REVIEW OF

ESPRIT PROJECT 2267

INTEGRATED SYSTEMS ARCHITECTURE

ISA

Final Project Review

held on 26 February 1993
at
BNR Europe, Harlow, UK

Date: 5 August, 1993
Classification: Commercial in Confidence
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1. INTRODUCTION

The final review meeting of the ISA project, which is reported here, took place on the 26 February 1993 at BNR Europe, Harlow, UK, who kindly hosted the meeting. The meeting reviewed the last year of the project.

Because of the good progress shown at the previous review, and for the sake of the efficiency of work, no further intermediate review meeting had been arranged. This enabled the consortium further to concentrate on the preparations for the ESPRIT conference 1992.

One of the reviewers, Prof. Danthine, was, unfortunately, unable to attend. No replacement could be engaged.

2. PROJECT OVERVIEW

This section presents an overview of the project at its current stage, i.e. after the end of the project. It summarises the facts as well the achievements as they have been perceived by the CEC and the reviewers. This text will be the basis for internal and external reporting about the achievements of the project. If there is any reason to update it, an updated version should be sent back as soon as possible.

2.1. Project Dates

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Project History

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<td>Fifth Review Meeting:</td>
<td>21 and 22 Jan. 1992, SEPT, Caen</td>
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<td>26 February 1993, BNR Harlow</td>
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<td>End of project:</td>
<td>28 February 1993</td>
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2.2. **Consortium**

BNR Europe Ltd.  
Architecture Projects Management Ltd.  
British Telecom  
CASE  
Digital Equipment  
GEC Marconi  
GPT  
Hewlett-Packard  
ICL  
Ericsson Telecom  
Chorus Systèmes  
CTI, Patras  
GESI  
ORIGIN  
Thomson-Syseca  
Voest Alpine Stahl Linz  
Alcatel Austria Elin  
Univ. of Newcastle  
SEFT/CNET  
Univ. of Paris 6  
Euroclid  
AEG/ATM  
Siemens  

Coordinator  
Subcontractor/  
Core Lab  
Associated Partner  
Associated Partner  
Associated Partner  
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Associated Partner  
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Associated Partner  
Associated Partner  
Subcontractor  
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2.3. **Background**

The ISA project was a continuation of the former ANSA project (1984-1988) developing the Advanced Network Systems Architecture within the UK Alvey Information Technology Programme. In the ISA project most of the original sponsors of APM were joined by partners of the European Community and also of EFTA countries, with the aim to disseminate the results of ANSA all over Europe and therefore to strengthen Europe's position in this area. The architecture continues to be known as ANSA.

The ISA project was one of the major projects of ABHSP in the area of distributed systems and is believed to have a strategic impact on the whole Office Systems area. It began in March 1989 and ended now four years later. The consortium had established a core laboratory at the site of APM at Cambridge. Own and seconded staff was working on the ISA project. The aim was to be a centre of excellence in distributed open systems. The Core Laboratory employed the Chief Architect, the Project Director and other key staff on behalf of the partners. The tasks which it undertook were selected and controlled directly by the partners, who either subcontracted their work on the project to the laboratory or carried out some of the remainder by seconding staff to it. In this way, BT, DEC, HP, GEC/Marconi, GPT, ICI, CASE, BNR Europe formed part of the core team.
The other partners collaborated within the project, but outside the core team. They were partly autonomously contributing to the development of the architecture, partly they were using the results of the core team in order to build another functionality on top, or to turn it into applications. An exchange of people took also place between some of these companies and the core team.

A first contract had been issued for a period of 2 years. As from 1st March 1990, with the first contract amendment, the ISA project was extended to include new partners and new tasks. The formal links with the COMANDOS project have been increased by means of joint tasks which appear in the extension task list of ISA and in a complementary task list in COMANDOS. The new tasks are known as ISAX and were attached as section III to the Technical Annex. It brought new partners to the project, namely CNET, GESI and Thomson-Syseca. A second amendment of the contract covered the project up to its end.

2.4. Objectives

The theme of the project is the Advanced Networked Systems Architecture (ANSA). This architectural framework is generic, optimisable and independent of special vendor systems.

The objectives of the ISA project were reflected in three categories: Firstly Coordination and Dissemination, then Technical and finally Demonstration Objectives. These objectives imply some activities which are associated with the name ANSA:

- Architecture: Development of an architecture for building distributed systems, in the form of an integrated set of structures, functions, design recipes and implementation guide-lines.

- Software: Development of software to demonstrate and validate the architecture (the ANSA Testbench or ANSAware).

- Standards: Contribution of ANSA results to international standards.

- Technology Transfer: transfer of the architecture and Testbench as a technology to both the sponsors of ANSA and to the community at large.

2.5. Actual Results Identified

The architectural framework has been provided as input to Open Distributed Processing (ODP) of ISO (International Standardisation Organisation). The ISA project successfully influenced standards, especially the Basic Reference Model of ODP, by participating in ISO/IEC JCT1 SC21 WG 7 and WG 6, or in the Distributed Application Framework of CCITT. Partners of the project were acting as rapporteurs. ISA has provided the focus and impetus of the ODP standard. The industrial partners are convinced that their standards contribution will benefit their business goals. The ISO ODP Reference Model is now (June 1993) adopted as a draft international standard (ISO 10746), which is a major ISA achievement.
Progress could also be achieved in the area of industrial standards. In OSF, ANSA is strongly considered for long-term perspectives. In general, a good acceptance has been recorded.

As a reference implementation of the architecture, the Testbench has been developed. This is a software suite in the form of a beta release, as the official project deliverable. The Testbench is - outside the funded project - further developed into ANSAware, which has the beta test corrections incorporated and full documentation, and which is licensed to outside organisations. Currently, ANSAware 5.0 is being prepared. The software shows a high performance, it runs on UNIX, MS-DOS, VMS, and other operating systems, in total on 14 different operating systems. It is even being ported to a multi-processor system for real-time process control. Various other applications are developed. A variety of network protocols is supported.

These achievements have been documented in an excellent way, in a series of public documents. The overall documentation consists of the final progress report, the exploitation report, 24 ANSA booklets, and the document and software baseline.

A high standard of collaboration has been achieved between the three projects ISA, COMANDOS, HARNESS. All three projects could take benefit from each other, and laid the foundation for further development and industrialisation of the results of this area.

The project exhibited at the ESPRIT Conference 1992, on a stand jointly staged with the Comandos, Harness and ISA-Demon projects, which is a further sign of their intense collaboration. The project's principal exhibit was arranged by GESI and featured a live demonstration of their hospital demonstration. A video showed the achievements of the area. Further highlights in applying ANSAware have been the NASA data system (see section 2.6), and the Italian hospital applications; the results of ISA are utilised in the EDITH project (EP 7508).

The core team at APM in Cambridge has been established as a centre of excellence. Several working groups have been founded, own and seconded staff was employed to contribute to the success of ISA. Several workshops accompanied the project and transmitted individual results to the entire consortium. They were also attended by other projects.

2.6. Exploitation

Standardisation was one of the main objectives of the project. In particular, the work of ISO/IEC JTC1/SC21/WG7 on the standardisation of the reference model for ODP has been heavily influenced by APM supported by consortium members as appropriate, who are also influencing national standards. Part of the standardisation work has been carried out outside of the project. The ISO ODP Reference Model is now (June 1993) adopted as a draft international standard (ISO 10746), which is a major ISA achievement.

The project aimed also at approaching industrial standards bodies such as the Open Software Foundation (OSF), the Network Management Forum (NMF), the Object Management Group (OMG), Unix International and X/OPEN. The consortium have intensive contacts with these organisations. One member of
the core team has been invited to lead the OMG Task Force on CORBA 2.0. Already OSF's DCE, and CORBA 1.0 have drawn heavily on ANSA results.

The work of the core laboratory is being continued, 100% industrially funded, by most of the former ISA partners, and also other companies which now support the further development of ANSAware. This continuation is called ANSA Phase III, and has an international horizon. It has been fully operative as from March 1993.

Links with other ESPRIT projects like COMANDOS, MULTIWORKS, CIM-OSA, and CNMA contributed to the propagation of ANSA. Relations have even been knitted to RACE projects, predominantly ROSA. These and other ESPRIT projects are using ANSAware. Strong relations to product making companies have been established. Results have already been incorporated into future products by the partners. The results of Phase III of the ANSA Workprogramme would be made available to future CEC projects at advantageous rates.

One of the greatest successes of the ISA project was the adoption of the Testbench by NASA. Announcing it, the NASA administration said "it was the dawn of a new age of information systems architecture and utility". The Testbench is included in the Astrophysics Distributed Data Service (ADS). The objective is to make the results of all NASA's space projects openly available to the NASA research community worldwide, which is done by connecting up all the computers as a Distributed System.

By the end of 1990, 3,500 user computers and workstations located all over the United States had been incorporated; these included PCs, Sun, HP and DEC workstations and computers, running many different operating systems - MS-DOS, HP-UX, SunOS, Unix, VMS, Ultrix - each having ANSAware installed. Over the next two years the systems will grow to incorporate over 100,000 users. This is the largest open distributed system in the world!

The first public demonstration of the ADS was made in Brussels at ESPRIT '90 when five different makes of computer were shown working on line as nodes in the system, via satellite links to the USA.

APM is also pursuing technology transfer programmes to promote the further adoption of ANSA. ANSA has meanwhile obtained a world-wide reputation. APM has commenced a programme of introducing ANSAware to as many universities as possible, which has continued to be a success. Further dissemination activities include reference material and design assistance, as well as an executive briefing developed by APM and directed at senior IT strategists. Siemens promotes ANSA by providing consultancy to other Siemens branches, which are building process information and control systems for power plants.
3. PROJECT REVIEW

Review meeting date: 26 February 1993
Location: BNR Europe, Harlow, UK

Partners Present

Dieter MATEJKA
Henry KRECIOCH
Kwaku FRIMPONG-ANSAH
Michael EYRE
Andrew HERBERT
Rob VAN DER LINDEN
Harold TOZE
Dave OLIVER
David LEARMONTH
Tony BENCE
Didier IRLANDE
Vassilis KALLISTROS
Gunnar JÅRNBerg
Jean-Bernard STEFANI
Enrico MELIS
Davies IAN
Graham HOOK
Chris PHOENIX
Cock VAN DORSSER
Pierre TOUZEAU
Markus KOLLAND
Elisabeth DAVID
Magnus ANDERSON

Reviewers Present

Manuel MEDINA
Neville HARRIS

CEC Project Officer

Ulrich BOES
Agenda of Review Meeting

09.00 Private Meeting of Reviewers
09.30 Welcome and Introductions (BNR/CEC)
09.45 Overall Review of Project
  • Achievements/Results/Deliverables (Technical Aspects, Standards, Dissemination, Marketing)
  • Highlights
  • Financial Aspects/Resources
10.30 The Future: ANSA Phase III
10.45 Individual Achievements and Expectations for Exploitation: What have we got out of ISA?
  1. Summary of Core Supporting, Partners' Benefits (BNR Europe)
11.30 2. The other industrial partners: (15 minutes each)
  • AEG
  • Alcatel ELIN
  • Chorus Systèmes
  • Ericson & Televerket
  • GESI
  • Origin
13.00 Lunch
14.00 Continuation:
  • Siemens
  • Syseca
  • SEPT
14.45 General Discussion
15.00 Reviewers' Deliberation
15.30 Reviewers' Comments, Concluding Remarks
16.00 Close of Meeting
4. REVIEW CONCLUSIONS

4.1. Introduction

This review meeting covered the last year of the ISA project. The following sections present the conclusions drawn by the European Commission after the review meeting. It is based on the reports of the reviewers who kindly assisted and consulted the CEC during this review process. The details will be found in their attached reports which should be further consulted.

4.2. Importance of Project Objectives

The objectives of the ISA project are very important and commendable, they have not changed since the beginning of the project. They comply with the ESPRIT objectives and have now led to results which strengthen Europe’s position.

4.3. Adequacy of Effort and Management Structure

The core team in Cambridge has been from the beginning a novel and unique structure to run such a project. The core team continues to deliver excellent results and has been developed into a centre of excellence.

The consortium contained a large number of partners, some of which are directly linked to the core team, others are not directly connected and carry out separate tasks. The management of the project showed its ability to cope with this complexity.

4.4. Achievement of Objectives

The project has progressed very well and well achieved its objectives. The consortium have progressed the technology of Distributed Systems at exactly the correct speed as the reviewers pointed out: not too fast in case industry is left behind and not too slow to make the technology uninteresting.

The consortium has disseminated the results out to Universities, research institutes and to companies outside the ISA consortium. In addition, they have achieved a considerable impact on formal standards.

The exchange of people within the project has to be appreciated because it helped to promote the technology within the project. This is also achieved by the workshops held.

The collaboration between the three projects ISA, COMANDOS, HARNESS has made good progress, in accordance with the work plan. ISA and COMANDOS are laying the grounds for an implementation of the interworking between ISA and COMANDOS, which will be realised in HARNESS.

4.5. Collaboration between Partners

The collaboration between the partners remained to be excellent.
4.6. **Quality of Deliverables**

The quality of the documentation is very good. The final documentation of the project is just an example of the high standard set by this project.

4.7. **Response to previous Suggestions**

The consortium's responses were appreciated.

4.8. **Recommendations for Action and Changes**

Since this was the final review of ISA, no recommendations could be issued any more.

4.9. **Conclusions**

The ISA project proved to be a very important, strategic and valuable project. It has disseminated the results of ANSA into the European Community and even outside the Community and has strengthened European competitiveness. The project has shown a significant impact on distributed processing, and it clearly contributed to establish and hold Europe's lead in the area of distributed systems. In this case, ESPRIT was a means to stimulate the advance of distributed systems, and successful exploitation in this area.

The overall progress as well as the final achievements are appreciated and are approved.
ANNEX 1

Synopsis of the Project

End-users are increasingly indicating a need to move away from a single-vendor central IT system policy and towards multi-supplier distributed systems. This growing market trend offers an opportunity to turn the fragmentation of the European IT industry into a strength by developing a standard generic architecture for such systems, enabling integration and interworking of applications from a wide variety of domains using heterogeneous equipment from multiple vendors.

The existence of an architectural platform for distributed systems creates important opportunities for European suppliers. It can be exploited not only by the major product-supply companies but also by skilled niche-suppliers, enabling them to integrate their products into a wide variety of IT systems and facilitating their ability to produce integrated multi-supplier offerings. By leading in the development of the architecture important advantages are gained, such as an early ability to produce conformant systems.

The ISA project developed and demonstrated such a generic architecture for Open Distributed Processing (ODP) in multi-vendor multi-domain heterogeneous systems.

As systems become distributed, the future of IT lies in the ability to achieve integration of computing and telecommunications; the ISA consortium had been structured to include strong representation by companies in both sectors so that each could benefit from the experience and insights of the others, and so that the architecture could cater for the needs of both.

ISA had three important themes: interworking, integration and standardisation. ISA enabled the integration of systems from multiple vendors by creating a set of common architectural constructs for distributed systems and by using these constructs in the development of standards. Achievement of integration has been proved by practical demonstrations of heterogeneous applications interworking via the software platform.

The objectives of the ISA project were to:

- develop an architectural reference model for Open Distributed Processing that will enable standards to be defined that are common to all application domains
- stimulate the generation of, make contributions to and encourage the adoption of the necessary standards
- demonstrate the practicality of integration and interworking using the architecture and associated standards
- provide a focus of expertise in ODP.

The architecture places important emphasis upon "evolution not revolution", so that existing systems may be encapsulated and incorporated; it must incorporate existing programming languages and many different operating
systems and infrastructures while at the same time making proper provision for future developments. In order to provide a common focus the project had established a "core laboratory" in Cambridge, where staff from partners' companies may meet and work together.

Different applications (for example, office, CIM, CAD, telecoms, network management, corporate information systems) require appropriate levels of functionality from the architecture and an ability to optimise it for a particular domain and emphasise suitable quality attributes, such as response time, throughput, security and robustness. This required an approach which pays careful attention, for example, to corporate goals and managerial issues, enabling their requirements to be described by means of viewpoints or projections of the architecture. Multi-media aspects, both in distribution and computation, had a key role in ISA, as had the ability to scale upwards to multi-country distributed systems and the need for federated management.

The project focused on the architecture, interfaces, platforms and standards and on transferring the technology into demonstrators within product development divisions in the partner companies. The major deliverables from the ISA project were:

- the architecture, which is known as ANSA,
- reference, architect, designer, programmer and user manuals,
- standards for the architecture and ODP,
- a software suite consisting of the architectural platform and the necessary tools,
- demonstrations of key features of the architecture
- the transfer of the technology to the project partners and other projects.
APPENDIX A:  Review Report of Prof. N. Harris
APPENDIX B:  Review Report of Prof. M. Medina
The ISA Esprit project was extremely successful. The project achieved its objectives as set out in the technical annex namely:

**Coordination and dissemination objectives**
The consortium has achieved more than any other Esprit project, that I'm aware of, in its contributions to international standards and also in its information dissemination. The recent publication and dissemination of twenty five architectural and technical reports is just an example of the high standard set by this project. The technology transfer arising from this project has raised the distributed processing technical horizons not only of the companies within the project but the horizons of many companies throughout the world. In addition a sizeable body of expertise has been built up in the project which has permeated and influenced many companies throughout the world.

**Technical objectives**
The ISA consortium developed an open distributed processing architecture. They promoted this architecture by publications, conferences, workshops, through standards bodies and by personal contact with many companies.

**Demonstration objectives**
The core laboratory produced a reference implementation which was used by companies both inside and outside the consortium as the basis for products. Some of the highlights have been the NASI data system and the Italian hospital system.

As already stated the project has been extremely successful but the benefits of the project will continue to be realised during phase III of the project. A high technology core company has been founded with a federation of participating companies all with the same goal namely to exploit (ie to make money) out of distributed processing products. The ISA project set the foundation and major exploitation rewards will now be harvested.
ISA REVIEW REPORT (ESPRIT 2267)

Barcelona, 10th of March 1993
By Manuel Medina / DAC / UPC

1. GENERAL IMPRESSION

The most relevant point to highlight of the results of the project is the signature of the agreement of the, so called, "Phase III". This consortium agreement guarantees both the continuation of the work, to maintain updated the ANSAware platform, and the dissemination of this work, at least, within the members of the consortium. The consortium includes (up to now) some of the most important computer manufacturers (DEC, hp, ICL, ...) and system integrators (BNR, GEC, ...) in Europe, among others.

During the project life, a lot of effort has been devoted to the dissemination of the project results, mainly thorough the core team effort. These efforts have had, at the end of the project, the following results:

* ANSAware, "the testbed", spread through more than 100 different sites and companies. It provides a unique tool to experiment the development of distributed systems.

* The ODP standard, that has progressed with the project up to the DS status, and will soon be accepted as IS. I personally consider, that without the public money used to work on it, the so long effort could not have been supported by a private company.

* The contributions to other industrial standards, such as CORBA or OMG, mainly with the experience obtained in the development of the platform.
To finish, some books have been published, collecting the ideas developed in the project, and possibly other books will emerge from other partners.

From the managerial point of view, I have to remind our thoughts and doubts about the future of the project, at its beginning, when we saw a relative big partner (the core team: APM), surrounded by so many little satellites (the others). Now we can see, not only the success of the project to integrate the work of most of the partners in the testbed, but also the exploitation of this idea by the own CEC, through the potentiation of the "centers of excellence".

2. ACHIEVEMENTS

In general I can say that the most interesting achievements of the project are the following:

- As mentioned in the highlights of the previous section, the first one is the DISSEMINATION of the knowledge about Distributed Systems, and the PROMOTION of its use between the ANSAware licensees.

- The PROGRESSION of the different parts of the ODP standard, some of them close to reach the IS status, thanks to the effort and experience with which the ISA members have contributed to the ISO WG.

- The CONCIENCIATION of most of the manufacturers of the project to use, by now just internally, the results of the project, and even more, to finance its progression, through Phase III.

From the achievements reached by each of the partners, it is interesting to highlight the following:
AEG/ATM has succeeded to get integrated its OSI communication service into the testbed v.4.2, and has ported the ANSAware to real time environment (REAL/X).

ALCATEL has organized successful ODP courses, internally to its company, and the students use ISA software to develop client and server stubs, just in one day. On the other hand, its portation of ANSAware to MVS is used internally to provide interoperability between the DEC and IBM worlds.

Chorus Systèmes has developed a prototype of ANSAware over Chorus Mix 3.2, that will certainly contribute to the dissemination of the platform, mainly through the COOL (Chorus O-O layer) v.2, that is OMG conforming, and includes object migration and storage models. The software is being tested, and used in a pilot phase, by the SEPT.

CNET has finished the semantic specification of the DPL, with its documentation.

APM (core team) has contributed mainly to get integrated the contributions of other partners into the v.4.2, helping some of them on its work (sometimes through the secondees). Its work has produced results in the following topics:

* Enterprise model (collaboration with Origin).
* Storage Replication and object migration.
* Federated platforms.
* Graphical User Interface for the Trader.
* Storage, Migration and Replication of groups.
* Security model.
3. EXPLOITATION

To begin it's good to say that the ANSAware platform has been adopted by many ESPRIT (10) and RACE (5) projects. I think that these figures may be considered a success of the project, from the exploitation point of view.
In the previous section, along with the description of some of the achievements of the ISA consortium members, it have also been given some exploitation consequences of these achievements. So, in this section I will just mention the general "feeling" that all these individual achievements leave "on the air".

As already mentioned in the introduction, the project has succeeded to get many of the partners involved on the Phase III. To my understanding, this will mean that APM will now be dedicated to "sell" the ANSAware platform, both physically and politically. This means that the consortium has agreed to leave APM the right and the duty of the ANSAware external dissemination, whilst each company will exploit it internally, to develop products, that will then be distributed.

I sincerely think that this is a good solution, since avoids overlapping of efforts, and competence between the partners in the distribution of the platform. On the other hand, it will keep a central site, responsible of all the maintenance of the software, with the necessary "critical mass" of people working there. This will have as a "good side effect" the possibility to upgrade the platform to upcoming standards (CORBA), that will prevent the "slow vanishing" of the project results.