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ANSA Phase III

A Guided Tour of RM-ODP Part 3 (Prescriptive Model)

The ANSA Team

Abstract

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Request for Comments (confidential to ANSA consortium for 2 years)

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A Guided Tour of the Basic Reference Model for Open Distributed Processing (Prescriptive Model)

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Context

- **Part 1: Overview and guide to use**
- **Part 2: Descriptive Model**
- ***Part 3: Prescriptive Model***
- **Part 4: Architectural Semantics**
- **Trader**

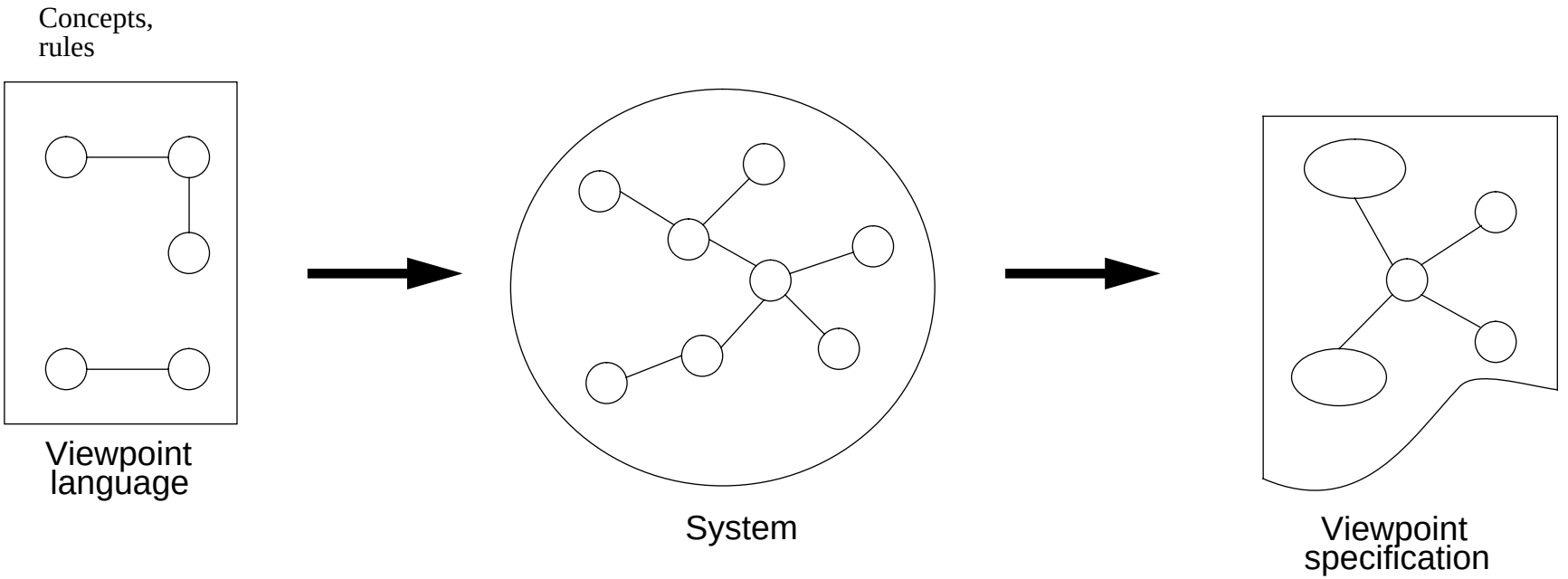
Scope

- **concepts and rules for specifying ODP systems**
- **framework for development of ODP standards**
  - **standards for *specification*, *modelling* and *programming* languages**
  - ***language bindings* (APIs) for ODP systems**
  - **functional components of ODP systems**

Languages and Viewpoints (1)

- ***Framework*** **consists of five** ***viewpoint languages*** **and a set of** ***ODP functions***
- **Each viewpoint language enables specification of an ODP system or component**
- **Languages are structured so that** ***consistency checking*** **between alternative viewpoint specifications is possible**
- **The chosen set is** ***necessary*** **and** ***sufficient*** **for needs of ODP**
- **Each language consists of** ***concepts*** **(vocabulary) and** ***rules*** **(grammar)**

Languages and Viewpoints (2)



- **Mathematical basis in *projection* of a set of concepts and abstraction/ specialisation relations over a semantic net.**

Viewpoints

- **Enterprise - purpose, scope and policies for a system**
- **Information - semantics of information and information processing in a system**
- **Computational - functional decomposition into objects suitable for distribution**
- **Engineering - the infrastructure required to support distribution**
- **Technology - the choice of technology to support distribution**

Conformance

- **Reference point - a potential conformance point**
- **Positioned by computational and engineering languages**
- **Specified in (some combination of) enterprise, information, computational and engineering languages**
- **Information specification determines universe of discourse for the reference point**
- **An ODP system is one which conforms to ODP standards at all reference points asserted to be conformance points**

Enterprise language

- **Role: agent, artefact**
- **Policy maker, administrator, arbitrator**
- **Resource, resource manager**
- **Community: set of objects with an objective (*contract*)**
- **Performative action**
  - **incur an obligation**
  - **fulfil an obligation**
  - **waive an obligation**
  - **acquire permission**
  - **be forbidden**

Federation

- **Federation: a *voluntary* community in which administration is a cooperative activity on a peer to peer basis**
- **Federation principles**
  - **freedom to join**
  - **freedom to leave**
  - **subject to agreed obligations**
  - **retain significant autonomy**
  - **no single administrator**
- **Federation colours many of the technical aspects of the Reference Model.**

Information Language

- **Concepts, relations**
- **Integrity rules**
  - **static schema (state and structure)**
  - **invariant schema (independent of behaviour)**
  - **dynamic schema (possible behaviour)**
- **Model behaviour as changes in class membership**

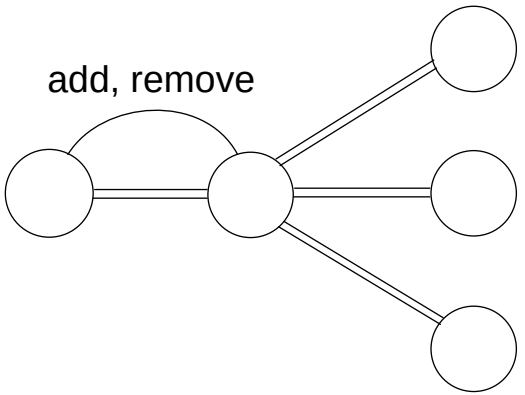
Computational language

- **Interface**
  - **Operational (interrogations)**
  - **Transactional**
  - **Stream (unstructured)**
- **Interface template**
  - **Signature (operations or stream)**
  - **Behaviour for operational interfaces**
    *** ordering relative to other invocations**
    *** conflicts relative to other transactions**
    *** operation behaviour**
  - **Environment constraint**
  - **Roles: client, server, producer, consumer**

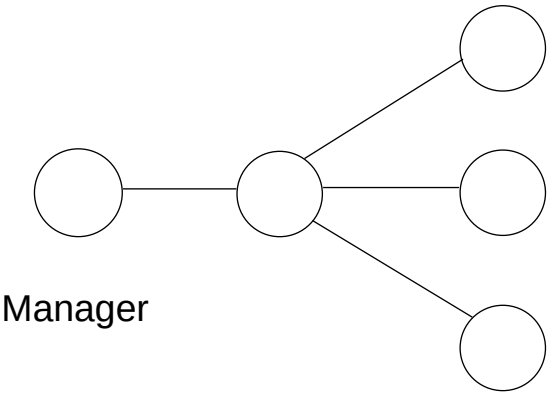
Binding

- ***Implicit*** **binding for operational interfaces**
- ***Explicit*** **binding for all interfaces**
- **BIND <binding type> {set of interfaces}**
  - **instantiates a new binding object**
- **Binding object has a control interface for supervising the binding**
  - **adding/removing interfaces**
  - **stopping/starting information flaws**
  - **monitoring events**

Binding examples



Stream multi-casting



Management domain

Operational interface typing

- **operation invocation is a *request-reply* model**
- **type checking for safety - no surprises principle**
- **server must provide at least operations required by client**
- **client must accept all possible terminations from server**
- **client arguments “smaller” than server requires**
- **server results “smaller” than client accepts**
- **arguments and results can be interface identifiers**
- **each operation has one or more *terminations***

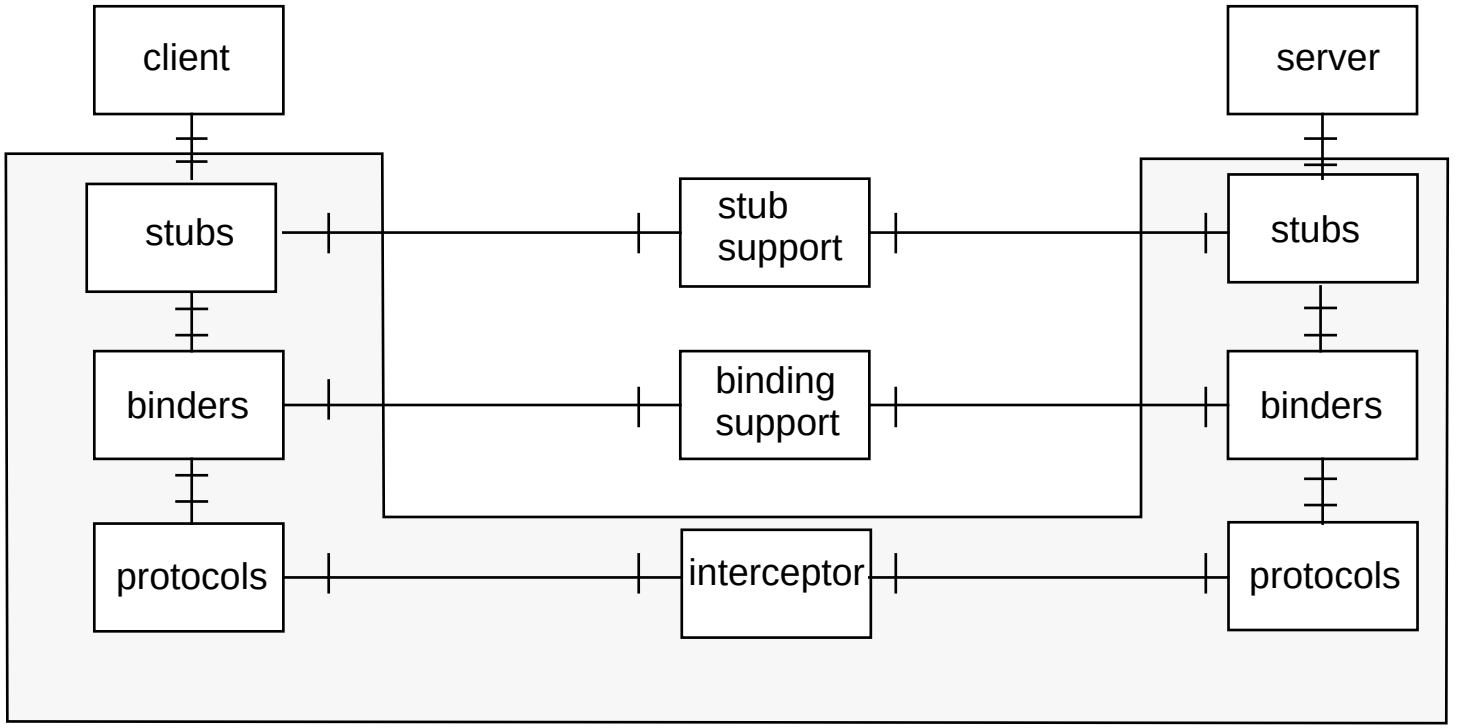
Transactions

- **Very general model - specific models defined in terms of**
- ***visibility* - how much interaction possible with objects outside the transaction**
- ***consistency* - invariant to be fulfilled at end of transaction**
- ***recoverability* - how much of transaction is undone after failure**
- ***permanence* - the degree to which failures can alter the effects of a transaction**
- ***dependency* - influence of other transactions on success or fail**
- **bracket transactions as operations**
- **label terminations *success* or *fail***
- **spawn actions generate independent transactions**

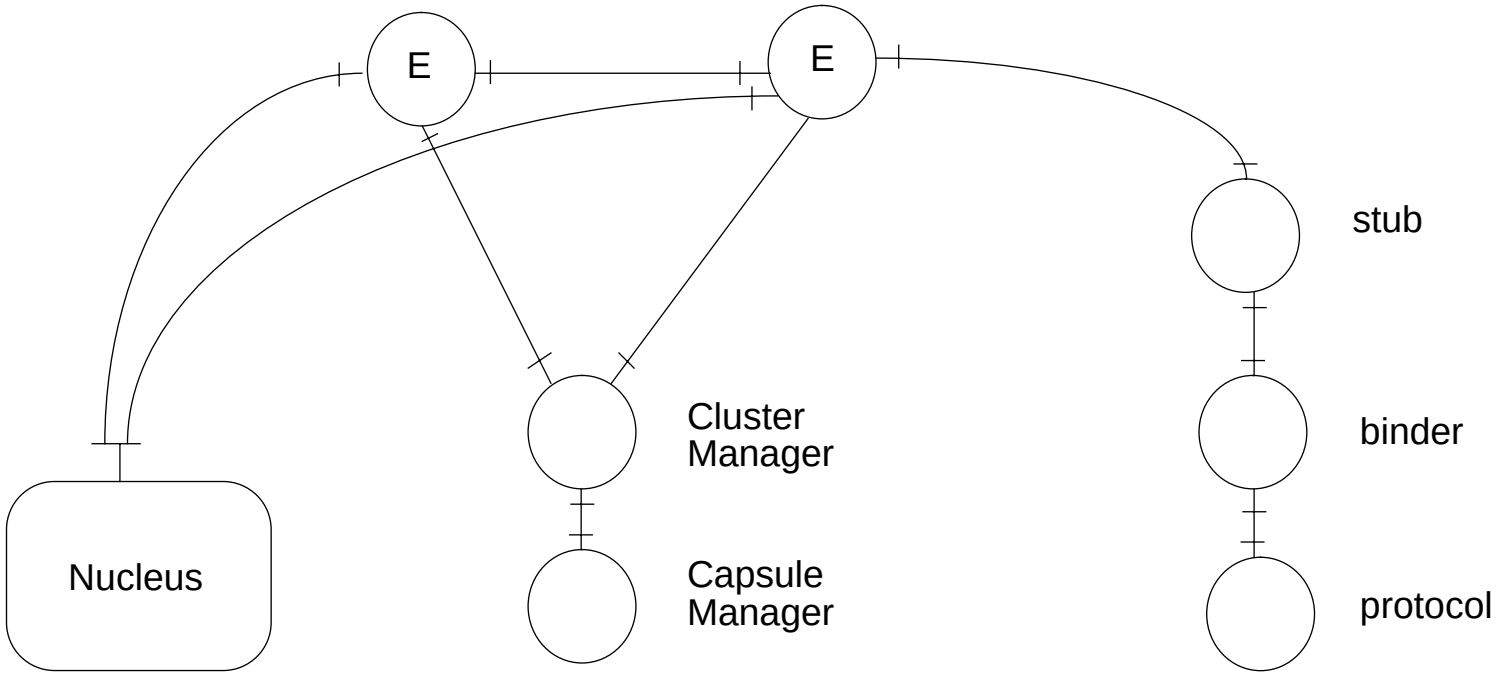
Engineering language

- **structures for implementing infrastructures supporting *selective transparency***
- ***channels* for communication**
  - **simple client server**
  - **multipoint channels**
  - **stream channels**
- **clusters for activation, deactivation, migration**
- **capsules for resource allocation, protection**
- **nodes for network addressing**

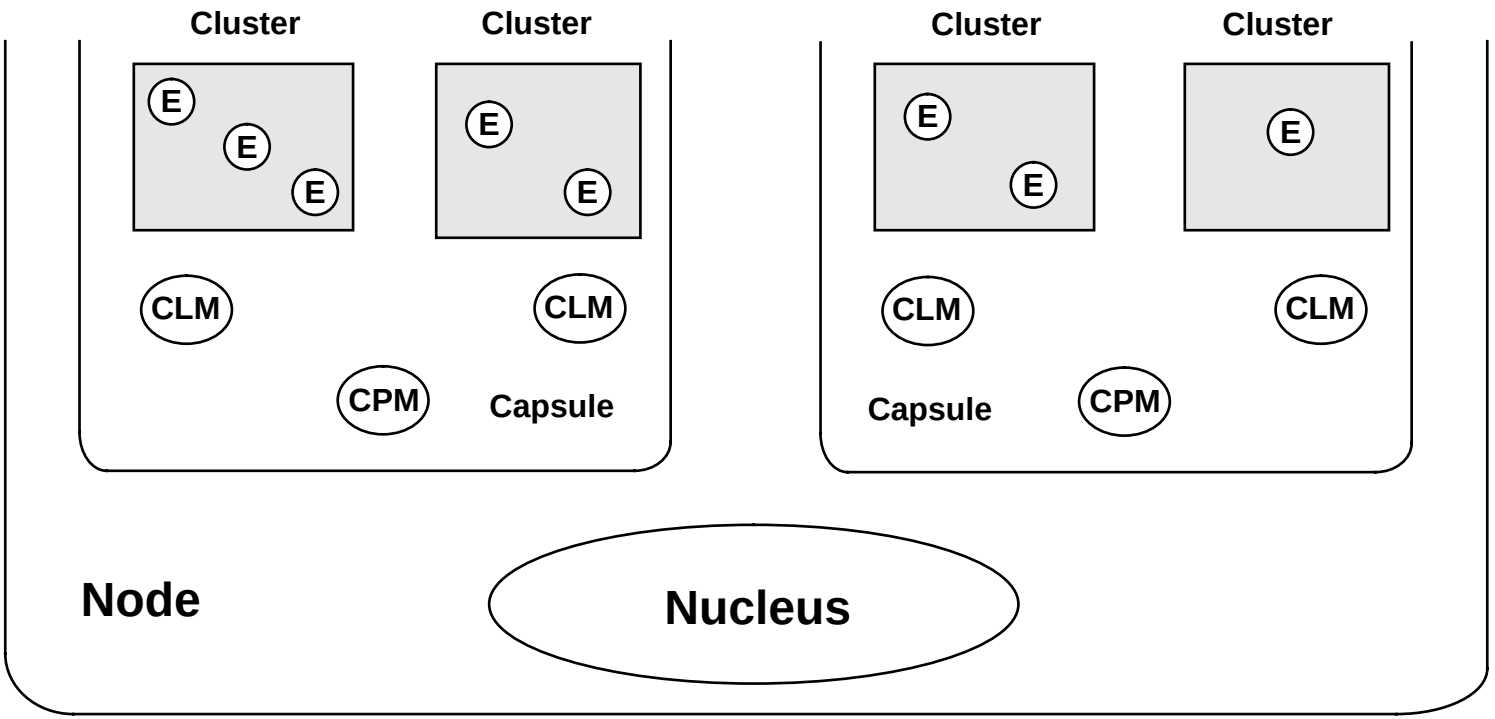
Client-Server Channel



Key engineering objects



Engineering structures



Engineering a binding

- **Engineering location**
  - **location of protocol object interfaces**
  - ***binding template* for stubs and binders**
- **Engineering location of an interface which can migrate is volatile**
- **Interface reference provides basis for (re) establishing binding - process may be multi-stage**
- **Interface reference**
  - **identifies binding template to instantiate**
  - **identified communications end points at which to start binding process**
  - **engineering interface identifier**
- **Engineering interface identifier**
  - **unambiguous**
  - **synonyms permitted**
  - **equivalent undefined**

Technology language

- **Implementable standard: template for a technology object**
- **Implementation Extra Information for Testing**
  - **technology specification in a standard defines a proforma IXIT**
  - **IXIT defines templates and names of interfaces required for testing**

Consistency constraints

- **Can never be complete**
  - **enterprise and technology aspects are based on *connotation***
  - **information, computational and engineering aspects are based on *denotation***
- **Rules give a least guarantee**
  - **give a transformation between a specification in one viewpoint language and another**

Functions

- **Management (object, cluster, capsule, communications, interface reference)**
- **Coordination (transactions, groups)**
- **Repository (Storage, relocation, types, trader)**
- **Security**
- **Transparency**
  - **recipes for using other functions to extend transparency of the infrastructure**

Management Functions (1)

- **nucleus**
  - **threads**
  - **channel setup**
  - **capsule manufacture**
- **object management**
  - **objects manage themselves**
  - **cluster managers ask objects to terminate, snapshot etc.**
- **cluster management**
  - **deactivate, migrate, terminate**

Management Functions (2)

- **capsule management**
  - **cluster instantiation, reactivation**
  - **termination**
- **communication domain**
  - **link to network management**
- **interface reference**
  - **tracking interface references**
  - **enables distributed garbage collection**

Coordination functions

- **Transactions**
  - **transaction manager**
  - **concurrency manager**
  - **deadlock manager**
  - **stable store manager**
  - **Log manager**
- **Groups**
  - **distribution**
  - **collation**
  - **ordering**
  - **fault detection**

Repository functions (1)

- **Separate out components of repository to enable distribution**
- **Storage function**
  - **data storage**
  - **deactivated cluster repository**
  - **interface reference fixing done on reactivation**
- **Relocation function**
  - **supports binder objects**
  - **retains interface reference to engineering location bindings**
  - **retains activation process for deactivated (checkpointed) clusters**

Repository functions (2)

- **Type repository**
  - **represent types as interface to type repository**
  - **each type can be queried for its relationship to other types**
- **Trader**
  - **exporter defines type and interface reference**
  - **importer defines type for trader to match**
  - **type: at least computational - typically includes other properties**
  - **trader policy: searching, federation**
  - **exporter policy: e.g. for resource control**
  - **importer policy: e.g. to direct/limit search**

Security

- **Access control**
- **Audit**
- **Authentication**
- **Integrity**
- **Confidentiality**
- **Non-repudiation**

Transparency

- **Access (marshalling/unmarshalling)**
- **Transaction (for resilient objects)**
- **Location**
- **Failure (checkpointing, replication)**
- **Federation (masking administrative boundaries)**
- **Migration**
- **Group**
- **Resource (transparent deactivation/reaction)**

Status

- **1988 First Working Documents**
- **November1992 First Committee Draft**
- **June 1993 Second Committee Draft**
- **February 1994 Draft International Standard?**
  - **structures for streams?**
  - **even treatment of all functions**
  - **flesh out transparency recipes**
- **1995 International Standard**
- **Populated via OMG activities**
  - **liaison in place**
  - **function correspondences identified**