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BUILDING THE CONCURRENT ENTERPRISE – THE CE-NET INITIATIVE

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Introduction

The main objective of CE-NET is to provide an infrastructure to support the shaping of the Concurrent Enterprise as being a full scale Concurrent Engineering implementation across partners' organisation boundaries within the Extended/Virtual Enterprise and a combination with Electronic Commerce area for trading models.

CE-NET is characterised by a multisectoral nature, with the involvement of different industrial sectors to promote cross-fertilisation of efforts dedicated to industrial competitiveness, exploiting the opportunities of re-using experiences and technological solutions deriving from different contexts, based on the sharing of general cultural features of the CE working environment. Bilateral confidential Benchmarking and CE Best Practice activities are essential part of the CE-NET operations and nodes interaction, especially between industrial manufacturing oriented nodes.

1 - Areas forming the Concurrent Enterprising domain

The following areas are not considered as a sequential progression but rather as a potential combination for generating a better comprehensive approach, defined as the ultimate type of operating environment, where synergy and complementarity between RTD projects of the areas mentioned below appears more evident and coherent.

1.1 - Concurrent Engineering (CE)

Definition:

"Concurrent Engineering is a systematic approach to the integrated, concurrent design of products and their related processes including manufacturing and support. This approach is intended to cause the developers from the outset to consider all elements of the product life cycle from conception through disposal, including quality, cost schedule and user requirements" [IDA88].

The manufacturing industries will gain enhanced competitiveness through the exploitation of CE technology, including the following benefits:

- Greater productivity and improved quality.
- Flexibility and improved collaboration with partners, suppliers & clients / customers i.e. no IT restriction on the choice of business partners if CE technologies are universal.
- Improved price - performance.
- Greater ability to respond to change.
- Improved Information management tools & enhanced working environment.
- Unlocking potential for growth & generating new business.

1.2 - Virtual Enterprise (VE)

Definition:

"A Virtual Enterprise (VE) is a temporary business organisation set up between trading partners, operating from geographically dispersed sites, for the duration of a common project. A VE is not a joint venture physically collocating the necessary resources on a same geographical site for achieving its business goals but rather a distributed organisation using remote resources. Multidisciplinary team members are electronically collocated and operating together through computer networks such as Intranet or Extranet".

Importance of VE technology to industry can be summarised as follows:

- Capacity of using remote resources
- Pooling of core competencies
- New way of organising operations across dispersed geographical sites, IT-enabled, customer initiated and solution oriented
- Remote collaboration and resource utilisation.

Virtual Enterprise concepts have been widely studied in the **VIVE** (**VI**rtual **V**ertical **E**nterprise) Project which addresses the creation of networks of companies co-operating on specific business opportunities. Further information is available at the URL *http://www.ceconsulting.it/VIVE*

1.3 - Electronic Commerce (EC)

Electronic Commerce is a wide domain from buying goods on the Internet up to business collaboration between trading partners.
The intersection between Virtual Enterprise and Electronic Commerce (Concurrent Enterprise) only concerns inter-enterprises electronic trading of models and collaboration across trading partners. Virtual models placed on the Business Network could be considered as trading knowledge objects.
EC has a deep impact in the business, such as:

- Speed up access to electronic catalogues
- Facilitate and accelerate sales and buying procedures
- Globalise the market
- Provide an opportunity to access the global market when appropriately organised

Concerning inter-enterprises relationships, the use of EDI can lead to

- Accelerates orders to be placed to providers
- Help to reduce stock
- Contribute to reduce cost to buy

2 - Concurrent Enterprise

Applying Concurrent Engineering and Electronic Commerce in the context of inter-enterprises business collaboration within the Virtual Enterprise is named Concurrent Enterprising. See the definition below for Concurrent Enterprise.

2.1 - Definitions

Concurrent Enterprise:
"A concurrent enterprise is a boundarylessness organisation operating concurrently with the market, trading partners, and users in a reactive and flexible way for improving creativity aptitude and innovation potential to meet the ever changing market demand". (M.Pallot, V. Sandoval, 98)
Concurrent Enterprises are able to trade product models on a Business Network.

Engineering:
Engineering is a discipline aiming at defining the way of developing a product.

Enterprising:
Enterprising is a discipline aiming at defining the way of doing business with trading partners.

2.2 - Concurrent Organisation - a universal model

"Enterprises are made of people whose individuality has a piece of the necessary knowledge, and altogether they constitute a new entity that is not only a juxtaposition of knowledge pieces but much more a puzzle where the symbiosis process helps to have pieces at the right place like a kind of sum.
A concurrent organisation is characterised by a system having a main conducting flow or stream where all existing entities belonging to that system are contributing to this flow in a complementary harmonised way (symbiosis).
An enterprise should be organised around a specific flow. This is a knowledge flow, which starts by needing understanding and then continues by creating ideas that are transformed into solutions

satisfying the needs. Concurrent organisations are multidimensional where different systems can contribute to another one, from infinitely small toward infinitely large or vice-versa. To understand how a concurrent organisation operates it is necessary to know interdependencies between its constituting entities. Here it might be helpful to explain to decision makers, such as politicians, and managers, that before undertaking any decision, they should try to simulate its impact in running a model made of interdependencies just to check whether it will be consistent or not." (M. Pallot, V. Sandoval, 98)

"A concurrent enterprise operates concurrently with the market, trading partners and users. To build a concurrent enterprise we need the concurrent engineering as normal engineering practices and the advanced know-how in virtual enterprise building, application and management. This new type of enterprise encompasses the electronic commerce Era. So every company must do any effort to adopt the new approach following a concurrent enterprising process, that means the process enabling the building of this kind of enterprise. Nevertheless, there are many factors, constraints and problems that need to be overcome before to set up concurrent enterprises.

First of all, the lack of adequate infrastructures in a wider sense. Within this context, one important point concerns concurrent systems technologies and tools for the sharing and interactive use of remote resources and concurrent activities in geographically dispersed locations, in the context of heterogeneous hardware and software architectures and systems. This point is a fundamental one to allow the concurrent enterprising process. Other points are interoperability and interworking particularly at the network management and service levels, to increase capacity, flexibility, reactivity and functionality and to promote the introduction of new services (including the evolution of the Internet) ; technologies for network integration (fixed and mobile, including satellite links) and new service independent architectures and systems, to ensure all users will have affordable access to broadband multimedia services; basic technologies and tools supporting real-time embedded systems applications and services." (M. Pallot, V. Sandoval, 98)

2.3 - Concurrent Enterprise - a scenario

The following is a description of a potential scenario for Concurrent Enterprises developing new products. Concurrent Enterprises are trading models on a business network constituted of potential providers.

Enterprises send information about their future or available models on the market that could be used in a business project (a kind of electronic catalogue) to a business network When a participant of the business network place a call for models (specific call for proposals), through its Virtual Buying Office, it automatically filters answering models that could be appropriate to the request. When there are several answers for designing a future model, an assessment of capabilities for operating in this virtual environment could help to select the most appropriate provider. Otherwise, parts of the models could be used by the Virtual Design Office for simulating its appropriateness within the targeted product or processes.

As soon as models are selected and contracts established, the real product and processes development starts in identifying the necessary interactions between trading partners. A Virtual Interaction Room support electronic collocation of people where constraints could be demonstrated in order to undertake the best decision for the product and processes architecture. In case of conflicting situation, a Virtual Negotiation Room provides the necessary tools for demonstrating any potential solution to the appropriate experts of trading partners. Finally, a Virtual Project Office facilitates the management and administration of the project across trading partners.

Concurrent Enterprising constitutes a strong opportunity for developing new telecom technologies, applications and services such as Telepresence or Telecooperation (P.Pulli, T. Pyssysalo, K.Kuutti, J.Similä, J.P. Metsävainio, O.Komulainen)

2.4 - Required R&D actions for Concurrent Enterprising

A life-cycle thinking of knowledge should be the basic framework behind the thematic network, i.e. the development stages: research, development work, dissemination and exploitation including deployment. From a planning viewpoint this is in line with a top-down identification of visions and needs, and a bottom-up initiation of projects/activities in the different phases of the life-cycle of concurrent enterprise knowledge – visions and short term as well as long term actions have to be integrated and attuned. Therefore, this is an iterative continuos improvement or learning process open for refinements and a corresponding initiation of new or modified initiatives to fulfil the goal of realising the concurrent enterprising concept.
The life-cycle approach can be illustrated in the following way.

Research:	**Development:**	**Deployment:**
Create visions	Define specific application areas based on basic research	Collect and categorise existing knowledge
Defining research purposes/areas	Define thematic oriented technology projects	Develop dissemination, exploitation and deployment channels and methods
Proof of Concepts projects	Develop technologies	Develop training programs
Development and elaboration of basic concepts	Examine organisational preconditions	Broadcast training programs
Thematic scope and framework description	Forecast and evaluate societal consequences	Find best practice and related technologies

3 - CE-NET Overview

It is widely accepted that for the effective advancement of the integrated product development environment within the overall context of concurrent enterprise there is a clear need for different organisations to continuously communicate with each other in order to exchange and share the latest developments/information. However, currently there is a lack of coherent infrastructure or mechanisms for the effective and constant cross-fertilisation of the research effort undertaken by various bodies whether they are in industry, academia or software vendors. Many of these organisations and institutes are involved in a range of concurrent engineering related projects both at European and National level.
Due to the lack of effective co-ordination of these developments one is not able to fully exploit the potential benefits from the output of the RTD efforts currently in progress Thus, the prime aim of the Concurrent Engineering Network of Excellence (CE-NET) is to establish a well co-ordinated and effective support infrastructure throughout Europe in order to share and exchange the latest developments in the concurrent enterprise domain.
However, specific objectives are:

- To provide the means for effective communication of tool and techniques available for the implementation of CE
- To integrate better the work undertaken in different national and European RTD projects
- To provide means for better cross-fertilisation of CE practices across different industrial sectors
- To raise level of awareness of potential benefits accruable by applying CE approaches
- To develop and provide means for better exploiting the results of RTD projects

These will be achieved by undertaking the following activities:

- Collect information about the existing industrial experimentation on CE implementation, CE studies events and reports for further utilisation and to avoid overlapping

- Cross-fertilisation by increasing awareness of CE concepts, approaches, technologies, implementation practices and their impact
- Provide concepts and guidelines to implement and apply CE between trading partners in a concurrent enterprise especially within the SMEs

The CE-NET consortium consists of some 26 organisations representing 12 countries. All members of the consortium, except ESoCE, will be involved as Associate partners. Each member of the network is positioned according to its specific skills in order to contribute to and to reap the benefits from the network most effectively. ESoCE will be the co-ordinator for the network.

EsoCE is an independent technical and non-profit society. Its mission is to promote the adoption and application of CE approach in industry and SME environment.
It has a networked structure, gathering similar organisations from all the European countries
Main objectives of ESoCE are:

- Improve and spread knowledge on CE point of view
- National and international exchange on information regarding CE initiatives
- Promote the participation of Industry to CE projects

3.1 - Objectives and Results

The CE-NET partners, large industrial companies such as Daimler-Benz Aerospace, Nokia, Odense Steel Shipyard, Signaal, Taylor Woodrow, and Thomson-CSF, are recognised as major players in the domain of CE implementation as well as SME's organisations such as Adepa, ATM, BCM, CCC, FIMET and InfoCom. Furthermore, academia is also very well represented by active research institutes in different fields related to CE such as Ecole Centrale Paris, Ladseb-CNR, PAKT, SISU, Tampere University of Technology, University of Bremen, University of Nottingham, University of Twente and VTT. So far, CE-NET partners are involved in a lot of initiatives and RTD projects related to CE.
Otherwise, there are a lot more organisations (large industrial companies, SMEs and research institutes) involved in CE related initiatives and projects as well as simply interested by the implementation of CE that represents a good potential to rapidly increase the number of participants to the network.

3.1.2 - Long Term Goal

Today, around the globe, there is an increasing pressure from the market forces to design and develop products with an increasing level of in-built complexity in the shortest possible time within a multi-company collaboration framework (providers often represent a large part of project success).
The complexity includes: the product itself: references, functionalities, security, technology, materials, integration, processes etc.

The global market and business environment requires European industry to increase its competitiveness and its ability to:

- manage multinational consumers, suppliers and corporate sites;
- establishing profitable consortia to cope with requirements and feature of large multinational programmes.

This increasing level of complexity can be best managed through the provision of an adequate integrated product/processes development environment which allows each individual participating company to concentrate to its core expertise and so contributing the global solution. The new shared

business process will be the heart of the Concurrent Enterprise through the full scale CE implementation within an Extended/Virtual Enterprise.
The main long term goal is to support the creation and functioning of the Concurrent Enterprise through the following three different phases:
1. Awareness and Foundation : define the concepts and processes for the Concurrent Enterprise.
2. Development and experimentation elaborate the functions of the Concurrent Enterprise, experiments IT solutions, specify the needs & requirements, and develop necessary technology in deploying R&D projects collaboration between nodes.
3. Training/education and technology transfer: identifying training and education requirements, and elaborate related programme and technology transfer activities.

3.1.3 - Objectives of this first phase

The prime aim of the CE-NET IS to establish a well co-ordinated and effective support infrastructure throughout Europe in order to share and exchange the latest developments in the broadest scope of CE implementation. Nowadays, the ultimate level of CE implementation IS represented by the Concurrent Enterprise paradigm (which is the implementation of CE within the Extended/Virtual Enterprise) that is often called Collaborative Engineering in US.

The overall duration of this phase is 18 months, and the allocated budget is 392 KEURO. The main tasks are:

- Build up a CE information database
- Develop and edit a CE newsletter
- Organise CE events: Conferences & workshops
- Build up a CE tools & techniques database
- Best CE practices and benchmarking

3.2 - Organisation and Project Management

3.2.1 - Network organisation

The CE Network is composed of Nodes and a Network Co-ordinator and has a Management Board and a Technical Committee. Nodes are also members of external organisations such as industry sectoral associations, research networks, SME's associations, working groups, user's groups and related initiatives. All those connections will be used as channels of dissemination and for collecting user's needs and market trends as well as the newest technology (see figure 3.1).

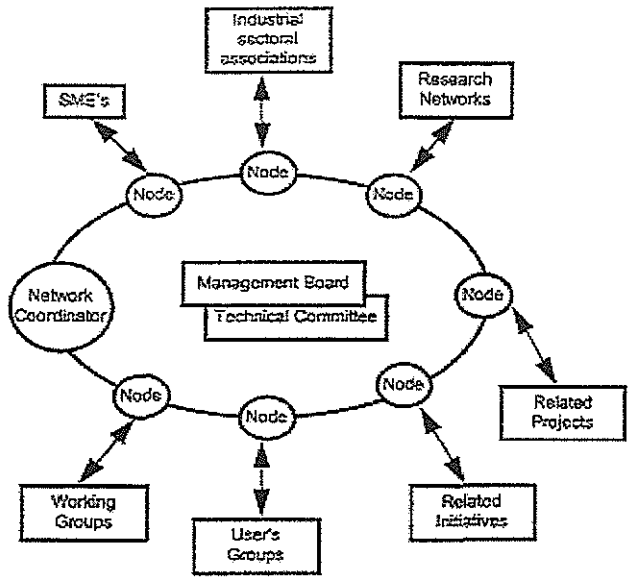

Figure 3.1 - The CE Network

3.2.2 - Network Nodes

Members of the network form nodes which can be a corporation or a part of it like a corporate's research centre, an independent research centre, an industrial company, an university or an industrial association. A national node can also be a co-operative group of these.

Each node will carry out the following tasks:

- To follow and collect information about its own, national, and regional R&D projects and activities on CE.
- To set up an Internet Server, based on CE-NET 's common taxonomy to disseminate information
- To measure, how effectively the information distributed by the node is exploited by potential users
- To identify needs and technologies for coming research projects and themes for workshops organised by the Network.
- To report its experiences to the Network

3.2.3 - Network Co-ordinator

The Network Co-ordinator (NC) is globally responsible for the overall administration of the network and act as the Network Secretary in the Management Board (MB).

The Network secretary (Network Co-ordinator) will be nominated by the MB and will have the responsibility to:

- Co-ordinate the overall contractual, financial and administrative aspects, including the reporting of the Network financial and budgetary status to the MB.
- Collect and submit to the CEC of cost statements for the project
- Draft the quality plan of the project
- Found and maintain the project archive

- Co-ordinate communication between the consortium and the European Commission or any external organisations
- To organise meetings of the Management Board and Technical Committee
- To support nodes arranging conferences or workshops
- To co-ordinate events and work between the nodes

The Network Secretary (Network Co-ordinator) will prepare the MB meetings that will be synchronised, when possible, with the TC meetings and Network events (conference and/or workshops) in order to have more efficient co-ordination and to reduce the travelling costs.

3.2.4 - Management Structure

The management of the Concurrent Engineering Network of Excellence (CE-NET) will be organised on two levels:

1. Network management level will be carried out by the Management Board (MB).
2. Technical management level will be carried out by the Technical Committee (TC).

In order to reduce the management overhead, the same representative of a project member may fill several positions in the management organisation.

Management Board

The MB will have the responsibility for the financial, administrative and exploitation aspects of the Network and will supervise the technical decisions. The MB will be chaired by an elected chairman who will act as chairman of the Network, seconded by a vice-chairman and they will be assisted by the Network secretary (filled by the Network Co-ordinator).

The MB will in particular:

- Decide the overall strategy for conducting the Network
- Review the progress of the project according to the strategy
- Review the policy and strategy for exploitation and publicity, authorise external presentation in meetings according to the information sensitivity classification level
- Assess any change to the procedures and contracts
- Elect the chairman and the vice-chairman of the Network and approve the nomination of the Network secretary
- To review the Network expansion policy
- To oversee the administration carried out by the Network Co-ordinator
- To accept new members and nodes
- To approve the actions plan

Technical Committee (TC)

The TC will have the responsibility of the technical decisions. The TC will be leaded by the Network Co-ordinator. It will be composed of the technical representatives of the project members.

The TC will in particular:

- Decide the technical directions according to the strategy defined by the MB.
- Assess the progress of the project, commission the corrective actions if necessary and authorise appropriate amendments to the work plan according to the recommendations of WP leaders in order to meet the project objectives.
- Approve the Quality Plan submitted by the Network Co-ordinator.
- Assess any change to the work programme and any technical recommendations to the MB.

- To define the action plans according to the long term strategies.
- To develop the information infrastructure (Internet CE-NET Web server).
- To define and update the Network common taxonomy for the CE reference database.
- To prepare the Conference and workshops themes.
- To review the working groups reports.
- To prepare recommendations and future directions.
- To assess the project proposals for the second phase.

The TC will normally meet three times during the first phase in a synchronised way with the MB meetings. The Network Co-ordinator will prepare the TC meetings that will be synchronised, when possible, with the MB meetings and Network events (conference and/or workshops) in order to have more efficient co-ordination and to reduce the travelling costs.

3.3 - How to participate

To join CE-NET a web site is available at the following URL

http://esoce.pl.ecp.fr/ce-net/

It is possible to take part to ESoCE initiatives. Further information available at

http://www.ceconsulting.it/ESOCE/default.html

APPENDIX A

Profile of the Author

Roberto SANTORO, CE Consulting-Italy

Mr. Santoro is directly involved in the development and dissemination of Electronic Commerce and Concurrent Engineering methodologies for adoption by European Industry, and has been acting for several years as expert reviewer of EU financed RTD projects within the ESPRIT programme. He is the promoter and co-ordinator of the European Society of Concurrent Engineering in Italy and the representative of Italian Confederation of Industrial Employers in the UNICE (Union of European Industrial Employers) CALS/Electronic Commerce Group.
Mr. Santoro is managing director of CE Consulting, an engineering service Company devoted to the development of advanced engineering methods and of the associated Information Systems, enabling integrated product development.
Mr. Santoro is providing business and technical leadership to a number of innovative European projects for which CE Consulting is the co-ordinating partner. Major examples include: VIVE (Virtual Vertical Enterprise), which addresses the constitution and operation of Virtual Enterprises specially devoted to Small and Medium Enterprises (SMEs) for the general market and in particular for responding to the new supply infrastructure requirements by Large Enterprise; CEPRA (Concurrent Engineering in Practice), which provides best practice tools and techniques to SME in the Aeronautics sector for adopting Concurrent Engineering.
Mr. Santoro is participating to the ESPRIT Project WeCAN (Wide Electronic Commerce Awareness Network of Excellence) dealing with awareness issues for the adoption of Electonic

Commerce by Small and Medium Enterprises. WeCAN supports Organizers of awareness activities by providing Best practice examples and case studies.

Mr. Santoro has been earlier leading, within the Datamat Group, the development of advanced Information Technology Systems and Engineering Services for the Industrial Sector.

Until 1988 Mr. Santoro has dedicated his professional activity to the design, licensing and operation of Nuclear Power Plants. As Managing Director of NUTECH European Operations since 1982, he provided management and technical direction to a variety of engineering projects for the European Nuclear Industry, requiring the integration of multiple engineering disciplines.

Born 1952 in Bari, Italy. Doctor in Mechanical Engineering, University of Genoa, Italy - 1976. Highest grade with Honours.

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