SOA

in Action Seminar Series

Enable Business Flexibility with Federated Connectivity

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Agenda

- What is "Connectivity Federation"

- Why do you care?

- What are some of the challenges?

- What are the underpinnings?

- What is IBM doing?

What is "Connectivity Federation"

Today's Globally Integrated, Agile Businesses Requires
End-to-end Transaction Integrity; Unified Governance; and
Security

A Federated ESB is an enterprise-spanning connectivity infrastructure of multiple ESBs working together to extend service reuse across as well as within domains.

SOA, Service Reuse and Connectivity

- SOA is about the *services* that allow an enterprise to achieve its business goals

- *Service reuse* and *flexibility* are key factors in the success of SOA

- A *Connectivity Infrastructure*
  - Allows the services to *interact*
  - Facilitates dynamic and flexible *service reuse*
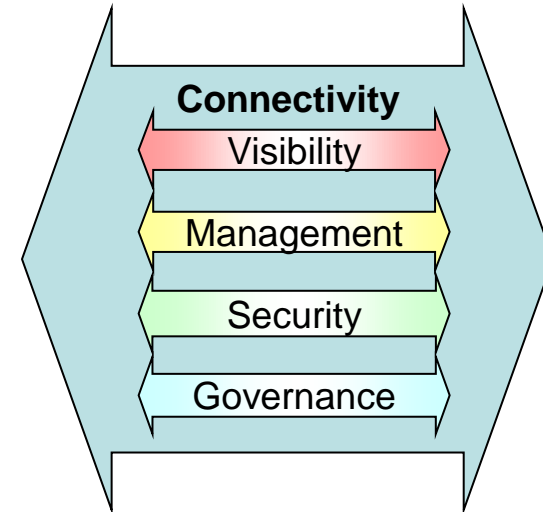
Enterprise

Connectivity

S S S S S
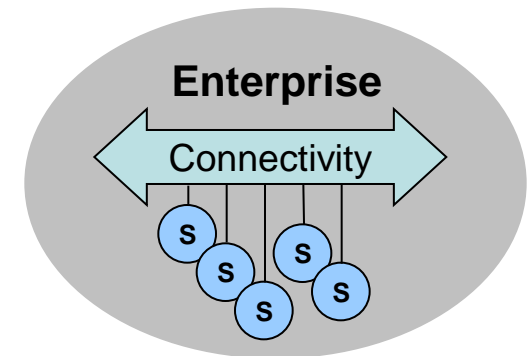
The Connectivity Infrastructure

Consists of many important elements

- **Service Visibility (& Interoperability)**
  - Allows a service consumer to interact with a service provider
  - Service registry and service bus (service virtualization)

- **Service Management (& Monitoring)**
  - Enables understanding of and dynamic adaptation to the changing service conditions
  - Management products, often facilitated by service registry and service bus (aspect-oriented connectivity)

- **Service Security**
  - Guards integrity by securing access to services
  - Security products, sometimes facilitated by service registry and service bus (aspect-oriented connectivity)

- **Service Governance**
  - Defines policies and processes controlling the other parts of the Connectivity Infrastructure, supporting the connectivity goals of the enterprise
  - Derives from cooperative parts of the other infrastructures

Connectivity

Visibility

Management

Security

Governance

The Reality of Modern Enterprises

- Most are **not** monolithic, and have **multiple business units**
- Each business unit encapsulates services reused **within** the business unit boundaries via its connectivity infrastructure
- The business units often are isolated and autonomous
- The business units are in effect **service domains ...** Islands of SOA

Business Unit 1
Connectivity
S S S S S

Business Unit 2
Connectivity
S S S S

Business Unit 3
Connectivity
S S S
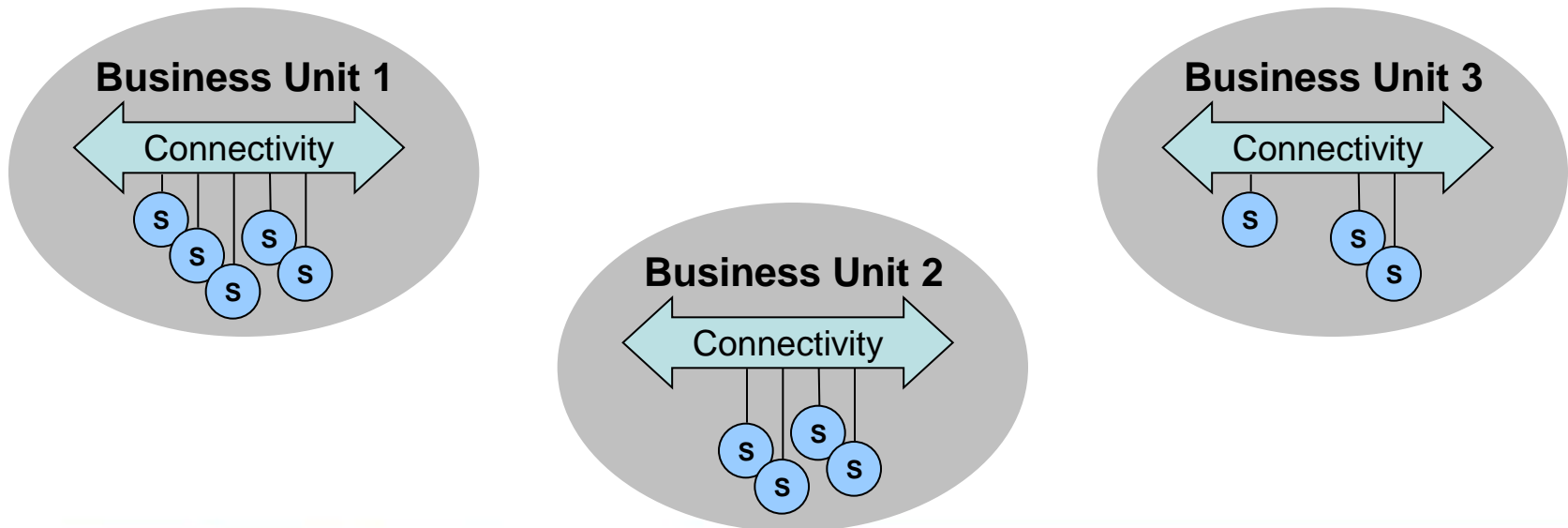
The Business Goal

- Maximise *service reuse* across the enterprise
  - Allow service reuse to span domain boundaries

- Enhance *flexibility* across the enterprise
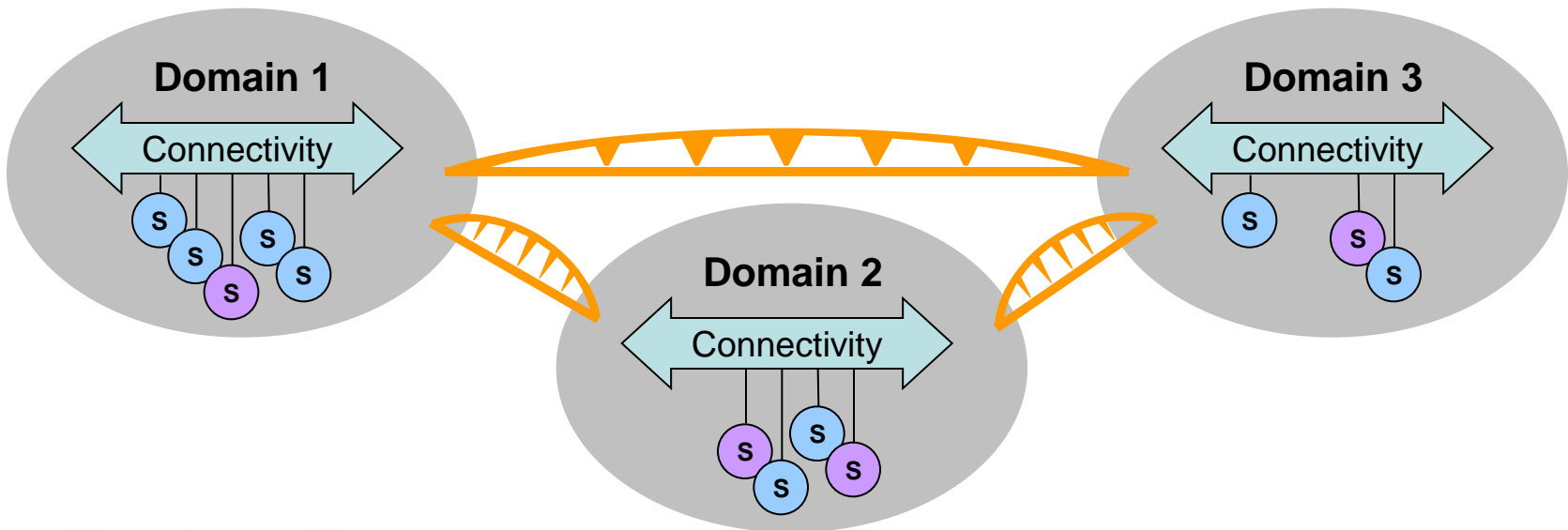 - Business process redesign with minimal disruption

- … *Federated Service Reuse*
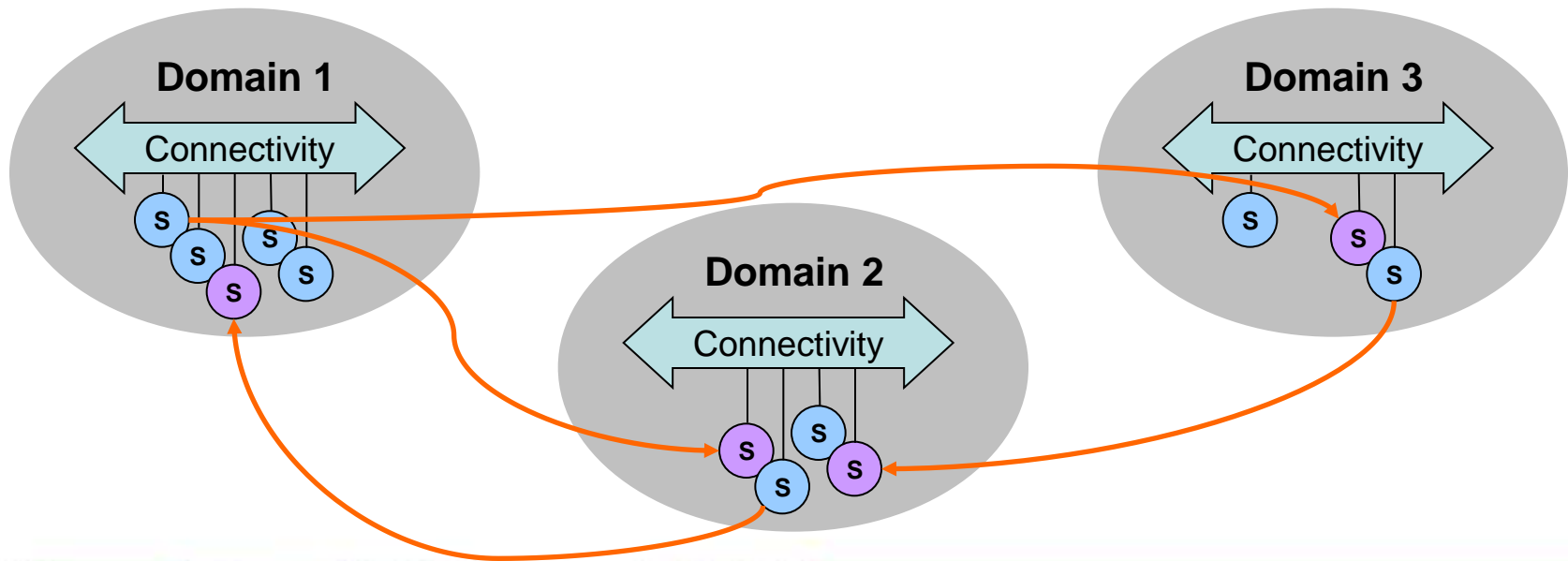
The Solution …
Federated Connectivity

- Bridge **Connectivity** across domain boundaries

- Resulting in **Federated Connectivity …**

- To achieve … **Federated Service Reuse**

Why Do You Care?

There are many reasons why multiple ESBs existing within the Enterprise.

Mergers and acquisitions have resulted in multiple ESBs

Business or funding models are distributed – multiple business units each with own P&L

Best practice requirement to isolate critical environments

ESB 1

ESB 3

Federated ESB

ESB 2

Departments have differing ESB requirements which are best met by different products

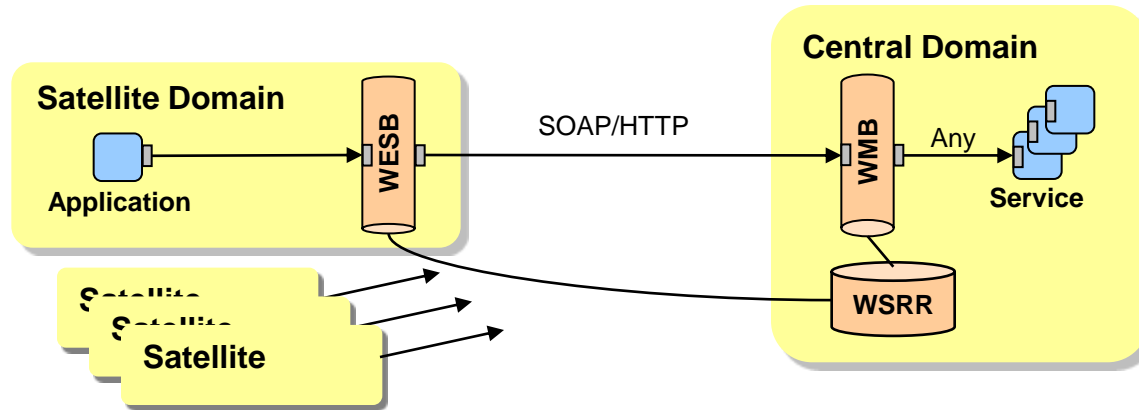Department ESBs need to be decoupled to allow asynchronous development and deployment

Architectural choices – decision for corporate shared service ESB

Distributed geographic locations

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Federated Connectivity
Example 1 – Parent/Child

- **Goals**
  - Match connectivity topology to multiple domain nature of the Organisation
  - Allow replacement of service(s) in Central Domain without impact on other Domains
  - Loosely coupled, intelligent connectivity in all domains

- **Solution**
  - Connectivity infrastructure in Central Domain
  - Independent Connectivity infrastructure in each Satellite Domains
  - Enterprise-wide service registry and service bus to bridge connectivity
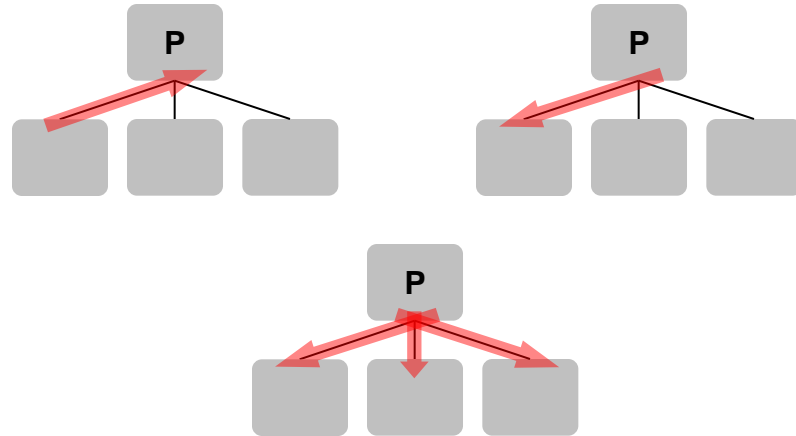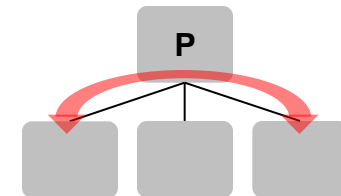
Topology Relationships & Roles
Parent/Child

- Direct interaction
  - Child to parent
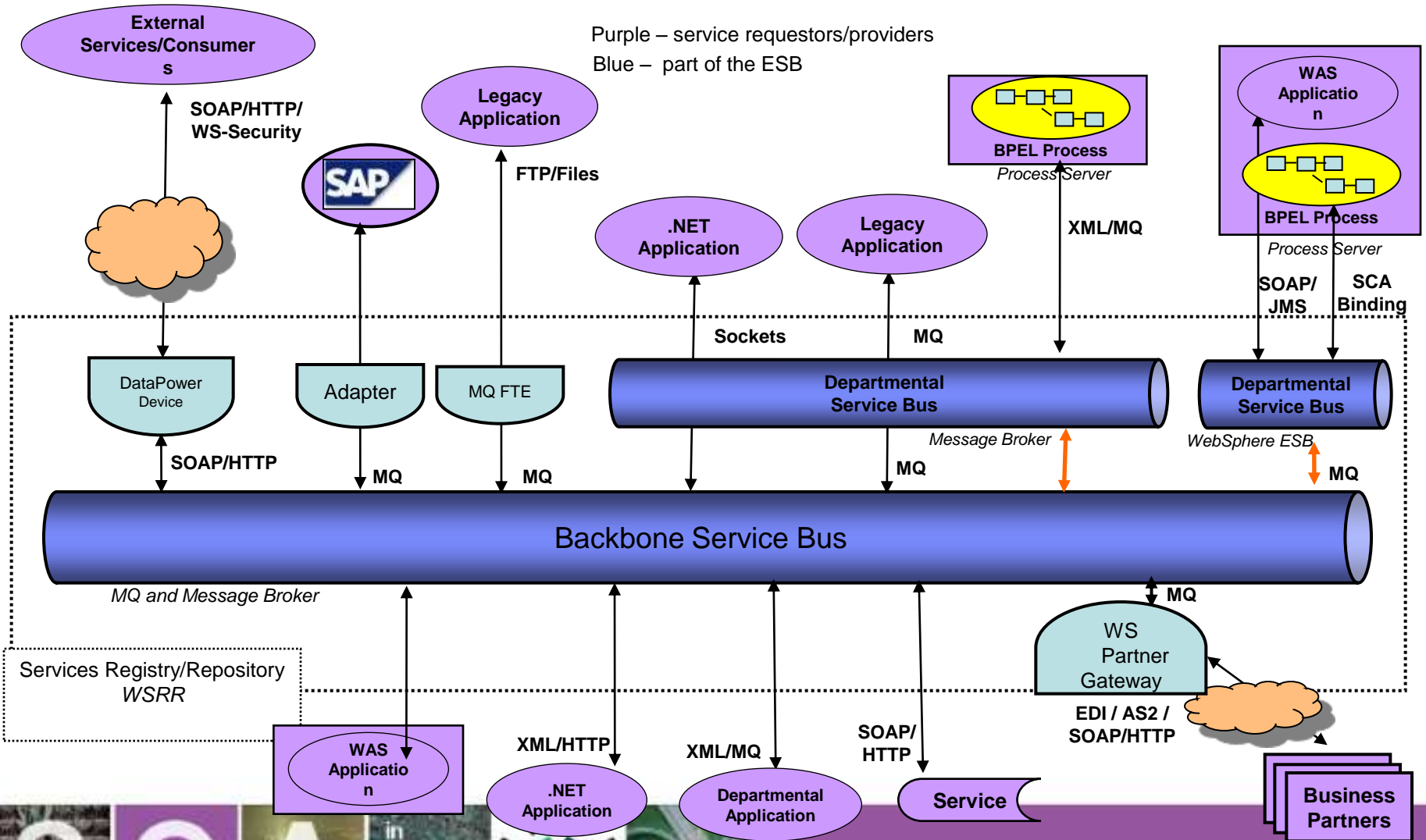 - Parent to a child
  - Parent to all children

- **Note:** if child-to-child communication is needed
  - Can use the parent as a "peer-to-peer" broker

Federated Connectivity

Example 2 – Peer to Peer

IBM

External Services/Consumers

SOAP/HTTP/ WS-Security

Purple – service requestors/providers
Blue – part of the ESB

Legacy Application

FTP/Files

BPEL Process

Process Server

WAS Application

.NET Application

Legacy Application

XML/MQ

BPEL Process

Process Server

DataPower Device

Adapter

MQ FTE

Sockets

MQ

Departmental Service Bus

SOAP/ JMS

SCA Binding

Departmental Service Bus

Message Broker

WebSphere ESB

SOAP/HTTP

MQ

MQ

MQ

MQ

MQ

Backbone Service Bus

MQ and Message Broker

MQ

WS Partner Gateway

Services Registry/Repository
WSRR

WAS Application

XML/HTTP

.NET Application

XML/MQ

Departmental Application

SOAP/ HTTP

Service

EDI / AS2 / SOAP/HTTP

Business Partners
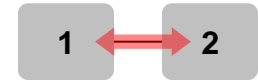
SOA

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Topology Relationships & Roles
Peer/Peer

- **Direct interaction (Distributed routing)**
  - Routing directly from the consumer domain to provider domain
  - Routing information distributed to all consuming domains
  - Any mediation needed done in domain of consumer

- **Brokered interaction (Centralised routing)**
  - Routing indirectly from consumer domain to provider domain via a broker domain
  - Routing information centralised in broker domain
  - Any mediation needed can be done in broker domain
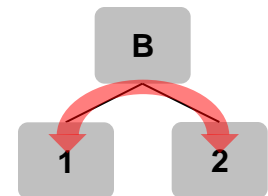
- **Direct vs. Brokered**
  - Fewer parts to manage
  - More parts to update for change
  - Complexity linear, Order(#peers) vs. constant
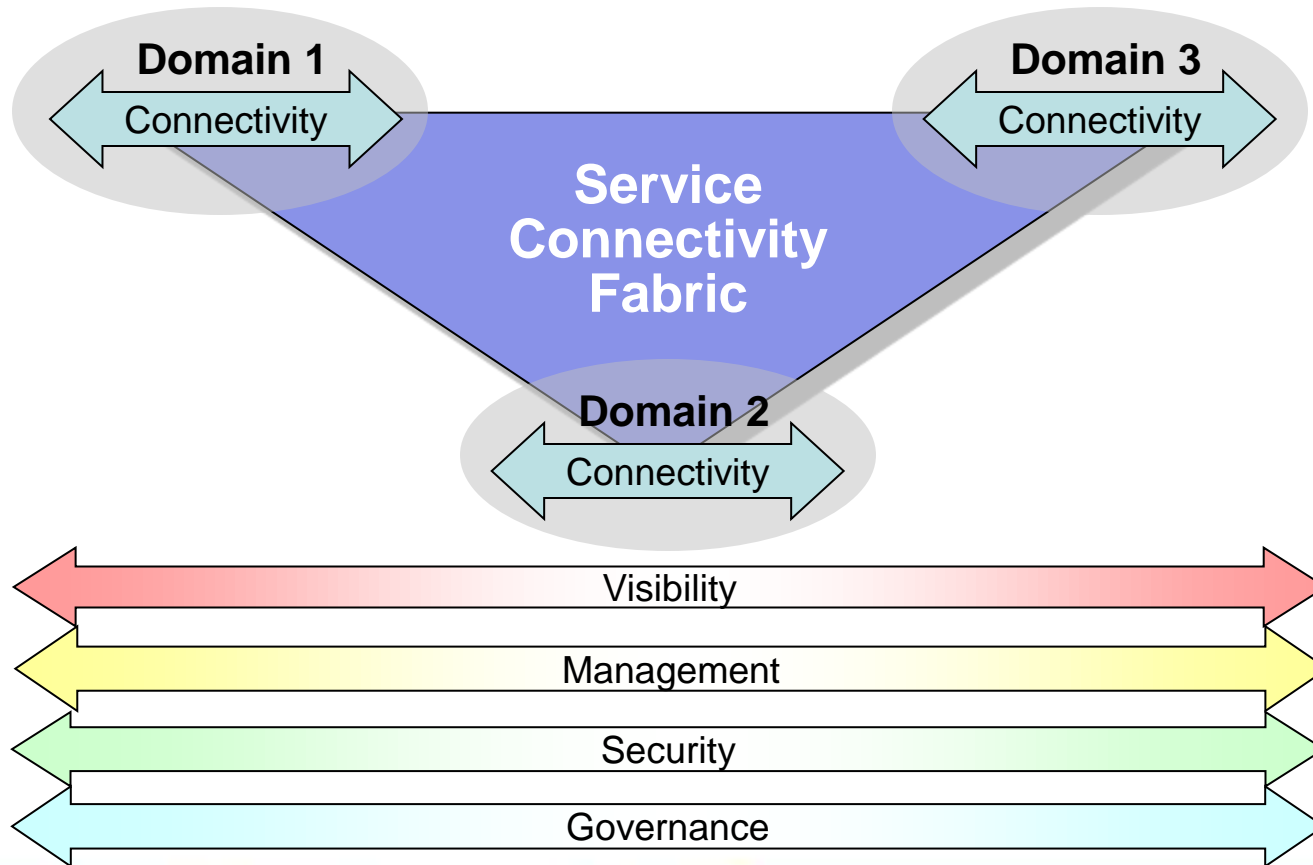 - More efficient interaction

Connectivity is Complex

Enterprise-wide connectivity is more complex

- Consideration must be given to ……

Domain 1
Connectivity

Domain 3
Connectivity

Service Connectivity Fabric

Domain 2
Connectivity

Visibility

Management

Security

Governance

What are some of the Challenges?

*Enterprise-wide connectivity is more complex – How does one …*

- **Visibility**
  - Establish basic interoperability between services in different domains
  - 'Advertise' services in different domains
- **Management**
  - Coordinate management and monitoring for all domains
  - Share relevant information about services in different domains
  - Deal with cross-domain impact analysis
- **Security**
  - Propagate, map and audit identities across domains
  - Deal with the higher possibility of greater risk of malicious intent
- **Governance**
  - Increase service reuse across the enterprise
  - Help services in different domains interact efficiently and dynamically
  - Enable enforcement of policies across domains

An Enterprise is Heterogeneous

- Federation must support multiple vendors
  - ESBs, of various levels of complexity, from 'edgy' to appliance
  - Service registries, from file to extended UDDI to full service registry (eg: WSRR)
  - Management & Monitoring products
  - Security products
  - Governance products and technologies

Domain 1
IBM

Domain 3
Non-IBM

Service Connectivity Fabric
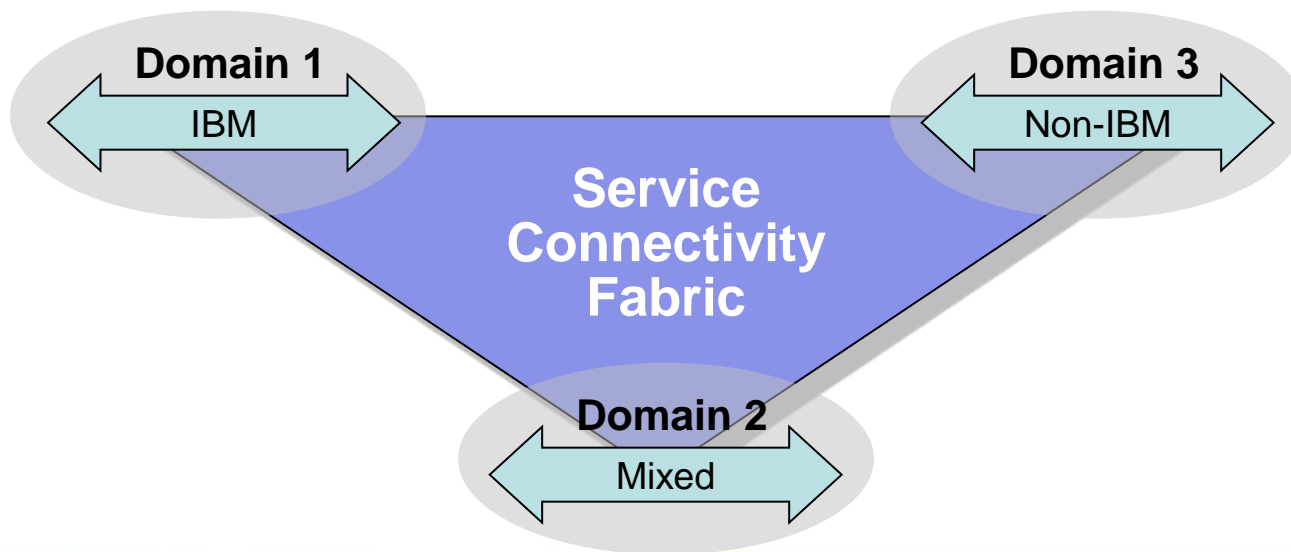
Domain 2
Mixed

Federation happens in different ways

- **Reactive (bottom-up)**
  - Federating existing domains that have grown in an enterprise because of mergers, independent decisions of business units, etc…
  - Objective is to enable interactions between the domains, to govern their configuration and manage & secure the interactions across domains, potentially with little control over the individual domains themselves

- **Proactive (top-down)**
  - Intentionally created Domains reflect requirements in an enterprise
  - Objective is designing a federated connectivity infrastructure to share services among domains, typically with control over the individual domains

- **Mixed (meet-in-the-middle)**
  - Reality is rarely clean
  - A little Reactive and a little Proactive

Domains & Federations differ in nature

- **Boundary**
  - Physical
  - Organisational
  - Governance
  - …

- **Autonomy**
  - Strong central control
  - Weak central control
  - …

- **Membership**
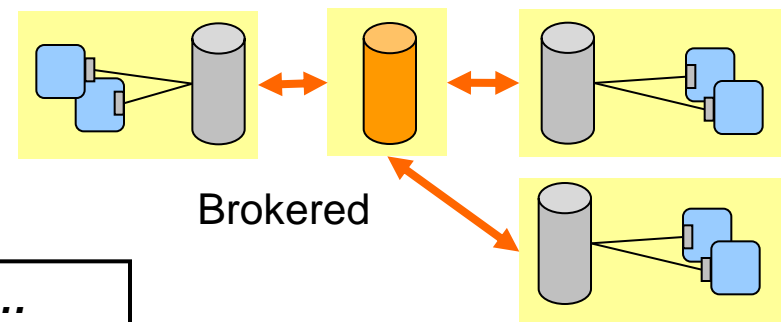 - Static
  - Ephemeral
  - …
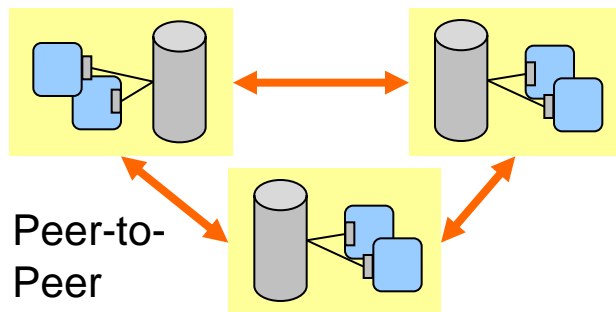
- **Relationships**
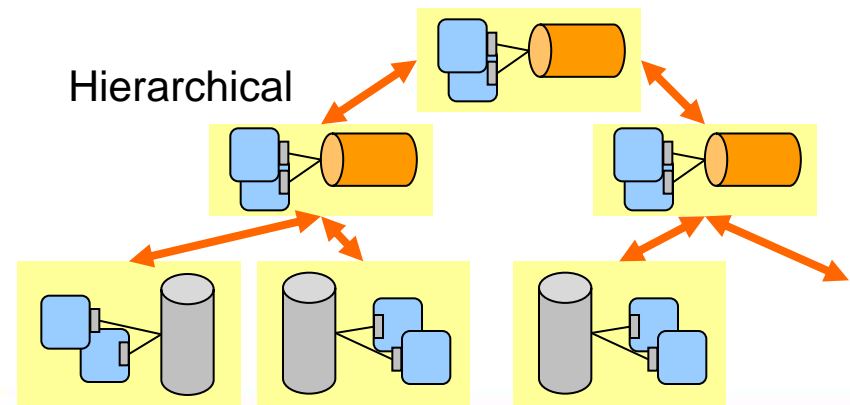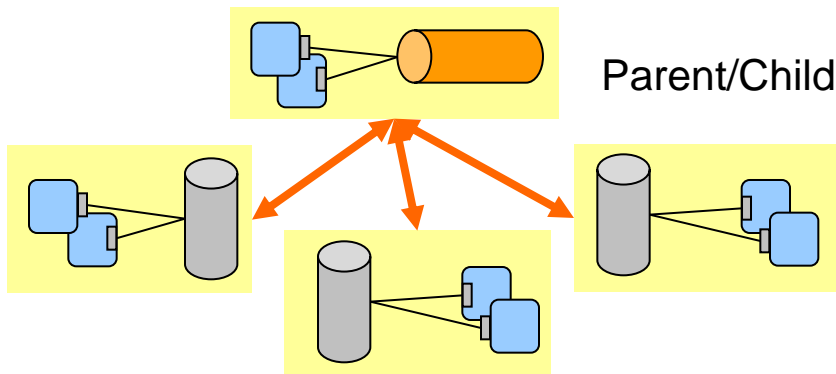 - Peer/peer
  - Parent/child
  - …

Topology alternatives abound

- No one topology works for all enterprises (one size does not fit all)
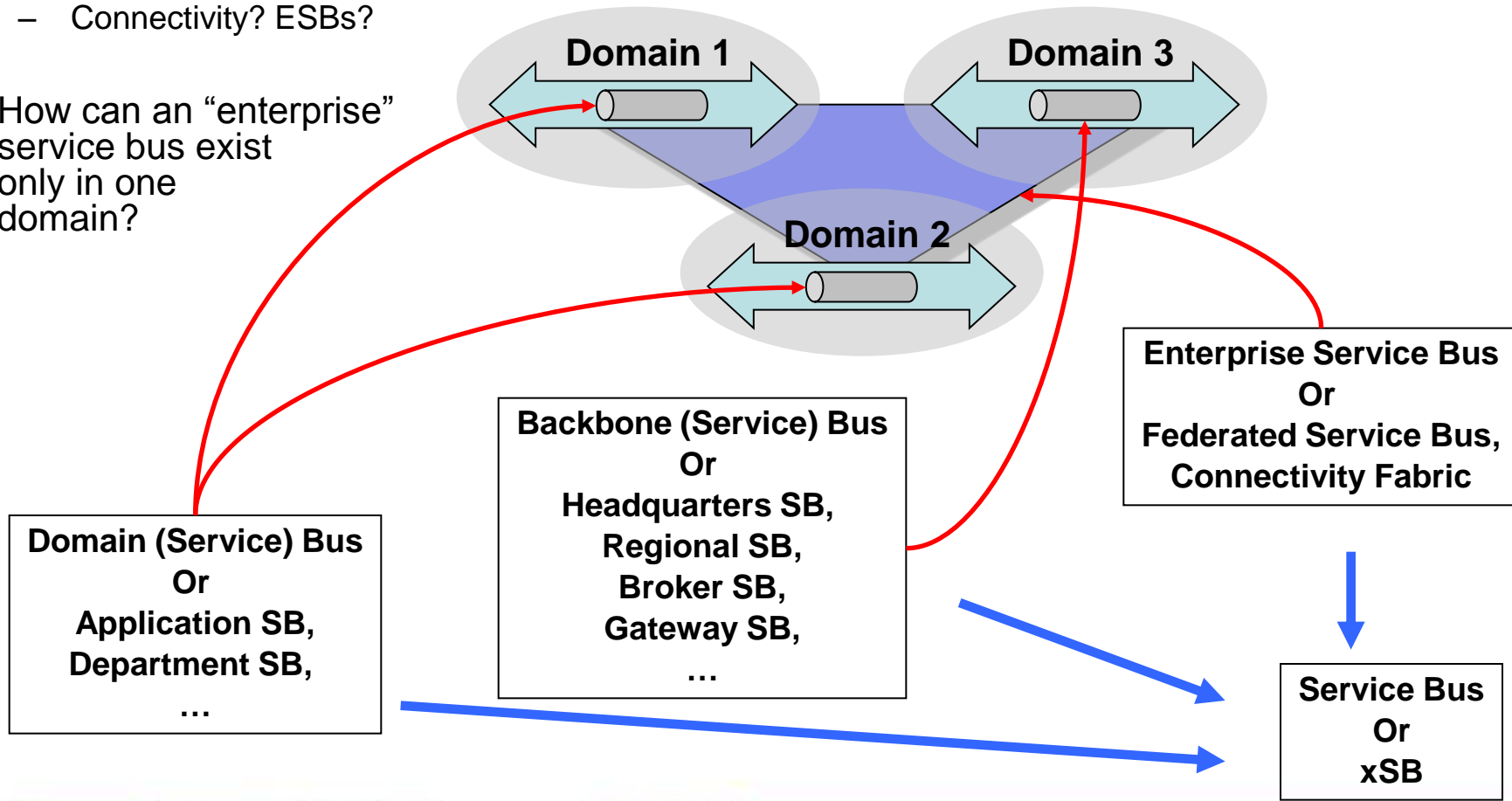- The topology can be fundamental to the success of the enterprise

Peer-to-Peer

Brokered

And **more …**

Parent/Child

Hierarchical

Terminology in Flux

- What are we really federating?
  - Connectivity? ESBs?

- How can an "enterprise" service bus exist only in one domain?

Domain 1

Domain 3

Domain 2

Domain (Service) Bus
Or
Application SB,
Department SB,
…

Backbone (Service) Bus
Or
Headquarters SB,
Regional SB,
Broker SB,
Gateway SB,
…

Enterprise Service Bus
Or
Federated Service Bus,
Connectivity Fabric
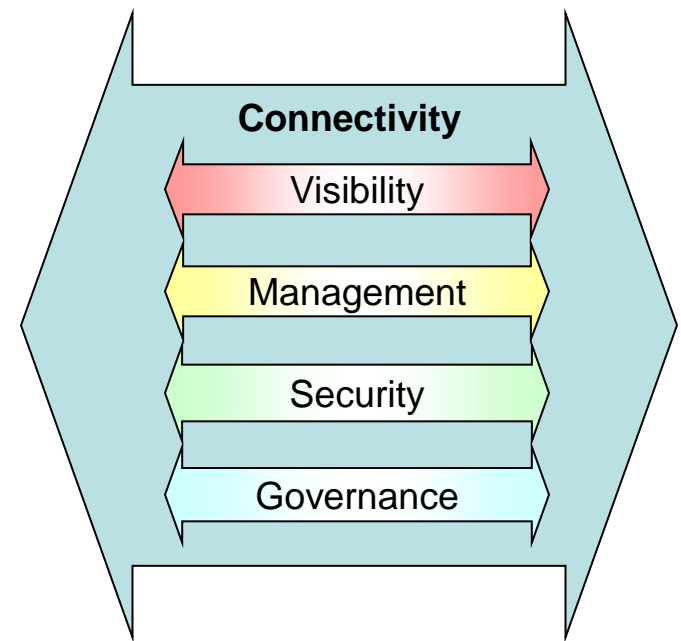
Service Bus
Or
xSB

What are the Underpinnings?
Revisiting the Connectivity Infrastructure

To understand how we actually federate, we revisit the connectivity infrastructure

- Goals
    - Identify the principles important to connectivity within a domain
   - Apply those principles to federation across domains

Connectivity

Visibility

Management

Security

Governance

Revisiting the Connectivity Infrastructure

- **Service Visibility (& Interoperability)**
    - Allows a service consumer to interact with a service provider
    - Service registry and service bus (service virtualisation)

- **Implementation Styles**

    - Within the Domain
        - <u>Direct Intra-Domain</u>
            - Direct Service Request within Domain

        - <u>Indirect Intra-Domain</u>
            - Request to Virtual Service via "Proxy"

        - <u>Dynamic Indirect Intra-Domain</u>
            - Request to Virtual Service via "Service Registry"
            - Uses Registry Content to implement Smart Mediations

    - Federated Inter-Domain
        - Recursive use of Intra-domain visibility pattern
        - Connecting **services** ..... **not service buses**

Connectivity

Visibility

Management

Security

Governance
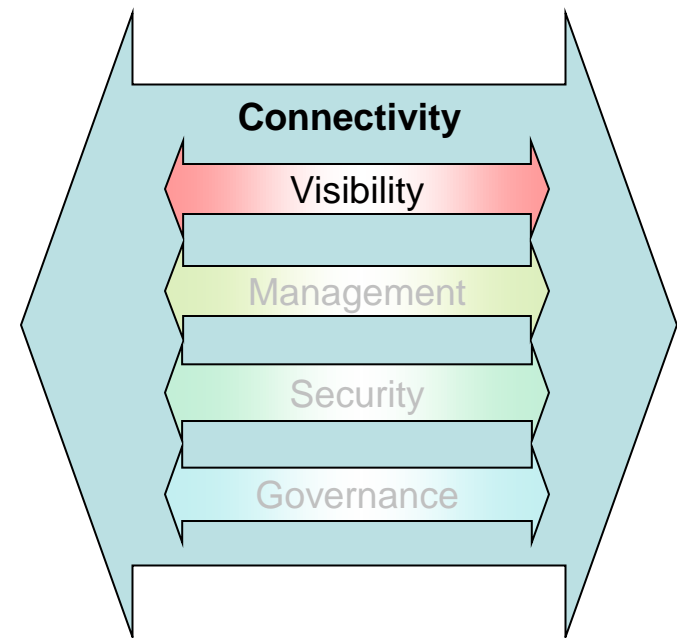
Revisiting the Connectivity Infrastructure

- **Service Management (& Monitoring)**
  - Enables understanding of and dynamic adaptation to the changing service conditions
  - Management products, often facilitated by service registry and service bus (aspect-oriented connectivity)

- **Implementation Styles**

  - Intra-Domain
    - Request via a Virtual Service
    - Status Management of the Services (endpoints)
    - Dynamic routing via Service Registry Information

  - Inter-Domain
    - Federating the Service Registry
    - Recursive connection of service …… not service bus

Connectivity

Visibility

Management

Security

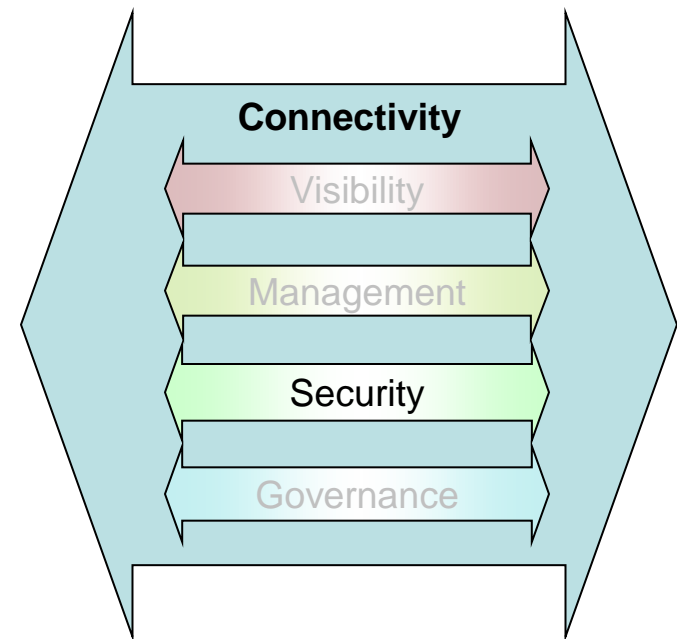Governance
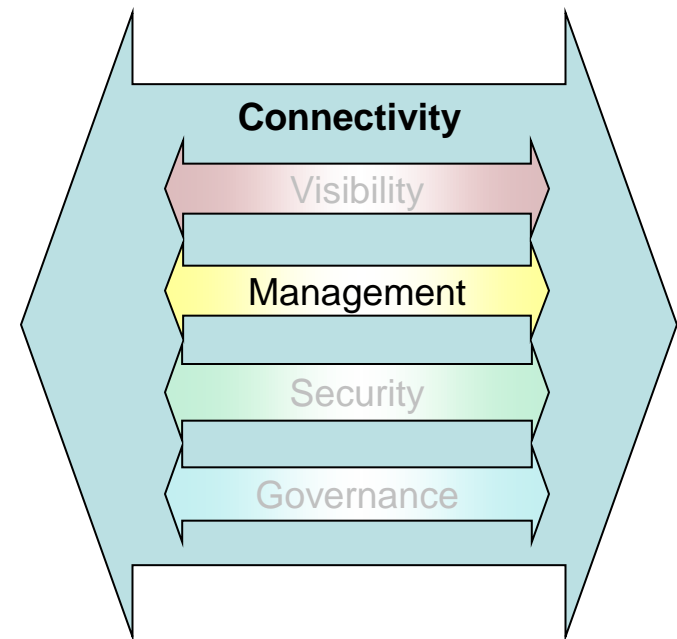
Revisiting the Connectivity Infrastructure

- **Service Security**
  - Guards integrity by securing access to services
  - Security products, sometimes facilitated by service registry and service bus (aspect-oriented connectivity)

- **Implementation Styles**

  - Intra-Domain
    - Request via a **Virtual** Service
    - Identity & Access for Virtual Service
    - Uses Identity to implement smart mediations
    - Delegates using identity for **Actual** Service

  - Inter-Domain
    - Federating the Security Manager
    - Identity Mapping between the domains

Connectivity

Visibility

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Governance

Revisiting the Connectivity Infrastructure

- **Service Governance**
  - Defines policies and processes controlling the other parts of the Connectivity Infrastructure, supporting the connectivity goals of the enterprise
  - Derives from cooperative parts of the other infrastructures

- **Implementation Styles**

  - Intra-Domain
    - Co-ordination of visibility, management & security to achieve the business goals within the Domain
    - Governing metadata describing all aspects of service interactions
    - Cross lifecycle metadata

  - Inter-Domain
    - Co-ordination of visibility, management & security to achieve the business goals in the *enterprise*, by co-ordination of governance infrastructures within domains
    - Governance focused on sharing services not connecting service buses
    - Must allow for adequate levels of domain autonomy

Connectivity

Visibility

Management

Security

Governance
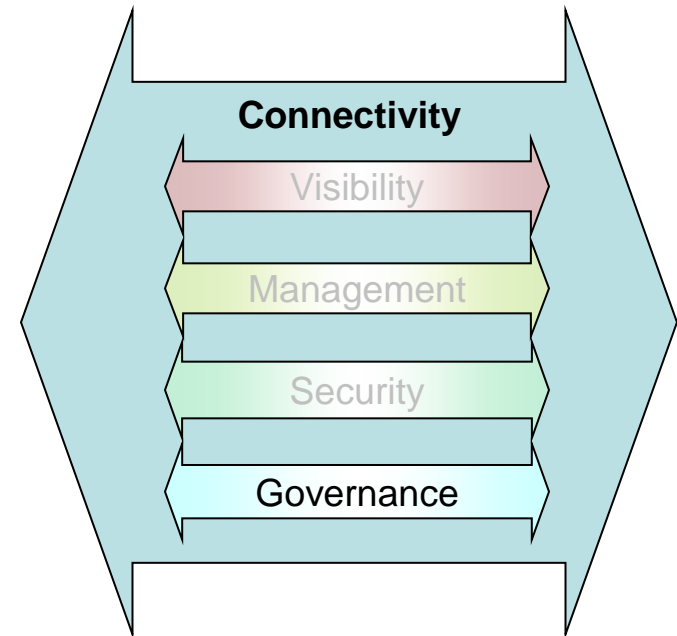
What is IBM Doing?

Making Federation Easier…..

- It is hard
  - No off-the-shelf products targeting federation
  - Enterprise-specific analysis
  - Custom integration work required

- It is possible
  - By applying familiar connectivity principles
  - Using existing IBM connectivity ecosystem products makes it easier

- It should be even easier
  - Because federation is becoming a fundamental part of SOA

- IBM is investigating
  - Connectivity patterns and recursion
  - Topology relationships for multiple-domain enterprises
  - Federation processes that span products
  - Product additions and enhancements
  - New technologies
 - Holistic approach for tying it together

RECAP: A Federation Model

- *Canonical representation* of the elements of federation

- **Federation**: aggregates all domains in a federation

- **Domain**: identifies service buses and service registry controlling service visibility

- **Bus**: a "factory" for proxies in domain

- **Proxy**: virtual service enabling connectivity within or across domain boundary

- **Registry**: holds service metadata related to connectivity

- **Service**: metadata for services owned by domain and shared from other domains
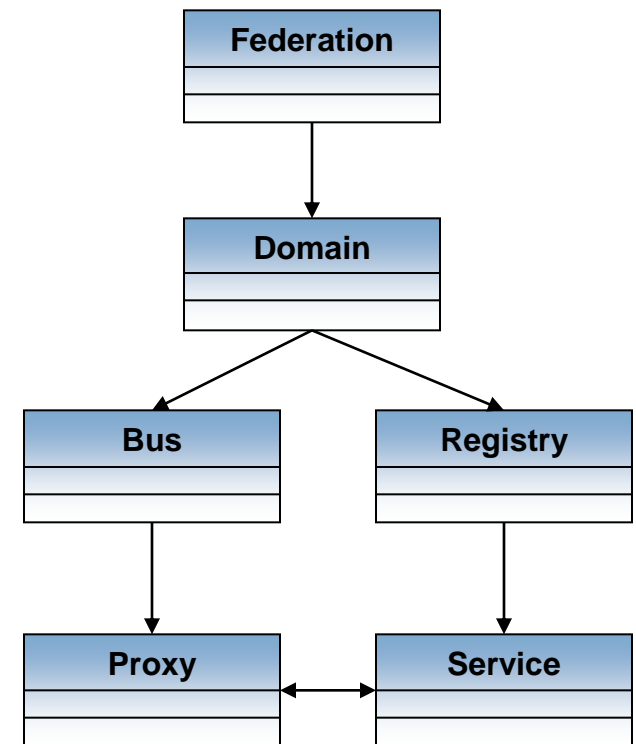
Service Visibility – Service Bus
IBM delivers the most complete ESB product portfolio

WebSphere ESB
Built on WebSphere Application Server for an integrated SOA platform

ESB Offerings from IBM WebSphere

WebSphere Message Broker
Universal connectivity and transformation in heterogeneous IT environments

✓ *Common mediation patterns*

✓ *Common transformation capability*

✓ *Common standards support*

✓ *Common integration with IBM connectivity ecosystem*

✓ *Mission-critical qualities of service*

WebSphere DataPower Integration Appliance XI50
Purpose-built hardware ESB for simplified deployment and hardened security

WebSphere Service Registry & Repository

✓ Publish & find Your Services

✓ Manage & govern your ESB messaging & services

✓ Ensure consistent policy enforcement