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ANSA Phase III

1994 - 1996 ANSA Workplan

ANSA

Abstract

This is the ANSA Workplan for the period October 1994 to September 1996.

APM.1275.01 **Approved** 9th September 1994

Marketing and Contracts

Distribution:
Supersedes:
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1 Summary

This is the ANSA Workplan from October 1st 1994 to September 30th 1996.

The work is divided into two principal areas.

The first is to successfully transfer the technology developed to date and as they mature, the results from this plan. This will be achieved by a variety of methods, including projects, training and consulting.

The second area is research.

So far ANSA has focused upon the methods for building distributed systems from multi-vendor, cross-domain, heterogeneous individual processing systems. In this plan, research focuses upon a higher level - how to build and make coherent multi-vendor, multi-service, heterogeneous networks.

A simile might be that the 707 was the first successful passenger jet aircraft, however it was the 747 which changed the world; in networks, the World Wide Web is the 707, ANSA's task is to discover the 747 and the difficult technological and managerial problems which it will present, and demonstrate solutions.

We shall continue our existing strategy of working in cooperation with other teams and harvesting university research where appropriate.

To meet the need for timely results, all workpackages are required to deliver significant results within 18 months of their commencement.

2 Research Vision

2.1 Electronic business

The combination of computerized information, interactive multi-media applications and broadband telecommunications is a springboard to new technologies spawning an electronic world of services supporting people going about their work, enjoying their leisure, protecting their health and many other aspects of life.

Whilst the desktop and domestic interfaces to the electronic world are in our grasp, the means to provide, deliver and manage services effectively remains elusive.

The technical challenge in achieving the electronic world is one of systems integration across:

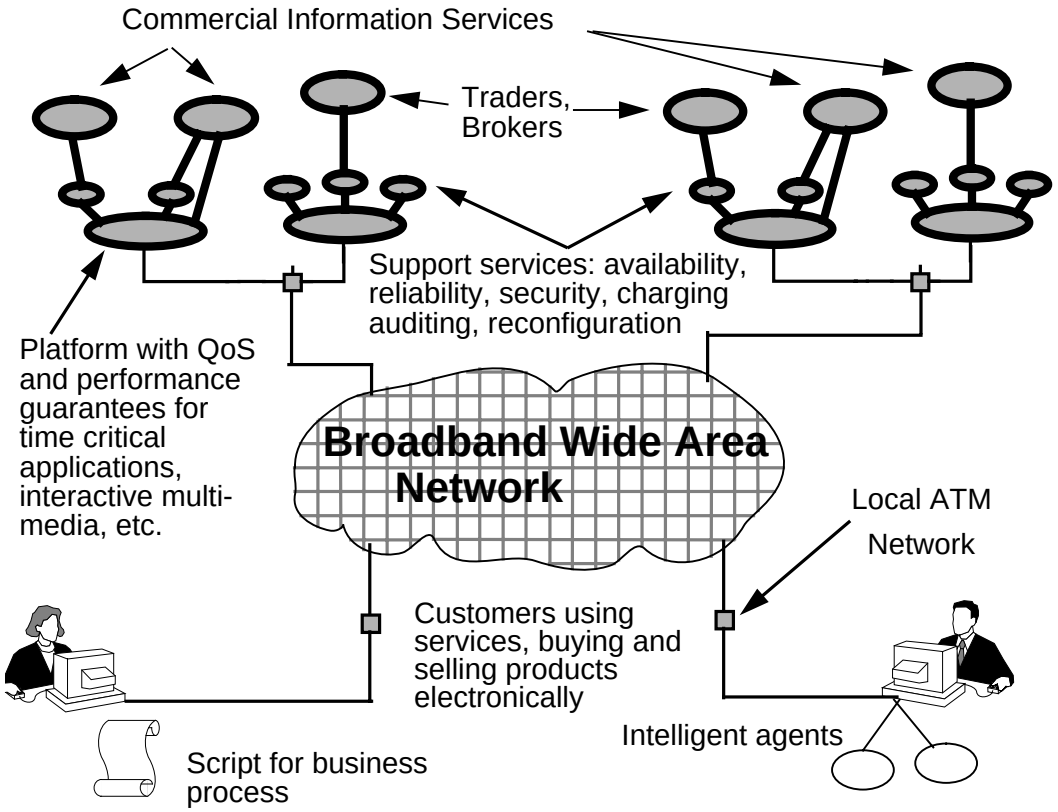
- information networking (e.g., the Internet and its emergent electronic market place)
- the desktop and workgroup (e.g., compound documents, workflow)
- broadband resource managed networks (e.g., ATM)
- interactive multi-media
- databases
- embedded systems (e.g., in cars, in medicine).

Federated, distributed object systems of the kind created by the ANSA architecture are the key to achieving this goal.

3 Scenario for research work

We have shown that a “scenario” or animation of the vision is beneficial in clarifying objectives and problems, and explaining the results. The scenario for this plan is Electronic Business, illustrated in Figure 3.1.

Figure 3.1: Electronic Business



The figure shows businesses using services, buying and selling electronically. It assumes universal, simple and inexpensive network connectivity, in a variety of public and private networks.

Today that connectivity is provided by the Internet: it is easy to connect to and cheap to use, but it offers few guarantees of performance, dependability and security, all of which attributes are essential for commercial use where substantial commitments of money, property, information and similar resources are made.

For example, to deliver interactive multi-media we have to look to the coming broadband wide area network where resource control will be in place and guarantees to deliver trustworthy, effective commercial services can be given.

As the broadband network expands, Internet connectivity will be one of many services it provides: a widely available, low cost, simple mode of access to traders and brokers for more demanding services.

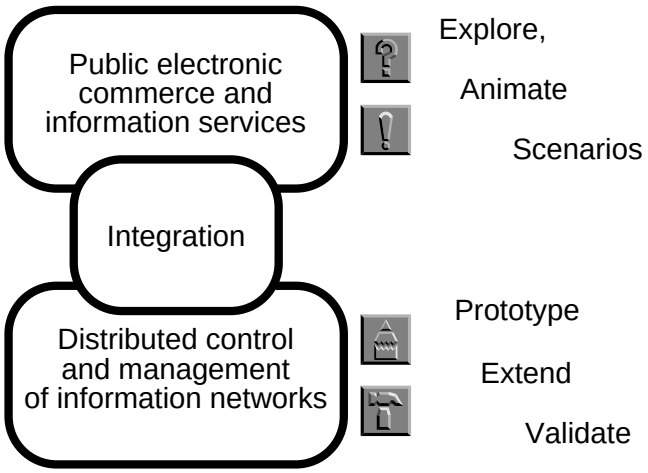
Organisations providing electronic information and services will be attached to the wide area network via local area broadband (e.g. ATM) networks containing servers running real time, dependable distributed object platforms.

4 Focus

There will be two key areas of focus, which are illustrated in Figure 4.1. In the diagram the upper section takes an application oriented view stressing scenarios, guidelines, animation and experimentation for public electronic commerce and information services.

The lower section of the figure addresses the technological requirements of distributed control and management of information networks, addressing core architectural issue of performance, dependability and scaling.

Figure 4.1: Activities



We believe that the key area on which to focus is applications interfaces between information services and networks, in part because both the upper and lower halves can be solved pragmatically in the short term but a long term solution, with appropriate support in industrial standards is needed for the “747 of information networks”. Developing these interfaces is a matter of distributed system architecture. They must offer portability, interoperability, resource control, quality of service and systems management.

The research work is divided into workpackages which follow the two areas of Figure 4.1.

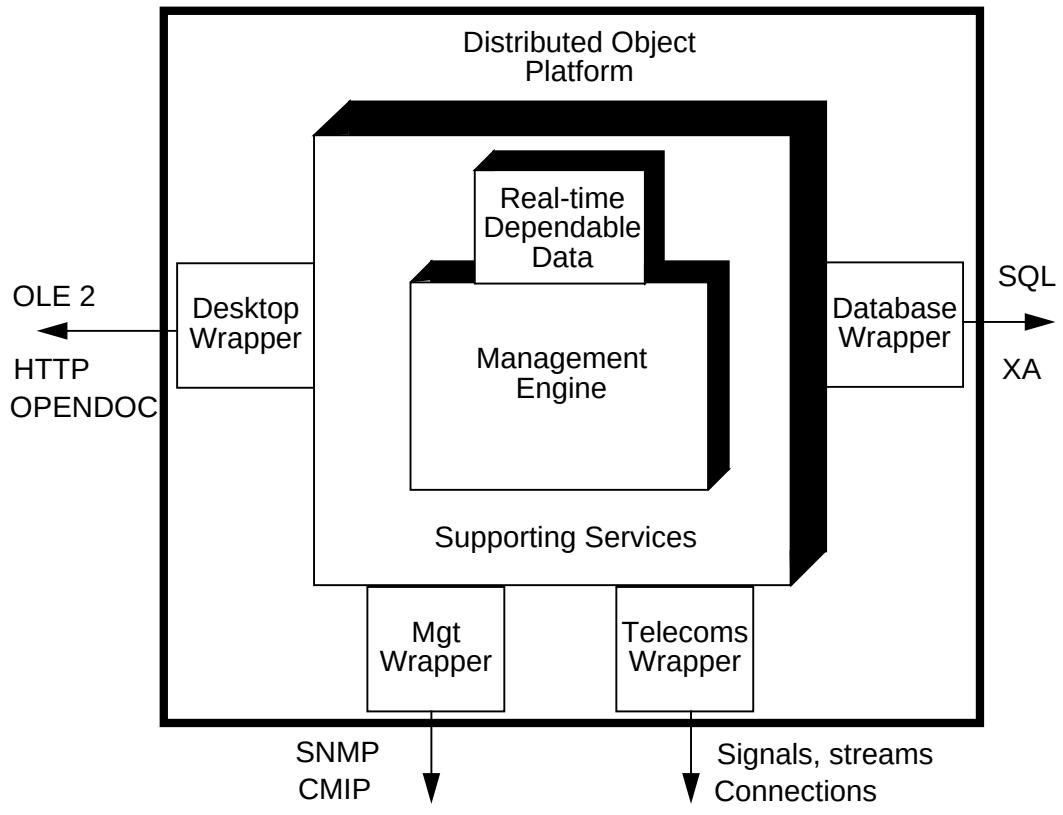
5 Key ingredients

Although not the exclusive or complete solution, we foresee two particular aspects of technology as crucial ingredients for the commercial success of heterogeneous networks.

5.1 Management engines for information services

An information service takes data from many sources, automates critical business processes and arranges for information to be presented to users interactively in an easy to use way. At its heart is mission critical, real-time, dependable data representing tasks in progress and a “Management Engine” coordinating those tasks and the resources of the underlying platform.

Figure 5.1: A Management Engine



The platform interworks with telecommunications, desktops, and databases using object wrappers that act as gateways or interceptors from the distributed object world to the standards and technologies for these other

functions. Since it has to support critical business processes, the platform must provide well defined quality of service guarantees to time-critical functions and enable dependable operation.

5.2 Brokers and agents

Even today users are increasingly becoming swamped with information and technology. In the future automatic observers and agents, realised in software, will act for users in their absence or when there are more important tasks to be done, monitoring events, looking for changes of importance to their owner, receiving data and giving reports.

For example, automatic brokers will help users find the information and services they need, and orchestrate business processes involving more than one enterprise or department. One method is for brokers to send transactional scripts across network for execution on the other parties' machines. For example, a customer may use electronic business to install a new operating system and a new set of applications on her computer, the software packages sourced electronically from several vendors. The broker provides a script that ensures that the installation takes place correctly and the organisation providing the broker service is paid commission by the vendors when the script is used.

Once again aspects of dependability, accountability, legality, time criticality and well defined quality of service are important aspects.

5.3 Something else

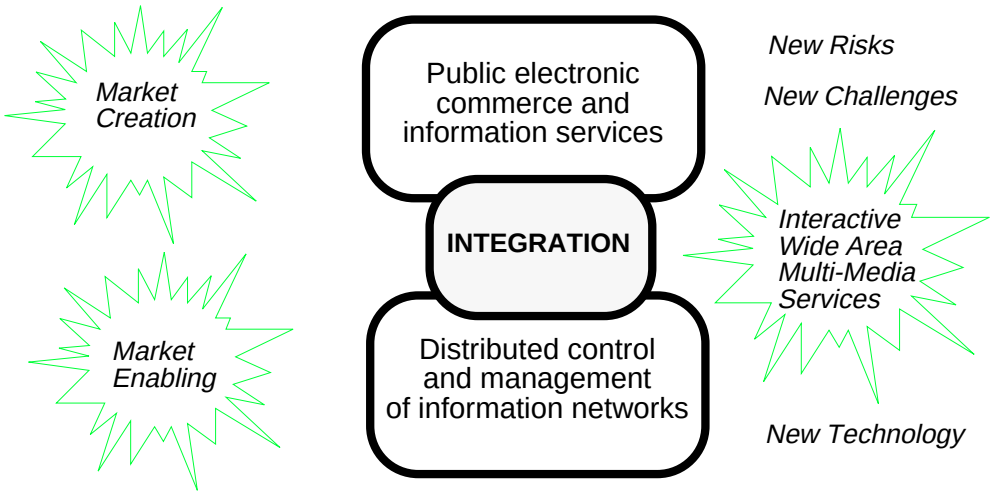
The development of information networking is fast changing - instanced by the speed of growth of the World Wide Web. We believe that during the course of this plan, some new key topics will emerge and the priorities will change. We shall therefore reserve resource for this contingency and for a timely means of identifying it.

6 Benefits

The research work will provide the following benefits:

- acceleration of creation of the market for information services
- understanding of the new challenges and risks of that market
- prototypes which provide proof of concept.

Figure 6.1: The market



By focusing on architecture and interfaces between the two areas of figure 6.1 the planned work will accelerate the ANSA sponsors development of interactive wide-area multi-media services.

The table below lists the key benefits.

Results	Enable	Benefit
Scenarios / animations for distributed commerce	New services; consensus and products	Revenue from new services; user confidence in services; avoid legislative backlash
Agents, scripting prototypes	Tools for service developers	Faster to market; better services
Management engine prototypes	dependable applications on open platforms	larger market for open systems
Federation prototypes	Controlled interworking; applications integration	Faster response to market change
Quality of service, performance prototypes	Interactive multi-media; distribution of, and into, embedded systems	Deliver time critical (interactive) services; access entertainment market

7 Workplan

7.1 Arrangement of work

The work is divided into four series of workpackages:

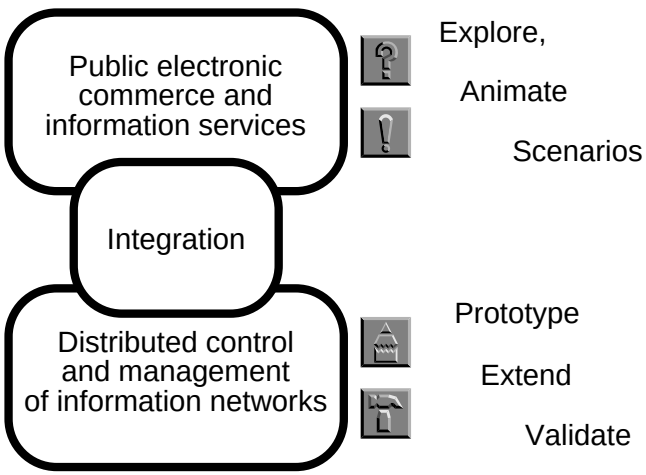
A Technology transfer of the stockpile of existing results including standards.

B Research addressing the upper part of Figure 7.1

C Research addressing the lower part of Figure 7.1

D "Something new"

Figure 7.1: Activities



Presently forecast division of the planned effort of 16-17 staff is:

- A series 30%
- B series 30%
- C series 30%
- D series 10%

An additional allowance is made for Programme Direction and for staff training and turnover. The Chief Architect's time is included in the staff level. Workpackages start with small staffing and grow as they become established; this growth is shown in the "Staffing" chart at the end of this plan by the two staff numbers separated by the "+" sign.

7.2 A series - Stockpile Technology Transfer

7.2.1 Focus

There is still much to do to achieve full transfer to sponsors of results from the work done so far in ANSA. The sponsorship package includes a defined number of “consultancy days” for each sponsor, with options to take additional days and this workpackage group provides effort for that work.

Increasingly the needs of this work are not common to all the sponsors, rather they are appropriate to individual companies or smaller groupings of one or two sponsors. This will also involve confidentiality - and this is provided for in the Phase III Contracts.

It is also convenient to place the standards work in this series, since once again the work is increasingly done for groups of sponsors rather than the whole consortium.

7.2.1.1 Workpackage: A1

Title: Technology Transfer

Objective: Take-up of ANSA results within sponsors.

Method: The methods of technology transfer may be:

a) Projects - where team members work on sponsor projects, such as Hyacinth

b) Training of sponsors’ staff in particular aspects

c) Workshops

d) Building of specific pieces of software for a sponsor.

Continuity: Uses all previous results as required, and new ones.

Results: Particular to sponsors. Additionally, where possible subject to confidentiality, the ANSA team members will produce:

a) reports on accomplishments and lessons learned

b) briefings, scenarios and animations to explain the approach and results

c) technical reports on the design

d) architectural reports on lessons learned, and the implications for other applications

Timetable: Continuous

7.2.1.2 Workpackage: A2

Title: Standards

Objective: Input to selected industrial standards processes

Method: Work to be selected and authorised by the Management Committee.

Continuity: Continues existing work, in particular on CORBA2 and Interoperability for the OMG. RM-ODP work will be completed by the end of Q1 95.

Results: -

Timetable: Continuous

7.2.1.3 Workpackage: A3

Title: Evaluation

Objective: Comparative assessments of various relevant technologies

Method: By experiment, often as part of other workpackages

Continuity: Continues existing work, the CORBA comparison having generated much interest.

Results: Reports

Timetable: Continuous, as required by the Management Committee.

7.3 B-series - Services

7.3.1 Focus

We will create an animation of support services which enable the competitive provision of dependable information services in wide area networks. These support services will enable the prototyping of Management Engines. They provide support for all aspects of the commercial information service lifecycle, including: reliability, availability, reconfiguration, service installation, caching.

The Distributed Information Publishing System [APM.1171] developed in the 1993-1994 Workplan provides a scenario for work to:

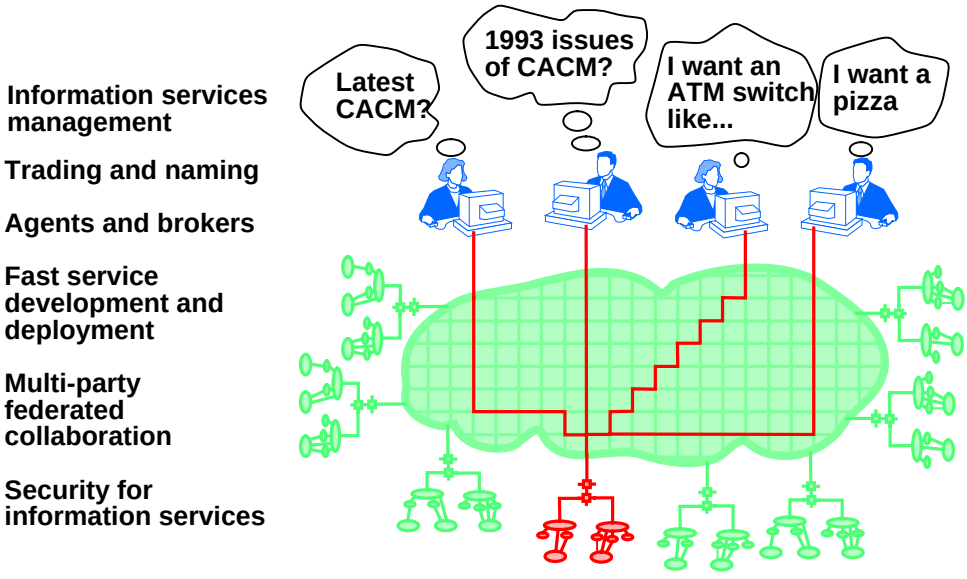
- validate architectural principles and real mechanisms for the construction of dependable applications
- investigate object replication versus object consistency techniques
- investigate interactions between high performance distributed object systems and remote information services
- investigate intelligent gateways between dissimilar environments (e.g. CORBA, the Internet, database management systems, transaction systems, and others)
- link the above into high performance distributed object platforms which can provide well defined quality of service guarantees.

In parallel we shall explore the software and supporting infrastructure required to support intelligent and automatic agents, including:

- scripting technology
- naming schemes which move beyond the current Internet to scalable heterogeneous networks
- brokering technology to find the right service
- agents and observers for coordination of multi-party business activities
- investigation of the commercial, legal and copyright (IPR) issues of networking commercially valuable information.

B-series workpackages assume access to a CORBA implementation, as this facilitates technology transfer and at some point we may need to insert dependability mechanisms “into” the CORBA implementation. Initial prototyping will be done using tcl/tk (a publicly available system).

Figure 7.2: B-series results



7.3.2 B-series Workpackages

7.3.2.1 Workpackage: B1

Title: Object wrapped information services

Objective:

a) A CORBA wrapper for the HTTP protocol and associated “resources” (named by HTTP URLs) enabling CORBA-based implementation of WWW information services.

b) Use of trading and advanced naming concepts to extend capability of HTTP URLs to embedded CORBA based applications and mobile resources.

c) An infrastructure to support work on Management Engines, and Scripts and Agents.

Method: This provides two ingredients for later workpackages: the information resources needed to drive the scenario in which the management engine is to be tested and an initial tcl/tk based infrastructure for the Management Engine.

Application animations based on WWW HTTP access and use of distributed object technology will require the application and demonstration of federation principles. The location of appropriate resources will require the application and demonstration of trading and naming principles.

Continuity: This work builds from 1993-4 plan deliverables D3: dependability engineering model and F4: interception.

Results: Software and prototype.

Timetable: Start: Now

End: 3/95

7.3.2.2 Workpackage: B2

Title: Management Engine

Objective: Develop architecture and concepts for

a) a “Management Engine” for dependability, providing the basic services to make the commercial information services highly reliable and available and also supporting in-service upgrades.

b) a “Management Engine” for distributed implementation of information services, e.g. facilities for cache management. This could be prototyped using Orbix to build a CORBA based cache manager for CORBA HTML files.

Both need to provide end to end services in a wide area network addressing such issues as:

a) what happens to customers if the local area network on which the service is sited becomes unavailable?

b) how to switch over to an alternative service?

c) how is such wide area redundancy managed?

In the longer term the management engine could be extended to include facilities for the following:

a) monitoring node load, thus enabling load balancing to achieve or maintain performance and QoS guarantees

b) high-level resource coordination to deliver end-to-end resource control in a wide area broadband network: making sure the service is as close as possible to where it is needed (by caching), making sure the broadband and local area networks collaborate to deliver the required end to end channel capacity.

Method: The work first builds on the infrastructure provided by the previous workpackage, to allow experiments with failure models and dependability mechanisms.

Secondly it build on results from the distributed control workpackages. Timed communications and rigorous quality of service guarantees make the detection of failures a more tangible task: it is not possible to distinguish between a failed service and a slow running service in the absence of bounded time communication. The binding architecture and prototype will allow time-outs (bounds on communication) to be fixed at bind time.

Continuity: There is a strong link with the current work on QoS architecture and engineering. Many of the topics were identified as important in a recent workshop, and documented in [APM.1220] and [APM.1233].

The work builds on 1993-4 plan deliverables D2: dependability management model and D3: dependability engineering model.

Results: Software and prototypes

Timetable: Start: 2/95

End: 10/95

7.3.2.3 Workpackage: B3

Title: Scripts and agents

Objective: The work will cover:

a) attribute and set based naming schemes for information services

b) agents and information brokering

c) script technology to coordinate multi-party business activities in a wide-area network dependably.

Method: This area grows the object wrapped information services to provide support for potentially mobile scripts and agents supporting multi-party information services and business processes.

Continuity: Builds on 1993-4 plan deliverables A8: Automated Transparencies for Dependability, D2: dependability programming model, and D3: dependability engineering model.

Results: Reports and examples

Timetable: Start: 12/94

End: 12/95

7.4 C-series - Control

7.4.1 Focus

We shall focus on architecture for distributed services management, service binding and service quality and resource management at a level of abstraction consistent with the applications programming interfaces found in current distributed object computing systems such as ANSAware, Microsoft's OLE 2, the Object Management Group's CORBA standard and Bellcore's INA.

Workpackages will address

- the extensions that are needed to current distributed computing object models, and their manifestation in applications programming systems
- the additions and extensions that are needed to supporting services for distributed services management (e.g. the ANSAware / INA trader, the OMG repositories), including additional functions
- the extensions needed to current distributed object computing infrastructures to enable interworking between them (e.g. support for multi-protocol ORBs, interception mechanisms)
- the extensions needed to current distributed object computing infrastructures to enable fine grained control and monitoring of resources to give integrity to quality of service guarantees
- the linkages between supporting services for distributed services management and fine grained control and monitoring of resources into an overall distributed system.

The work will use the ODP object model, and the work to date in ANSA on trading, configuration management, explicit binding, quality of service management and performance management as a baseline.

The planned work will

- detail and animate the architecture outlined above
- develop prototype technology that shows what has to be added to current distributed object computing systems to meet the above requirements
- identify strategies for enhancing the manageability, performance and predictability of current distributed object systems and their supporting operating systems.

We plan an incremental stream of architecture and prototype technology primarily directed at sponsor's broadband interactive multi-media development projects.

The emerging industry standard for distributed systems platforms is OMG's CORBA and we shall use this for service building where possible and whilst it remains appropriate. These services would include:

- integrated trader, repository and life cycle services for federated systems
- interceptors for interworking.

APM.1059 showed that real-time functionality could not be added on top of a CORBA platform and would have to be built-in to it. Therefore we have assumed that we shall obtain a source licence to a CORBA product and help that CORBA vendor extend its product, and that the Management Committee will select the CORBA to be used. If a suitable choice is not made in a timely manner, we could to build our own. The necessary extensions to CORBA include:

- provision for multiple protocol stacks with selective multiplexing from the link layer to the application layer
- time bounded protocols
- explicit binding and QoS engineering
- resource separation and independent scheduling
- dependability mechanisms
- ability to map onto any suitable real-time technology

The ORB interoperability work should provide a basis for interworking between a real-time CORBA and other CORBA products.

Neither ANSAware nor current CORBA products provide programming support for streams, synchronous programming, explicit binding or extensible types, all of which are key components of the ANSA performance framework (see APM.1137). Therefore technology must be developed including:

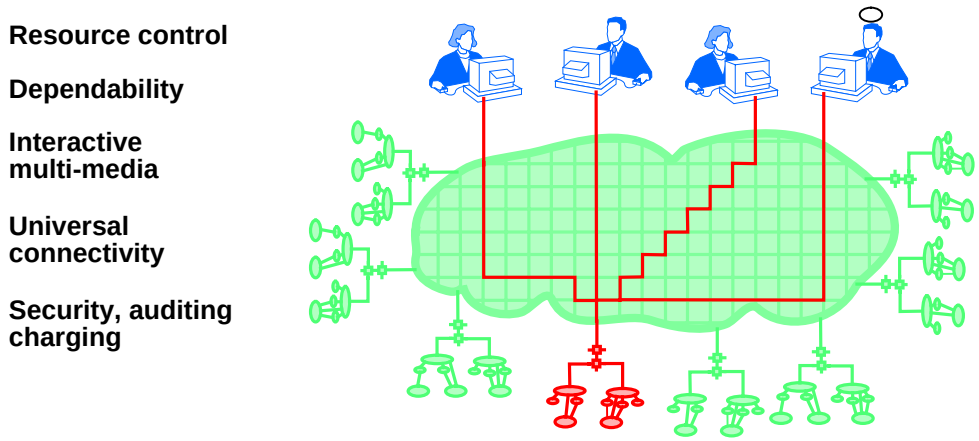
- libraries, macros or extensions for C++ which adds stream, signal, binding and synchronous programming related concepts
- a type inferencer and type conformance checker for operation, stream and signal interfaces, so that interfaces are extensible and support subtyping

- C++ libraries wrapping the engineering support
- an implementation and interface repository which supports objects using signal and stream interfaces as well as operational interfaces.

We will use Abstract Syntax Tree techniques in the implementation of the repositories to keep components as independent as possible and to allow cross ORB and cross language working.

Example areas in which the results should contribute to infrastructure products are shown in Figure 7.3.

Figure 7.3: C-series results



7.4.2 Workpackages

7.4.2.1 Workpackage: C1

Title: Federation and life cycle

Objective:

a) ORB interoperability - including consultancy on OMG input, and impact on CORBA repository architecture

b) integration of trading and repository services with life cycle services to provide federated object management.

Method: First generation OMG object services for life cycle and naming have been defined, however extensible schemes for trading and managing distributed objects in federated systems have not been forthcoming because of hard technical problems that rule out current solutions, and also the lack of coherent architecture.

Continuity The work builds on the 1993-1994 workplan deliverable F3.

Results: Reports; standalone prototypes; implementation through sponsor projects.

Timetable: Start: Now

End 3/95

7.4.2.2 Workpackage: C2

Title: Architecture for distributed interactive multi-media

Objective: Architecture for:

a) explicit binding of interfaces, including streams, including end-to-end definition of QoS

b) interfaces for interaction with a wide range of multi-media sources (signal interfaces)

c) synchronization of activities driven by streams and signals

d) orchestration of composite media across individual streams

e) dependability and performance aspects, including resource separation, independent scheduling, timeliness in failure detection, bounded recovery mechanisms, high performance redundancy management, and high performance recording mechanisms.

Method: Build on the concepts defined in ODP and TINA-C, using existing results to develop a full architecture, scoping the application programmers' interface and the structure of the supporting engineering. Issues of multi-media presentation and storage are our outside the scope of the work.

Continuity: -

Results: Reports, examples.

Timetable: Start: Now

End: 3/95

7.4.2.3 Workpackage: C3

Title: Engineering for distributed interactive multimedia

Objective: Validate the engineering aspects of the distributed interactive multi-media architecture of workpackage C2.

A prototype will be built showing:

a) an extensible distributed object run-time environment optimised for use in real-time systems (derived from ANSAware)

b) signal handling and signal synchronization

c) end-to-end quality of service negotiation and set up

d) performance and dependability features.

Method: Builds on Workpackage C2

Continuity: From C2

Results: Working prototype

Timetable: Start: 1/95

End: 6/95

7.4.2.4 Workpackage: C4

Title: Application programmer's interface for distributed interactive multi-media

Objective: Present the applications programmer with a clean high level interface to the engineering developed in C3, using the ANSA

principles of “Abstract and Automate”. It is part of the validation of the architecture developed in C2.

Method: The work is in two stages:

a) Develop technology to support an extensible interface repository (i.e. conformance based type checking) and an extensible implementation repository (i.e. abstract syntax tree support).

b) Develop extensions to C++ preprocessors and libraries to support streams, signals, explicit binding, QoS management, synchronization and orchestration.

Continuity: This workpackage is complementary to C1 and will proceed in parallel.Workpackage (a) is a continuation of the 1993-1994 plan deliverables F3 and F4.

Results: Software, examples

Timetable: Start: now

End: 7/95

7.5 D-series

With the dynamic growth of multiple networks we forecast that topics and priorities will change quickly and that new items will appear. This workpackage provides effort for such work and a means of identifying it.

7.5.0.1 Workpackage: D1

Title: Something New

Objective: TBD

Method: The Chief Architect and Programme Director, with assistance from the sponsors, will select a small group of senior advisers from industry and academia to meet with the Chief Architect from time to time to identify candidate topics for research and select those to be further investigated.

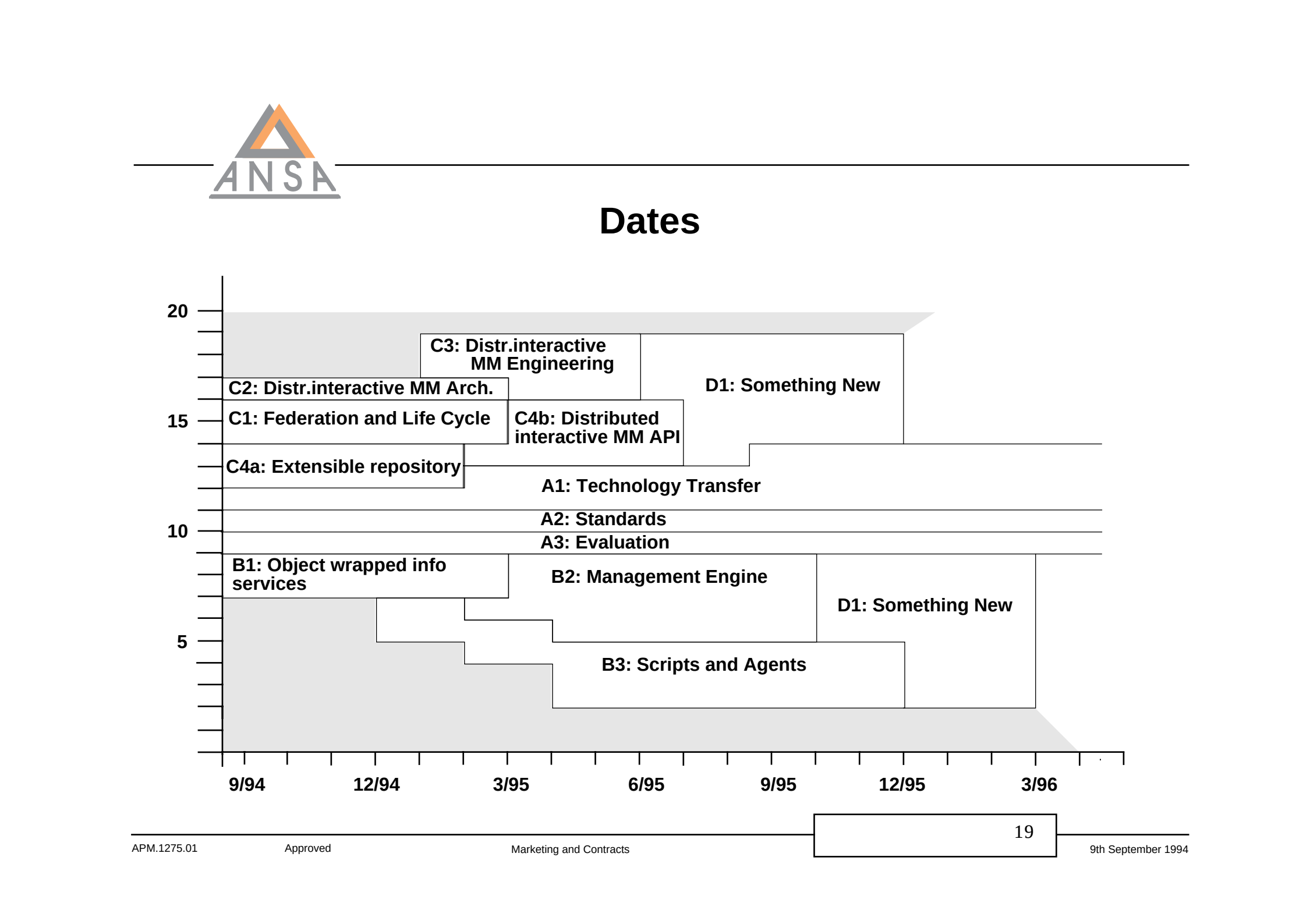
Continuity: --

Results: TBD

Timetable: Working Party starts Q4 94

Start: c mid 95

End: TBD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Dates

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C3: Distr.interactive MM Engineering
C2: Distr.interactive MM Arch.
C1: Federation and Life Cycle
C4b: Distributed interactive MM API
C4a: Extensible repository
D1: Something New
A1: Technology Transfer
A2: Standards
A3: Evaluation
B1: Object wrapped info services
B2: Management Engine
D1: Something New
B3: Scripts and Agents
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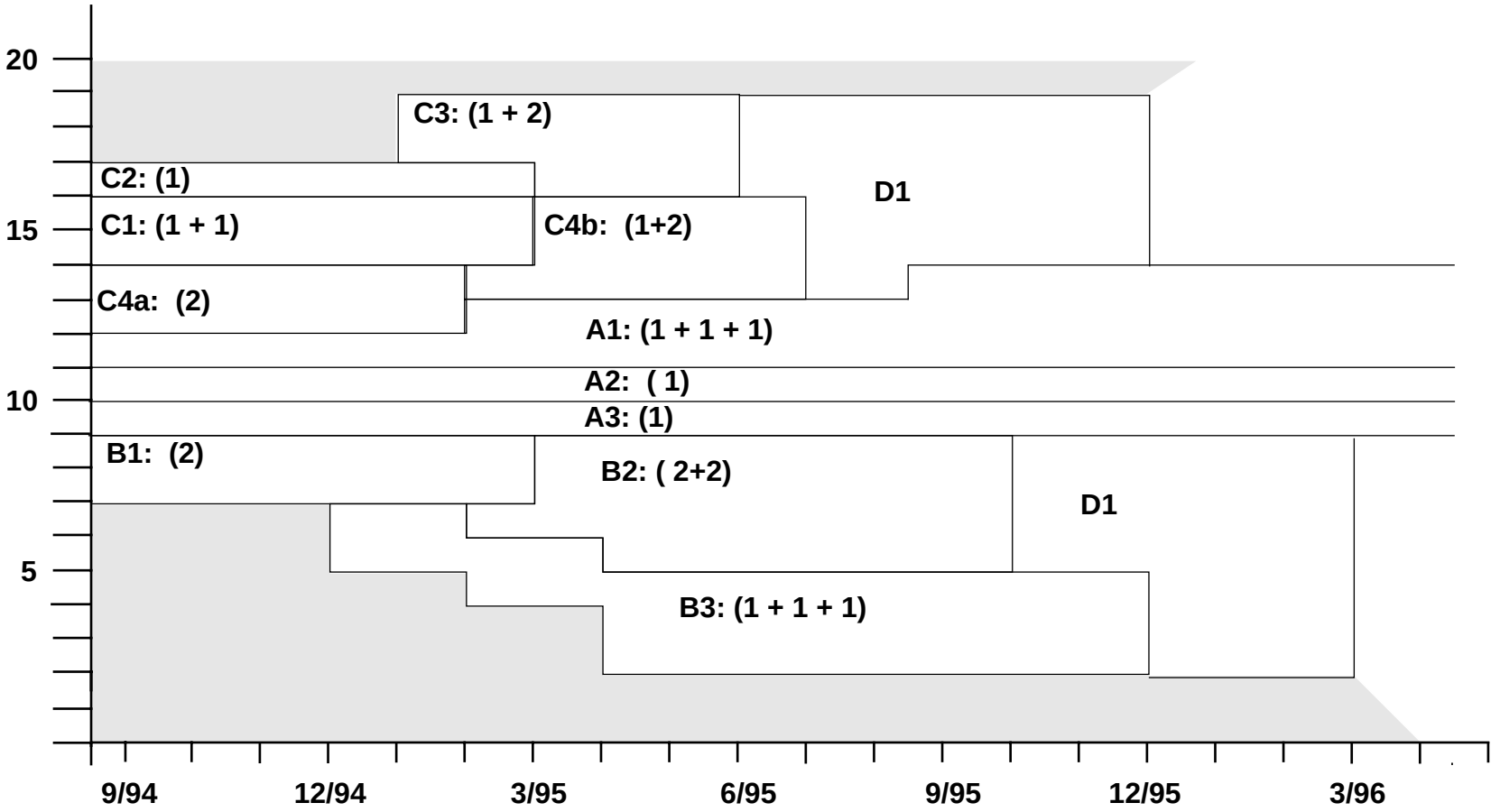
Staffing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