Telework Business Process Co-ordination - The supporting tool engineering life cycle

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Abstract

Computer technology for process support using transaction processing has a long tradition, but with mixed results. In a fast changing environment like nowadays, traditional information systems approaches need to be upgraded with workflow management technology. Telework, considered as an innovative work organisation-form for new decentralised organisational structures, further call for the use of workflow management technology. Currently there is no co-ordination-tool with specific planning functionality for this purpose. This paper presents the approach taken to engineering of a workflow management system, supporting the co-ordination of decentralised telework activities through telework activity chain model execution.

Keywords
Telework, Workflow Management System

The original version of this chapter was revised: The copyright line was incorrect. This has been corrected. The Erratum to this chapter is available at DOI: 10.1007/978-0-387-35390-6_58

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1 INTRODUCTION

Computer technology for process support has a long tradition. Information systems have tried to cope with this issue by transaction processing. Previous attempts to automate office work and increase productivity failed, because individual activities were automated without an understanding of how those activities fit into the entire business processes. On the basis of past experience of procedure automation systems, new software products and enhanced office information systems' functionality are developed which fall under the new domain of workflow management technology. It is not a new technology for procedure automation, but takes the formal part of procedure processing applications and combines it with general communication and information sharing facilities. This added value to traditional office automation results from support to requirements for co-operative work. Thus, computer systems have to support, and not necessarily to automate, predictable and formal structures of business processes, as well as the coping with unanticipated contingencies, dynamic change and breakdowns, to achieve the final objective of customer satisfaction.

Telework which, considered as an innovative work organisation-form for new decentralised organisational structures, further call for the use of workflow management technology. The flexibility of telework in the dimensions time, location of task execution and the legal status of employment contracts must make it possible to take advantage of this work organisation for the companies competitiveness. The COBIP project (COBIP - "telework CO-ordination services for co-operative BusIness Processes" - project within the Telematics Application Programme UR 4002 - SECTOR 6) aims at demonstrating the usage of workflow tools in the management of telework decentralised activities. The success of this demonstration project will foster the motivation of companies to implement telework widely and support the consolidation of European internal labour market and the compensation of labour market between urban and rural areas.

Today telework is only used for isolated tasks and those with fewer cross-references to others. The increasing effort for co-ordination and monitoring is seen to be the main obstacle of co-operative telework. But telework will only achieve its full potential, if attention is given to the fact that business processes are normally co-operative processes. Currently there is no co-ordination-tool with specific planning functionality for this purpose. In this project we will address these issues by a specific business process model, oriented for the implementation of decentralised structures and the support of its management. On the methodological basis of this specific model we will develop and implement telework co-ordination services for model execution as well as planning and monitoring functionality including a module for flexible time management of teleworkers.

The objective of the COBIP project is therefore to improve companies' competitiveness by the use of telework-based organisational structures. COBIP aims therefore at supporting the management of virtual departments and teams through telework, by providing the adequate teleworkers support services.

This paper presents the approach taken to engineering of a workflow management system, supporting the co-ordination of decentralised telework activities through telework activity chain model execution.

2 THE ENTERPRISE ENGINEERING LIFE-CYCLE

Telework may be included within the scope of the distributed / virtual enterprise. As a result, we could describe this project's objectives by buzzwords such as co-ordination, distribution and integration. We aim indeed at solving the problem of information and processing distribution across geographically far apart enterprise working places, allowing for the co-ordination of distributed information-processing activities.

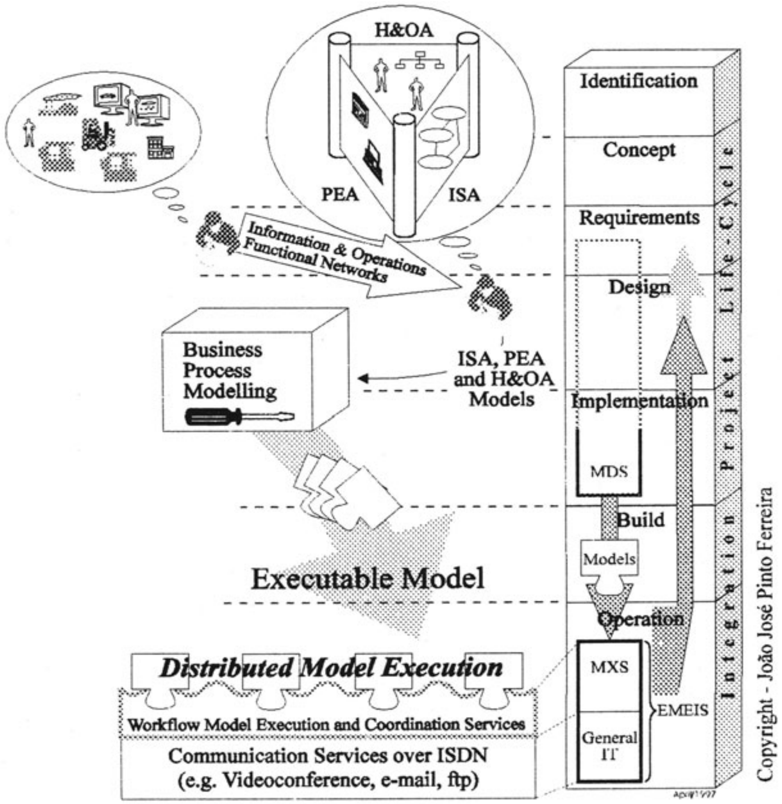

Figure 1 - Telework Engineering Life-cycle

The engineering of the telework enterprise may follow the Purdue Enterprise Reference Architecture life-cycle. Figure 1 illustrates the engineering project life-cycle phases, according to the so-called Purdue Enterprise Reference Architecture (PERA).

The life-cycle starts with Identification phase of the CIM Business Entity, leading to the first description of the management's mission, vision and values the for that entity plus any further philosophies of operation or mandated actions concerning it, such as choice of processes, vendor selection, etc. From the management mission, vision, etc., the operational policies for the units for all areas of potential concern are derived in the Concept Phase. The earlier prescription and selection by the management of possible options leads to the establishment of operational requirements for the manufacturing plant, which in turn lead to a statement of the requirements for all equipment and for all methods of operation which are developed along the Definition Phase. It should finally be noted that there are only two types of requirements, those defining information processing tasks and those defining physical operation tasks. These tasks become collected into modules or functions, and these can in turn be connected into networks of information or of material and energy flow, resulting in the Information Functional Network or in the Operations Functional Network.
No consideration of the place of the humans in the system has been made yet. PERA nevertheless recognises that in any enterprise development program, the human and organisational system is as important as the information system and physical components. This means that, once the implementation is considered, the first need is to define which tasks on either side of the overall architecture will be fulfilled by people. Accordingly, three Implementation or Physical Architectures are introduced into the telework engineering project. These are:

- the Information System Architecture (ISA in Figure 1), (comprising the description of all infrastructure and application software, as well as their integration);
- the Human and Organisational Architecture (H&OA in Figure 1), (encompassing the role played by teleworkers in the each of their remote working places, as well as their integration into the overall organisation so that enterprise objectives can be achieved);
- and the Physical Equipment Architecture (PEA in Figure 1), (referring to the actual physical system architecture, such as computing, networking, and live communication equipment).

Having in mind all these aspects, the modelling tool may be used to capture the inherent co-operative business processes for telework. Further model refinement will lead to the construction of the so-called executable model. Upon its release, this model will be executed on top of the so-called Enterprise Model Execution and Integration Services (EMEIS in Figure 1).

3 COBIP SUPPORT TO WORKFLOW MODEL EXECUTION

Life-cycle view

The distributed / virtual enterprise is clearly the scope of this project, whose infrastructure requirements could be summarised by buzzwords such as distribution and integration (figure 2). We aim indeed at solving the problem of information and processing distribution across geographically far away enterprise sites and working places, as well as the integration with other systems external to our project such as the so-called Manufacturing Execution Systems or Business Systems.

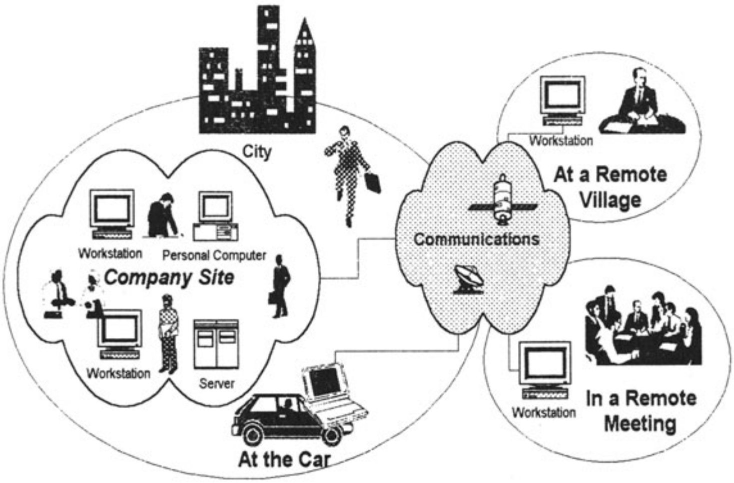

Figure 2 - Physical Architecture for Telework

As presented above we will consider the following Implementation Architectures in this telework enterprise engineering project: the Information System Architecture (ISA), the Human and Organisational Architecture (H&OA) and the Physical Equipment Architecture (PEA). Within the scope of this project we aim at addressing the enterprise workflow modelling issue, having in mind:

- The enterprise and its equipment distribution, i.e., the Physical Equipment Architecture (PEA), which refers to the actual physical system architecture, such as computing, networking, and live communication equipment. This architecture will be built according to the identified user needs for telework support of co-operative business processes.
- The enterprise Human and Organisational Architecture, encompassing the role played by teleworkers in the each of their remote working places, as well as their integration into the overall organisation so that enterprise objectives can be achieved.
- The Information System Architecture includes the actual enterprise workflow models as well as the corresponding services supporting for model execution. The system to be delivered will feature a telework monitoring, management and co-ordination layer, as well as other supporting services such as the video conference software and a digital library.

The Information System Architecture, running on the actual physical system, will comprise the description of all infrastructure and application software, as well as their integration.

Figure 3 illustrates the Conceptual Application Architecture for Telework Support. Once developed, the business process model is released for execution on the Model

Execution and Co-ordination layer. This layer uses standard operating and database services, as well as special multimedia and video-conference services. As described in this scenario, the actual model execution will use underlying services such as the video conference which will allow two teleworkers to meet and discuss some relevant issue, along with the storage of the recorded video clip of this activity log area in the Digital Library. An interface Information Services layer is used to cope with permanent change that characterises today's information services, like the Internet. This way, plug and play standard modules can easily be added/removed from the system, also allowing for some scalability, reducing basic system's cost. This way, a SME (Small Medium Enterprise) may start with a basic system (e.g. without videoconference services) and later add those services as necessary.

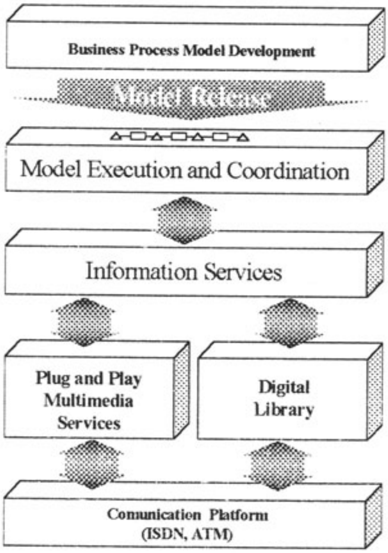

Figure 3 - Conceptual Application Architecture for Telework Support

The Modelling view

This paragraph presents the GERAM framework based on the "Generalised Enterprise Reference Architecture and Methodology" Version 1.5 document [5]. Further information on this topic could be found in the early GERAM papers such as [6] and [7], and books such as [1].

Previous Research, carried out:

- by the AMICE Consortium on CIMOSA [4],
- by the GRAI Laboratory on GRAI and GIM [8],
- and by the Purdue Consortium on PERA [9],

produced reference architectures meant to organise all enterprise integration knowledge and serve as a guide in enterprise integration programs.

The IFIP/IFAC Task Force analysed these architectures and concluded that even if there were some overlaps, none of the existing reference architectures was contained in the others; each of them had something unique to offer. The recognition of the need to define a generalised architecture was the outcome of the Task Force work, leading to the definition of the so-called "GERAM" (Generalised Enterprise Reference Architecture and Methodology). GERAM comprises those methods, models and tools which are needed to build and maintain the integrated enterprise, be it a part of an enterprise, a single enterprise or a network of enterprises (virtual enterprise or extended enterprise). GERAM defines a tool-kit of concepts for designing and maintaining enterprises along their entire life span, and provides the means to organise existing enterprise integration knowledge.

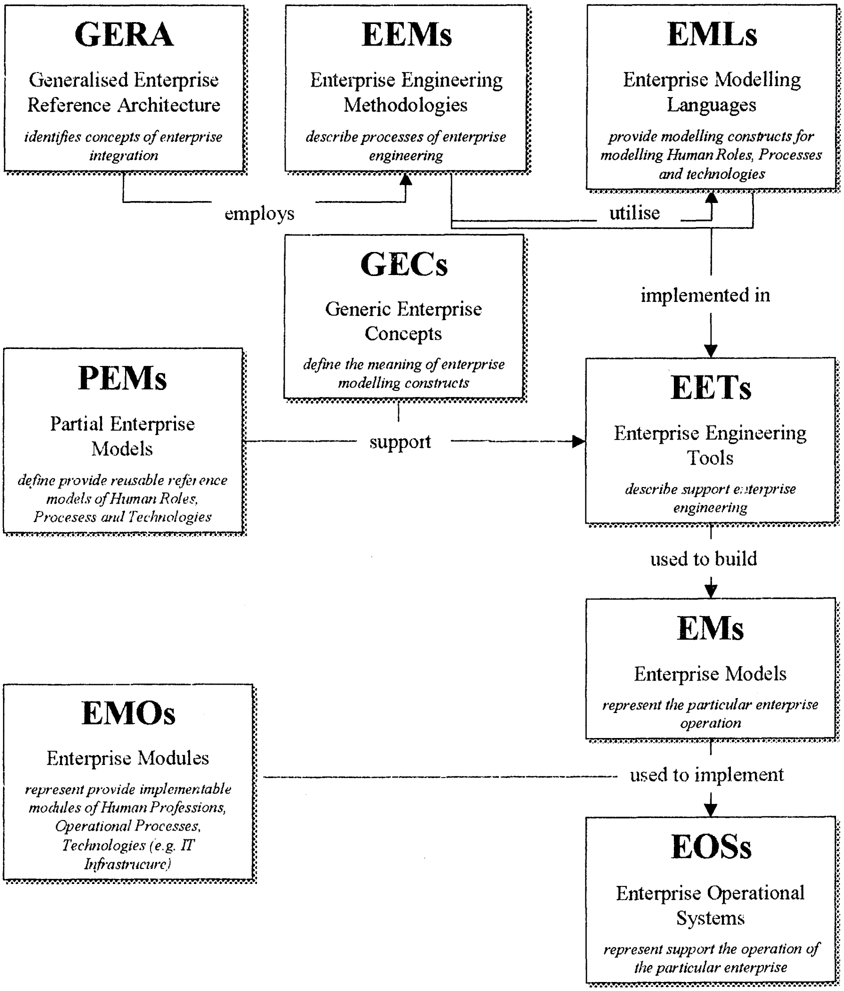

Figure 4 - GERAM Framework for Enterprise Integration

The GERAM framework is presented in Figure 4 and provides the necessary guidance of the modelling process and enables semantic unification of the model contents as well.

The framework identifies the set of components necessary and helpful for enterprise engineering. The general concepts identified and defined in the reference architecture consists of the life cycle, life history, and model views among others. These concepts help the user to create and maintain the process models of the operation and use them in her/his daily work. The modelling tools will support both model engineering and model use by providing the information on functionality and dynamic behaviour needed for efficient operation. Operational models cover both the intra and inter organisation operation and thereby allow to model interactions with customers, suppliers or supporting organisations (e.g. banks, distributors, etc.).

The GERAM framework provides the best background for the tool construction project. The Telework Enterprise Partial Model will be built based on both on partners experience, and on the analysis of three telework pilots, including a major European car manufacturer, a system integrator company and a publicity firm. Iterative analysis on these models will provide an early definition of a telework activity library, and a glossary defining the actual modelling constructs. Further examination of these models will allow the Telework Enterprise Modules derivation: human skills and infrastructure functional operations. As a result of this approach, we will have a library of telework activity partial models, as well as a library of infrastructure functional operations supporting model execution. Combined, these libraries will allow the construction of a model based telework planning and co-ordination infrastructure to be installed and demonstrated at the pilot sites.

Although is not questioned de need for models, it is not at all practical to model in fine detail an entity such as an enterprise. As, by definition, 'models' are an abstraction of reality and often are imprecise, they are also expensive to build, validate and maintain. Whereas the use of models (even an imprecise one in some cases) is essential, these models more often happened to be 'mental models' rather than 'computer based models'. Whatever, an abstracted understanding of what might happen, what needs doing and how it can be done is needed to allow us to reason and make decisions about the best way of doing things. Also, some sort of model is essential to facilitate the communication of purpose and state between individuals, and thereby enable them to work cohesively, specially in loosely coupled working environments such is the case of telework and the virtual enterprise. On the other hand, specially in fast changing market environments like we face nowadays, the model has to follow enterprise changes in its quest for survival, or soon become obsolete and useless. This imposes sever requirements on model creation and update, difficult to attain in a centralised modelling environment.

In order to overcome these problems related to modelling, mainly the management of change, a structured and distributed approach should be taken. In this scenario, the organisation multilevel distributed model is jointly managed by business unit and business process managers, but in a very loosely coupled way. Each manager is responsible by his business process model (functional model describing the implementation of a process using resources from business units) or his business unit model (hierarchical model describing the resources of the business unit and their functional capabilities). This process goes up to the top management level, aggregating multiple business units into macro units, etc.

Model are built, using PEMs (Partial Enterprise Models in Figure 4) as building blocks (in a 'LEGO' or plug and play fashion), in the EET (Enterprise Engineering Tools in Figure 4) this project aims to develop. In the beginning, the PEMs library should be based on standard industry-wide reference models library, being enriched over time with other locally built PEMs. In the implementation phase, PEMs are mapped to EMOs (Enterprise Modules in Figure 4) at the operational level, either directly (one-to-one relationship) or through EMO aggregations (one-to-many) as it is most often the case. EMOs development will probably be left to software/equipment vendors and only in very special cases could be home made, at least in SMEs.

In order to derive some kind of coherence from the complete model, several partial views should be generated for analysis (functional diagrams of business processes [e.g. DFDs], resources hierarchy [e.g. organisation charts] and relations, workflow diagrams[11], workload diagrams, etc.). This way, business process reengineering can be fostered without major disruptions, as changes occur most often at the function/resource relation (e.g. function F1 executed by resource X1 from business unit BU1 is replaced by function F2 executed by resource X2 from business unit BU3 and by function F2 executed by resource X2 from business unit BU5) and propagate smoothly through the model structure. When executing the model, the sate of each block should be always available for management monitoring.

4 CONCLUSIONS

Due to past experience of procedure automation systems with mixed results, the need arised for the development of new software products and enhanced office information systems, which fall under the new domain of workflow management technology. It is not a new technology for procedure automation, but takes the formal part of procedure processing applications and combines it with general communication and information sharing facilities. The objective of enterprise information system should be to support, and not necessarily to automate, predictable and formal structures of business processes, as well as the coping with unanticipated contingencies, dynamic change and breakdowns, to achieve the final objective of customer satisfaction.

Telework which, considered as an innovative work organisation-form for new decentralised organisational structures, further call for the use of workflow management technology. Currently there is no co-ordination-tool with specific planning functionality for this purpose. In this paper it was presented the approach taken to engineering of a workflow management system, supporting the co-ordination of decentralised telework activities through telework activity chain model execution.

A telework engineering life-cycle was proposed, based on the Purdue Enterprise Reference Architecture (PERA). Furthermore, the development and use of the tool the COBIP project aims to create was clearly identified in the scope of the GERAM Framework for Enterprise Integration.

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