Process dependability

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goals:
reliability, availability, repairability, minimize impact of errors
The ingredients

User

Processes

Infrastructure
A user perspective

User class uc₁

User class uc₂

Services

Databases

Db₁

Db₂

Db₃

Db₄

Service₁

Service₂

Service₃

Service₄

Service₅

Also the infrastructure matters

- In redundant contexts where data are replicated there is the probability that a user accesses out-of-date data

...we investigate the...

• Relationship between data and service quality and dependability

• Design of adaptive service compositions
Processes and services

Request

WS1

WS2

WS3

WS4

WS5

Messages

a_i

a_{i+1}

a_{i+2}

a_{i+3}

a_{i+4}

Exchanged Data

Boston, ICIQ '08
Self-healing web service

- Self-healing web services
  - Diagnosis
  - Repair actions
- Adaptive design
  - Self-healability = diagnosability + repairability

 Failure chain

- fault
- error
- failure

cause
state
alarms, observables, events, symptoms, faulty behaviors, discrepancies, exceptions and WS fault messages (notification)
Failures and data quality

- Databases misalignment
- Wrong item
- Wrong code
- Data unavailability
- Data incompleteness
- Missing code
- Service Failure

Boston, ICIQ '08
Dependability in composed services

• Depends on
  – the structure of the process
  – the ability to react to possible errors
  – available infrastructure
  – is strictly related to Quality of Service
The structure of the process

• Basic structure
• Patterns for increasing dependability
  – Redundancy (e.g. branches – N-out-of-M joins)
  – Dynamic service selection and substitution
the ability to react to errors

Actions
• Data quality blocks
• Exception handling
• Retry
• Redo
• Substitution
infrastructure

• Monitoring and detection
• Dynamic service management
• Self-healing
Process design Overview

Business Context Analysis

- Description of the business process
- Business Goals

Process Analysis

- Candidate processes, actors and roles

Process Analysis & Logical Design

- Design time actions
  - Insertion of monitors
  - Exceptions

- Run time actions
  - Service Redundancy
  - QoS constraints
  - Substitution of failed service
  - Architectural reconfiguration
  - Diagnosability
    - Retry the invocation of a failed service
    - Compensation

Pre-defined Mgmt mechanisms

Run time Mgmt actions

Instance level

Class level
Quality of service

• Relationships between quality dimensions

• Relationship between quality dimensions and design choices and adaptation actions

• Quality of Service and dependability

Each process and thus the services that compose it can be evaluated along the following quality dimensions:

- Accuracy
- Completeness
- Timeliness

- Availability
- Execution cost
- Failure risk

- Reputation
- Fidelity
Design Time

- Process Analysis
- Dependability Improvement Strategies Analysis
  
  - Ranking of the Dependability Improvement strategies
  
  - Selection of the final set of strategies

RunTime

- Process Monitor
- Reputation Assessment Module
- Dependability Rule Manager

1. Service 1
2. Service 2
3. Service 3

- Registry
  
- Selection of the final set of strategies
• Focus: link dependability and quality of service

C. Cappiello, B. Pernici, QUADS: Quality-Aware Design of dependable Service-based processes, on going work
## Relating improvement actions and qualities

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ECO metrics

• Focus on metrics for assessing power, energy consumption of applications and environmental impact

• EU project: ECO_{2}Clouds

• Issues related to dependability:
  – Power/Energy consumption capping
  – Power failures

Plans and on-going work

– Supports the process designer in the selection of suitable dependability improvement actions

– Extend the analysis to dependability of information systems in general
  • Classifying faults and failures
  • Energy-related problems
  • Deployment and management of applications on clouds
Some relevant papers...


• QUESTIONS?