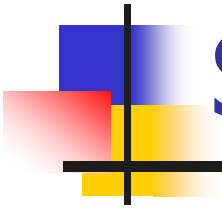
Best Practices for Developing Components for Shared Services



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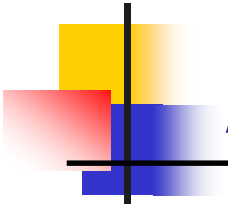
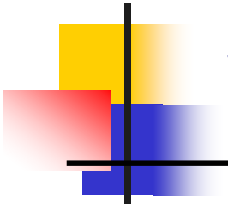


Agenda

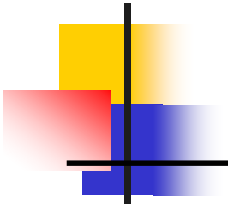
- Definitions
- Background
- Best practices
  - Service granularity
  - Service composition
  - Service presentation
  - Common Business vocabulary
  - Automation of process



What This Is…

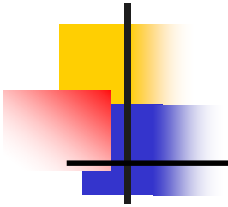
- A set of principles that allows efficient construction of services that may be deployed within a Service Oriented Enterprise

- Applicable to web services, services under a SOA and enterprise services that are standalone



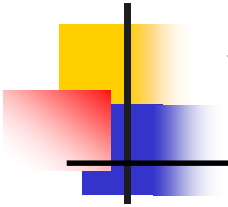
Some definitions

- Component
- Service
- Process



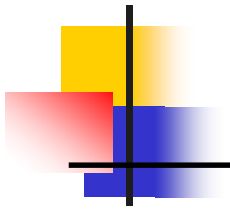
Component

- Reusable unit of code created in a silo'd environment
- Typically a POJO (plain old Java object) but well packaged and documented
- Deals with the basic business objects



What Is a Service?

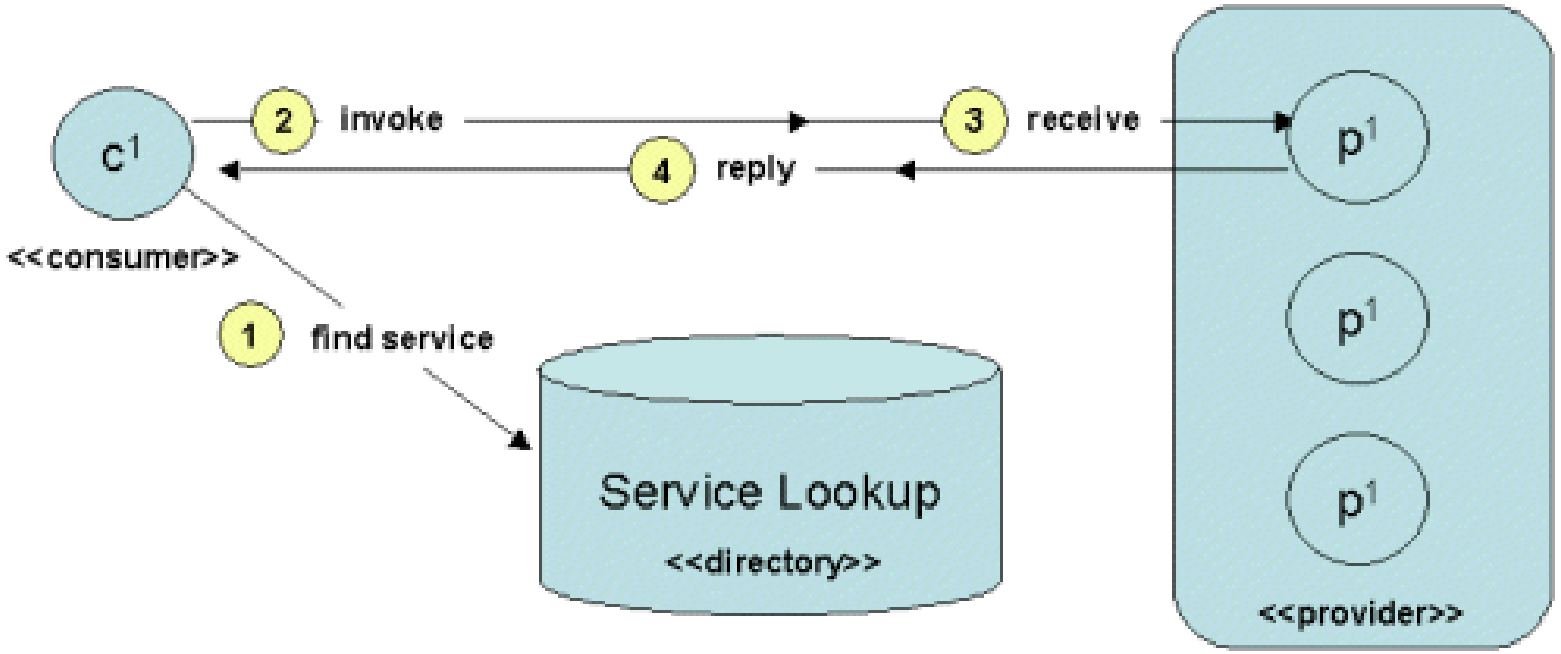
- A unit of software that is
  - Reusable
  - Confirms to a well defined interface
  - Is complete in itself

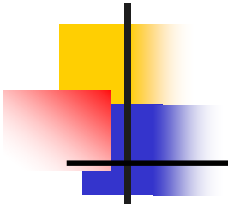


Classic View of a Service

- Provided by a '*provider*'
- Exposed *via* a '*directory*'
- Looked up and located by a '*consumer*'

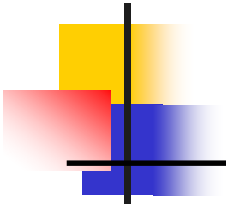
View of a Service





Service Categories

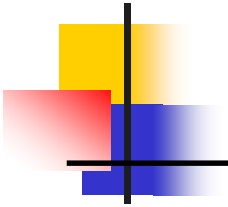
- Component services
  - Finer grained, atomic
  - Do not depend on others
  - Typically not directly accessed by external client
- Composite services
  - Built using component services



Process

- A **business process** is a collection of related structural activities that produce a specific outcome for a particular customer

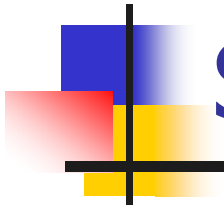
- A business process can be part of a larger, encompassing process and can include other business processes that have to be included in its method



Hierarchy

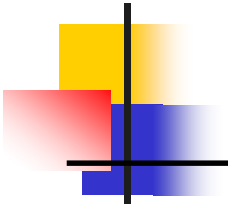
- Components aggregate and wrap classes
- Services do the same for components
- Processes *compose* workflows using services

How do all these relate to SOA?



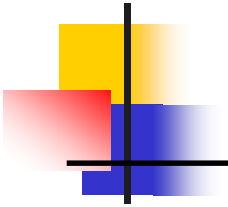
Service Oriented Architecture

Implications for service design



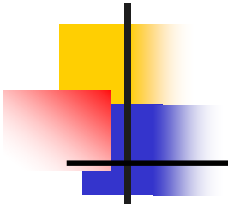
Service Oriented Architecture

- SOA is a pattern that allows construction of applications by composing them using loosely coupled independent services
- It is a flexible and resilient pattern that accommodates change by allowing a system to be reconfigurable at the assembly level, rather than by using code



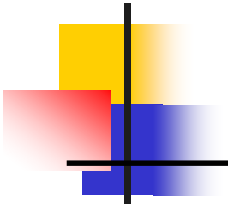
SOA – Goals

- Move components out from silos within an enterprise to be more generically accessible
- Moves focus from integration efforts to process workflow definition
- Loosely couple the services deployed so that change is easier to accommodate
- Do this in a standards based environment



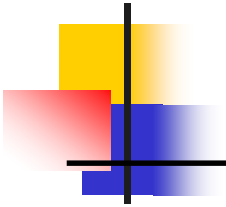
Phased Approach to Adoption

- Big bang is rarely (if ever) an option
- Pick a small application that has a good chance of success
- Reuse legacy assets rather than doing it from scratch
  - Use service adapters, façades to wrap them



Design Time Issues to Consider

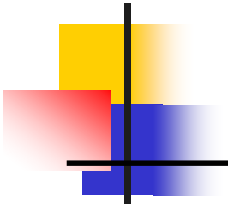
- Do not overlook issues such as:
  - Billing
  - Security
  - Logging
  - Auditing
  - SLA management



Billing Issues

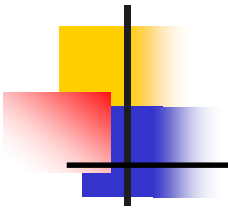
- Most services are for profit

- How do you track who owes how much ?
  - Keep track of service call chain
  - Persist this to a repository
  - Ideally this is done in an async fashion
    - Push it to a billing queue in a fire and forget fashion



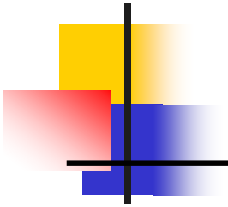
Security

- A presentation by itself, basically security can be done at the:
- Transport layer
  - HTTP header
- SOAP layer
  - SOAP header element
- Payload (in-band)
  - Attribute in the message body



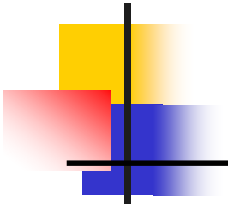
Service Level Agreements

- Sooner or later someone is going to dispute a bill or payment
- Proof is needed
  - Make sure there is enough data persisted so that audits can verify it
- Runtime correction – dynamic load balancing of services



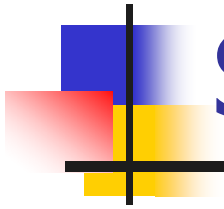
SOA Best Practices

- Use *service Façade* pattern
- Use a common data model
- Use a multi-grained interface to maximize reuse
  - Create focused interfaces

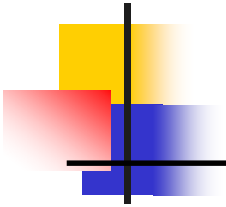


Payload Format

- By and large, the web services seen so far have been an ad-hoc mix of SOAP encoding and document literal
- Tooling is driving the standards toward doc-literal payloads
- Doc literal format has the advantage of inherent scalability
  - Marshalling/unmarshalling step is skipped until needed

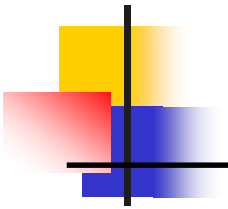


Service Design



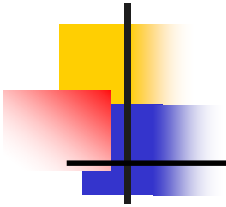
What Makes a Service Reusable?

- Easy to use (well defined interface)
  - Few operations
  - Meaningful parameter (Doc literal)
- Easy to maintain and version
  - Documentation (tools)
  - Consistent schema definitions
- Correct level of granularity



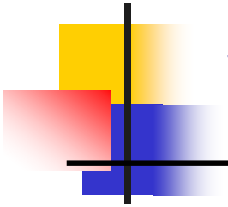
What Makes a Service Reusable?
(Continued)

- Design to an interface
  - Build a model
  - Generate schemas
  - Derive and compose request/response types based on the model



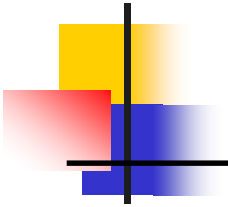
Well Defined Interface

- Typically a single service addresses a specific business need
- If you see the operations within a service grow – question yourself whether they are really necessary there
- Keep them stateless (easier to compose)



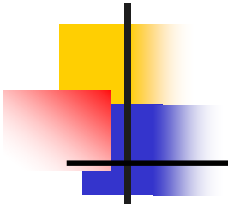
Well Defined Interface *(Continued)*

- Make the service accept multiple input formats and increase its reuse
  - Does not mean the interface is different, simply means the service can be deployed within different contexts (object 2 object in a JVM and XML-XML across JVMs)



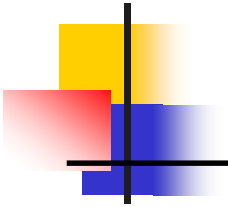
What NOT to Expose as a Service?

- Infrastructure APIs
  - Rather than build a transcoding layer – use the far more efficient transforms that an ESB provides
  - Rather than roll your own SAML token service, wrap an existing API



Interface Design

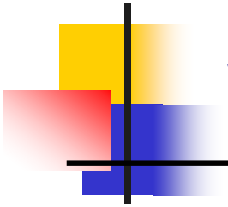
- Interface design should be driven by business needs
- If a business need is not met the service has little if any reuse potential
- For example: In the travel industry, writing a web service to return a cryptic dataset from a mainframe GDS (Global Distribution System) has no relevance to a web site based travel aggregator



Interface Design *(Continued)*

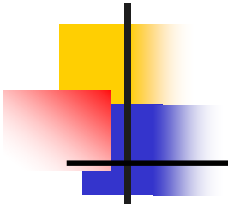
- Instead a 'HotelShopper' service with an interface that takes the destination, duration of stay and price range and returns a list of properties with pictures attached is VERY useful.

- http://www.orbitz.com
- http://www.octopustravel.com



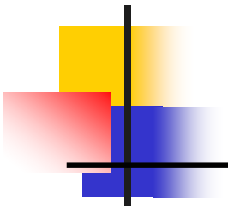
What Does an Interface Mean?

- In the world of SOA an interface is usually rendered (I use this term deliberately) as a network accessible WSDL document
- The WSDL (Web Services Description Language) document describes the interface and its allowed operations – down to the data type of the input(s) and output(s)



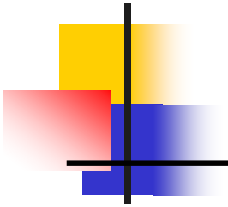
Granularity

- The level of detail that an interface presents determines the reuse
  - An interface that is very fine grained is more usable within the enterprise at the app level
  - An interface that is coarse grained has more business tier applicability for clients
- There are always exceptions – go multi grained in that case



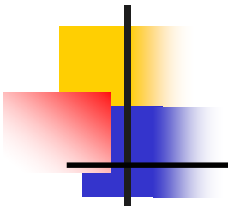
Favor Composition over Inheritance

- Use inheritance ONLY where necessary
- Design services so that they are easily used in process flow engines (BPEL)



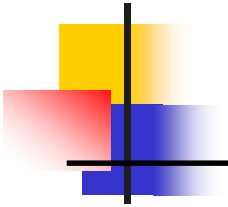
Using Our Travel Domain Case

- Usually a travel website deals with a GDS on the level of availabilities, bookings and cancellations
- Interfaces are coarse grained and resemble the one shown:
- <PlanTrip name="joe" startDt="20040812"
  endDt="20040815" DEP="LAX" DEST="DEN"/>
  [abbreviated for clarity ☺]



Using Our Travel Domain Case
(Continued)

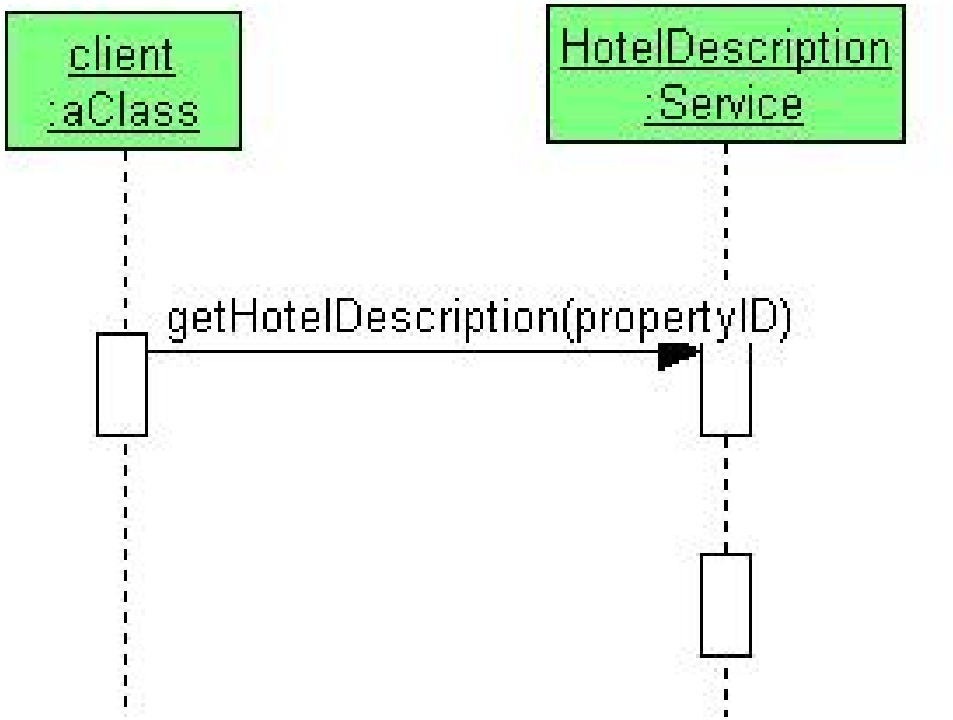
- The example on the prior slide is actually a façade that uses a number of finer grained services
- The output from each of these services is sliced and diced to return the end result that the client of the 'trip planner' service expects

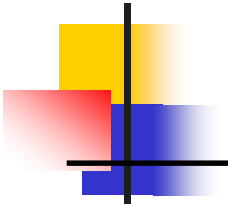


Sometimes …

- However, on occasion – when a client requests that an additional person be added to his tour then a search by the PNR (Passenger Name Record) needs to be done to retrieve the trip
- This is a very host specific call that represents a fine grained case

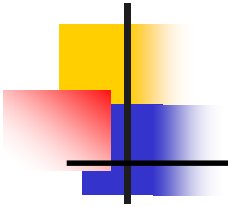
Fine Grained Call



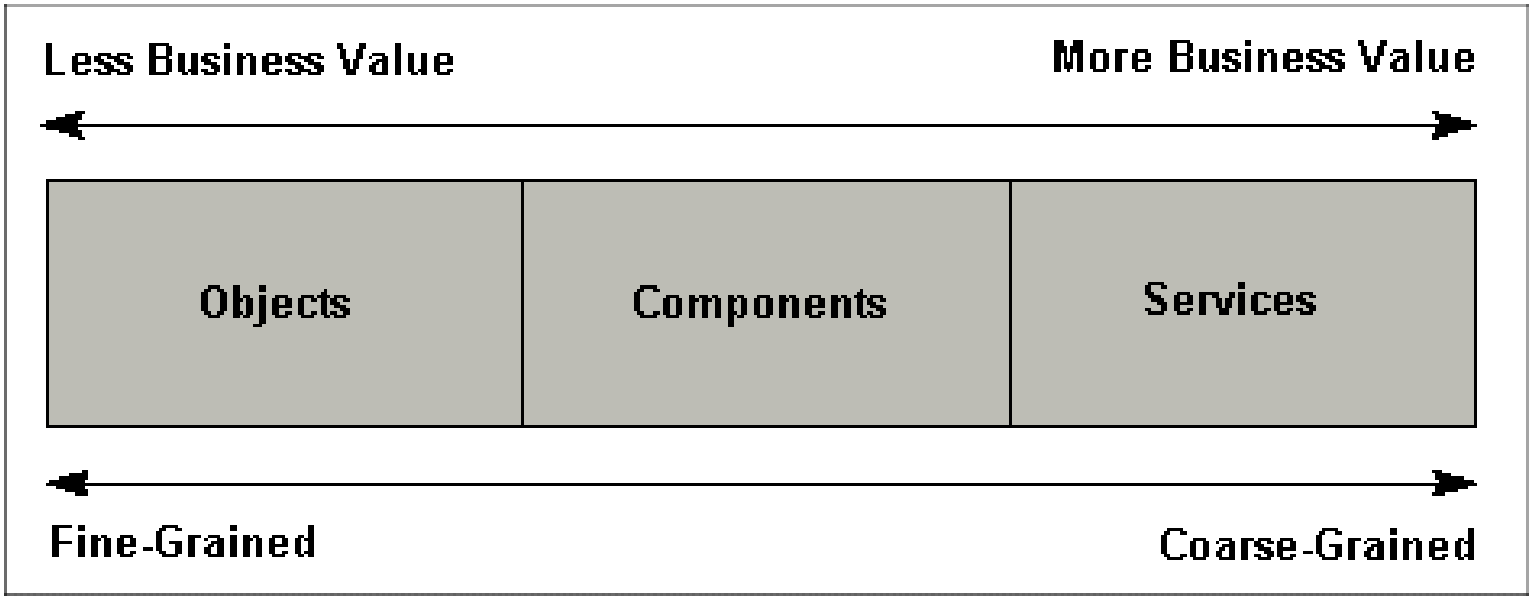


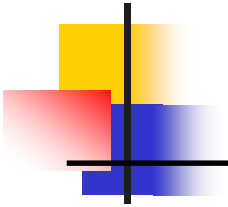
Multi-grained Approach ?

- In order to maximize reuse potential, use the multi-grained approach.
  - Expose both fine grained as well as coarse grained interfaces
  - If you cannot – err on the side of excess, rather than increase the number of network hops



In General Though ...

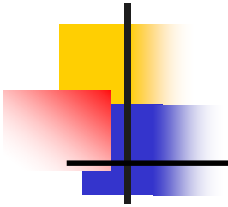




Effect on Performance

- In the case of very coarse grained interfaces overall network time is reduced (chunks of data returned in a single call)
- However, often a large server side collation of data may prove to be expensive as well
- (leave XML processing to the client?)

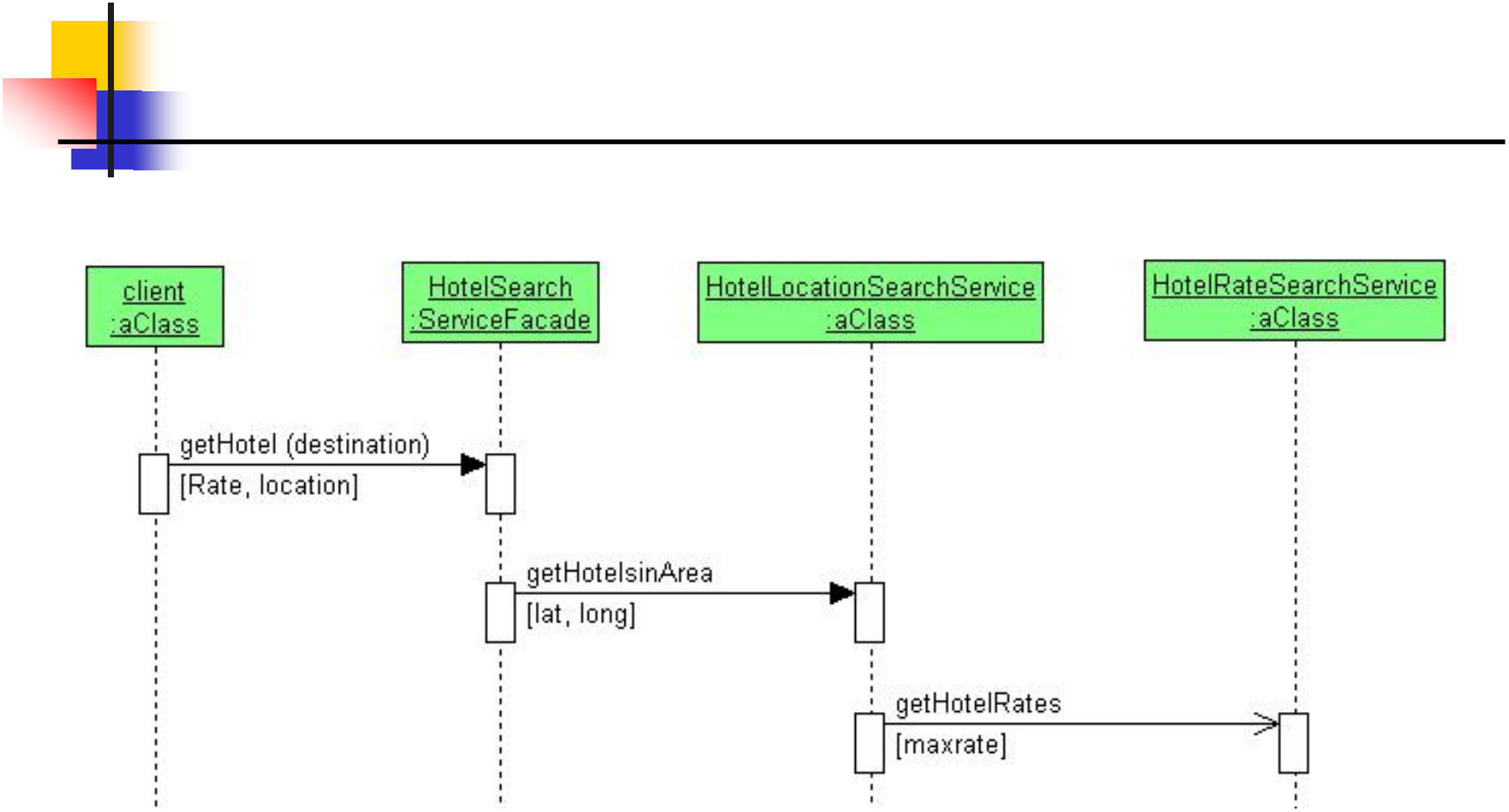
- The answer: choose wisely depending on the circumstance (intranet roundtrip *vs.* web times)

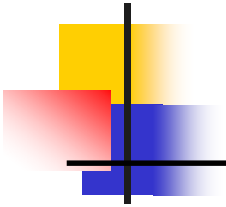


Service Façade Pattern

- Coarse grained access to finer grained atomic services
- Less network time
- Handles the process flow

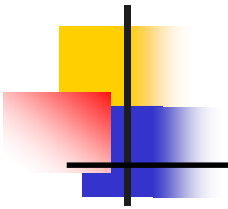
- This can be accomplished in 2 ways





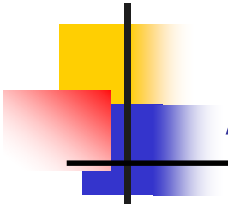
Service Façade Implementations

- In Java code
  - Basically build your own process flow
  - Unless you create a generic rules-engine, it's a task per application
- Use a standards based Business Process engine to choreograph the flow



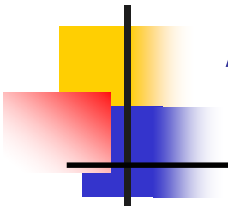
Service Façade Implementations
(Continued)

- Take the example of a data access service(DAS)
  - Obviously SQL *via* SOAP is NOT the answer
  - Neither is allowing access to CRUD
- What then is the level of access ?
  - Façade the lower level CRUD with process based services (clients don't do DB access)



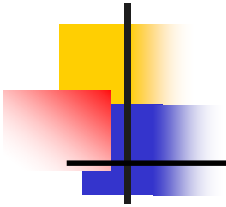
Allow for Long Running Processes

- Design services such that a result is not black or white
- Accommodate partial results
- ACID principles do not always apply in the case of web services
- WS- transaction has options
  - Relaxing one or more stringencies
  - Take this into account when designing messages



Allow for Long Running Processes *(Continued)*

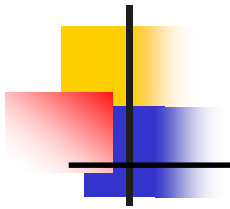
```
<results>
    <serviceResults>
        <serviceResult/>
        <error/>
        <serviceResult/>
        <error/>

        ……..
        ……..
    </serviceResults>
    <error/>

</results>
```



Handlers

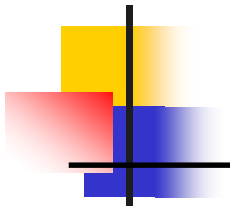
- Split your information between the application payload and the out-of-band data

- Example:
  - Information such as credentials, TP context need not become intermingled with the business data



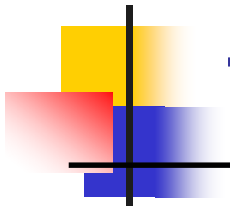
Handlers *(Continued)*

```
<soap:env>
    <soap:header xmlns:ns1="mynamespace">
        <ns1:tp_info context="45ff"/>
        <ns1:myCreds uid="kdjkdj" pwd="#$#$"/>
        </soap:header>

        <soap:body>
        ....
        ...
        </soap:body>
    </soap:env>
```



Is There a Magic Mantra ?

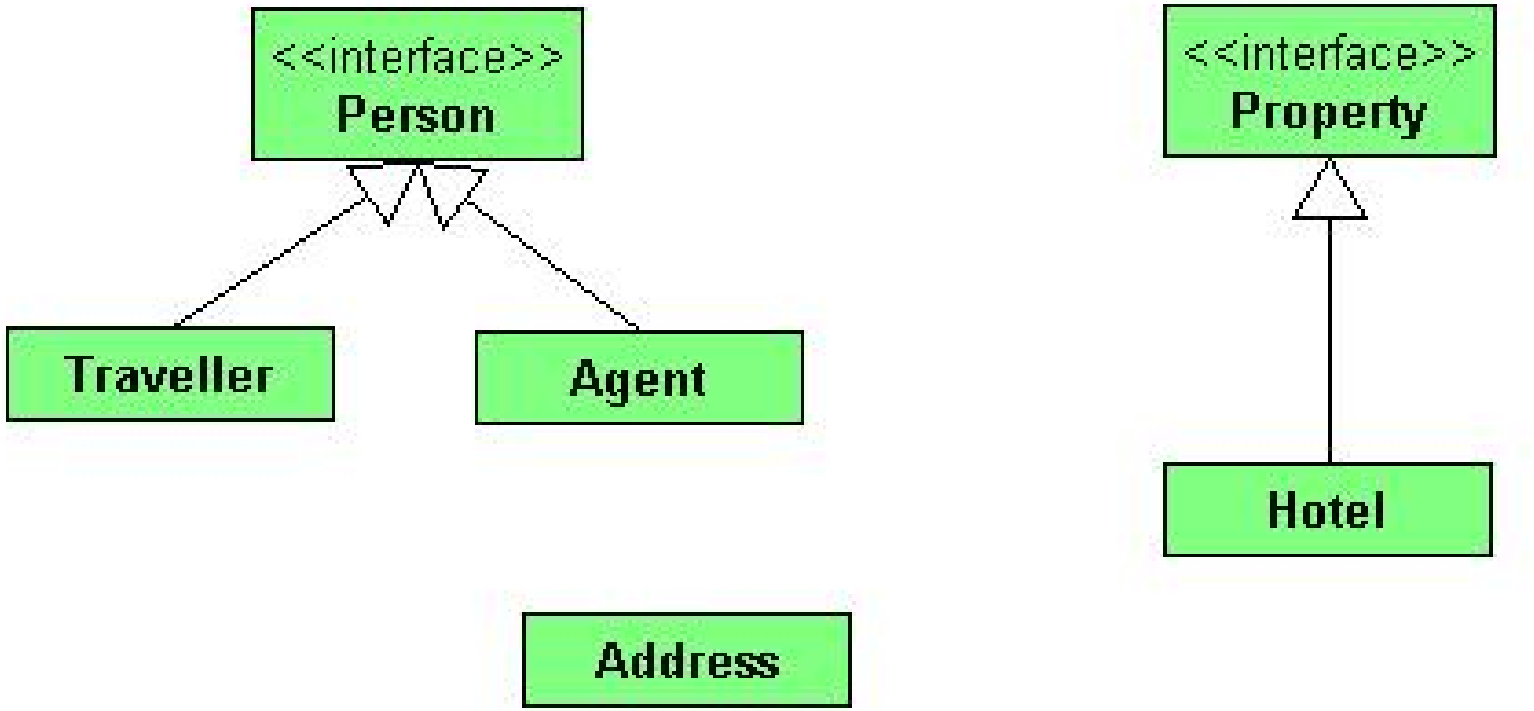
- Design your domain model
- Derive your business objects from the business model artifacts
- Compose granular components and services using these fine-grained business objects
- Compose coarser grained services using a mix of these components and services

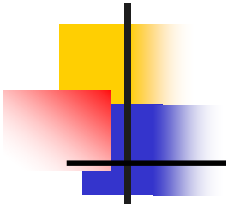


The Model Driven Approach

- Design your domain model using a language neutral format such as UML
- Use tools that allow easy movement between logical model and physical artifact

[generate XML schemas from the UML diagrams]

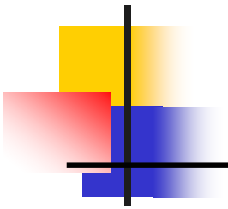




Model to Implementation

- Using tools such as PowerDesigner, we can generate the business model as a set of XML schemas

- Following best practices for using namespaces in these schema documents, we get a set of schemas that represent the business domain model

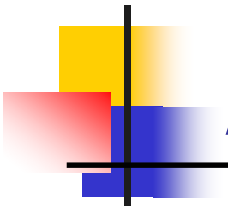


Sample Schema

```
<schema>
<import namespace="personNs"
  schemaLocation="./person.xsd"/>
   <complexType name="traveller">
      <complexContent>
      <extension base="person"/>
      </complexContent>
   </complexType>
</schema>
```

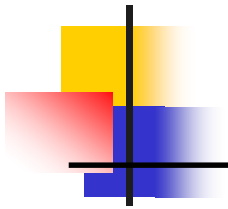
Compose a Higher Level Schema

```
<schema>
<import namespace="ns1"
  schemaLocation="traveller"/>
<import namespace="ns2"
  schemaLocation="address"/>
<complexType name="profile">
   <element ref="ns1:traveller"/>
   <element ref="ns2:address"/>
   </complexType>
```



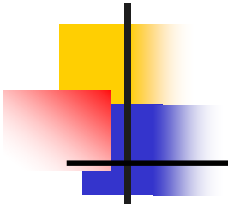
And Use That in Your Request

```
<schema>
    <import namespace="n1"
      schemaLocation="profile.xsd"/>
    <import namespace="n2"
      schemaLocation="preferences.xsd"/>

  <complexType name="AirlineRequest">
    <element ref="n1:profile"/>
    <element ref="n2:preferences"/>
  </complexType>
```



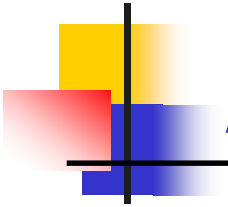
Putting It All Together

```
<definitions>
  <types>
    <element name="req" type="AirlineRequest"/>
    <element name="resp"
    type="AirlineResponse"/>
  </types>
  ....
  <message name="xmlIn" part="req"
  </message>
```



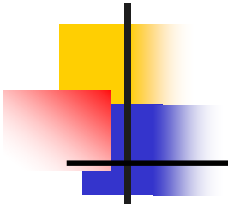
Namespaces for Schemas

- Remember to qualify namespaces
- As we move to more and more services there needs to be a way to uniquely identify the language
  - *i.e.* – make sure namespaces distinguish intent
- RDF may be one way



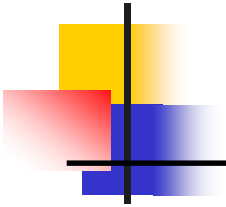
Advantages

- When a business object changes, the client automatically picks up the change by a refresh of the WSDL
- The server side objects and client code are kept in sync with minimal effort
- As long as the interfaces are invariant, there is no ripple effect



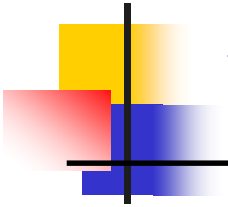
Importance of WSDL Doc

- Almost every tool on the market uses them
- Make sure the WSDL accurately reflects the message content
  - Tools such as .NET VStudio won't be able to use it otherwise (interoperability is a concern)
  - Namespaces are a concern as well (standards differ between how .NET and AXIS handle them)



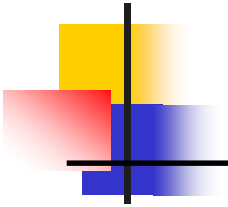
Loosely Coupled Interfaces

- Only two things need be known for a client to use a service:
  - Endpoint URL (available from the WSDL)
  - Input and output message types (-ditto-)



While on the Server Side …

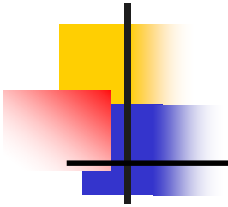
- The service APIs and the business schemas are processed using an XML binding tool such as CASTOR or JAXB
- A common business domain model jar is then created and used throughout the domain
- All these changes are done at compile time



Business Process Integration

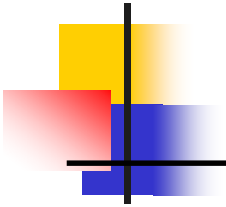
- Done using tools that allow workflow design
- Visually compose the flow and inspect the generated WSDL

- A process is itself a 'Service' – hence the meta-service paradigm still holds
- Standards compliant BP Managers are the way to go



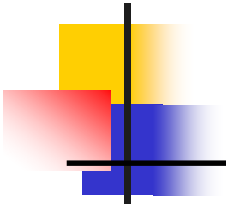
Business Process Managers

- Run on app servers (Tomcat)
- Typically expose the process as yet another web service that can be invoked by a client
- Have tools that integrate with IDEs such as WSAD and eclipse (generate XML)



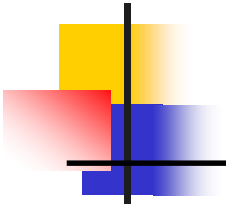
Design Your Process

```
<definitions name="EmpService" ...
   xmlns:plnk="http://schemas.xmlsoap.org/ws/2003/05/partner-link/"
   xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/">
...
<portType name="EmpInterface">
     <operation name="getEmpSalary">
          <input message="tns:EmpInterface_getEmpSalary"/>
          <output message="tns:EmpInterface_getEmpSalaryResponse"/>
      </operation>
          </portType>
          ...
     <plnk:partnerLinkType name="EmpServiceLink">
               <plnk:role name="EmpServiceProvider">
               <plnk:portType name="tns:EmpInterface"/>
              </plnk:role>
     </plnk:partnerLinkType>
     </definitions>
```



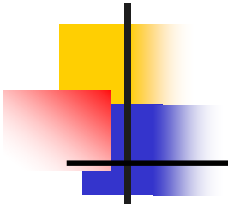
Instrument Your Services

- SOA framework should have this at all touchpoints
- This provides out of the box monitoring information
- In addition provide hooks for service writers to implement custom monitoring



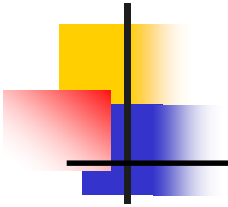
Example

- Client calls a service
  - The SOA framework logs transit times between a WS Gateway and Broker
  - When a service makes a network hop to another remote node, the transit time there is logged by that instance of the broker
  - How is transit time spent in a legacy or 3rd party service available?
    - Case for use of the custom hooks



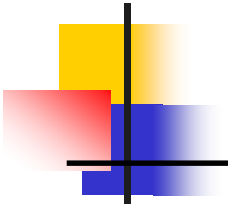
Location and Interface Neutral Code

- Get URLs from JNDI, nothing is hardcoded
- Interface ubiquity – all the services on all nodes are accessed using identical interfaces
  - The payload determines the processing
- Relocate responsibilities for infrastructure tasks (security, logging, monitoring) to the framework



Don’t Reinvent the Wheel

- Use off the shelf component (within budgetary constraints)
- Rewriting transport adapters and XSLT transforms for every new project is a waste



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