Service Composition

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ROAR

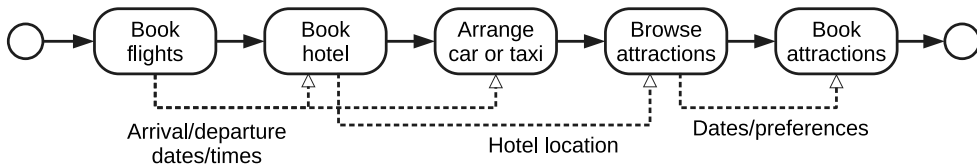# Topics Covered

- Service composition

Software development with services

- Existing services are composed and configured to create new composite services and applications
- The basis for service composition is often a workflow
  - Workflows are logical sequences of activities that, together, model a coherent business process
  - For example, provide a travel reservation services which allows flights, car hire and hotel bookings to be coordinated
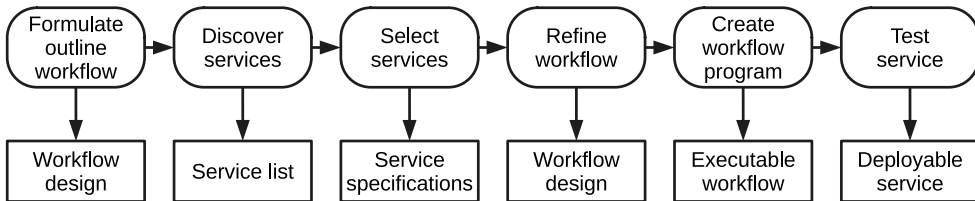
Vacation package workflow

Service construction by composition

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┌──────────┐   ┌──────────┐   ┌──────────┐   ┌──────────┐   ┌──────────┐   ┌──────────┐
│Formulate │ → │ Discover │ → │  Select  │ → │  Refine  │ → │  Create  │ → │   Test   │
│ outline  │   │ services │   │ services │   │ workflow │   │ workflow │   │ service  │
│ workflow │   │          │   │          │   │          │   │ program  │   │          │
└────┬─────┘   └────┬─────┘   └────┬─────┘   └────┬─────┘   └────┬─────┘   └────┬─────┘
     ↓              ↓              ↓              ↓              ↓              ↓
┌──────────┐   ┌──────────┐   ┌──────────┐   ┌──────────┐   ┌──────────┐   ┌──────────┐
│ Workflow │   │ Service  │   │ Service  │   │ Workflow │   │Executable│   │Deployable│
│  design  │   │   list   │   │specifica-│   │  design  │   │ workflow │   │ service  │
│          │   │          │   │  tions   │   │          │   │          │   │          │
└──────────┘   └──────────┘   └──────────┘   └──────────┘   └──────────┘   └──────────┘
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Construction by composition

- Formulate outline workflow
  - In this initial stage of service design, you use the requirements for the composite service as a basis for creating an 'ideal' service design.

- Discover services
  - During this stage of the process, you search service registries or catalogs to discover what services exist, who provides these services and the details of the service provision.

- Select possible services
  - Your selection criteria will obviously include the functionality of the services offered. They may also include the cost of the services and the quality of service (responsiveness, availability, etc.) offered.

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Construction by composition

- Refine workflow.
  - This involves adding detail to the abstract description and perhaps adding or removing workflow activities.

- Create workflow program
  - During this stage, the abstract workflow design is transformed to an executable program and the service interface is defined. You can use a conventional programming language, such as Java or a workflow language, such as WS-BPEL.

- Test completed service or application
  - The process of testing the completed, composite service is more complex than component testing in situations where external services are used.
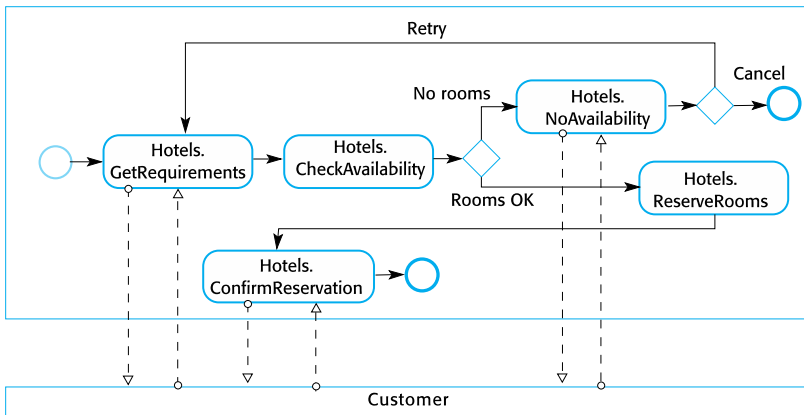
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Workflow design and implementation

- WS-BPEL is an XML-standard for workflow specification. However, WS-BPEL descriptions are long and unreadable

- Graphical workflow notations, such as BPMN, are more readable and WS-BPEL can be generated from them

- In inter-organizational systems, separate workflows are created for each organization and linked through message exchange.

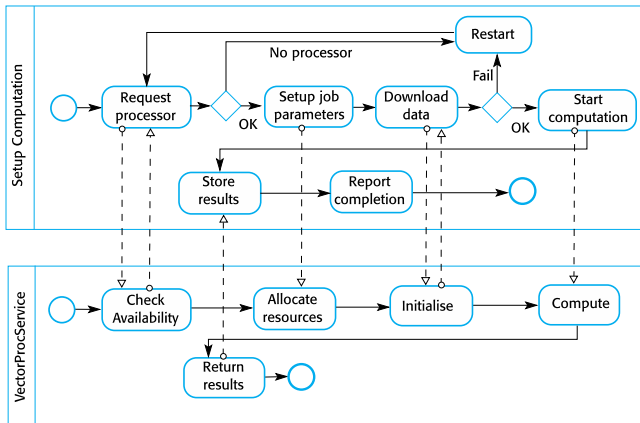- Workflows can be used with both SOAP-based and RESTful services.

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A fragment of a hotel booking workflow

Interacting workflows

Testing service compositions

- Testing is intended to find defects and demonstrate that a system meets its functional and non-functional requirements.

- Service testing is difficult as (external) services are 'black-boxes'. Testing techniques that rely on the program source code cannot be used.

Service testing problems

- External services may be modified by the service provider thus invalidating tests which have been completed.

- Dynamic binding means that the service used in an application may vary - the application tests are not, therefore, reliable.

- The non-functional behavior of the service is unpredictable because it depends on load.

- If services have to be paid for as used, testing a service may be expensive.

- It may be difficult to invoke compensating actions in external services as these may rely on the failure of other services which cannot be simulated.

Key points

- The development of software using services involves composing and configuring services to create new composite services and systems.
- Graphical workflow languages, such as BPMN, may be used to describe a business process and the services used in that process.

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Are there any questions?

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