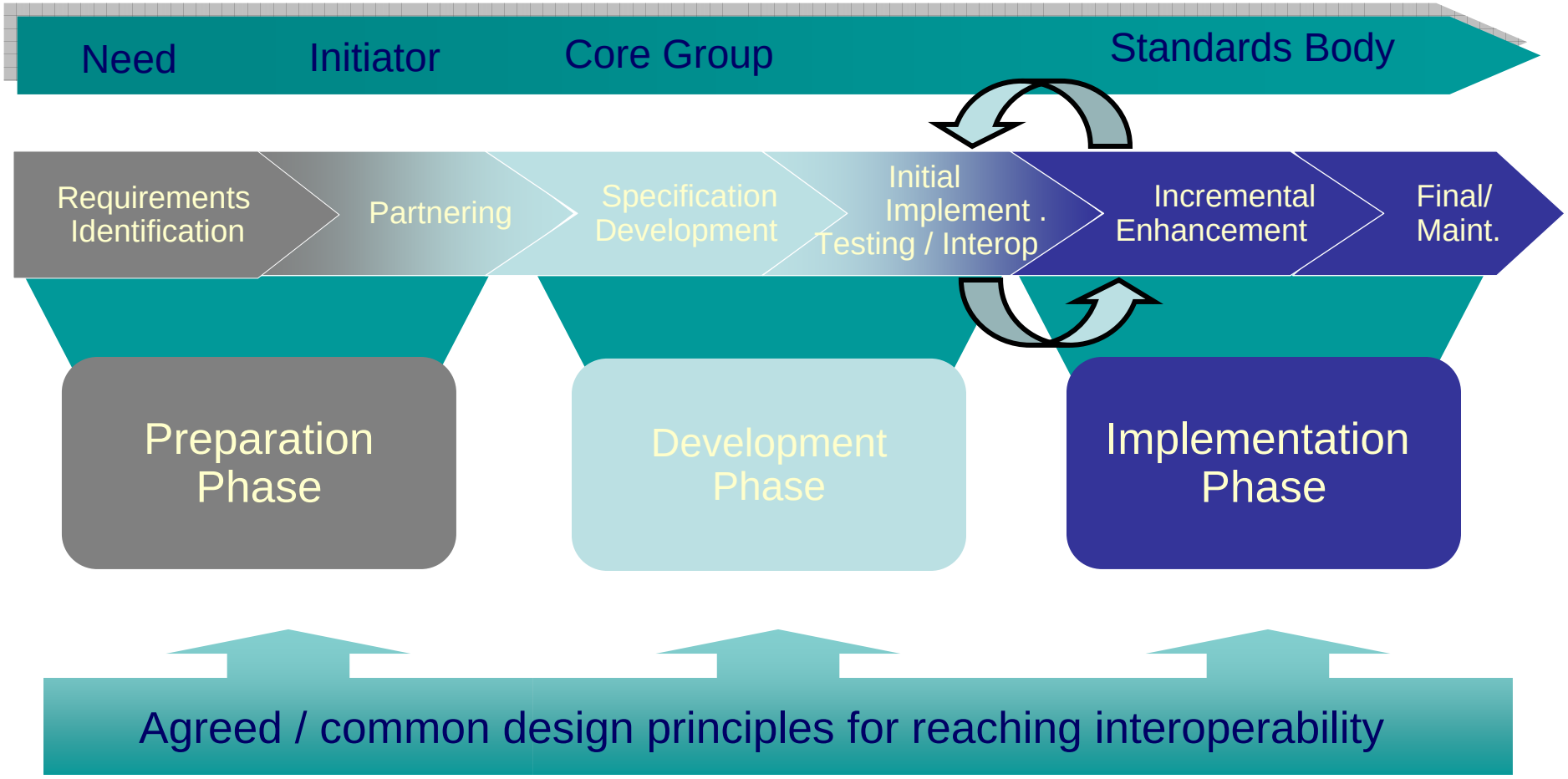
- A specification outlines APIs/data/formats from one or more vendors working together
  - Proposed by vendors to address a gap
  - Often supported by some vendor's software
- Usually submitted to a standards body
  - More companies get involved, specification changes, sometimes merged with competing specifications
  - Goes through multiple drafts and reviews
- Standard is agreed to by the standards body's committee members and is declared a 'version x' standard

Standardization underlies the ability to innovate

- **Collaboration** is key to innovation
- Open standards are essential to collaborative innovation: **interoperability is key**
- **Both proprietary** and **open source** are important forms of software development
- Patents should be granted only for what is new



Phases in Standardization



Standards Process - Ideal

- Industry customers provide comprehensive, unchanging requirements
- Standards bodies create unambiguous specifications
  - Orthogonal to all other specifications (or at worst, with the full knowledge of and cooperation of complementary standards efforts
  - Foreseeing all possible usages
- Developers follow specifications exactly
  - Never need “best practices” because using the specification properly **is** the best practice

Standards Process - Reality

- Constantly changing requirements
  - Often discovered as a result of the standards they are supposed to drive
  - Using an iterative process is not enough, since so many different standards groups are working independently
- Standards are coupled at many different levels
  - May sometimes be ambiguous or unclear
  - Cannot really be tested until they are already established
  - Cannot rely on other standards to stand still
- Developers do not know which standards to use, how to use them or how to tell if a product actually supports standards

Not all Standards are Created Equally

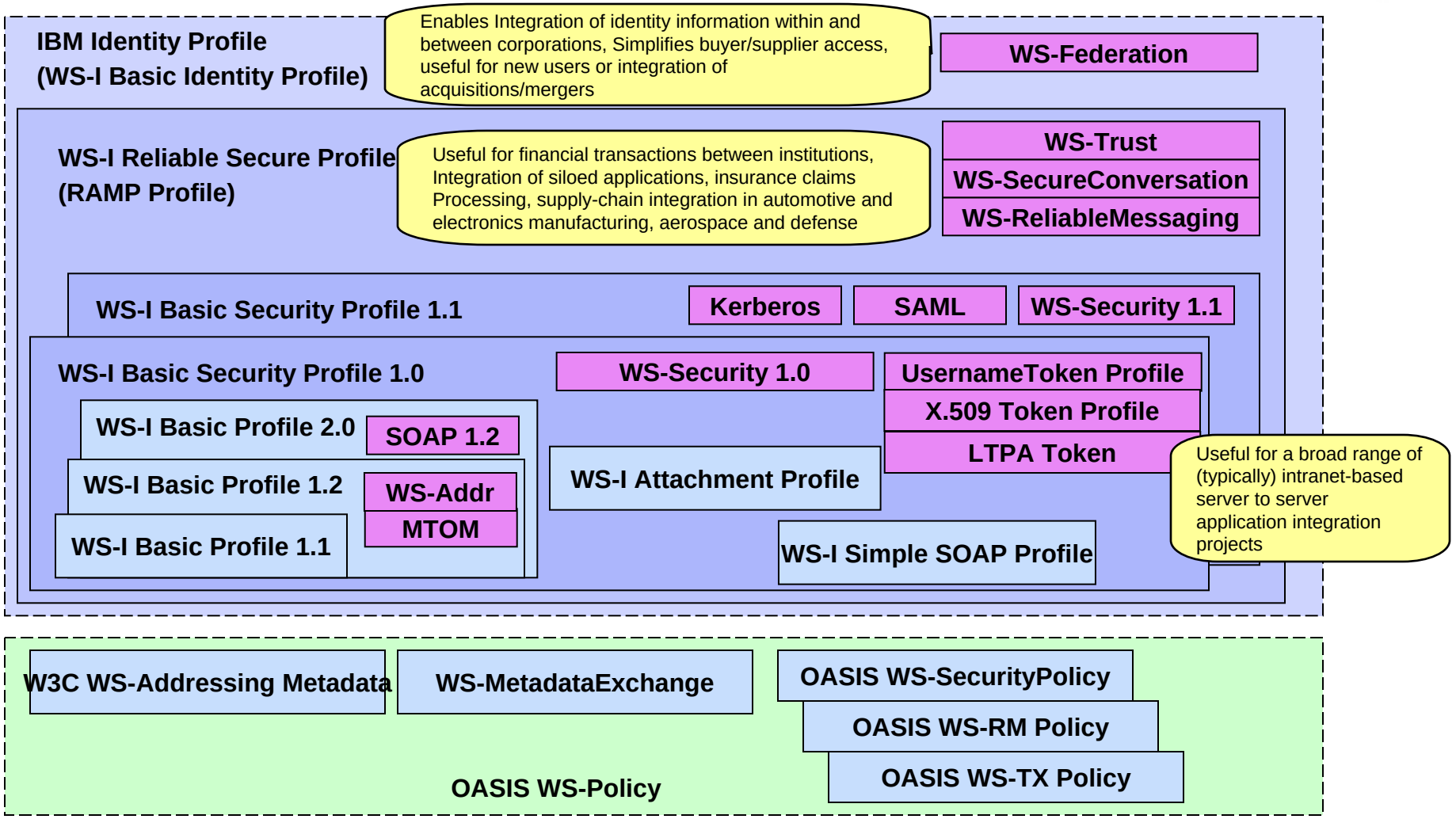
- Standards bodies vary by process, rigor, respect and adoption rate
  - And specific standards vary with respect to adoption
- Key standards bodies for SOA:
  - W3C, OASIS
  - WS-I
    - Consortium to promote interoperability of web services standards
- Most established, proven SOA standards:
  - XML, XML Schema, SOAP, WSDL, WS-Security
- Opinions vary as to whether Java Community Process (JCP) is a standards body

Java Community Process

- Does this matter in the standards domain?
  - YES!
  - Interoperability Scenarios exist in a context.
    - e.g. *a business problem needs to be solved*
  - The programming model exposed to an end-user may dictate behavior
    - e.g. *a WS-ReliableMessaging create_sequence request may be issued during a request*
  - The programming model may define limitations in what can/cannot be done
    - e.g. *JAX-RPC only defines a subset of mappings*

WebSphere's approach to Web Services

Making Standards *Simple* and *Useful* – Roadmap



WebSphere Web Service Standards Status

Web Services Standard	Introduced in	W3C or OASIS Status	Profile
WS-Security	5.0.2, 6.0, 6.1, 6.1 FeP for WS*	OASIS approved 1.0 – OASIS approved 1.1 -	BSP 1.0 BSP 1.1
W3C WS-Addressing	6.1	W3C recommend – 8/2005	BP 1.2, 2.0
WS-Notification	6.1	OASIS approved – 10/2006	
WS-Atomic Transaction	6.0 (submission)	OASIS approved – 6/2007	IBM BPMP
WS-BusinessActivity	6.1 (submission)	OASIS approved – 6/2007	IBM BPMP
WS-ReliableMessaging	6.1 FeP WS	OASIS approved – 6/2007	WS-I RSP 1.0
WS-SecureConversation	6.1 FeP WS (submission)	OASIS approved – 3/2007	WS-I RSP 1.0
WS-Trust	6.1 FeP WS (submission)	OASIS approved – 3/2007	WS-I RSP 1.0
W3C MTOM	6.1 FeP WS	W3C recommend – 11/2004	BP 1.2, 2.0
W3C SOAP 1.2	6.1 FeP WS	W3C recommend – 6/2003	BP 2.0
WS-DistributedManagement 1.1	6.1 FeP WS	OASIS approved – 8/2006	IBM SMP
Kerberos Token Profile		OASIS approved – 2/2006	BSP 1.0
WS-Addressing Metadata		W3C recommend – 9/2007	
WS-Policy		W3C recommend – 9/2007	
WS-SecurityPolicy		OASIS approved - 7/2007	

WS-I Profile Status

Basic Interoperability

- Basic Profile 1.1, Attachments Profile 1.0 – *closed*
- Basic Profile 1.2 * – ***Target closure 1H2008***
  - MTOM, WS-Addressing
- Basic Profile 2.0 * – ***Target closure 2H2008***
  - MTOM, WS-Addressing, SOAP 1.2

Reliable / Secure

- Reliable Secure Profile 1.0 – ***Target closure 1Q2009***
  - WS-ReliableMessaging, WS-SecureConversation, WS-Addressing

Secure

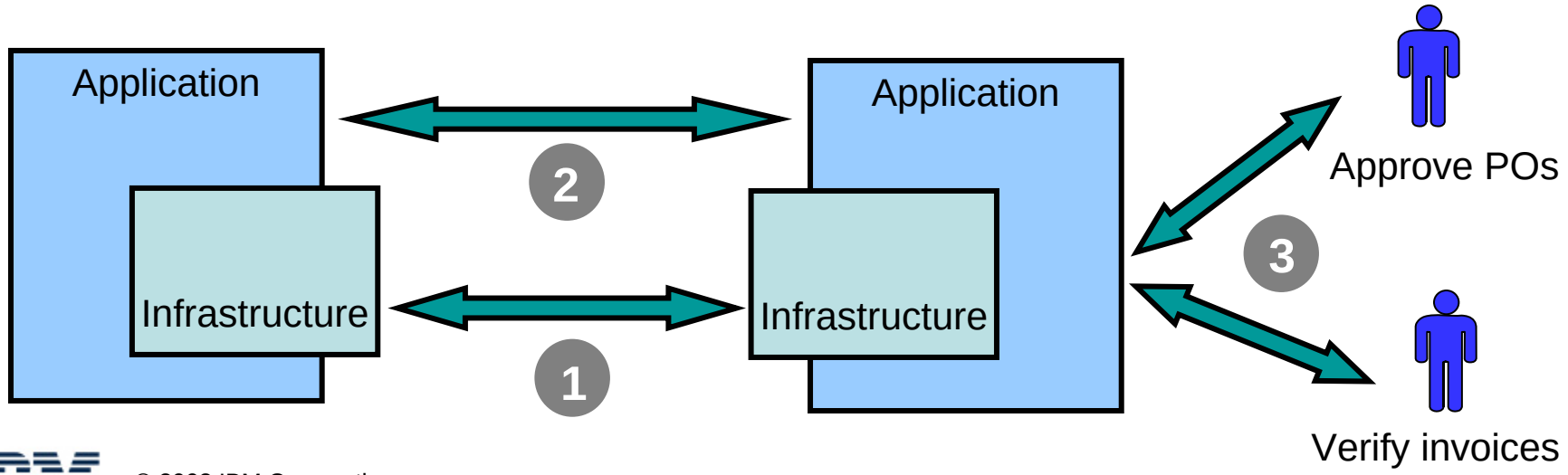
- Basic Security Profile 1.0
  - Username Token Profile, X.509 Token Profile – *closed*
- Basic Security Profile 1.1* – ***Target closure 2H2008***
  - Kerberos Token Profile, SAML Token Profile

*** BP 1.2, BP 2.0, BSP 1.1 - 5 interoperable implementations required for closure**

What WebSphere is doing to help achieve interoperability

Interoperability Layer

1. Technical Interoperability (Wire-level)
   - Messages are exchanged securely and reliably from sending and receiving infrastructure
   - Receiving infrastructure responsible for delivering the message payload to application
2. Semantic Interoperability (Application level)
   - Application knows the business context to which the payload belongs
   - Payload is valid from an application perspective
   - Application successfully processes payload
3. Organizational Interoperability (Process Level)
   - Application notifies appropriate users that are responsible for verification and approval steps and tracks deadlines



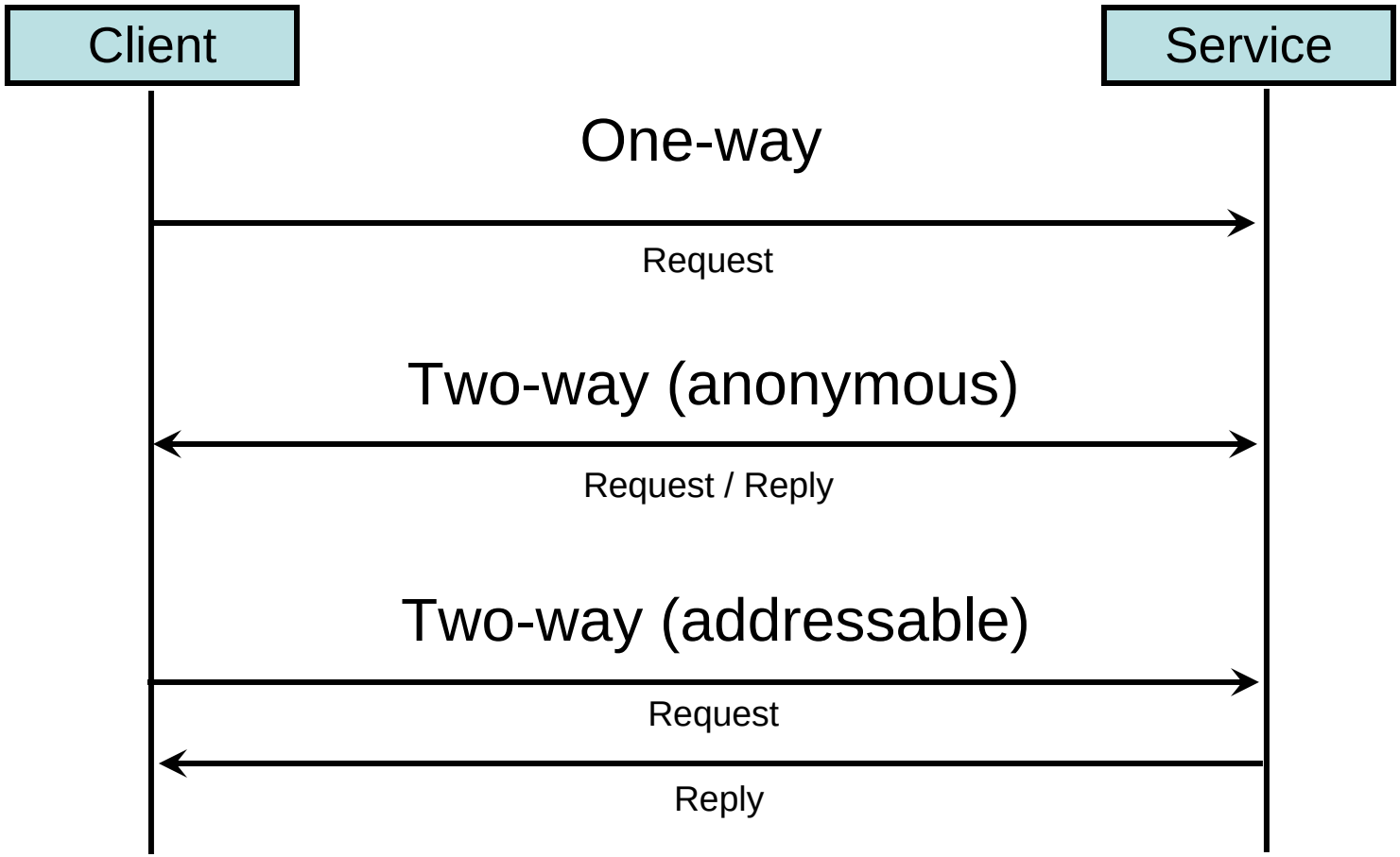
Interoperability Testing Methodology

- Technical interoperability (Wire-level)
  - Simple Message Exchange Pattern Test Suite
  - Samples shipped with WebSphere Web Services Feature Pack
- Technical & Semantic interoperability
  - ACORD Insurance Scenario
    - Jointly developed and tested with Microsoft
  - WS-I Supply Chain Management Sample
    - Donated to WS-I Sample Application Group

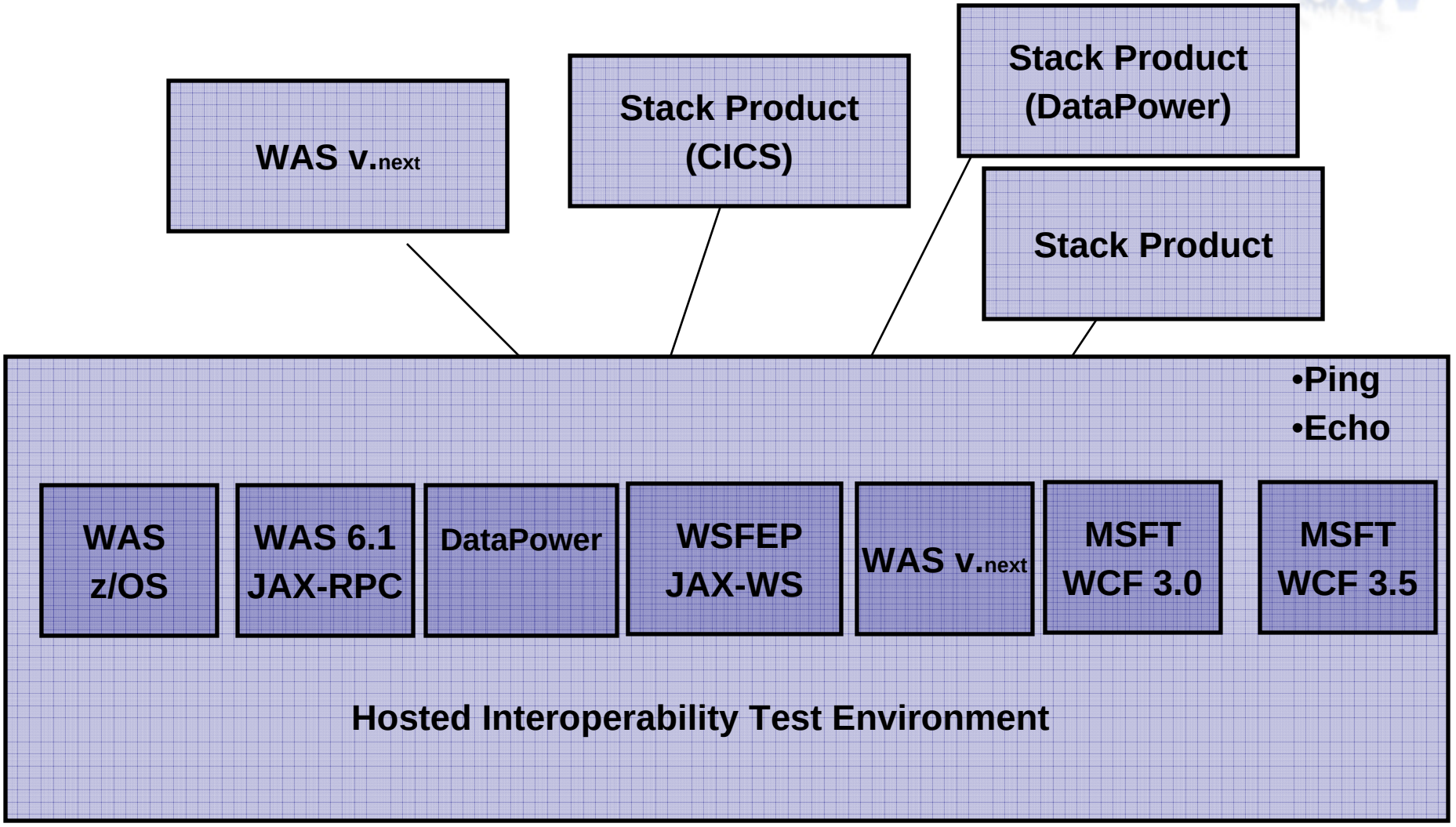
Internal & External testing

- Internal
  - Focused scenario testing with Microsoft WCF 3.0/3.5
  - Testing with IBM stack products (e.g. CICS)
  - Integration with DataPower
- External (testing with other vendors)
  - WS-I testing (Microsoft, BEA, Oracle, SAP, Sun, Novell)
  - Web Services Test Forum (WSTF)
  - Other standards based interoperability testing

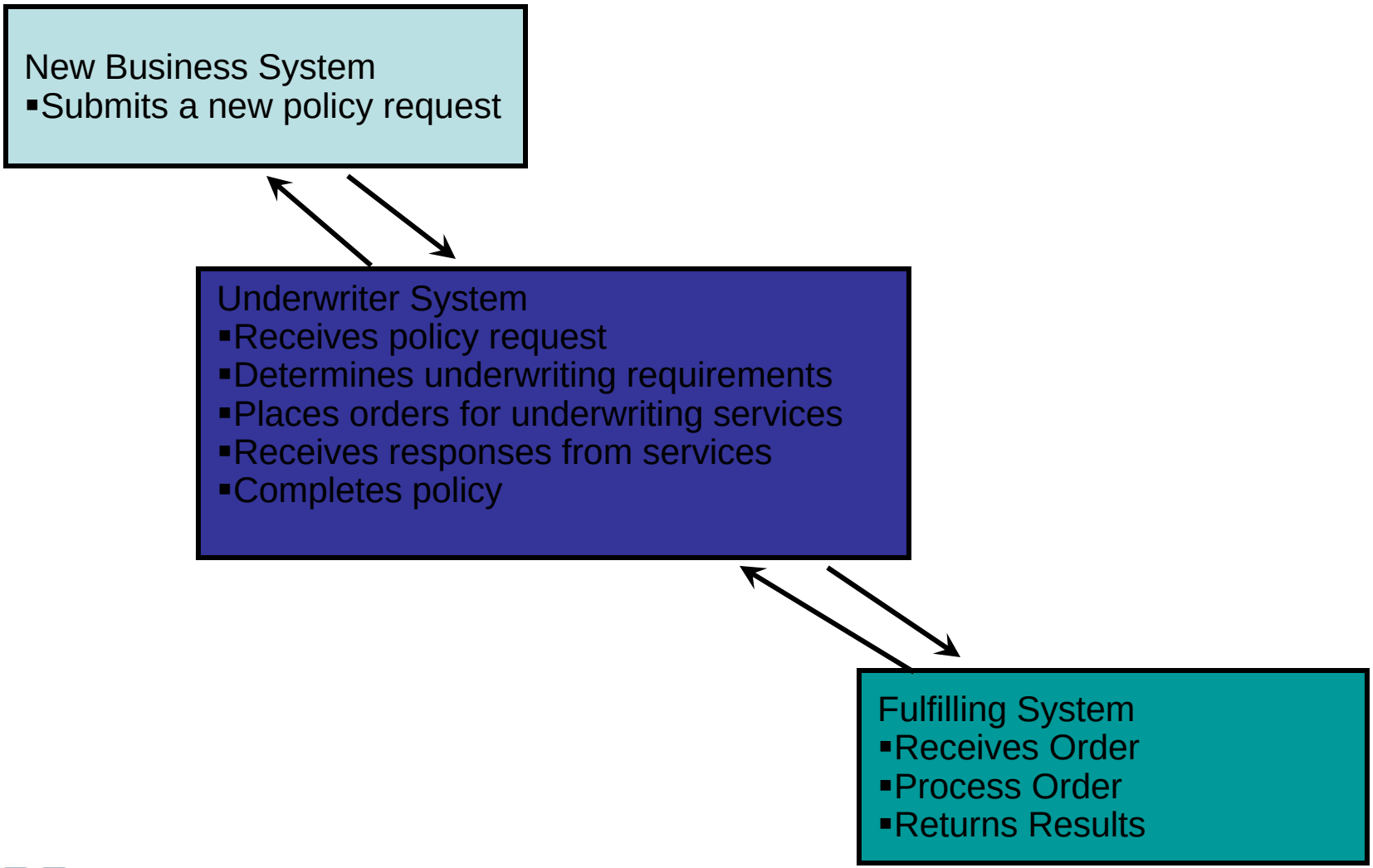
Simple Message Exchange Patterns

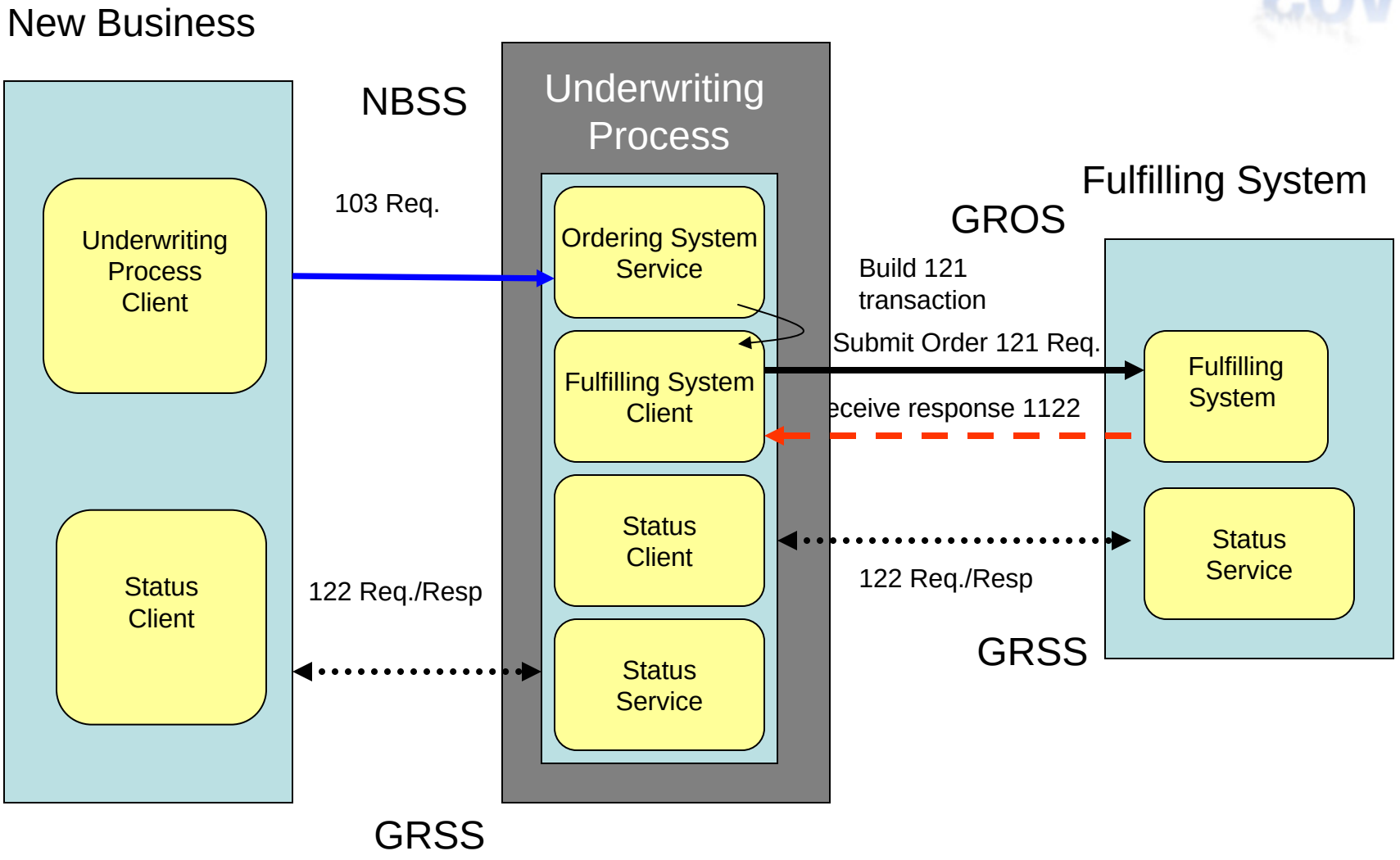


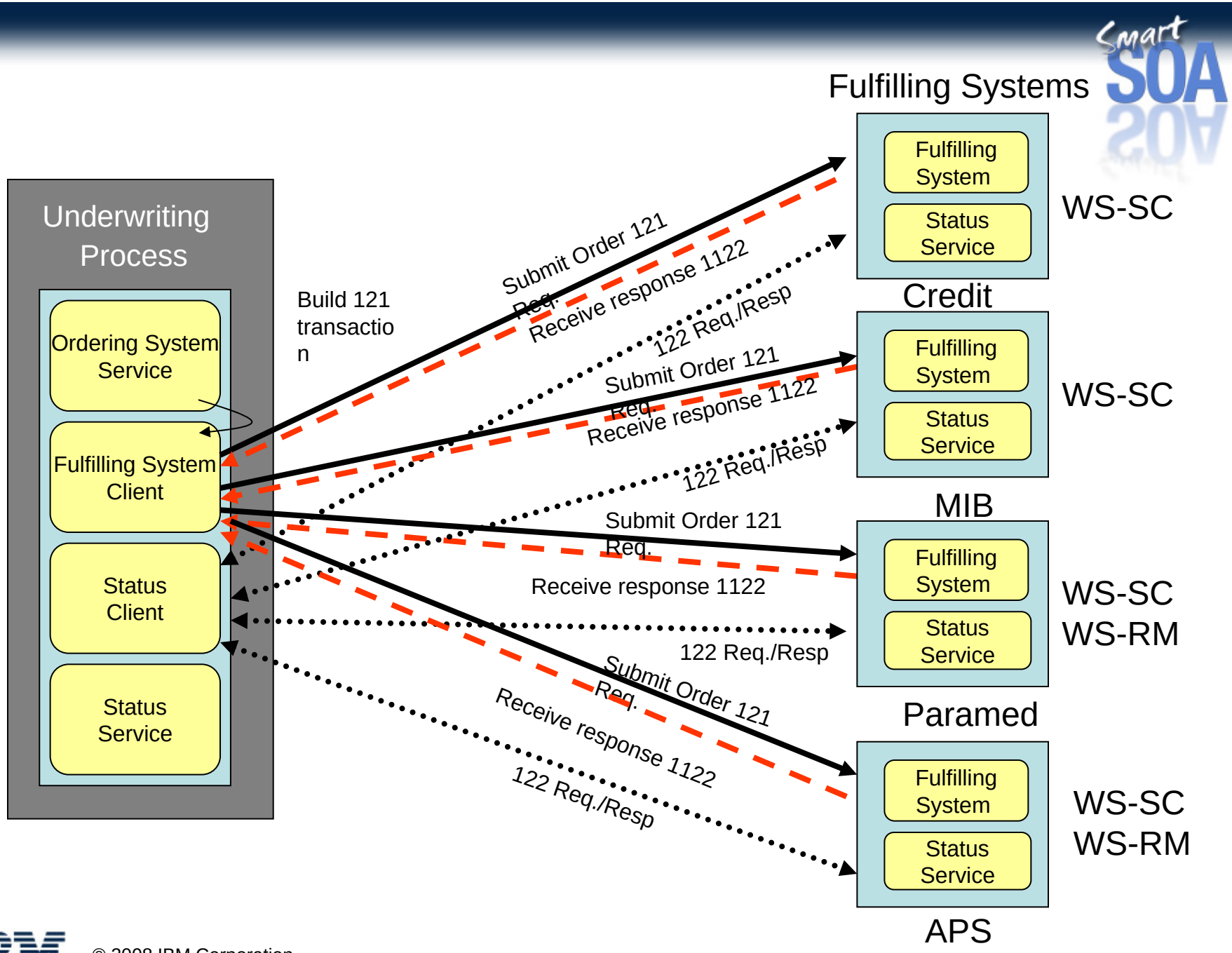
Internal Interoperability Test environment



ACORD Insurance Underwriting Scenario

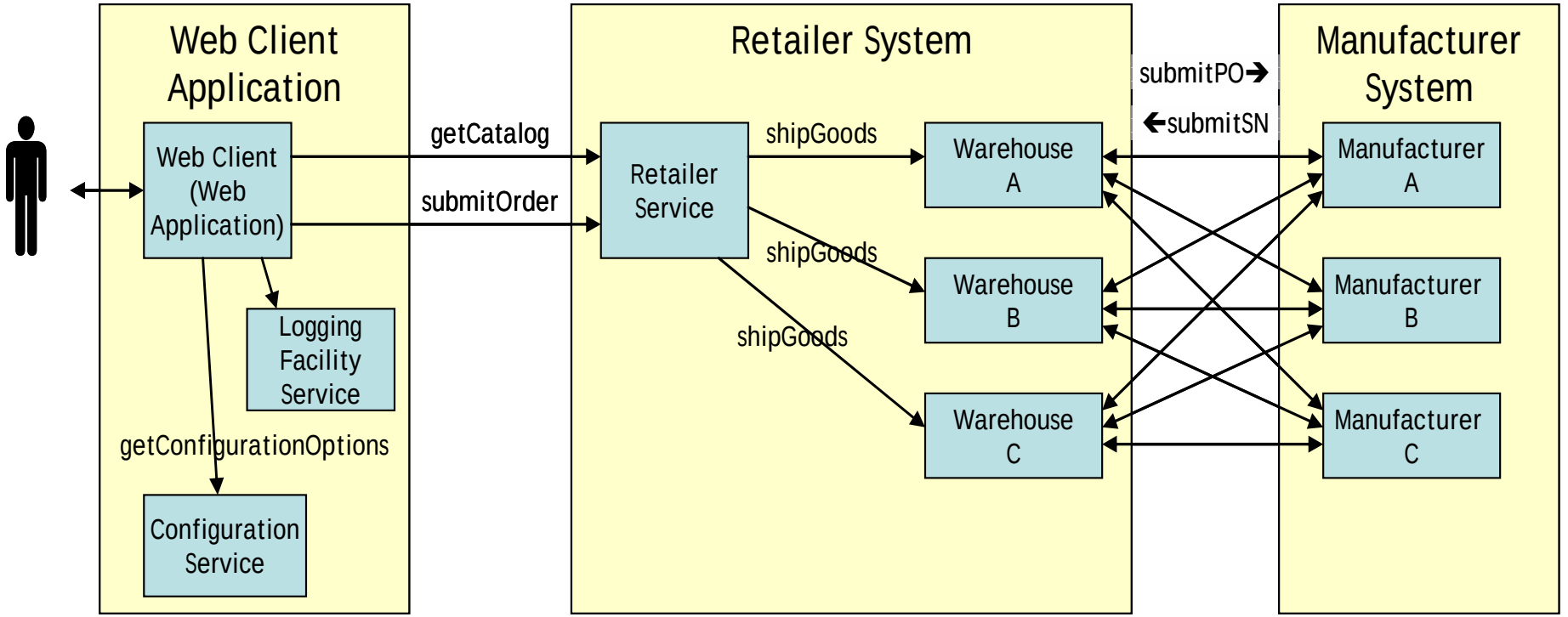






WS-I Secure Supply Chain Management Sample

Used to test BSP 1.0 interoperability for WAS 6.1



WAS/WCF Interoperability Test Scenarios

- SOAP 1.1/1.2
- WS-Security 1.0/1.1
- Username Token Profile
- Kerberos Token Profile
- X.509 Token Profile
- WS-Addressing
- WS-Addressing Metadata
- MTOM/XOP (for SOAP 1.1/1.2)
- WS-Reliable Messaging 1.0/1.1
- WS-SecureConversation 1.0 (submission spec and OASIS approved version)
- WS-Trust (submission spec and OASIS approved version)
- WS-Atomic Transaction (original AT support and OASIS approved version)
- WS-Policy (including OASIS WS-SX Security Policy, RM Policy, and TX policy)

Web Services Interoperability (WS-I)

What is WebSphere doing to make progress in WS-I ?

- Salim Zeitouni from the WebSphere Interoperability team now chairs the Sample Applications group
- Working closely with Microsoft to define the scenarios for BSP 1.1
- Charles LeVay from the WebSphere Interoperability team driving completion of test assertions, test scenarios, and test tools for RSP 1.0
- IBM Emerging technology group driving completion of test assertions, test scenarios and test tools for BP 1.2, BP 2.0

Web Services Test Forum (WSTF)

Problem Statement

- Web Services are becoming the dominant integration technology
  - “lingua franca” of SOA
  - underpin many enterprise architectures/roadmaps
- Most (all?) large enterprise environments are heterogeneous
- Unknown but significant risk around interoperability
  - WS interoperability largely untested except for simple compositions of technologies, e.g.:
    - SOAP 1.1
    - WS-Security
  - Projects may be delayed or fail due to unexpected interoperability issues

WSTF Details

- Almost everything is private (mailing lists, scenario work, votes...)
  - But low bar for entry – want people to discuss issues w/o fear of looking bad
- Unpublished scenarios can be tested, but nothing is made public
- Scenarios are made public only after a vote by the implementers
  - Requires at least 5 implementations + 2/3 ‘yes’ vote
  - Vote provides a simple filtering to prevent diluting the value of the group
    - Shows broad industry support
- Testing
  - Each scenario has a list of endpoints (private and public lists)
  - Endpoints are expected to be “long lived”
  - New implementations (non-members) can test at will using ‘published’ scenarios and endpoints
  - Implementers are encouraged to make their test code/config etc. available
  - Interoperability issues are brought to the appropriate forum(s) by individuals (not the group)

WSTF Status

- Charter and Participant's Agreement are now finalized
- Web site (http://www.wstf.org) is ready
- Founding members are working on initial set of scenarios
  - Very basic ones to test the infrastructure of the group
  - Provide a base-line for more advanced scenarios
- Soliciting next round of members

What Can Customers Do?

- Develop your own interoperability test lab
  - infeasible unless you can dedicate a large amount of resources
- Join the Web Services Test Forum (WSTF)
  - http://www.wstf.org/
  - open forum focused on developing and testing non-trivial WS scenarios
    - no dues, no board, minimum of process
    - consensus driven
    - scenario-based
  - provides an on-going, “shared” test bed available for the entire WS community to use

WSTF Involvement

- Observer
  - 1 (medium technical) person/day month
  - gain visibility into areas of biggest concern
  - scenarios may not match your business requirements
- Participant
  - 3 (highly technical) person/days month/scenario
  - same benefits as observer plus scenarios will more closely match your business requirements
- Evangelist
  - 5 (highly technical) person/days month
  - scenarios tailored to your business requirements
  - WSTF becomes your virtual interop lab

Best practices customers should know for implementing interoperable web services

High Level Best Practices *(top-down)*

- Start with Data Model and build schema
- Create Doc/Lit or Doc/Lit/wrapped WSDL
- Use tooling to validate WSDLs, schemas and instance documents compliant with WS-I Basic Profile
- Create stub service and code implementation
- Test application level interoperability

High Level Best Practices *(bottoms-up)*

- Utilize tools to generate artifacts (schemas, WSDLs)
- Use tooling to validate WSDLs, schemas and instance documents compliant with WS-I Basic Profile
- Deploy service test with clients generated from WSDLs
- Test application level interoperability

Meet in the middle – a combination and reality

- This is the most typical approach
  - top down design is difficult to implement
  - bottom up design generates ugly WSDL/XSD
  - bottom up design has language-specific bindings
  - bottom up implementation not Web service friendly
- Options:
  - Write custom serializers to map directly from XML to existing objects
    - Framework provided in WebSphere Application Server v6
    - JAX-WS Provider makes it easier to use other mapping capabilities
  - Write a facade service which maps from generated Java classes (mapped from XML) to existing code
  - If need to map from WSDL to existing XML, consider using an ESB
- Challenges
  - extra work to keep implementation and WSDL/XSD in sync

Top 10 tips for web services interoperability

- Avoid empty arrays
- Understand how data types map to package names
- Test for null using isNil instead of == null
- Avoid null dates altogether
- Be careful when comparing dates - use compareTo
- Use trace tools to log message exchanges
- Know how to adjust listening ports for your tools
- Use unit testing to ensure client and service handle edge cases correctly
- Use doc/literal per WS-I as the encoding type
- Think in terms of XSD, even if you write code-first

WebSphere / WCF interoperability

WCF Bindings

- basicHttpBinding
  - MEPs: One-way, two-way (anon),
  - SOAP 1.1, WS-Security (optional)
- wsHttpBinding
  - MEPs: One-way, two-way (anon),
  - SOAP 1.2, WS-Addressing, WS-Security (optional), WS-RM (optional), WS-SC (optional)
- wsDualHttpBinding
  - MEPs: two-way (addr)
  - SOAP 1.2, WS-Addressing, WS-Security (optional), WS-RM, WS-SC (optional)
- customBinding – EVERYTHING is Configurable !

SOAP 1.1 / SOAP 1.2 (Action)

- Scenario
  - WAS Client -> WCF Service
- Issue
  - For SOAP 1.1 WCF requires http header to contain SOAPAction
  - For SOAP 1.2 WCF requires action parameter in Content-Type to be defined
- Resolution
  - Define SOAP action in WSDL

    e.g. **<soap:operation soapAction="pingOperation" style="document" />**

  or

  - Define SOAP action in client code

```
// Configure SOAPAction properties
BindingProvider bp = (BindingProvider) (ping._getDescriptor()
                                        .getProxy());
bp.getRequestContext().put(BindingProvider.ENDPOINT_ADDRESS_PROPERTY,
                                        endpointURL);
bp.getRequestContext().put(BindingProvider.SOAPACTION_USE_PROPERTY,
                                        Boolean.TRUE);
bp.getRequestContext().put(BindingProvider.SOAPACTION_URI_PROPERTY,
                                        "pingOperation");
```

MTOM / XOP

- Scenario
  - Attempting to send binary data (jpegs/images) via MTOM
- Issue
  - WCF defaults to limiting attachments to 64k in size
- Resolution
  - Increase default max receive message size for MSFT is 64k

WS-Addressing

- Scenario
  - WAS Client -> WCF Service
- Issue
  - WCF does not correctly handle a wsa:ReplyTo with a valid EPR unless the service is configured for compositeDuplex
- Resolution
  - Configure WCF with both compositeDuplex and oneWay stack elements
  - Recommend customBinding for this configuration

WS-Addressing

- Scenario
  - .Net Service Generation
- Issue
  - svcutil generates the wrong code for ReplyAction, it should NOT be ReplyAction="*" which means don't set any value
- Resolution
  - Either remove the ReplyAction definition altogether, or explicitly set it to the value you are expecting. Therefore, change

```
[System.ServiceModel.OperationContractAttribute( Action = "foo", ReplyAction = "*" )]
```

to

```
[System.ServiceModel.OperationContractAttribute( Action = "foo" )]
```

or

```
[System.ServiceModel.OperationContractAttribute( Action = "foo", ReplyAction = "bar" )]
```

X.509 Token Profile

- Scenario
  - WAS Client -> WCF Service, WCF Client -> WAS Service
- Issue
  - If DN contains multiple attributes
    e.g. cn=abc, ou = raleigh, o=ibm, c=us

  WAS removes the spaces, WCF doesn't like that.
- Resolution
  - Make sure your certificates have a key identifier defined
  - Use key identifier instead of X509issuer Token
  - To be fixed in a future release of WCF
    - http://www.codeprof.com/dev-archive/201/153-118-2012214.shtm

Username Token Profile

- Scenario
  - WAS Client -> WCF Service, WCF Client -> WAS Service
- Issue
  - When using WS-Security to secure the UNT, WCF defaults to a symmetric encryption algorithm (HMAC-SHA1) not supported in WAS. This algorithm is not configurable in the binding
- Resolution
  - Use SSL to secure UNT
  - We are trying to understand how to over-ride this in WCF code

WS-Secure Conversation

- Scenario
  - WAS Client -> WCF Service, WCF Client -> WAS Service
- Issue
  - Enabling signature confirmation in the bootstrap policy, WCF defaults to a symmetric encryption algorithm (HMAC-SHA1) not supported in WAS. This algorithm is not configurable in the binding
- Resolution
  - Don’t use signature confirmation
  - We are trying to understand how to over-ride this in WCF code

WS-Secure Conversation

- Scenario
  - WAS Client -> WCF Service, WCF Client -> WAS Service
- Issue
  - WAS and WCF use different default key sizes for signing
- Resolution
  - Configure key sizes to match

WS-Reliable Messaging (offer)

- Scenario
  - WAS Client -> WCF Service
- Issue
  - WCF Service requires the WAS client to provide an offer with a create sequence request for any 2-way MEP. According to the WS-RM specification, offer is OPTIONAL
- Resolution
  - For WS-RM 1.0, use the WS-ReliableMessaging 1.0 Policy Set
  - For WS-RM 1.1, use the WS-RM SPIs to enable the WAS client to send an offer

WS-Reliable Messaging & WS- Make Connection

- Scenario
  - WAS Client -> WCF Service, WCF Client -> WAS Service
- Issue
  - WCF does not support WS-MakeConnection (WS-MC). WS-MC is used to re-initiate a broken sequence for a 2-way (anonymous) MEP. WCF supports a proprietary message replay scheme.
- Resolution
  - Use WS-ReliableMessaging 1.0 Policy Set which disables MakeConnection and implements replay for interoperability with WCF
  - Use WS-ReliableMessaging Default Policy Set (RM 1.1), but do not use two-way (anonymous) MEPs – remember to use WS-RM SPIs to enable the WAS client to send an offer for two-way (valid address) MEPs

WS-Reliable Messaging (Sequence expiration)

- Scenario
  - WAS Client -> WCF Service
- Issue
  - WAS Client throws exception when it receives an unknown sequence fault due to sequence expiration due inactivity
- Resolution
  - Catch exception and use WS-RM SPIs to send a Create Sequence Request, don't forget to send an offer for two-way MEPs
  - Increase the sequence inactivity timeout in WCF service (default 10 minutes). FYI - WAS sequence inactivity timeout is 24 hours.
  - Working on adding feature in WAS to handle this situation without client code.

WS-ReliableMessaging & (WS-Sec. or WS-SC)

- Scenario
  - WAS Client -> WCF Service, WCF Client -> WAS Service
- Issue
  - By default, WCF does not secure WS-RM control messages e.g. CreateSequeunce. WAS applies the application level security policy to the WS-RM control messages
- Resolution
  - Add and additional behavior to the WCF Client and Service endpoints to encrypt the WS-RM control messages .
    - http://forums.microsoft.com/MSDN/ShowPost.aspx?PostID=913081&SiteID=1

WS-AtomicTransaction

- Scenario
  - WAS Client -> WCF Service
- Issue
  - WS-Coordination message hangs on WCF service due missing WS-Addressing RelatesTo in the WAS message. This is a WAS bug.
- Resolution
  - Resolved by applying an iFix. The iFix will be made available shortly.

Additional Resources

- developerWorks articles

  http://www.ibm.com/developerworks/websphere/library/techarticles/0710_levay/0710_levay.html
  http://www.ibm.com/developerworks/websphere/library/techarticles/0712_levay/0712_levay.html
  http://www.ibm.com/developerworks/websphere/library/techarticles/0711_zeitouni/0711_zeitouni.html
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- Interoperability Organizations

  http://www.ws-i.org/

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  http://www.wstf.org/

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Other comments

Questions to ask about standards

- Does it address a requirement you have?
- Do you have requirements not covered by the standard, but covered by proprietary alternatives or extensions?
- Do you require interoperability or portability across platforms?
- Is it a standard or a specification? If a specification or draft standard how mature?
- Is it supported on all of your vendors platforms? By some of them? At a consistent version level?
- Is the standard covered by a WS-I profile? Do vendors support the profile?
- Do you need to adopt the latest version of the standard?
- If the vendor support doesn't exist for the standard and exists for an earlier specification, what would it take to migrate?
- Can you put a layer in front of the specification/standard APIs to protect your code from API changes?
- If the alternative is to develop your own equivalent to the standard/spec, don't – usually you are better off using the standard/spec
- Is the standard/spec more complex than what you need?

Questions?

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