Extra-functional Properties Applicable to Variety of Component Models

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Motivation

- Current trend to develop software by composing components
- Need for component compatibility verifications
- Compatibility verification must take extra-functional properties (EFPs) into account
- EFPs applicable to variety of component models
- Attempt to treat EFPs from their definition, assignment and comparing to result evaluation
- Others often deals with specialized EFPs or framework
- We aim at general EFPs framework applicable to other component models
Framework Overview

Framework composed of several sub-modules

Figure: Framework Overview
Universal Repository for Extra-functional Properties

Figure: Universal EFP Repository
System of Registries

Extra-functional repository composed of Registries

Figure: Registries
EFP Types

- models world of extra-functional properties,
- represents local + global registries,
- represents extra-functional properties,
- data types of properties.

EFP Assignment Types

- represents assignment of EFPs to components,
- contains concrete assigned values,
- contains assignment to particular registries.
Extra-functional property:

\[ E = \{ e \mid e = (n, E_d, \gamma, T, META) \} \]

- is defined via name \( (n) \) and data type \( (T) \),
- contains extensible block of meta \( (META) \) informations (e.g. measuring unit),
- may be simple or derived one (derived from other ones \( (E_d) \)),
- comparable with each other using gamma function \( (\gamma) \).
Extra-functional Repository

Repository usage:
- EFPs are generally available via Internet,
- it gathers all existing EFPs at one place,
- EFPs are compatible since they are from one registry.

Different types:
- global - set of domain specific EFPs,
- local - set of context specific values for each domain,
- different contexts belong to one domain.
Extra-functional Repository – Formalization

$$GR = (id, name, E)$$

- $id$: Integer is the registry’s unique identifier,
- $name$: String is a human readable name of this GR,
- $E$: is a set of extra-functional properties.
Extra-functional Repository – Formalization

\[ LR = (id, GR, name, id_{parent}, S, D) \]

- \( id \): Integer is the registry’s unique identifier,
- \( GR \): is the Global Registry this LR is linked to,
- \( name \): String is a human readable repository name,
- \( id_{parent} \): Integer is the (optional) identifier of a parent LR,
- \( S \): is a set defining context dependent values for simple properties,
- \( D \): is a set of derived property definitions.
EFP Assigned to Component

Figure: EFP Assigned to Component
Assignment of EFPs to Components

Assignment of EFPs to component:

\[ AT = F \times E \times V \]

- **F** set of all generic representations of component features, consists of all \((name, type, role, mandatory, \mu)\),
- **E** set of all extra-functional properties,
- **V** set of all values

Three type of values:
- directly assigned values,
- values from local registry,
- mathematical formulas.
Evaluation Concerning Extra-functional Properties

Algorithm:

- components are matched ($\mu$ function) by provided and required element pairs,
- graph of connected components is created,
- EFPs on connected components are compared ($\gamma$ function).

Figure: Graph of connected components
Registry Server

- J2EE Server,
- Spring, Hibernate, Apache CXF,
- data provided via SOAP.

Figure: Tool - Registry Server
Registry GUI

Figure: Tool - Registry GUI
Assignment GUI

Figure: Tool - Assignment GUI
Evaluator embeddable to other systems

- implemented as Java SE application,
- provides API to evaluate components,
- distributed as JAR files embeddable to other JAVA based systems.
EFP framework applicable to other component models,
- it covers EFP definitions, application and evaluation,
- created as meta-models and formalizations,
- repository implemented as J2EE server,
- evaluator embeddable to other systems
- tool support to create and assign EFPs.

Thank you for your attention