Advanced Networked Systems Architecture

ANSA

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The ANSA Climbing Frame

Number: AO.16.02

Date: 3rd September 1986 10:29 pm

Area: AO (Architectural Overview)

Status: P (Discussion Paper)

Classification: C (**COMMERCIAL-IN-CONFIDENCE**)

Distribution: T (ANSA Team)

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CONTENTS

0 CHANGE HISTORY

Version AO.16.2 has minor editorial changes, and terminology review.

The change made to version AO.16.1 is the addition of an extra dimension - Level of Abstraction. This is the result of continuing discussions, and exploration of the concepts both within ANSA and outside.

1 INTRODUCTION

This document describes the main Architectural Framework upon which ANSA will be constructed. It follows the conceptual schema described in [1], deriving the main architectural dimensions of the ANSA problem space, and establishing the coordinate system that will be used to place the various objects comprising the architecture within this space.

There are a number of issues relating to the construction of models, and the placement of the architectural objects within the problem space that are being studied, and these are addressed in [2].

2 PROCEDURE

This section outlines the procedure that was followed in establishing the dimensions and associated coordinate system.

2.1 Properties

The first step in the procedure was to list the properties of objects that are to be placed within the problem space that might of sufficient and general importance that they merit consideration as dimensions of the problem space.

2.2 Selection criteria

Once the properties are listed, criteria were sought by which to select from those properties those that are most relevant to an understanding of the problem space. The use of these criteria should give a selection of the properties that are in some sense fundamental to the expression of the architecture within the problem space, and that help in the presentation of the architecture to those concerned with it.

2.3 Dimensions

Application of the selection criteria to the listed properties results in a subset of the properties. These, with some adjustment for the removal of similar properties, become the **dimensions** of the problem space. A dimension should be related (1:1) to variation in a single property, it should reflect a fundamental difference between the various components of the architecture, and the set of dimensions should form a cohesive and consistent basis for the subdivision of the problem space. It is **not** necessary for the selected dimensions to form a 'minimum ortho-normal' set, (which would mean that they are a minimum set of properties which are both necessary and sufficient to derive **all** of the other properties.). In practice many of the properties (quality, security, etc) cannot be derived from the dimensions, and so although the properties associated with the dimensions might be necessary, they are certainly not sufficient to determining all of the characteristics of the architecture.

In order to assist in the representation of the architecture to the various audiences, some at least of the dimensions chosen should correspond to the fundamental properties of interest to those audiences. The description of the architecture to them, and their understanding of it and reasoning about it will thereby be made easier.

2.4 Coordinate system

Once a set of dimensions have been established, coordinates must be established for each so that some measure of position within the problem space may be associated with each component of the architecture.

The coordinate system for each dimension must correspond to variation in the associated parameter, and need **not** be continuous and without discontinuities. Indeed many of the parameters of interest are parametric in nature, taking discrete values without intermediate values. In these cases it is convenient to consider whether the discrete values may be placed in some sequence, what the basis for such a sequence might be, and whether each value should be considered to be a point on the dimension or a region along it.

2.5 The framework

The descriptions of the dimensions and of the coordinate system together form a **framework** upon which the rest of the architecture will be built.

3 Properties

This section describes the main properties that were considered in establishing this framework.

3.1 Definite

The following properties were considered to be possibilities for selection as dimensions.

- Communications
  - interworking
  - local model - DASE etc.
- Dependability
- Evolution
  - Existing architectures
  - phased time track of ANSA releases
- Human Interface
- Information structures
  - documents
  - databases
  - files
- Integration of -
  - Services
  - Human Interface
  - communication
- Management
- Quality
- Security
- Structure
  - Service structure
  - Logical structure
  - Physical structure

3.2 Uncertain

The following properties were considered to be of uncertain relevance to the selection of dimensions, mostly because they would seem to be included under a more generic heading.

- Manufacturability
- Reliability (and availability ...)
- Service Styles
- Testing

4 Selection criteria

Two criteria for selection were considered, technology based, and people based.

4.1 How

Dimensions could be selected on the basis of the technologies that are used in implementations of the architecture, or the design of conforming systems. However it was felt that these would **not** assist in the derivation and description of architectures that were long lived, that could evolve, or that were easy to present to a wide range of audiences.

4.2 Who

Since dimensions should be relevant to the presentation of the architecture to the various audiences, it is clearly beneficial to select the dimensions according to some human based criteria. There is a link here to the Perspectives derived from the requirements analysis phase of the Architecture Design Process.

After consideration of many possible audiences to whom the architecture would need to be presented, the following were selected as a basis for selecting dimensions.

- Those concerned with the **User's perception** of conforming systems
- Those concerned with the **Vendor's perception** of conforming systems
- Those concerned with the **design** of conforming systems
- Those concerned with the **external communications** of conforming systems.

5 Dimensions

This section describes the dimensions chosen for use in describing the ANSA architecture, and the properties to which they are linked. They are the result of the original discussions and the subsequent wider discussions.

5.1 Evolution

The evolutionary dimension reflects the changes that will occur in the architecture over time. These changes will occur in stages as the various versions of the architecture are released. These releases will occur in discrete steps throughout the lifetime of ANSA, at times that will depend on the progress made, and the changes accumulated since the last release, rather than the passing of particular time intervals. Therefore the coordinates used to place parts of the architecture on this dimension are related to the release of versions of the architecture, rather than the passing of time. The dimension is therefore parametric in nature, with discrete regions being assigned to the various releases.

At this point in the development of ANSA we identify four sequential regions along the Evolution dimension, as described below.

Release	Designation	Content
0	Framework	Architectural Overview (AO)
0.5	Basic ANSA	AO + Principal Modules (PM)
1.0	Full ANSA	AO + PM Subordinate Modules (SM)
1.1	Extended ANSA	AO + PM + SM + modifications

5.2 Structure

The Structure dimension relates to the topologies of the architecture at various levels of abstraction. Abstraction is a difficult concept to measure, and although it might be considered to be continuous, we choose three levels of abstraction as being characteristic of ANSA's problem space. These are described below.

Designation	Description
Physical	The Physical Structure is concerned with the actual physical parts of conforming systems, the computers, cables, workstations, and so on.
Logical	The Logical Structure is concerned with providing a consistent structural view that can be provided by many implementations (different Physical Structures), and that can be used to build a variety of Service Structures. The Logical Structure therefore provides an architectural description that assists in providing portability by isolating the Service Structure from the Physical Structure, and encourages reconfiguration, replication, etc by providing a mapping mechanism between Physical and Service Structures.
Service	The Service Structure is concerned with the provision and support of functionality or service. It is therefore concerned with 'what the system does'.

5.3 Human Interface

The Human Interface dimension is concerned with the User's view of conforming systems, gained by their interactions with it. Without being too precise about the meaning of the terms, the dimension relates to the perceived 'depth' from the User 'into' the (behaviour of the) system. This is a difficult concept to measure, and although it might be considered to be continuous, we choose four levels of 'depth' as being characteristic of ANSA's problem space. These are described below.

Designation	Description
Input/Output	The I/O level of the HI dimension is concerned with the equipment with which Users interact with the system. This equipment is the avenue via which Users perceive the behaviour of the system. It is anticipated that objects within the I/O level will have a strong correspondance with objects in the Physical Structure, and possible also the LOgical Structure.
Dialogue	The dialogue level of the HI dimension is concerned with the dialogues governing the exchange of information and control between User and system.
Conceptual Model	The User gives commands in order to cause effects on the behaviour of the system, and to cause actions to occur. Commands only have meaning when they have things upon which to act, and when there are user perceived relationships between these things through which effects can occur. These various things and relationships form a conceptual model which is presented to Users so that they can reason about the behaviour of the system. The Conceptual Model represents to the Users all of the hidden capabilities of the system.
Resources	The resources level of the HI dimension is concerned with the various hidden 'engines', resources and capabilities that animate the conceptual model.

5.4 External communications

The External Communications dimension is concerned with structuring the architecture so as to provide compatible interworking with the non ANSA world with which conforming systems will have to communicate. Our present expectation is that such communication will take place using the standardised OSI protocols, and so we provide regions along this dimension that correspond to the OSI 7 layer model of communications.

5.5 Level of Abstraction

The level of abstraction dimension is concerned with the range of abstraction that is used to represent the architecture. At one extreme, the representation is a single object - ANSA - , and at the other it is a considerable amount of detail about the implementation of systems conforming to ANSA.

Details of appropriate coordinate systems are unclear, but must broadly correspond to 'degree of decomposition', or in the case of software objects, the depth of the type definition down the inheritance tree (mesh).

5.6 Others

There are several other candidates for dimensions, the most likely ones known at present being **management** (which could be parameterised into 4 regions - Policy, Administrative, Activity, and Operational) and the **degree of conformance** to agreed standards (which could be parameterised into 3 regions - Conforming, Intercepting, and Non-conforming).

6 References

[1] *On the Dimensionality of Architectures* (AO.14)

[2] *On the Building of Models* (AO.17)

[3] "An Expanded Approach to Objects" Harold Lorin