Reflektiiviset väliohjelmistot

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Sisältö

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Johdanto

Trendejä

- Hajautettuja / yhteentoimivia järjestelmiä
- Sovellusten sopeuvuus erilaisiin ympäristöihin, tilanteisiin; räätälöitävyys
- Sovellusten älykkyys, havainnot käyttäjästä ja ympäristöstä vaikuttavat toimintaan

Vaatimuksia

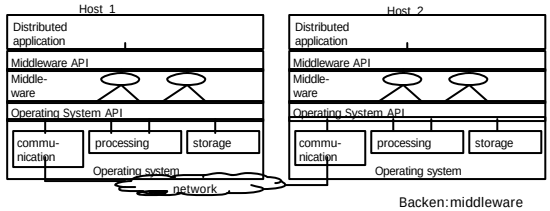
- Ohjelmiston elinkaarikustannukset alas
- Ohjelmistotuotannon vaativuus alas

Keinoja

- Väliohjelmistot korottavat abstraktiotasoa
- Reflektiivisyys tukee erityispiirteiden tai muutosten soveltamista perussovellukseen tai toteutusympäristöön

Defining middleware

Middleware is a class of software technologies designed to help manage the complexity and heterogeneity inherent in distributed systems. It is defined as a layer of software above the operating system but below the application program that provides a common programming abstraction across a distributed system.



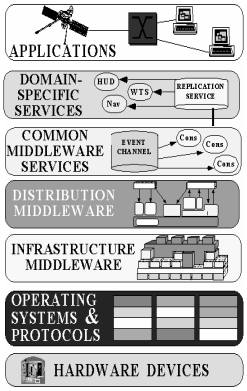
Backen:middleware

Roles of middleware

- Dual role
  - Communication glue between partners
  - Bridge between programmer and processor
- Dual tools
  - Services in the runtime environment = infrastructure, platform
  - Software engineering tools
    - Programming language concepts, like objects, components, RPC, transactions, operations/methods/invocations
    - Descriptive language support: IDL, UML, WSDL, ebXML, …
    - Generative and reuse tools
    - Software engineering processes, product lines, …
  - In combinations: component frameworks, application servers, ...

Types of middleware

- **Transactional middleware**
  - IBM CICS, BEA Tuxedo, Transarc Encina
  - communication, storage, limited facilities for processing
- **Message oriented middleware, MOM**
  - IBM MQSeries, Sun Java Message Queue
  - communication, no processing, limited storage
- **Procedural middleware**
  - RPC variations
  - communication, processing, no storage
- **Object and component middleware**
  - CORBA, DCOM, Java RMI, EJB, SOAP, .NET
  - communication, processing, and storage



- **sovellusalueen palveluja**: lennon navigointialgoritmeja, potilastietokantamalleja
- **yleispalveluja**: ilmoitukset, turvallisuus, transaktiot, kuormantasaus, tietovirrat, vikasietoisuus
- objektien ja komponenttien välinen **kommunikointi** (RMI, CORBA)
- **yhtenäinen** näkemys käyttöjärjestemä- ja kommunikointipalveluihin

väliohjelmisto = middleware

Reflection - Definition

- **Reflective system** is a system that is able to describe and manipulate itself, or other related systems.
- **Computational reflection** is the behaviour exhibited by a reflective system, where a reflective system is a computational system which is about itself in a causally connected way. - Maes 1997
- **Metaprogramming** involves methods and tools for creating programs and methods for reading, writing and changing other programs.

Methods of reflection

- Foundations
- Metalogical reflection
- Managing self-references
- **Computational reflection**
  - Compile time: Shiba
    - partial evaluation; static and dynamic
    - runtime code generation; deferred/dynamic compilation
  - **Runtime**: Smith, **Maes**
  - **Reflective programming languages with built-in metainterfaces**
  - Rewrite logic programming languages
- **Metaobject protocols and metaprogramming**
- **aspect-oriented programming**
- **open implementation style**

Terminology

- Reify/kuvata – to explicitly describe the system behaviour and rules
- Inspect/tutkia – to retrieve reified information
- Reflect/päättää – to make decisions as a result of inspection
- Adaptation/sopeutua – a change in system behaviour as a result of reflection
- Causally connected self-representation – a change in the self-representation causes immediate change in behaviour
- Metaobject reifies some aspects of an object
- Metaobject protocol specifies how (protocol or interface) metaobject can be accessed

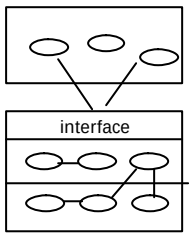
Open implementation styles

Boxes

- black: generic solution, no user interference; heavy to run
- white: user uses internal pieces at will; complex to use
- open: common interface, user can change internals at will

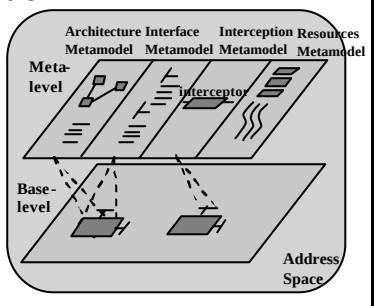
Styles of open box

- Procedural reflection – new code
- Declarative reflection – select existing code by parameters
  - compilation time
  - runtime
- Changes in interfaces & inspection



Reflective middleware - Definition

Reflective middleware is a middleware system that provides inspection and adaptation of its behaviour through an appropriate causally connected self-representation.



Expectations on middleware

- Middleware able to cope with change
  - Applications are deployed in hostile and dynamic environments
    - Multimedia, Group communication, Realtime and embedded environment, Mobile and handheld computing
  - But there is a problem as conventional ORBsare static:
    - Fixed threading model, transport protocol: IIOP (over TCP/IP), security strategy (typically no security), scheduling
- Middleware provides self-healing systems
  - Fault-tolerance, replication groups, …
  - Self-monitoring by injected monitors; adaptation by strategy selectors reacting to feedback from monitors; alternative strategies implemented as separate components or aspects
- Middleware provides for Context-aware applications
  - Device awareness (memory, battery power, screen size, internal resources),
  - Environment awareness (bandwidth, network connection, location, services in reach, external resources),
  - User and application profiles
  - Service levels: best effort, … quaranteed

Solutions in reflective middleware

- Metainformation management services in middleware provide meta-level data
  - service trading, service types, system architectures
  - transparencies (location, migration, group, …)
- Base-level objects/components can be managed in a framework of components and connectors
- Middleware services provide functions and metadata repositories declarations for open box manipulation

Seminaarin ohjelma

- Reflektiivisyyden peruskäsitteet
- Metadatan hyväksikäyttö väliohjelmistoissa
- Perusmalleja
  - mobiliteetti, QoS, group management,
  - security
- Platformeja
- Arkkitehtuuripohjainen reflektiivisyys
- Yhteenvetoistunto - ryhmätyöskentelyä