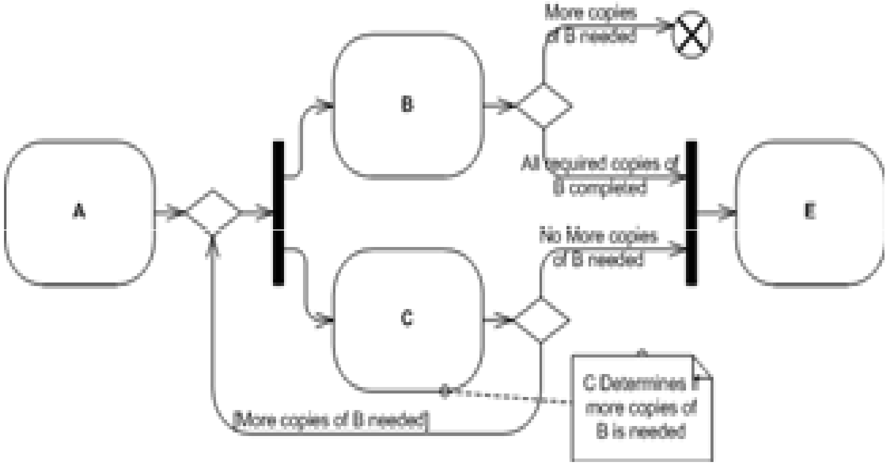
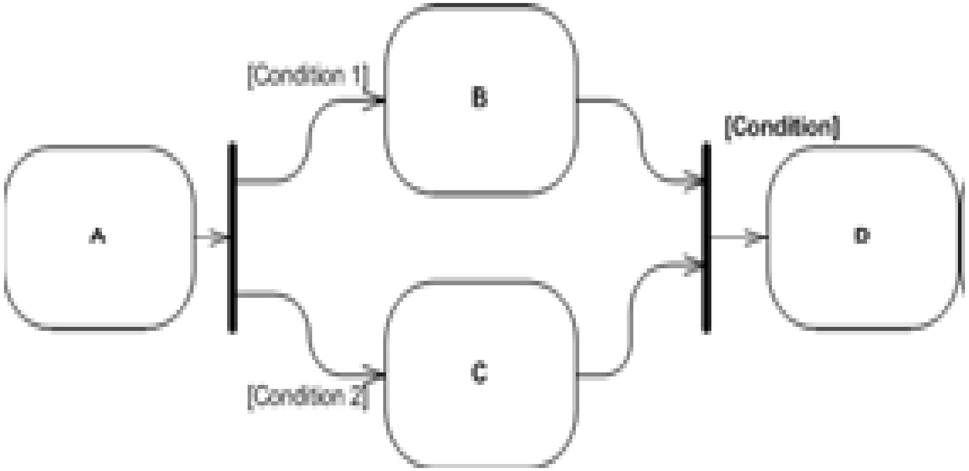
Business Process Modelling
Service Modelling

Business Process Modelling

- UML Activity Diagram primer
- Consists of
  - Actions
  - Control flow
  - Split and Join
  - Decisions
  - Swimlanes


More copies of B needed
B
A
All required copies of B completed
E
No More copies of B needed
C
C Determines if more copies of B is needed
[More copies of B needed]



Business Process Modelling

- Customization of Activity Diagrams
  - Use of UML profiling for making diagrams specific for business process modeling
  - Possible to create own activity types by using stereotypes

IT support for business processes

- Business process models can be implemented as executable workflows
- A Workflow is
  - also a model of the business process, but contains much more details about technical issues
  - a program written in a declarative language, most often XML based
  - executable by a runtime engine, which can interprete the workflow language

IT support for business processes

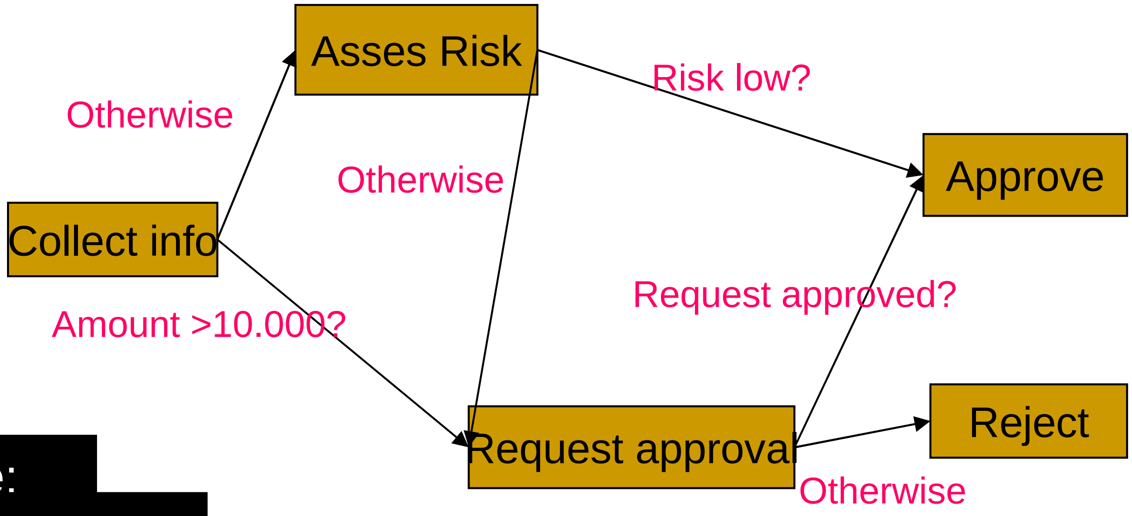
- Building blocks in a workflow

Activities

Control flow

Conditions

Data



Asses Risk

Otherwise

Risk low?

Otherwise

Approve

Collect info

Request approved?

Amount >10.000?

Request approval

Reject

Otherwise

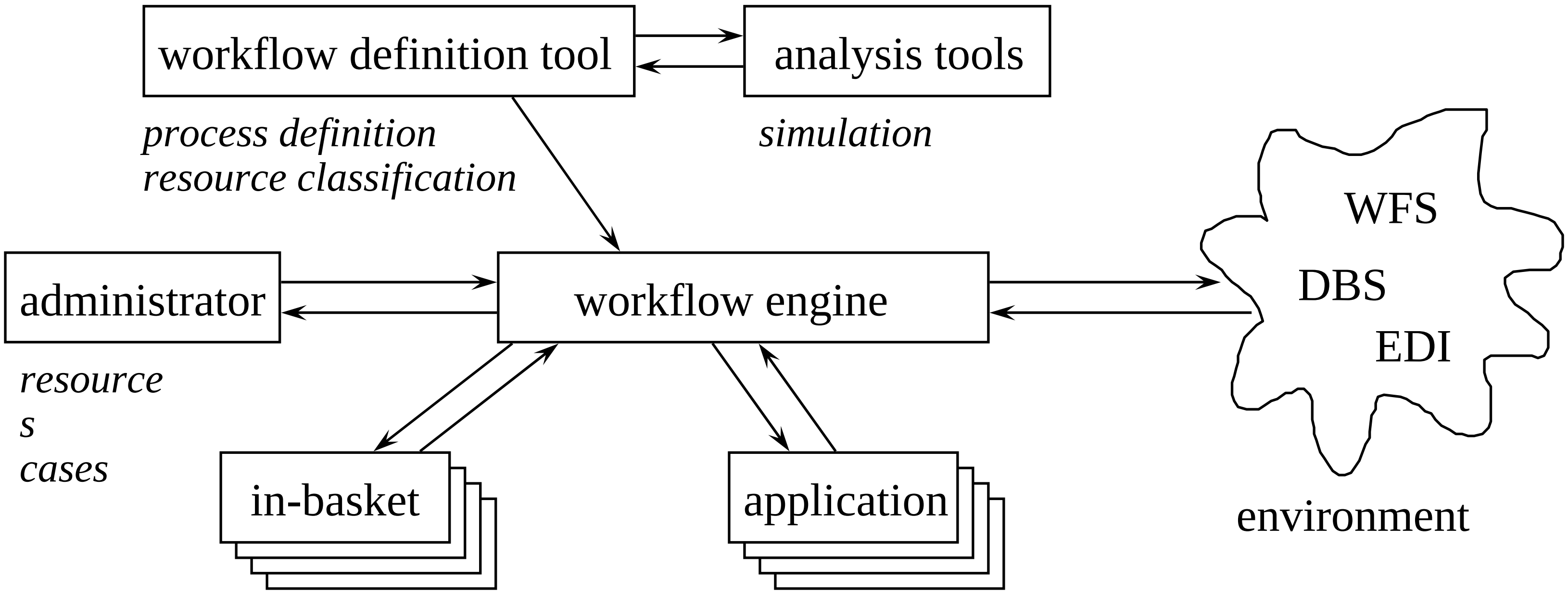
Age:
Amount:
Yearly income:
231.450

IT support for business processes

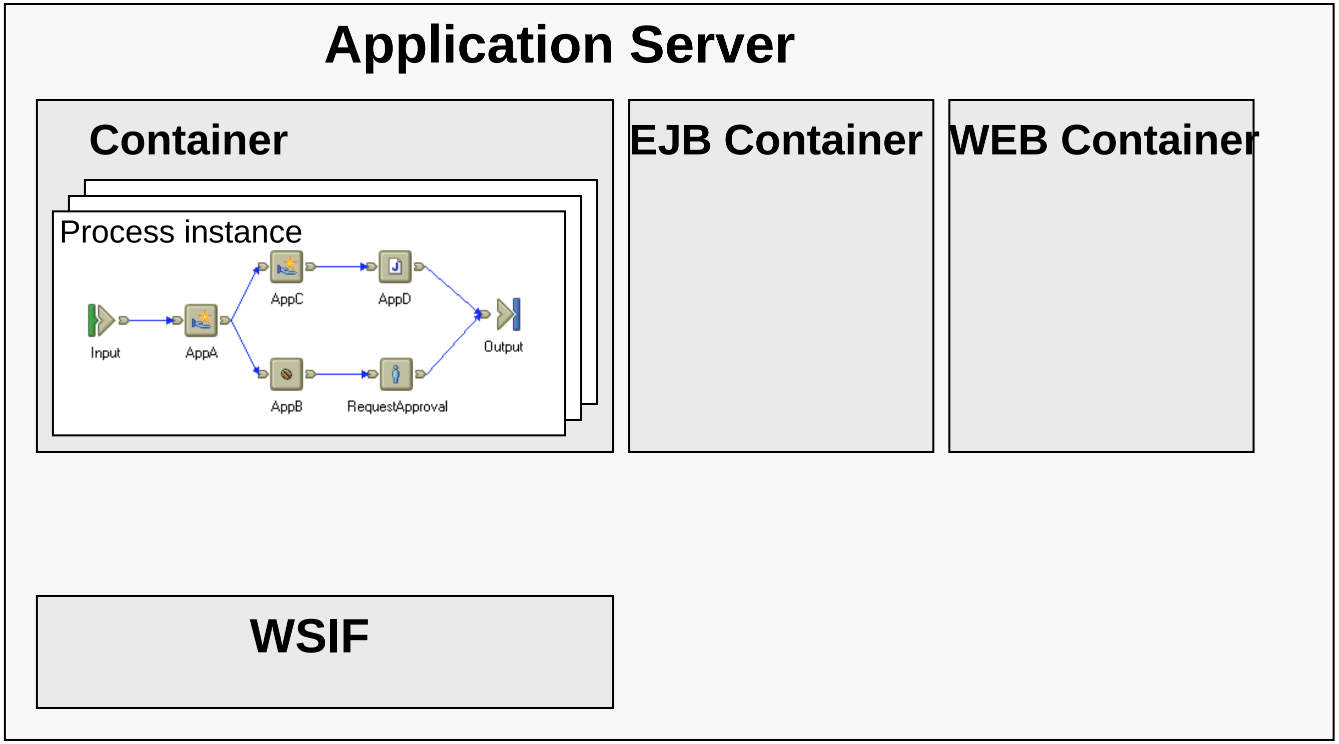
- Workflow Management System
  - IT infrastructure to build, execute, monitor and optimise workflows
- Consists of
  - Language,
    - Some kind of web service composition language, eg. BPEL, BPML.
    - Often based on graphs
  - Build time IDE to build the workflows. Gives a graphical user interface to the language
  - Runtime engine to handle instances of the workflows
  - Monitor to get overview of running and finished processes

IT support for business processes

- Architecture of a Workflow management System



IT support for business processes



Application Server

Container

Process instance

EJB Container

WEB Container

WSIF

IT support for business processes

- Advantages of Workflow Management
  - Higher productivity
  - Moves knowledge from people to documented process
  - Rapid adaptation to the market
  - Location of bottlenecks and runtime changes of process
  - Statistics about processes
  - Continued optimization
  - Reuse of services and processes
  - All processes are implemented in same framework

IT support for business processes

- Requirements for implementing WFM system
  - Well established IT infrastructure
  - SOA: Applications called as services
  - Resources to model the business, to implement them and to support and monitor the running instances.
  - The organization must be ready for change. People get new ways of working.
  - Skilled people!

IT support for business processes

- Challenges
  - Difficult to map from business process model to workflow
  - Services to be called are not documented or required data is missing in the process
  - Workflows can be very complex and they can be difficult to comprehend
  - Limitations in the WFM system compared to requirements
  - Many technologies and platforms are involved. It requires a lot of the process developer.
  - ….

Development Process

Business analyst

Defines the As Is, ToBe and the makro flow

IT Architect

- Ensures the makro flow conforms to the IT infrastructure
- Enriches the makro flow with information about the IT infrastructure
- Defines service interfaces

Process developer

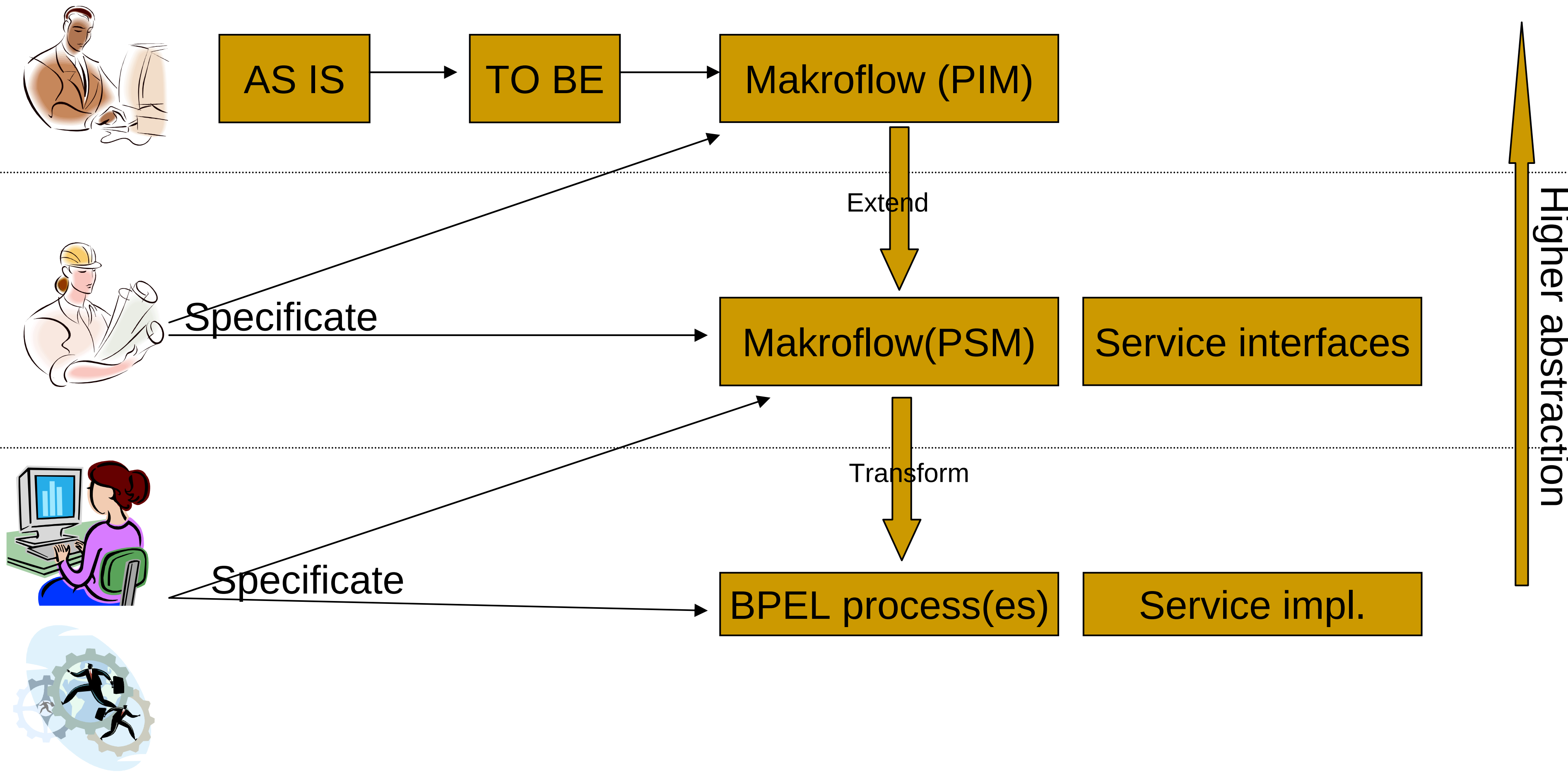
Takes the makro flow and transforms it into “code”, eg. BPEL

Service developer

Develops implementations to the specified

service interfaces

Development Process



AS IS

TO BE

Makroflow (PIM)

Extend

Specificate

Makroflow(PSM)

Service interfaces

Transform

Specificate

BPEL process(es)

Service impl.

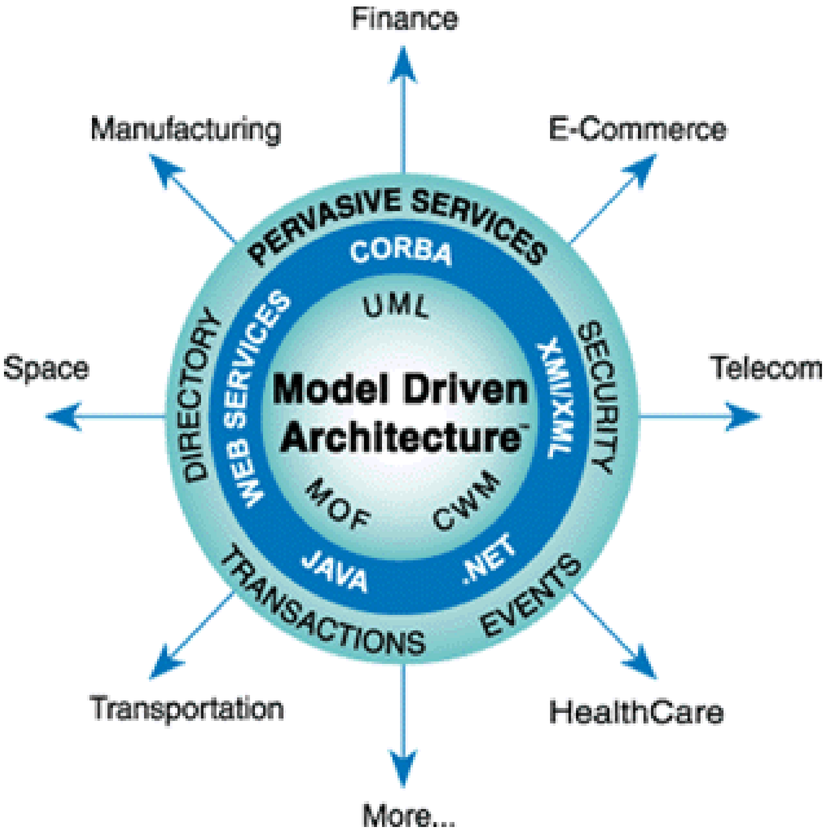
Higher abstraction

Development Process

- Challenges
  - Models at different abstraction levels are not synchronized. Changes have to be made manually in all models.
  - The gap between makro flow and code is large. Many changes has to be made in the code.
  - When a change is made in the business model, the same changes has to be made in all levels below.
    - High risk of conflicts between models
    - High risk of making coding errors
  - Difficult to coordinate work between the people with very different mindset

Development Process

- The Model Driven Engineering paradigm
  - The programming level is raised from code to models
  - The code is generated from the models
  - The process developer should work on the makro flow and the code, eg. BPEL should be generated from the makro flow
  - Working on higher abstraction level speeds up development time, decreases the amount of errors and decreases the reaction time to changes in the marked
  - Is still in a very early stage.

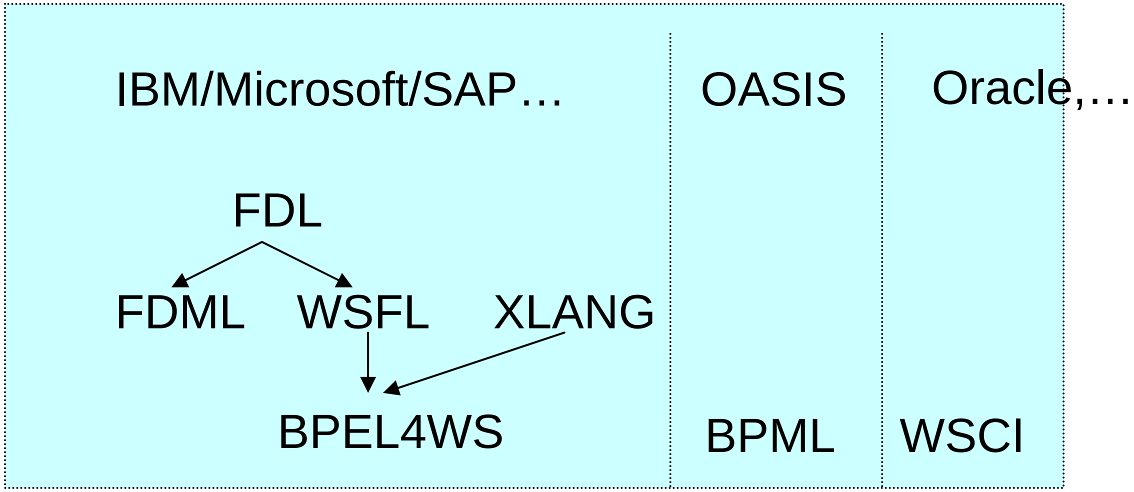


Workflow Patterns

- 21 patterns described by Vil van der Aalst
  - Basic Patterns
  - Advanced Branch and Join patterns
  - Structural patterns
  - Multiple Instances patterns
  - State based patterns
  - Cancellation patterns
- Used to evaluate Business Process languages
- Additional Patterns
  - Communication patterns
  - Human interaction patterns
  - Enterprise specific patterns

Web Services composition

- Composition/Orchestration of web services into executable business processes/workflows.
- A Workflow Management System handles the definition and execution
- Languages based on XML schemas
- Builds on top of Web Services (WSDL)
- Many different languages
  - BPEL4WS
  - BPML
  - WS-CDL
  - WSCI
  - WSFL
  - XLANG
  - FDML
  - FDL
  - BPSS
  - XPDL



IBM/Microsoft/SAP…

OASIS

Oracle,…

FDL

FDML

WSFL

XLANG

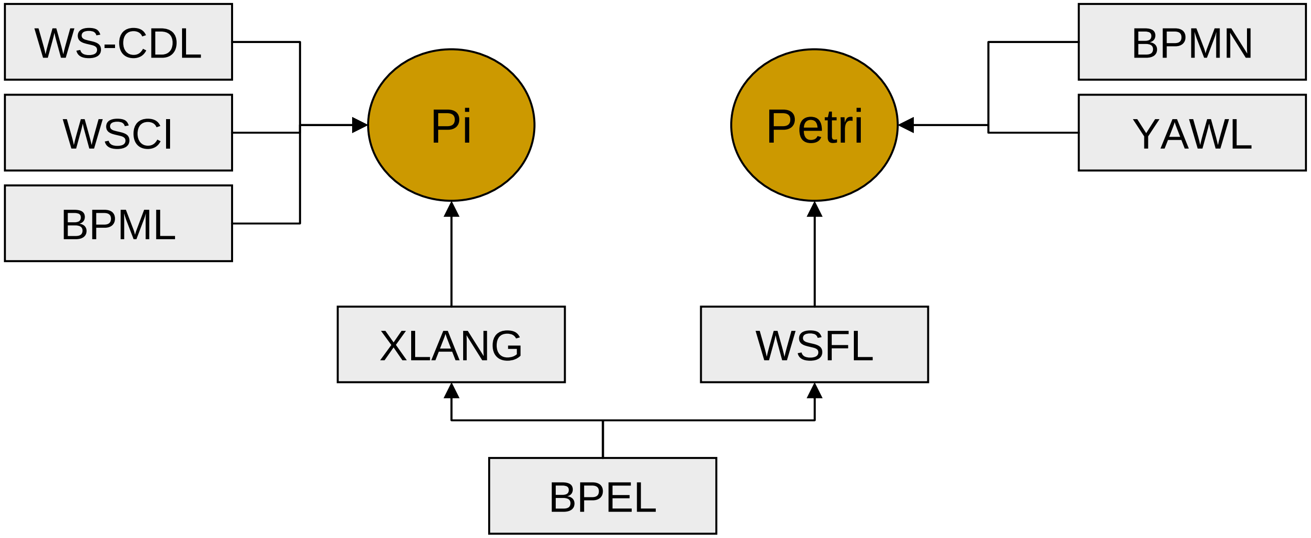
BPEL4WS

BPML

WSCI

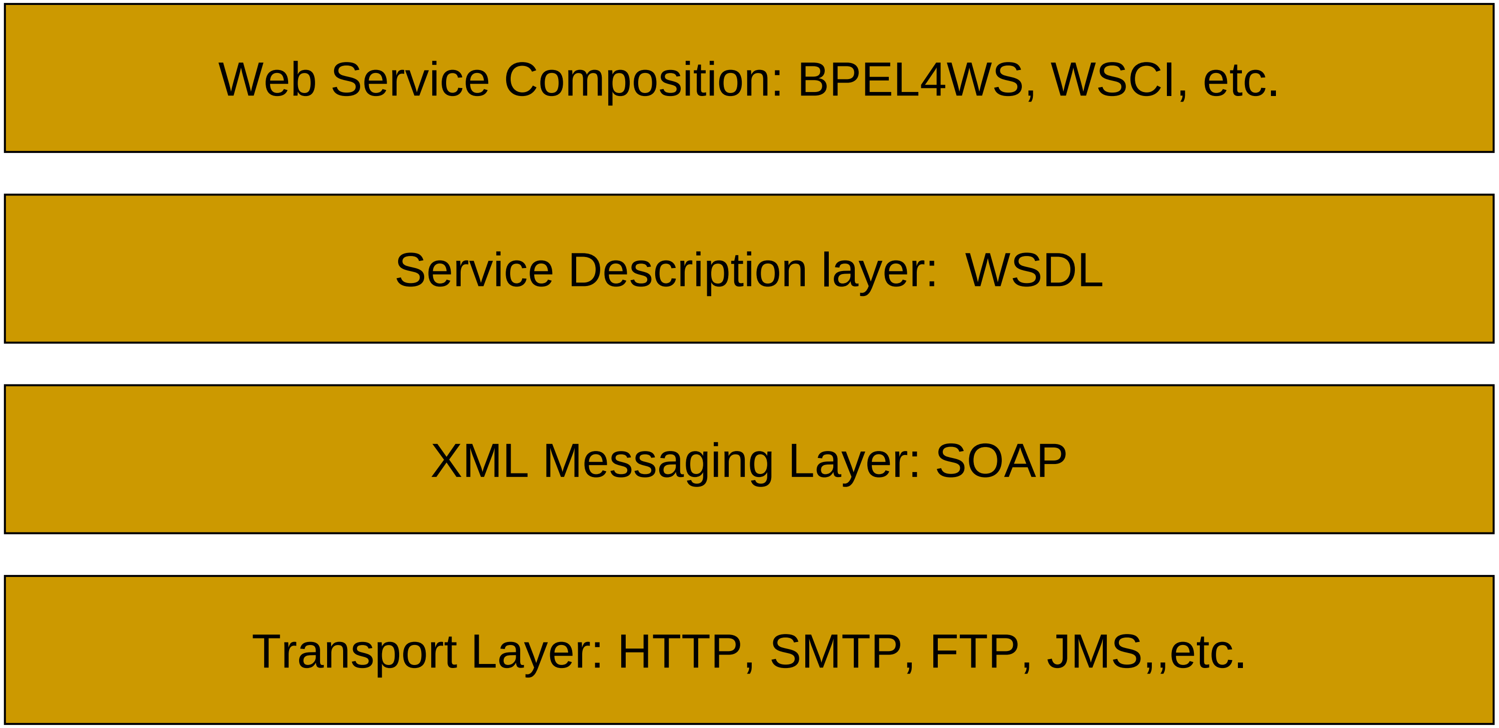
Web Services composition

- Theoretical foundation of languages
  - Based on Petri net and/or Pi calculus



Web Services composition

- The technology stack



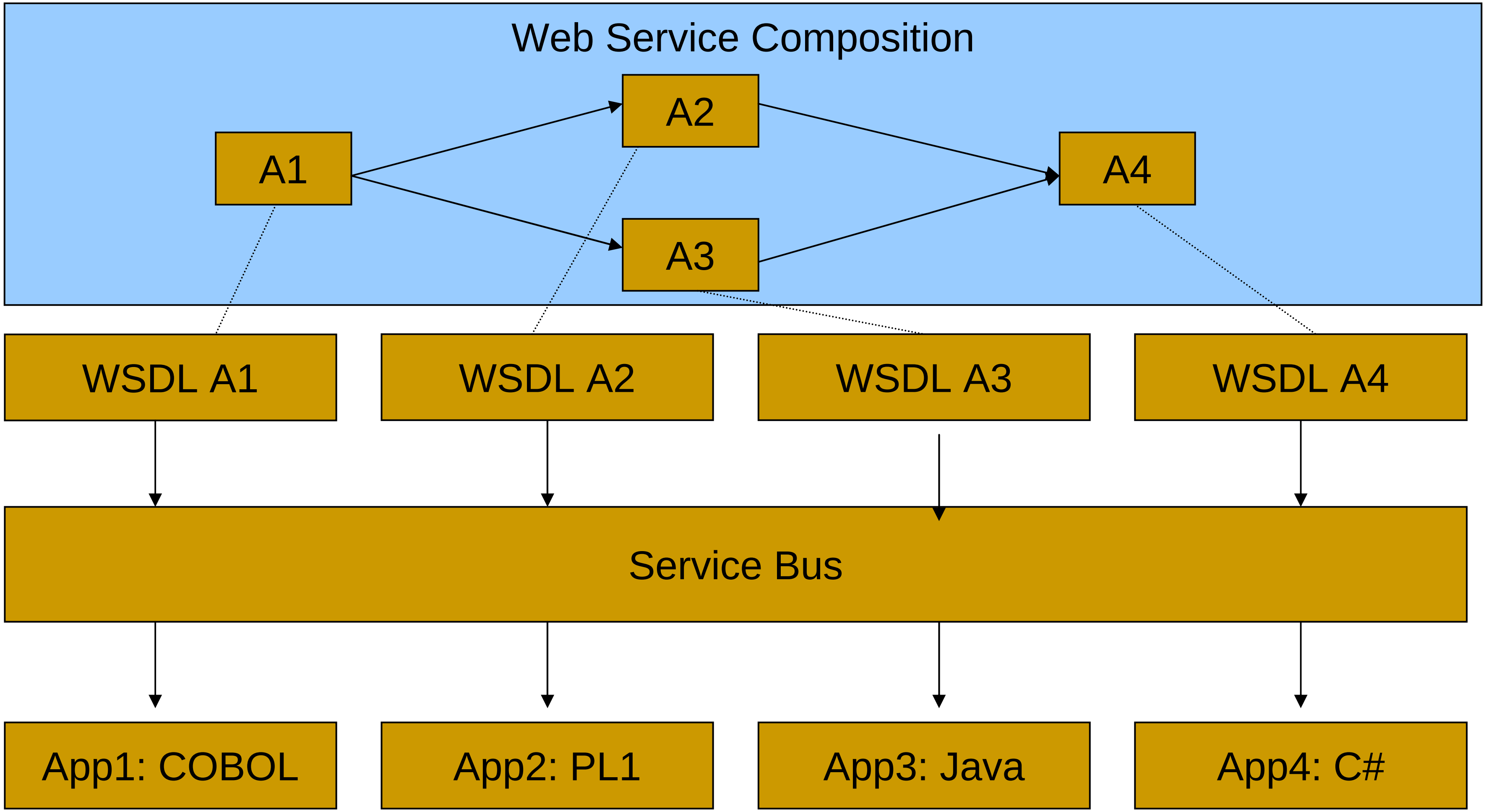
Web Service Composition: BPEL4WS, WSCI, etc.

Service Description layer: WSDL

XML Messaging Layer: SOAP

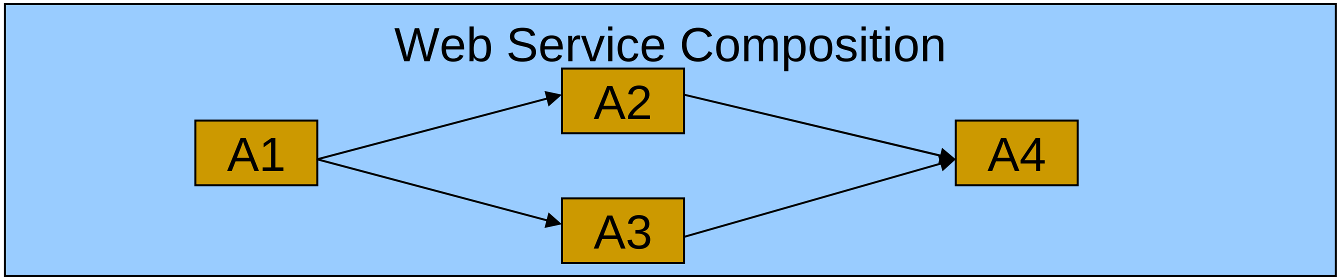
Transport Layer: HTTP, SMTP, FTP, JMS,,etc.

Web Services composition



Web Services composition

- Execution engine
  - Interprets workflows based on a language
  - Knowns how to call Web Services through different protocols
  - Enables long running transactions (days, weeks, month) by persisting state information for the workflow
  - Enables ACID transactions and compensation in case of exceptions



ACID: Atomicity, Consistency, Isolation, Durability

BPEL4WS

- Business Process Execution Language for Web Services
- Defined by IBM, Microsoft, SAP, BEA, Siebel
- Builds on top of XML and Web Services technology stack
- Extensible for new language elements
    - Eg. BPELJ
    - IBM BPEL: Staff activity, Java snippet, Control links
- Is like a programming language combined with graphically representation

BPEL4WS

- Properties of a BPEL process
  - Is itself a web service. Has a WSDL interface
  - Can be synchronous or asynchronous
- A BPEL process consists of
  - Activities
  - Structured activities
  - Control flow
  - Variables
  - Partner links

BPEL4WS

- Activities
  - Waiting for the client to invoke the business process through sending a message, using <receive> (receiving a request)
  - Invoking other web services, using <invoke>
  - Generating a response for synchronous operations, using <reply>
  - Manipulating data variables, using <assign>
  - Indicating faults and exceptions, using <throw>
  - Waiting for some time, using <wait>
  - Terminating the entire process, using <terminate>, etc.

BPEL4WS

- Structured Activitied
  - Sequence (<sequence>), which allows us to define a set of activities that will be invoked in an ordered sequence
  - Flow (<flow>) for defining a set of activities that will be invoked in parallel
  - Case-switch construct (<switch>) for implementing branches
  - While (<while>) for defining loops
  - The ability to select one of a number of alternative paths, using <pick>

BPEL4WS

- Control Flow
  - Defines the sequence of the activities
  - True/false evaluation is attached to each control link
- Variables
  - Defines data for service invocations
- Partner links
  - Defines all services to be called or which can call the process. A partner link is linked to a WSDL file

BPEL4WS

- A BPEL process contains at least:
  - A client partner link and a corresponding receive activity to start the process
  - Normally at least one invoke activity and a partner link
  - At least one variable for the input data to the process
  - Allways two variables for an invoke activity

BPEL4WS

- Still need to define the three WSDL files
- Complex and hard to model directly in XML
- Several BPEL tools exists at the market