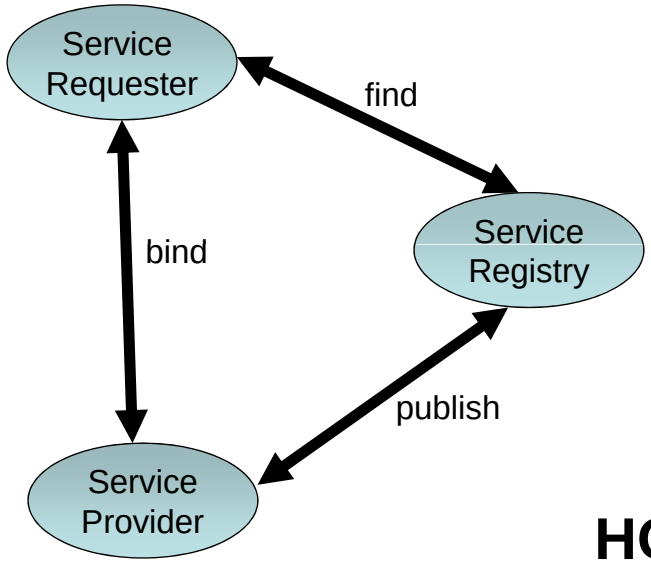
The Enterprise Service Bus: Making Service-Oriented Architecture Real

M.T. Schmidt et al.

Presented by: Mikael Fernandus Simalango

Introduction

- **SOA in Early Days**



-simple publish-find-bind triangle

-plain vanilla interaction:

-request-response between service requester and provider

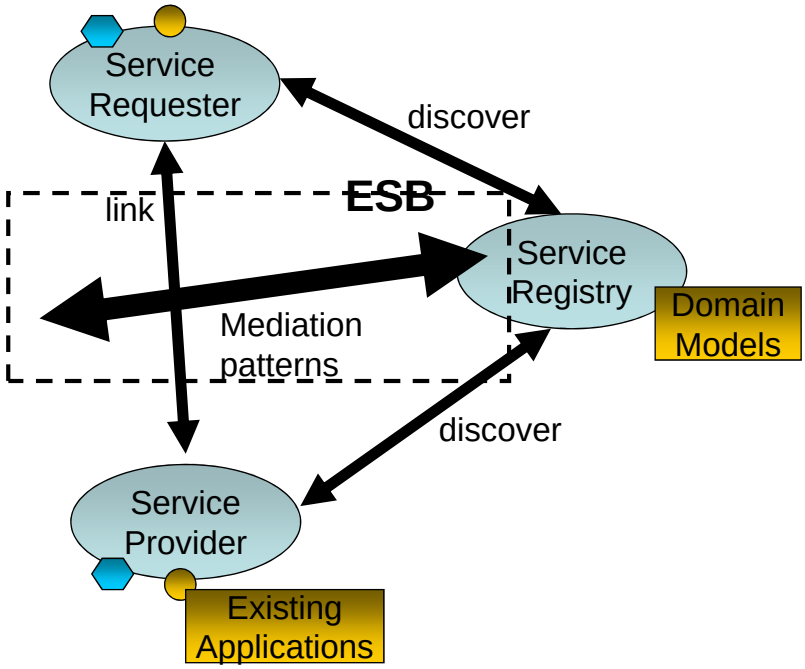
-how about other interaction patterns eg. asynchronous invocation, publish-subscribe, complex events?

-we need more capabilities and flexibility

HOW?

Introduction

- **Enabling Enterprise Service Bus**



ESB in A Nutshell

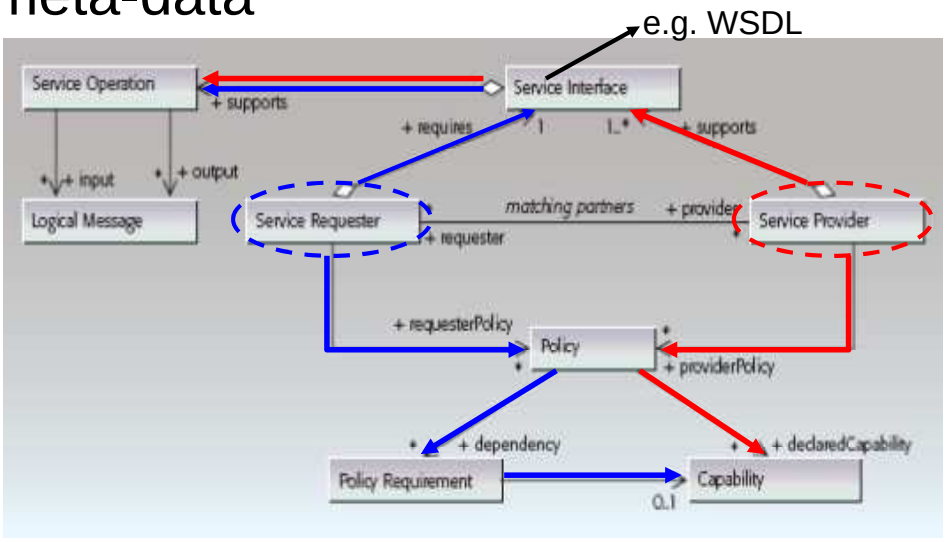
- **Formal definition:**
  - The infrastructure which strengthen a fully integrated and flexible end-to-end SOA by providing connectivity layer between services
  - Does not include business logic of service providers, requestors, or containers that host the services
- **Services Revisited**
  - A service : a software component that is described by meta-data, which can be understood by a program
  - Distinguishing feature of a service: meta-data descriptions are published to enable reuse of the service in loosely coupled system across networks
- Hence, ESB basically deals with the meta-data

ESB in A Nutshell (cont'd)

- ESB and meta-data
  - Meta-data contains description of service requestors and providers, what they require and capable of providing, respectively
  - The meta-data is independent of implementation specifics
  - This meta-data is stored in ESB registry to assist the process of mediating and matching requestors and providers (link matching)
  - All meta-data can be discovered, used, and modified at runtime

ESB in A Nutshell (cont'd)

- Service capability and requirements declaration for meta-data



ESB Functionalities

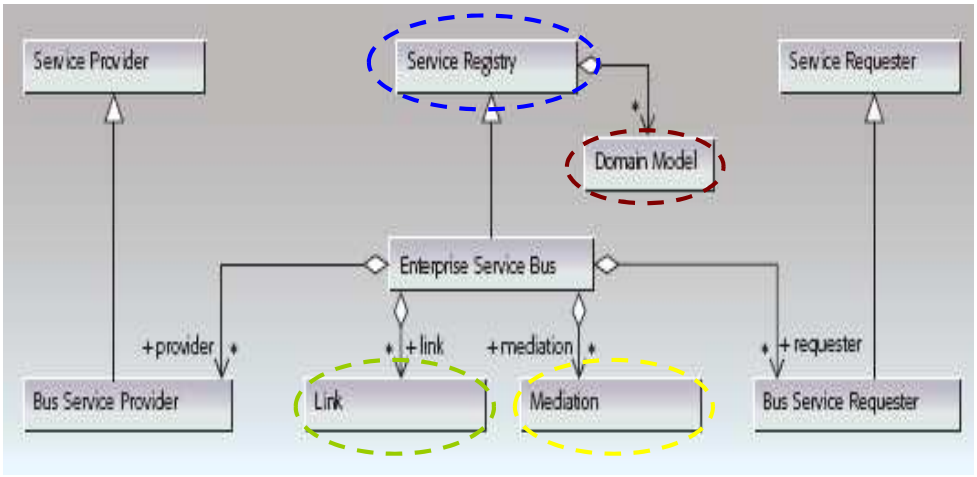
- Core ESB Components
  - Service Registry
  - Link
  - Mediation pattern

ESB Service Registry

- Service registry manages meta-data about service interaction endpoints and also information about domain model
- Domain model can be:
  - A standard message sets representing general knowledge about a topic space
  - Complex ontology describing concepts and their relation in a particular topic space

ESB Service Registry (cont'd)

- ESB service registry content



ESB Service Registry (cont'd)

- Endpoints need to register with the ESB
- Registered service requestors are represented as **bus service requestors** (BSRs) and registered service providers are represented as **bus service providers** (BSPs)
- Service providers that are not registered as BSPs are invisible to the ESB
- ESB also holds details of **links** and **mediations**

ESB Links and Mediations

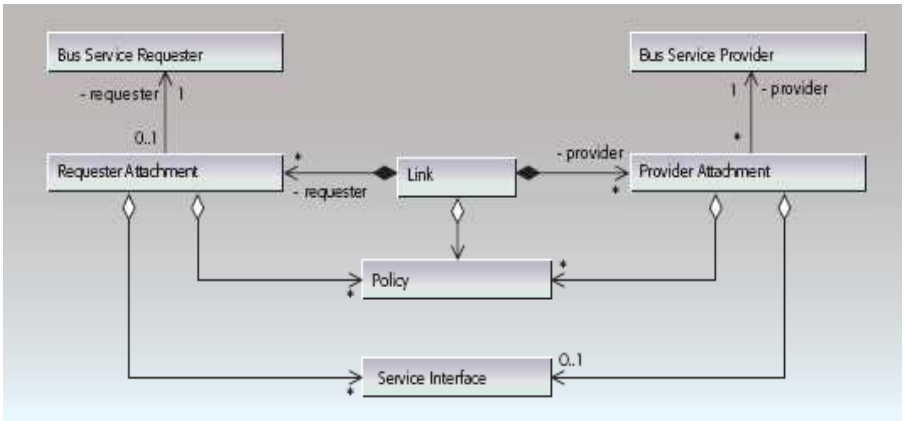
- ESB supports two concepts to facilitate interactions between endpoints:
  - **Links**
    - Between service requestors and providers (interaction endpoints)
    - Enable basic connectivity between interaction endpoints with a configurable QoS
  - **Mediations**
    - Between interaction endpoints
    - Connectivity by dynamic alterations to routing and QoS
    - Allow interaction endpoints to modify their behaviours
- Both realize the contract between interaction partner that is implicit in the declaration of the capabilities and requirements

ESB Links

- Has two endpoints
  - One for attachment to BSPs
  - The other for attachment to BSRs
- A link defines “ideal counterpart” for service requestors and providers
  - Can be configured manually
  - Can be created dynamically based on requirements and capabilities of the endpoints

ESB Links (cont'd)

- ESB links in a diagram

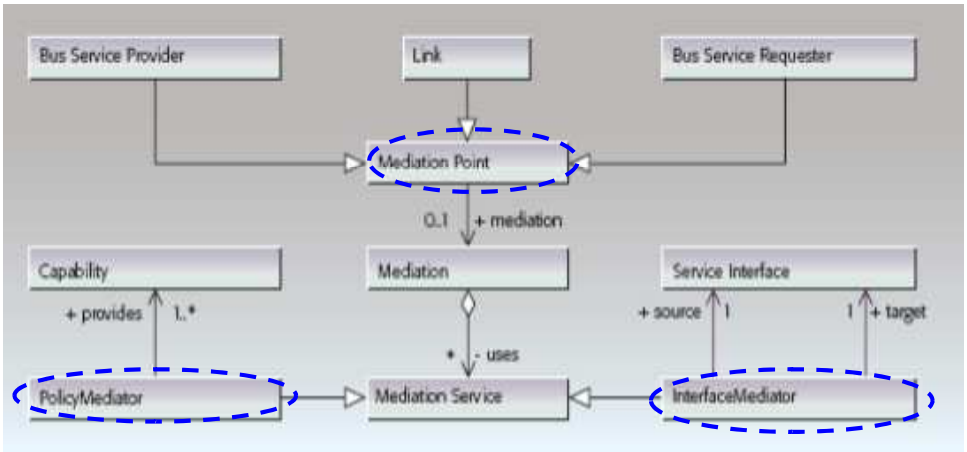


ESB Mediations

- Problem: existing applications were seldom designed to be linked together
  - Protocol mismatch
  - Format mismatch
  - QoS mismatch
- Addressing the problem: ESB mediation
  - Interposing mediations between service requestors and providers
  - It can reconfigure the links between requestors and providers
- Hence, the role is to satisfy integration and operational requirements within the infrastructure

ESB Mediations (cont'd)

- Mediation in ESB integration model



ESB Mediations (cont'd)

- Mediation point
  - At the requestor -> mediation will be performed regardless of provider for the requestor
  - At the provider -> mediation will be performed whenever provider receives a request, regardless of the requestor
- Interface mediation
  - Operate on the message payload, can change its content and structure
  - Message payload: information required by service provider
- Policy mediation
  - Operate on message context
  - Message context: available in message header, containing additional QoS and routing information about the link and mediations required between service requestor and provider

Mediation Patterns

- Basic patterns for mediation:
  - **Monitor pattern**
    - Used to observe messages as they pass through the ESB without updating them
  - **Transcoder pattern**
    - Changes the format of the message payload without changing its logical content
  - **Modifier pattern**
    - Updates the payload of the message without any change to the context information
  - **Validator pattern**
    - Determines whether a message should be delivered to its intended destination or not
  - **Cache pattern**
    - Returns a valid response to the requestor without necessarily passing the request to a service provider

Mediation Patterns

- Basic patterns for mediation (cont'd):
  - **Router pattern**
    - Changes the intended route of a message, selecting between the service providers associated with the mediation
  - **Discovery pattern**
    - Queries ESB registry to discover the set of service providers that match the requirements of the requestor, selects one of them, and routes the message to it
  - **Clone pattern**
    - Makes a copy of message and modifies its route
  - **Aggregator pattern**
    - Monitors messages from one or more sources over a time period and generates a new message or event , based on the input it considers

ESB Usage Patterns

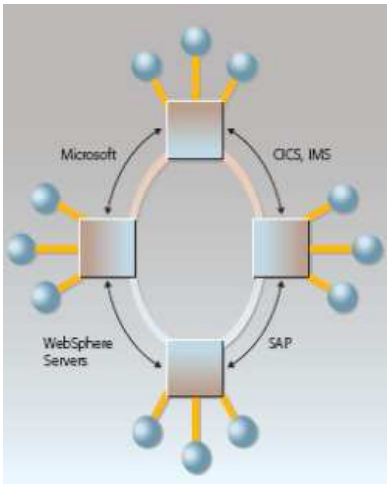
- Brings abstract patterns into real-world implementations
- Provide a means for describing and defining interactions and component topologies at the system or solution level
- Fundamental concept: broker application pattern
  - Distribution rules are separated from applications
  - Enabling flexibility in the distributions of requests and events
  - Reducing the growth of point-to-point connection
  - Simplifying management of network and system

ESB Usage Patterns (cont'd)

- Variations of broker application pattern:
  - Service and event-routing pattern
  - Protocol switch pattern
  - Proxy or gateway pattern
  - Event distribution pattern
  - Service transformation pattern
  - Matchmaking pattern

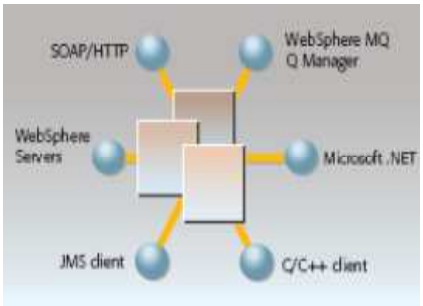
Service and Event-routing Pattern

- A request or event is distributed to at most one of multiple target providers
- Target selection can be made based on availability, workload, or detection of error situation after looking up appropriate service providers in the service registry



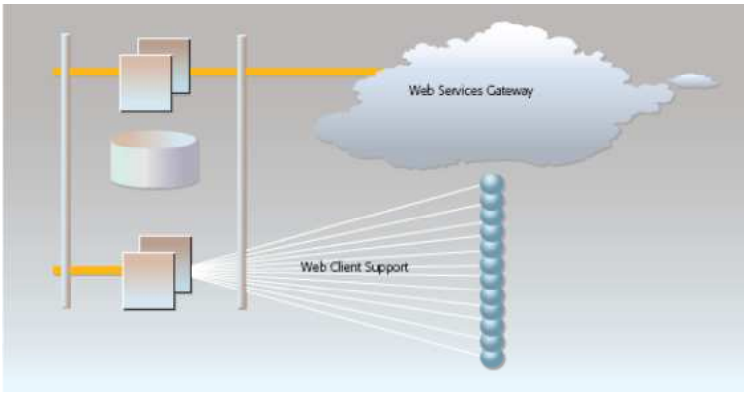
Protocol Switch Pattern

- A routing pattern
- Requestors and providers use different network protocols
- From the example:
  - SOAP/HTTP requests are mapped into SOAP/JMS infrastructure



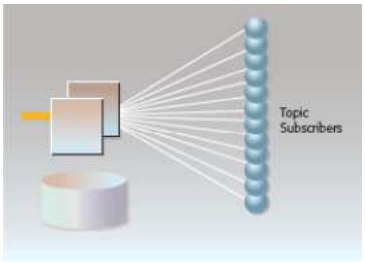
Proxy or Gateway Pattern

- Another routing pattern
- It maps service interface or end-points, usually to provide security functions or auditing capabilities
- A single point of contact is provided for multiple services and the details of inner services can be hidden from the service requestors



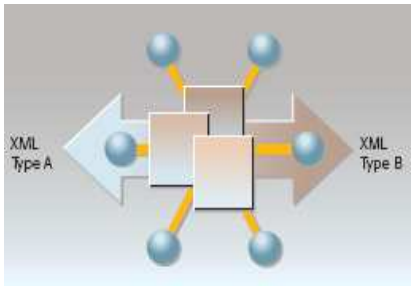
Event Distribution Pattern

- Events can be distributed to one or more target provider
- Service requestors may subscribe themselves to get notification about certain events of interest



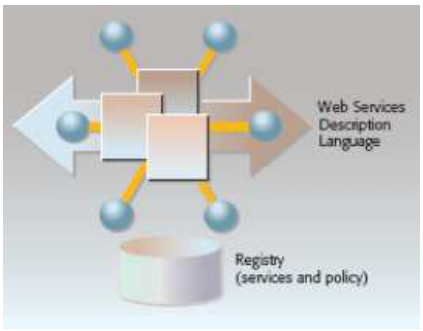
Service Transformation Pattern

- Requestors and providers use different service interfaces or providers of same business function provide different interfaces
- ESB provides necessary translation for the differing interfaces



Matchmaking Pattern

- Another routing pattern
- Suitable target services are discovered dynamically based on a set of policy definitions
- Used in dynamic environments with hundreds or thousands services attached to the ESB



Conclusion

- ESB leverages an integrated an flexible SOA
- Service meta-data managed through a service registry is the key component of ESB
- Clear definition of the interfaces, capabilities and requirements of the service will enable mediations to handle differences between service requestors and providers
- Several ESB usage patterns exist to articulate abstract ESB concept into enterprise implementation

THANK YOU