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**ANSA Phase III**

# F1 Overview
# (Synopsis of first federation deliverable)

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**Abstract**

Businesses today have to be more customer oriented than ever: they must provide high quality personalised services which can be deployed rapidly and configured easily, often by customers themselves. As business begins to be conducted in the electronic medium established by wide area networking (e.g. the Internet), new challenges emerge to support the commercial information superhighway.

An electronic market place will require support for searching for services and negotiating the terms of use. Diverse systems will have to be made to interwork virtually upon reaching such agreements.

Work on federation is central to achieving interworking after negotiation.This briefing note summarises the first federation deliverable, which sets out the agenda of work to meet some of these challenges, and displays early results.

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# 1 Executive Summary

This document sets the context for the first deliverable from the federation group.

This deliverable consists of the following documents:

1. The 'Federation Manifesto' [APM.1193], which discusses trends which make federation increasingly important, different sorts of boundaries which can occur in distributed systems, approaches for dealing with such boundaries, an enhanced model of trading and proposals for building a trader prototype to demonstrate some of the ideas in action;
2. 'Data Management for an Enhanced Trader' [APM.1162], which describes how relational database technology can be used in the provision of trading functions;
3. 'Remote Database Queries in Open Distributed Systems' [APM.1138], which tackles the problem of supporting remote query language access in an object-oriented distributed system;
4. 'ORB comparison' [APM.1194], which compares currently available Object Request Broker products to select one for use in a trader prototype;
5. 'Micro-scenarios for federation' [APM.1095], which lists examples of situations in which there are different kinds of obstacles to interoperation.

The audience for this overview document is the Management Committee, the Technical Committee and project leaders in sponsor companies, to help them place the ANSA federation work in the context of their own projects and developments. The ANSA federation team would welcome input as to how they can help transfer their technology into such projects.

# 2 Why Federation ?

Businesses today have to be more customer oriented than ever: they must provide high quality personalised services which can be deployed rapidly and configured easily, often by customers themselves.

The example below provides an insight in the kinds of business and technical challenges which await us in a world where services are advertised electronically, where negotiation to use services takes place over the network and where diverse systems have to be made to interwork at the very moment an agreement has been reached.

Work on federation is central to achieving interworking after negotiation. The first federation deliverable introduced here sets out the agenda of work to meet some of these challenges and displays early results.

## 2.1 Example: an electronic marketplace

In the Information Superhighway customers may seek a video on demand service. The search for such a service and the negotiation which is required to become a subscriber can be handled completely in the context of the Information Superhighway itself. This places severe constraints on the speed and flexibility of service provision, requires support for electronic advertising, and places a different emphasis on the way in which dissimilar systems may be federated.

One customer for instance already has a decoder and a television, a credit card account which she wants billed, and an interest in particular types of video films. She also wants to be able to block the screening of video nasties, and have access to her account to see how much is owed at any one time. There are many different video on demand services available. Different decoder technologies are in use, different picture sizes and qualities, different charging schemes, and a host of additional facilities. From the point of view of our customer, the only way to find out about differences between her requirements and those on offer along the Superhighway is by being informed about the other services. A shopping robot is employed to monitor the network and inform our consumer about new opportunities. This information enables her to choose a suitable service and the robot may help make decisions about how to overcome any differences (e.g. buy or rent a new decoder, install a new protocol, allow direct debit instead of use her credit card, etc.). Businesses who offer services require information about their customers so they can offer tailored services. If our customer wanted a subscription which could be redirected (during a holiday for instance), then a “special” may well be provided ahead of offering this as a general feature after negotiation by the customer (or her robot) with the service provider.

The way in which our customer finds out about services and then decides to subscribe is conveniently captured in a so called “shopping model”. In this model a customer has an incomplete specification of requirements. These are

refined as information about services becomes available, leading to a final decision to buy and if so what to purchase. Similarly, the service provider has an incomplete view of customer demands and needs to make decisions about what additional facilities to supply.

## 2.2 Negotiation and federation

In the above example, several systems have to work together to provide a new service for a customer. The dissimilarities between the customer's system and the available services require negotiation. Negotiation is a natural process, to which people are well accustomed. Computer systems are well suited to providing information necessary for negotiation and decision making.

## 2.3 Overview of deliverables

The Federation Manifesto [APM.1193] discusses:

- the challenge - the increase in numbers and in size of distributed systems, and the need to access information about other services at development time;
- the response - the federation technology to address diversity and the repositories to enable access to service information when it is required;
- the consequences - an enhanced model of trading in which services can be found with less information than before - the "shopping model";
- the technology required to support federation - notably the use of relational databases to support trading.

The "shopping model" extends trading so that it can be offered at all stages of the life of software components (objects in client and server roles). This leads to more information about objects, available in the system at all times. This in turn enables a number of other desirable features: increased consistency between systems and their descriptions, leading to simplified management, reduced running costs, more flexible configuration, and more customer friendly systems. There will be less duplication of effort through reuse of advertised components, resulting in shorter time to market and reduced development cost.

The adoption of the "shopping model" results in a different model of federation - rather than just systematising differences between systems, and developing mechanisms to overcome those differences, it involves the provision of information services which hold information about software components and their environments.

Such information services have to be extendable to deal with new information all the time. An initial information model is being developed starting from the model employed by existing ODP Trading Services. It will be extended to include information about remuneration (billing and charging for services) for instance. The Federation Manifesto [APM.1193] lists several key aspects of this information model.

The information service prototype is being built on technologies which can be extended (e.g. commercial database management systems). Where appropriate existing specialised information services are used. Examples of such services are name servers, existing trading services, interface

repositories, implementation repositories, information resource dictionary systems (IRDS), etc. Not all of these technologies can be integrated at once. A first step is to integrate an existing relational database management system (HP's AllBase) with ODP Trading Services in an OMG CORBA infrastructure.

The deliverable contains several documents describing the feasibility of this approach. [APM.1162] "Data Management for an Enhanced Trader" describes how relational database technology can be used in the provision of trading functions. In particular it tackles the difficult issue of representing a type hierarchy in a relational structure and how to support remote query language access in an object oriented distributed system. This last point is presented in greater detail in [APM.1138] "Remote Database Queries in Open Distributed Systems". As part of the selection process for a suitable distributed systems infrastructure for the prototype, a comparison between different Object Request Broker technologies was carried out. The study, reported in [APM.1194] "ORB comparison", is based on the technologies we could get access to. We will extend the comparison as and when further products are made available to us.

To test the validity of the results of work on the prototype and the model of federation, trading and interception, a series of micro-scenarios have been derived. [APM.1095] "Micro-scenarios for federation" is a repository of examples of situations in which obstacles to successful interoperation are highlighted. We will update this document regularly and we expect to include it in future deliverables. We would like input from sponsors to ensure that the examples are realistic. The ANSA objective for federation is to architect and prototype distributed computing technology; the policies executed by that technology will come from scenarios supplied by sponsors.

# 3 Technical Summary

The approach to federating diverse computing and telecommunications systems traditionally starts from the identification of one or more boundaries. Although differences between systems can be systematised, the assumption that a few standard mechanisms can be employed to overcome all differences in a running system is false, because such an approach takes the view that there exists a design authority which straddles all boundaries under consideration.

Assuming the existence of such a design authority becomes invalid in large customer oriented systems and in situations where authority to take decisions is delegated a long way down the organisational structure. In a large organisation, every profit centre has the obligation to serve their customers best. This often results in incompatible technologies, policies and management practices.

Discovering boundaries is no longer possible by appealing to some “domain manager”, since such a manager does not necessarily exist. Moreover, many sorts of boundaries exist and there are no guarantees that they coincide in places convenient to collocating gateway and interceptor technology.

Examine the following three ANSA principles:

- Objects are encapsulated and accessed via (well defined) interfaces
- Objects manage themselves
- Objects protect themselves

All three point to a level of autonomy for the object and its designer. The designer decides how an object is to offer a particular service and what management and security policies are appropriate. There is no requirement for a third party to impose a particular style. Any solution to the general interworking problem needs to be feasible in a system where no third party exists (even though in many cases there will in fact be such an entity).

If an object wants to use a service offered by another, or if a designer wants to make use of a service developed elsewhere, there is a need to know about the other object or its design. Knowledge about the other indirectly conveys knowledge about any dissimilarities which may impede cooperation. Knowledge about the difference does not exist in isolation. For instance, when an interface is traded, the interface reference contains information about the protocols in use by the server. A client object (infrastructure) decides on the basis of this information which, if any, common protocol to pick.

The encapsulation, management and protection principles imply that information about the way an object functions is private to that object. If it is necessary to have access to this information, it is necessary to access the object. But this is not possible without knowing about the object first. There is thus a need for an initial exchange of information to bootstrap the whole

process. In ANSA the Trading Service has been used to fulfil the initial information exchange.

## 3.1 Direction of work

The existing ANSA trading service supports a particular information model: it delivers an interface reference in return for an interface type (name/ description) and a set of property name/value pairs. It also restricted to operate in a run-time environment; there is no support for finding out about services much before trying to interwork (e.g. during the design process). To support the discovery of boundaries beforehand, we need a service which will support a richer information model: a component and environment description service.

This gives three immediate starting points for the work on federation:

- analysis of boundaries, including ways of representing information about components in a system, at all stages of the life cycle of a component in that system
- storage of and access to the information, so that decisions on the nature of any boundaries can be made at any time
  - — the use of database technology for storage and access
  - — the use of interface and instance repositories, name servers, and other related technology
- rules and recipes for the construction of mechanisms to cross boundaries
  - — static creation of such gateways and interceptors using tools
  - — dynamic creation using factories
- an evolving set of micro-scenarios to test the results of our work.

Full justification and details of this work are provided in the manifesto [APM.1193].

## 3.2 Issues not addressed in F1

The relationship between trading services and the various lifecycle services (especially object creation) has not been addressed in the F1 deliverable, neither have the relationships between traders and export policy controllers. These issues are, however, being addressed in current work within the federation group, and the results will appear in the future deliverables F3 and F4.

# References


[APM.1095]

"Micro-scenarios for federation", Gomer Thomas (editor)

[APM.1138]

"Remote Database Queries in Open Distributed Systems", Gomer Thomas & Rob van der Linden

[APM.1162]

"Data Management for an Enhanced Trader", Gomer Thomas, Mike Beasley, Yigal Hoffner

[APM.1193]

"Federation Manifesto"

[APM.1194]

"Comparison of CORBA-compliant Platforms", Mike Beasley