36 INTERNET BASED ICT PLATFORM FOR SUPPORTING VIRTUAL ENTERPRISES OF SMEs

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This document aims to present the ICT platform and SW tools developed in the frame of the IST project PROVE-SME (Promoting Virtual enterprises out of SMEs): IST–1999–20276 PROVE-SME. The project aims to define and experiment best practices to put very small enterprises, with high collaboration potential, in a condition to constitute efficient Virtual Enterprises (VEs). This is achieved by providing SMEs with a Methodology and developing a SW platform (based on SMEs requiremenst) to support communication and co-ordination within the VE. In particular, the paper presents the specific ICT infrastructure developed based on SMEs requirements and that will be experimented and validated during the project by the three real test cases: COXA-VE, CORMA-VE and ETA-VE.

1. INTRODUCTION

The economic environment of many Italian and Southern European areas (like France and Spain), is strongly characterized by the presence of small enterprises with less then 15-20 employees (IST-1999-20276 ANNEX I). The new economy, market trends and other factors push SMEs to aggregate themselves in networks to form virtual organizations to compete with big companies and stay on the market.

As a matter of fact, SMEs display positive qualities behaving like networks nodes, thanks to their lean structure, adaptability to market evolution, active involvement of versatile human resources and habit of establishing sub-contracting relations (Filos, 2000). The problem is to succeed in aggregating these enterprises guarantying them to maintain their own identity and management autonomy (these enterprises are very proud of these factors). Furthermore, usually they have a very pure use of ICT and Internet tools (Bonfatti, 1996). This is the context of PROVE-SME project that aims to provide SMEs with suitable ICT tools to support their collaboration (web site: www.prove-sme.com).

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L. M. Camarinha-Matos (ed.), *Collaborative Business Ecosystems and Virtual Enterprises*

These tools are going to be specialized and adapted to a different context of enterprise cooperation, that of the biomedical sector. This occurs within the project BIDMED (IST-2000-28618) Co-operative BIDding in the MEDical sector. The main objective of this project is to define and experiment a best practice to support the collaboration among SMEs of the bio-medical sector, up to the constitution of their smart bidding organization (SBO). In particular BIDMED defines a best practice to facilitate the constitution of bidding organizations made of SMEs and a collection of ICT tools to support the co-operative bidding in particular for public calls for tender (that is the more complex scenario for co-operative bids preparation)

The ICT tools presented in the paper can facilitate the communication among the partners, support the co-operative work of bid preparation and order execution (i.e. sterilization, stocking, shipment). More specific software tools are needed for managing a unified product catalogue, interacting with the customer in every phase of the supply life cycle, and providing a comprehensive and easy-to-access repository of legal issues relevant to this peculiar industrial sector.

2. TOOLS SURVEY AND SELECTION

2.1 Market survey

An up-to-date survey of the available SW tools suitable for the Very Small and Medium Enterprises (for satisfying the SME requirements) has been conducted with the final objective to select and customize the ICT platform to be adopted by the three SME networks involved in the project. For this purpose, also some SW prototypes developed in past EU projects have been taken into account for finding the most suitable solution.

Both the available tools on the market and the tools produced in past EU project have been compared with the requirements of the three networks of the project to select and set-up the final PROVE-SME ICT infrastructure.

The identified and examined classes of SW tools to support the activities of the Virtual Enterprise are **PDM** (Product Data Management) and **SCM** (Supply Chain Management). In fact the networks in the projects mainly deal with the management of products, orders and of the supply-chain (Hirsch B, 1995).

The conducted analysis demonstrated that the available commercial SW tools and packages on the market are not suitable to cover all the needs of micro enterprise networks, due to the following main reasons (IST-1999-14095, Deliverable D4, Deliverable D1):

- high costs and complexity
- long training time (learning curve)
- high human impact (they require introducing deep changes in the way of working and in the company working procedures)
- not integrated (each SW package is independent) and they are not easy to be integrated with the actual legacy system of each single SME
- not Internet based

2.2 Prototypes produced in EU projects

Since the available market tools are far away from being adapted to micro enterprise VEs (too complex, hard to use, expensive, not integrated, not suited to be used via Internet by a simple browser) PROVE-SME SW is based on a EU prototype. The European projects that have been analyzed are: BIDSAVER, COWORK, VIVE, PLENT and GNOSIS (see Table 1).

Among them, the most interesting projects to cover PROVE-SME user requirements demonstrated to be COWORK and GNOSIS-VF. GNOSIS-VF Planner and WFM, with COWORK model for exchanging information based on Internet, have been used as a background to build the PROVE-SME platform.

Table 1 – Relevant examined EU projects

Project Number	Project Acronym	Full Title
IST10768	*BIDSAVER*	*Business Integrator Dynamic Support Agents for Virtual Enterprise*
EP25360	*COWORK*	*Concurrent project development IT tools for small-medium enterprises net works*
EP26854	*VIVE*	*Virtual vertical enterprise*
EP20723	*PLENT*	*Planning small medium enterprise networks*
EP28448	*GNOSIS-VF*	*GNOSIS the Virtual Factory*

It must be highlighted that also other significant EU projects in the filed of ICT infrastructure for SMEs networks and Virtual Enterprises could be considered: PRODNET (Production planning and management in an extended enterprise) and NIIIP (Information Infrastructure for the Industrial Virtual Enterprise).

3. PROVE-SME ICT PLATFORM

3.1 ICT platform logic architecture

PROVE-SME platform is fully Internet based (and accessible by the Browser without installing any SW) and supports all the main features required by the three project pilot cases. The ICT platform is formed by the following SW modules (IST-1999-20276, Deliverable D02a):

- **CUSTOMER** module, to support the leader company in managing its relations with suppliers;
- **PLANNING** module, to support the leader company in scheduling tasks and selecting the partners to involve;
- **SUPPLIER** module, to support the partner company in managing customer orders and their states;
- **MESSENGER and workflow manager** module, to manage and track communications and document exchanges (messengers and workflow functions are incorporated in the three above mentioned modules, to provide the VE leader and the VE partners with all the required utilities);

Communications are based on a predefined protocol with classes of messages (to allow also an easy Workflow Management) and with the simple use of a Browser. Each company (both leader or VE nodes) can enter all the modules and functions needed. All the data are stored on the ICT platform server and can be accessed everywhere using a browser (Billington, 1997).

The general platform architecture is reported in the figure below:

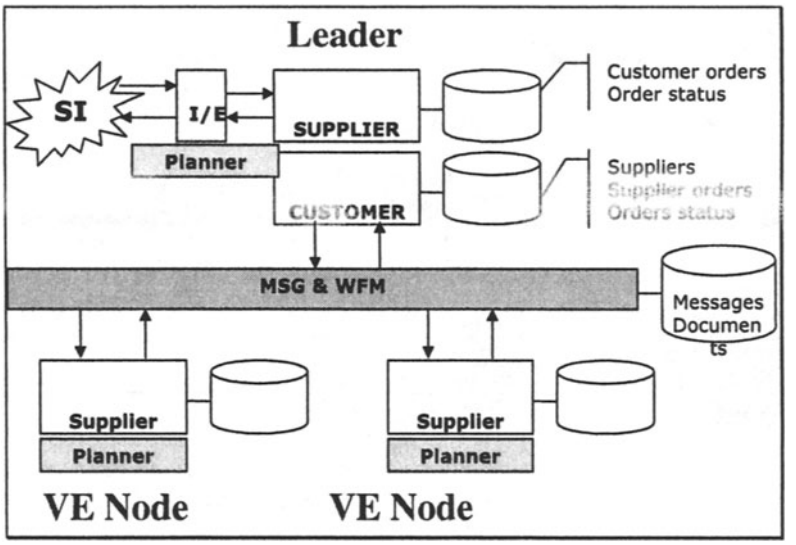

Figure 1 – Platform architecture

3.2 Architecture description

The VE leader uses the SUPPLIER module for managing the relationships with the external customers (and all the data related to the customer orders and their states are stored in the Data Base on the server)

The VE leader uses the CUSTOMER module for managing all the relationships and communication with the network nodes (the Leader is a customer of each network node):

- The CUSTOMER module allows orders and information exchange between leader and VE nodes (thanks to the Messenger and WFM functions). All the exchanged documents, orders and messages are stored and available on the Data Base in the Server
- The PLANNER module is integrated with the other SW modules for allowing the VE leader to:
  - Create project GANTT and manage plans
  - Orders and activities management

Each VE node uses the SUPPLIER module to communicate and exchange information with the VE leader and with the other partners (thanks to the Messenger

and WFM functions). All the exchanged documents, orders and messages are stored and available on the Data Base in the Server.

Apart from these sets of general functions (that are required by almost any kinds of network), special functions (and customizations) can be made available to the specific partners, when necessary (IST-1999-20276, Deliverable D02a). In this way, the developed platform will be easily customized to be adopted by others VEs out of the project.

3.3 Main functions of each SW module

The developed SW is fully Internet based (no SW needs to be locally installed by any users). Furthermore, the application has been designed to be compliant with the technological user requirements (IST-1999-20276, Deliverable D01) and provides the following features:

- Monitoring of the order (project) status and progress: Order management
- Support for bidding: negotiation phase
- Fast, cheap and easy to use communication support (for orders, problems, documents, drawings and so on): dedicated Internet based message management
- Planning function at network level and node level
- Capacity overview (declaration and update)
- Document management: disciplined and Internet based for remote access
- Stock situation control and mmanagement of change orders
- Low costs, easy to use and Internet based

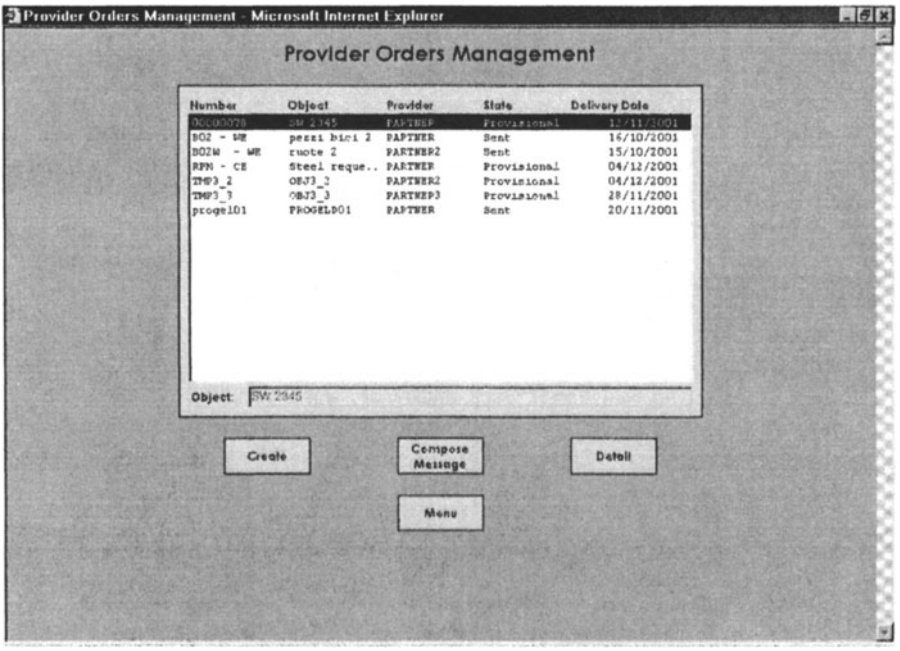

Figure 3 – Order Management for the VE leader

The developed SW allows the set-up and the management of several VEs. Each network is characterized by a VE leader and one or more VE nodes. Both for the leader and for the VE partners (each company of the VE) several user profiles can be defined.

The messages management function refers to the Messenger module. In fact, the Messenger module has been integrated in the other modules that suppliers and customers can enter. The suppliers and customers are allowed to exchange many types of messages. Messages have been classified, to implement an efficient Workflow mechanism.

3.4 CUSTOMER/SUPPLIER module functions

The customer/supplier module puts several functions at the users disposal, each one linked to the others. The available functions are:

Messages Management	It allows the users to send and receive several kinds of messages and to attach some files to the messages. The messages are referred to a certain project and may concern the sending of an order, the acceptance/refusal of an order, or they may be used to send technical drawings or other documents referred to a project.
Order Management	It allows the users to access the orders and the order lines, to see and to update the progress status. The customer is also allowed to create new orders and to modify those already existent. The order management also allow sending messages referring a certain order (it recalls the messages management).
Files Management	It allows the users to manage a hierarchical structure of folders, where documents can be contained. The documents can be uploaded from the user hard disk (client) or they can be the attachments of received messages. The users are also allowed to download files from the server to their hard disk.
Products Management	It allows the user to display information about the products of the network. The customer may also decide to add new products or to eliminate some existing.
Network Management	The user may display information concerning his network. The partners may define and modify their capacity for each product they are able to produce. The customer, in the other side, decides which products are assigned to each partner of the network
Projects Management	Only the partners have this function at their disposal. It allows the user to display information about the projects concerning products required in some orders. The user may also decide to create new projects, or to modify or eliminate some existing.

3.5 Planning module

Projects Management	It allows the user to display information about the projects concerning products required in some orders, and to change the project.
Template Task Management	It allows the users to display information concerning the typical tasks (which can be used in the template plan definition). It also allows the user to establish the list of available suppliers for a template task.
Template Plans Management	It allows the users to display information concerning the typical plans and their detail, to create, modify and delete template plans. The template plans can be used for generating plans to execute the projects.
Plans Management	It allows the users to display information concerning the plans and their detail, to create, modify and delete plans. The user can also generate the orders for the suppliers involved in the plan execution.
Orders Management	It allows the users to display and manage information about the orders.

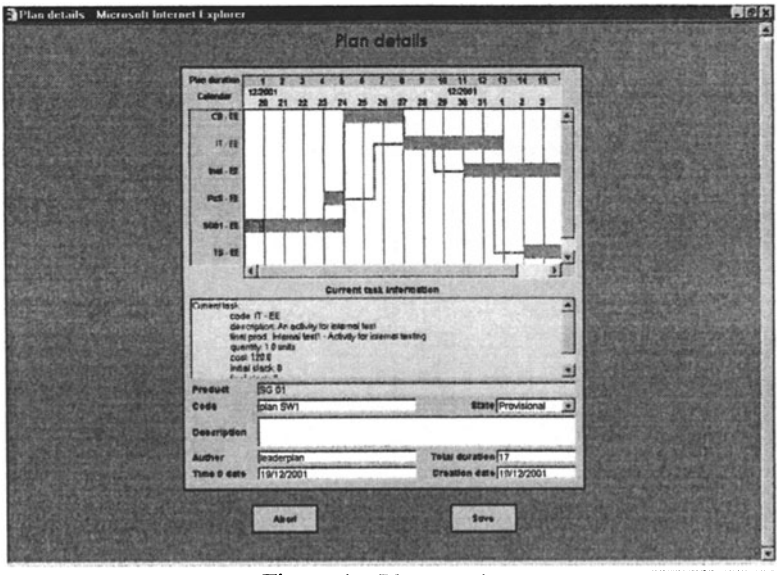

Figure 4 – Planner view

3.6 ICT Hardware architecture

The ICT platform is build according to the J2EE architecture based on JAVA. It is structured in two layers: web application and business logic. The web application is performed by the servlets those provide the user interfaces (html format). The business logic is the core application containing all the data and the rules for accessing data stored in the DB and it is performed by a set of ejbs.

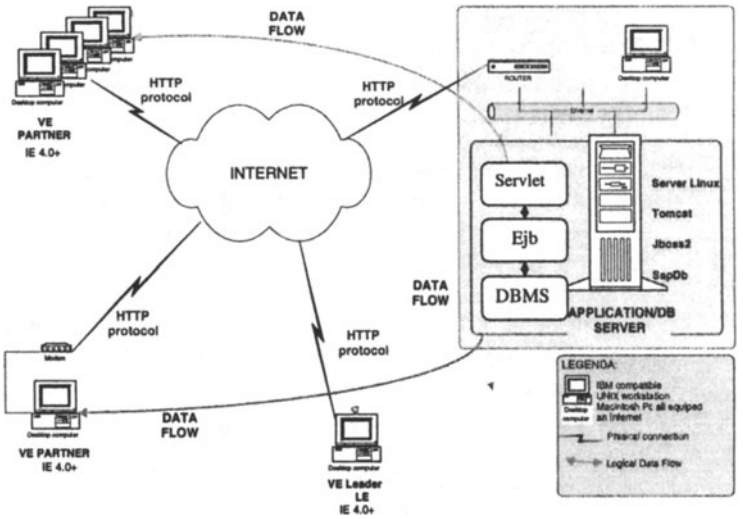

Figure 4 – Platform HW architecture

5. CONCLUSIONS

The PROVE-SME ICT platform will be experimented within the project by the three involved virtual enterprises (COXA-VE, ETA-VE and CORMA-VE), to validate and improve the final ICT platform. At the end of December 2001 qualitative and quantitative data from each pilot case will be available also to consider the extension of the platform to other networks in the mechanical and automation fields.

Considering support tools for VE in specific market sectors we can recall another important EU funded project: BIDMED (IST-2000-28618). The main objective of this project is to define and experiment a best practice to support the collaboration among SMEs of the bio-medical sector, up to the constitution of their smart bidding organisation (SBO). In particular BIDMED defines a collection of ICT tools to support the co-operative bidding in particular for public calls for tender (that is the more complex scenario for co-operative bids preparation). At the end of May 2002 the ICT platform and the SW tools for supporting the SBO activities will be ready to be tested in the project.

6. REFERENCES

1. IST-1999-20276 ANNEX I: Description of Work, 10/06/2000
2. Bonfatti F, et altri: "Co-ordination functions in SME networks", 2nd Int'l Conference on Architectures and Design Methods for Balanced Automation Systems, Lisbon, June 1996.
3. Erastos Filos, European Commission. "New Methods of Work and Electronic Commerce". 2000.
4. IST-1999-14095 UCANET, Deliverable D4, Products, tools and organisational models benchmarking.
5. IST-1999-14095 UCANET, Deliverable D1, Survey of study and statistical analysis
6. Hirsch B. E. "Decentralized and collaborative production management in distributed manufacturing environments". Ios Press 1995.
7. IST-1999-20276 PROVE-SME Deliverable D02a: Tools assessment, description and use
8. IST-1999-20276 PROVE-SME, Deliverable D01, SMEs requirements and gap analyses
9. Billington, J., A.Tokmakoff. Infrastructure for Collaborative Enterprises. 1997, Massachusetts, USA.