PCTE '91

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From 25 to 27 September 1991 the first international conference on PCTE was held in the Hague (see [1] for the chairman's personal view). This PCTE '91 conference was the first international conference solely dedicated to PCTE. It was supported by the three main organisations involved in PCTE : ECMA TC33, IEPG TA-13 and PIMB. The conference was organised by the TNO Physics and Electronics Laboratory.

PCTE '91 showed that PCTE is gaining wide acceptance. This was not only illustrated by the large number of attendees (about 160 from 16 countries in Europe, North America and Asia), but also by announcements made by several major platform suppliers (Digital, HP and IBM). Furthermore, a large number of CASE tool vendors discussed the use they are, or will be, making of PCTE. The conference consisted of three days, each targeted at a different audience. The first day was targeted at decision makers, the second at application builders, and the third at tool builders.

DAY ONE - DECISION MAKERS

On the first day, the Decision-Makers' Day, the conference was opened by P. Spohr, Director of TNO-FEL. In the opening address he distinguished three kinds of open systems : Proprietary (P type), De facto (D type) and Standardised (S type). PCTE clearly is an S type of open system. Apart from the advantages open systems offer a user, P. Spohr also identified several (sometimes forgotten) advantages open systems offer a supplier : less risk at product introduction, broader base or larger initial market, and stability of market. He concluded his talk by stating the user requirements that emerged from a discussion about the introduction of a standard CASE tool at TNO-FEL. The requirements were : portability of tools, similarity of user interfaces, support for different methods, interoperability of tools, and team support.

The organisations behind PCTE presented their motivations to support PCTE related programmes. Myer Morron, chairman of ECMA TC33, divided the road PCTE is traversing towards international standardisation into four steps. The final step, ISO standardisation, will be taken fast, but only if there is enough support for this within ISO. According to Myer Morron, PCTE is now being applied to real problems. Evidence of this is the recent NIST decision to use the ECMA PCTE specification as the basis for the development of an integrated set of ISEE PTI standards (see [2] for more detail on this). This will have a great impact for the availability and take-up of PCTE by US developers.

Brian Gladman, chairman of IEPG TA-13, outlined the defence requirements for starting the PCTE+ programme. Since it is felt these requirements are fully met by ECMA PCTE, there now is an international PTI standard supporting also the defence software engineering needs (see [3] for his opinion on this).

Robert Cochran, chairman of the PPG, described the work of the PIMB as well as that of the PPG. The PIMB has been mainly involved in building the PCTE community ; the PPG is promoting PCTE take-up. Early in 1991 the Terms of Reference of the PIMB were changed radically : the PIMB is now open to all interested parties (see [4] for more information). As the chairman of the promotional group Robert Cochran ended his talk with two slogans : "PCTE is now the standard Open Repository" and "PCTE is here, is in use, is endorsed, is available, is controlled".

David Talbot, CEC DG XIII, TII&I and Esprit, sketched the European Community's involvement in PCTE related programmes. Futhermore, he identified what is needed for PCTE take-up. According to David Talbot non-technology issues are currently of major importance, e.g. confidence in supply, back-up capabilities, choice of implementations, and ease of buying.

In the session on Industrial PCTE Strategy, major platform suppliers revealed their PCTE strategy.

Luciano Vernocchi of Digital Equipment sketched the Cohesion strategy and the advantages obtained by incorporating PCTE within Cohesion. Within Cohesion, presentation integration is obtained using OSF Motif, control integration is provided by the use of Application Architecture Services (ACAS) as proposed by the OMG, and data integration is obtained by the use of Data Servers, which are applications registered in ACAS. These servers provide a single, uniform interface for tools

to access different repositories. Currently, targeted repositories are CDD/Repository (ATIS) and PCTE.

George Tatgé of Hewlett Packard stated that HP endorses the use of ECMA PCTE as the open repository standard for CASE frameworks. HP plans to implement the Control Integration Standard on PCTE. For this development, projects are now being staffed at Fort Collins, an HP product division.

Germain Sagols of IBM outlined the Open Entreprise application development. Within it, AD/Cycle on an enterprise level, and AIX on a departmental level, play a central role. ECMA PCTE 149 is among the standards to be used in AIX ; in the area of data integration. Germain Sagols stated that IBM supports PCTE as a central effort for standardising CASE environments.

In this session on Industrial Strategy, Phil Thornley of British Aerospace (Military Aircraft) Ltd. presented experiences gathered in the procurement of the EuroFighter IPSE and in the Eureka project Aims. As part of the strategy formulated in Aims to influence current development work, he participated in both PCIS workshops where he put forward aerospace requirements. He observed that PTI programmes are starting to address real user needs, for instance environment evolution. In the aerospace industry there is a definite need for long term support : the life time of products is over forty years.

Jack Kramer of DARPA/SEI gave an overview of the context and status of the Software Technology for Adaptable Reliable Systems (STARS) programme. As part of the programme, STARS will demonstrate three integrated Software Engineering Environments on three real applications to investigate whether there is real "profit" to be gained in using framework based environments. Two of the three prime contractors, IBM Federal Systems Division and Unisys Defense Systems, have chosen to use PCTE as the basis for their environments. The third, Boeing (in alliance with DEC), has preferred CIS ATIS.

Several of the speakers of this day participated in the panel chaired by E. van Hoek, Director Defence and Development of the Dutch MoD. During the lively discussion the need for migration guides was raised. A panel member suggested that environment suppliers will be more than willing to help tool builders to integrate their tools in the suppliers' environment. It was suggested to integrate tools in an evolutionary way, starting with a loose integration. The PPG recognised the need for integration guides. Within the TA-13 programme tool integration is also investigated. Another important issue discussed was the question as to what the major impediments for widespread PCTE take-up are. The panel agreed that it was necessary for PCTE to become a true multi-vendor environment. One of the conference participants mentioned that their basic customer research showed that, in general, non-technical issues were most important ; it is especially necessary to show the customer what the return on investment will be. Other issues raised were PCTE as bundled software, availability of ECMA PCTE implementations, need for a European user group, and certification mechanisms for PCTE.

The Decision-Maker's Day was concluded by a management introduction to PCTE given by Ian Campbell of Emeraude. This provided him the opportunity to use the promotional slides produced by the PPG. He stressed that the quality of software can become a limiting factor, since it nowadays plays a crucial role in business success. Hence, software engineering must be treated as a corporate resource, not just as a technique. The keystone of software engineering success is an Open Repository based on Open Public Standards. PCTE is the only candidate today.

DAY TWO - APPLICATION BUILDERS

On the Application Builder's Day, the second day of the conference, several environment builders described how they extended the capabilities of PCTE to satisfy several important user needs, e.g. customisibility and traceability. They also indicated the lessons learned on the usability of PCTE. Furthermore, there were some more general talks on CDIF, PCTE training, and comparing current repository offerings.

Jean-Claude Derniame of the University of Nancy described how the users' need to tailor software engineering environments is satisfied by ALF (Accueil de Logiciel Futur - see [5] for more on ALF). Within the ALF Esprit project an environment framework has been built on top of Emeraude's PCTE implementation. This framework can be customised using a MASP (Models for Assisted Software Processes) resulting in an ALF-based IPSE.

Customisibility is also a main focus within the Eureka East project described by Jean-Philippe Bourguignon of SFGL (see [6] for more information on East). To achieve this, process modelling services have been added to PCTE. The East environment also incorporates facilities to encapsulate tools. The development of the East environment taught that PCTE enables the construction of information systems dedicated to software development. The increasing complexity of software development can be mastered by enriching the information contained in the system. This is made possible by the evolutionary capabilities of the PCTE data model. To enable a user to enrich his system, the Schema Definition Sets need to be published and some need to be standardised.

The HyperWeb environment described by Gérard Memmi of Bull also enables customisation, in this case by means of a scripting language. HyperWeb consists of an integrating framework and a set of integrated tools. The HyperWeb technology is based on the observation that software is not just code, but a complex "web" of all kinds of information. HyperWeb is built on top of Emeraude's PCTE implementation (see [7] for more information on Hyperweb).

Edouard André of Sema Group argued that fine grained objects are necessary to support traceability. However, using fine grained objects could lead to performance degradation. Within the Concerto environment this problem has been solved by providing a generic repository interface. The way a specific object type is implemented and cached is left to experts in the corresponding domain. Efficiency can be obtained by relying on the structuring concepts for that particular type. According to Edouard André, the Concerto architectural model does not conflict with the PCTE Object Management System. However, the PCTE implementation has to address the problem of grain size.

Another approach to tackle this problem is the use of a two tier database. This approach is used in ToolBuilder, a CASE tool generator, described by Paul Harris of Ipsys Software. The Ipsys repository technology, which is central to their ToolBuilder technology, is PCTE compliant.

H.G. Rau of GPP described the EPOS (Engineering and Project Management Oriented Specification) environment. EPOS is an IPSE supporting development as well as reverse engineering. It is a proven product interfacing with many other tools. However, it has a dedicated repository, dedicated user interface, and is dependent on the data security/integrity of the underlying operating system. Within GPP a strategic decision has been taken to use PCTE in order to improve standardisation and user acceptance. According to H.G. Rau, PCTE offers a variety of promising features that are of interest for software tool manufacturers, e.g. common repository, data security functions, and data exchange mechanisms. However, the question of semantical data exchange between tools is still an open issue. He also explained it is a risk for a small business to adopt a new technology and invest the necessary ressources. The first version of the PCTE port of EPOS will be built on Emeraude's PCTE+ prototype implementation. The release to customers is expected at the end of 1992. Several purchase options have already been placed.

Martin Kirby of SD-Scicon demonstrated how the main user requirements (authority, stability, and reliability) for the EuroFighter Aircraft IPSE could easily be met by PCTE. To model authority entities in the EFA IPSE, PCTE users, user groups and program groups can be used. The stability requirements can be met by placing navigation restrictions and using stabilising and reference links. To achieve reliability, transactions can be used for atomic updates. Program groups and usage modes can realise non-falsifiable accolades. According to Martin Kirby, the management conditions of the EFA IPSE map directly to PCTE facilities. Using these facilities makes the tools independent of management conditions. A participant at the conference summarised the keypoint of Martin Kirby's case as follows : major user requirements can easily be met by tool providers by building tools on top of PCTE ; therefore, procurement of an IPSE will not take as long as it took to procure the Eurofighter IPSE.

Mark Ratcliffe of the University College of Wales at Aberystwyth described the contents of the PCTE course given at his university. The emphasis of the course is on gaining practical experience. During the course the TIPSE (Teaching IPSE) built on top of PCTE is used. TIPSE provides a fully integrated environment for teaching software engineering. TIPSE does not hide PCTE from its user, to emphasise the benefits PCTE gives.

Mike Imber of LBMS described the CASE Data Interchange Format (CDIF) standards and their relation to PCTE. The objective of CDIF is to facilitate movement of information between CASE tools by providing a single interchange format for use between CASE tools. This requires definition of the meaning of information transferred and of the transfer format. CDIF can be used for the interchange of information between PCTE databases or between a PCTE database and another environment. The CDIF standards also provide a means to define standard SDSs to enable tool communication. Using the CDIF standards for PCTE is an assessment of the modelling capabilities underlying them. (See [8] for further information on PCTE and CDIF).

A study comparing PCTE with other current repository offerings was reported on by Jean Bérubé of Orsand Ltd. The initial focus of this study was the comparison of ISO and ANSI IRDS. However, in the report it will be made clear that there is more than those two : IBM Repository Manager and PCTE have also been included as additions in the study, in which the data concepts, architectures and modelling conventions of the reviewed repositories were compared. Several ambiguities and confusions were identified and resolved.

After this inspiring, but heavily loaded programme, not all participants could enjoy the attractions of the Hague ; in the evening a meeting between PCTE and CFI (CAD Framework Initiative) was held. EuroCFI happened to have a meeting in Eindhoven in the same week PCTE '91 was held. The purpose of the PCTE/CFI meeting, chaired by George Tatgé, was to see how both communities could cooperate. The discussion centred around the question whether PCTE can be used as the

repository component of the CAD Framework. Furthermore, the use of the control component of the CAD Framework for control integration in PCTE based environments was discussed.

DAY THREE - TOOL BUILDERS

On the Tool-Builder's Day, the last day of the conference, several tool builders described their experiences with integrating their tools with PCTE-based environments. At the start of the day, there were two more general talks : one on tool documentation, the other giving an introduction to PCTE. In general PCTE was considered as a very useful backbone for integrating CASE tools. However, a need was felt for more guidance, for instance in the form of migration guides.

In her talk on documenting tools for PCTE-based environments, Margaret Aldis of Syntagma argued that, as a corollary of the three well-known integration dimensions, it is necessary to add a fourth one : documentation integration. As PCTE gets taken up more widely, integration activities are less and less to be performed within close cooperation. This makes the definition of responsibilities and rules for integration, including integration of documentation, very important. Implicit in the integration process is some degree of reusability of documentation. One of the most difficult problems associated with this, is the context-sensitiveness of documentation.

Régis Minot of Emeraude gave an introduction to PCTE for tool builders. He described a general approach for designing and integrating PCTE tools. First, the tool's data schema must be designed and the invariant semantics specified to integrate its data. Then operations must be associated with the data for control integration. For this control integration several (non exclusive) approaches can be used : structured design, object-oriented design, and inter process synchronisation. Finally, to achieve presentation integration, the interactions with the user must be designed and related with the operations. When designing a PCTE tool one has to consider whether the tool will have to run in any PCTE based environment, or will run in a particular environment or framework. This choice influences the assumptions made about the environment the tool will run in and the use made of existing SDSs. Régis Minot summarised the advantages PCTE offers a tool builder : solutions to data integration problems which otherwise would imply high development costs, simplified error recovery by means of transactions, transparent distribution, concurrent access, and access to foreign systems and tools in a controlled and portable way. The performance of PCTE implementations can be close to the native operating system. Moreover, in the current prototype of PCTE+, the security facilities show only a 10 % overhead. PCTE must be complemented by a user interface presentation package and possibly higher level control integration services.

Brian Basdell of SD-Scicon distinguished four types of tool integration : functional, data, control and presentation integration. Orthogonal to this division in types is the difference between horizontal integration, integration between tools, and vertical integration, integration between a tool and the underlying services. To integrate a tool vertically three approaches can be followed. A tool may be integrated as a foreign process or as an interface layer. Both these approaches result in a relatively loose integration and performance degradation. Porting the tool's source is a more expensive approach, but it results in tight integration and simplifies horizontal integration. SD-Scicon experienced that the integration of lifecycle tools is straightforward ; the integration of management tools remains problematic.

Paul Vickers of HP Research Laboratories Bristol described how HP combined the tool integration facilities of three mature CASE integration technologies : PCTE (providing Data Repository Services and Data Integration Services), Motif (providing User Interface Services), and the SoftBench Broadcast Message Server (providing Message Services and Task Management Services). In their port of the BMS on to PCTE, they used PCTE for process execution and inter-process communication. HP's experience with PCTE is that PCTE does provide help for the tool writer, although (or may be due to the fact that) tool writers have to make engineering trade-offs. At the moment there is not enough support available for PCTE tool writers. A PCTE Users Group may be useful to share experiences and agree on schemas.

B.P. Bhat of Heuristix Systems told us that his company had implemented the OMS part of PCTE+. This implementation forms one of the common service modules of their Vulcan CASE environment providing an integrated set of CASE functions. Vulcan has an application programming interface consisting of a collection of C++ class definitions and functions to manipulate objects in the environment. A CommonLisp interface allows users to extend the functions of the environment by building their own tools. In its initial implementation of the PCTE+ OMS, Heuristix used a relational database. Moving their implementation to a file system improved its performance by an order of magnitude.

Hans Keus of Westmount Technology described the development of the Project Management Environment (PME). PME is built as part of the Netherlands contribution to PCTE+ assessment in the IEPG TA-13 programme, and is an interactive workbench with functionalities for organisation modelling, project definition, planning, monitoring and reporting. Although

PCTE provided definite advantages, some shortcomings were experienced, like the lack of a query language for fine grained objects. Furthermore, there is a need for standard public SDSs and tool migration guide-lines. SDSs are a necessary (but not sufficient) means for easy and successful tool integration.

Insufficient guidance for porting was also mentioned by Aytül Ercil of Bogazicl University and STFA Savronik. She described the Turkish contribution to the IEPG TA-13 programme : the development of the requirement analysis tool STAR (Structured Analysis of Requirements).

Gérard Boudier of Emeraude, on behalf of the PCTE+ Definition Consortium, reported on early feedback from the PCTE+ assessment phase. The output of this phase is twofold : comments on the PCTE+ specifications are submitted to the PCTE+ Definition Team during the assessment work ; a final report will be produced at the end of the programme giving a synthetic summary of all contributors' assessments. At the date of the conference 1,300 comments on the PCTE+ definition have been received, 400 responses and their corresponding change lists have been delivered, 300 responses are currently reviewed. About 30 raised comments, of the 400 responded to, can be regarded as substantial. Examples of areas where significant comments have been raised are : the replication mechanism, transactions, consequences of workstation failures, and execution mechanisms. Some of the comments on the PCTE+ specifications have already been taken into account in the PCTE standard ECMA 149.

PCTE is used as the data integrator in the Entreprise II environment, described by Amaury Legait of Syseca. Entreprise II is an IPSE used for managing and controlling development and maintenance. It has been created under the pressure of real life users. The IPSE should support large projects, enable integration, and be open. Amaury Legait distinguished four technical integration factors : data, presentation, and process integration, and openness. Non technical integration factors are often more important and harder to meet. Examples of these factors are : delays, industrial property rights, and maintenance of the IPSE. (See [9] for more information on Entreprise II).

Anders Lundkvist of Telia Research provided valuable guidance for tool porting. He described the porting of ARCS, an Ada Programming Support Environment that is data integrated with the TeleSoft Ada compiler TeleGen2 (see [10] for more information on this work). To make a first port of Arcs and TeleGen2, a one-to-one mapping of a Unix file onto a PCTE object was made. Despite the simplicity of this approach, this use of the OMS offered already several advantages : referential integrity, sharing of sublibraries and sharing of source text are made explicit. The performance of the PCTE based version is comparable with that of the file based version. The ported environment will be used as development environment, thereby exploring the facilities provided by PCTE. This strategy offers an incremental approach to porting tools.

In the port of AdaNice, described by Nando Gallo of Intecs Sistemi, a different approach was followed, that also provides useful guidance in tool adaptation to PCTE. AdaNice offers a tool compliant with Hood Version 1.3. To port AdaNice on to PCTE four different architectures were identified, varying from coarse grain (file is an object) to fine grain. Based on three evaluation criteria, openendedness/integrability, efficiency, and porting/-implementation cost, the most suitable architecture was chosen. Major Hood entities (objects, operations, etc.) are implemented as OMS objects and their relations as OMS relationships. This architecture allows a high degree of openendedness, since the most relevant information is described in the schema. Nevertheless, an acceptable level of efficiency can be achieved through a proper run-time organisation. Moreover, the implementation cost and the complexity of the design are acceptable. Several PCTE features have been proven to be particularly useful, for instance nested transactions, and the SDS/Working Schema mechanisms. Nando Gallo stated that AdaNice has been successfully ported on to PCTE : it is fast and already integrated into the East IPSE. Doing the port properly has been a major re-engineering effort, but resulted in a clean design.

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