FirstSTEP Process Modeler – a CIMOSA Compliant Modeling Tool

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Abstract: Since its market release in late 1994, the FirstSTEP toolset developed by Interfacing Technologies of Montreal, Canada has been proven to be one of the most practical solutions for business process management initiatives. Being a methodology independent enterprise modeling and simulation application, FirstSTEP has been adopted by industry leaders from such diversified sectors as manufacturing, finance, telecom, healthcare, public, and others. Its concept and approach are compatible to the CIMOSA framework. Most notably is the user front-end simplicity that has enabled its acceptance by the typical business manager who is not usually academic in his/her approach.

The paper presents the FirstSTEP tool suite, its concept and approach and demonstrates its capabilities using an application with a most recent FirstSTEP user – America Online, Inc.

Keywords: Business Process Management, BPR, Business Process Design, Enterprise Modeling, First-STEP, Modeling tool, CIMOSA.

1   Introduction

Based on extensive research that was initially sponsored by the National Research Council of Canada and a consortium of Canadian industry leaders, the FirstSTEP framework is based on five groups of enterprise objects. The concept and approach developed is now the basis for all three members of the FirstSTEP product family (Designer, Viewer, and Charter).

Extensive research has been and is being conducted in enterprise modeling and integration [1-5]. This report is written from a business perspective, translating a list of capabilities afforded by enterprise modeling technology into practical use by business architects and managers who are looking to improve and transform their enterprises and operations.

IT initiatives are often considered separately from the business processes they support. Enterprise modeling tries to bridge this gap by describing all aspects of the business processes, which make up the enterprise operation. These aspects or views as being called in CIMOSA concern all the assets of the enterprise – knowledge and capital investments, recognizing humans, as well as IT and other resources.

Therefore, FirstSTEP models identify organization, resources and information as they relate to the business process and its constituent activities. Processes are described in terms of their functionality and dynamic behavior. This allows not only to capture business process structures and contents, but to evaluate their performance through very detailed simulation and subsequent reporting of the different performance parameters.

The particular application is concerned with a business case demonstrating how America Online, the world leader content provider for Internet, employed Business Process Management (BPM) principles to justify a technology initiative for transforming the process of handling employee expenses and vendor invoices.

2   The Creation of an Enterprise Model

Attempting to represent the reality of the enterprise life through the construction of an Enterprise model can be a complex task. There are many classes of objects with even much higher orders of magnitude of interactions among them occurring in the time dimension with the ultimate goal of satisfying the enterprise stakeholders. Since so many entities in various states need to be considered, a methodical approach has to be followed to create a practical virtual environment.

If we examine the enterprise from the strategic consideration of markets and products we will quickly discover the links to the enabling organizational assets that facilitate value delivery to the stakeholders. A number of frameworks and methodologies were developed for that purpose, most notably is the Balanced Score Card developed by Kaplan and Norton [6]. The challenge addressed by well-built enterprise model is to tie the strategic measures to the daily measures of operations and organizational unit performance.

In creating the construct for a practical modeling environment, that can be very quickly understood by any business executive, the following principles are key:

1. All relevant objects need to be classified in no more than a handful of groups, thus enabling the comprehension of the model.

2. Hierarchical decomposition enables drilling down to expanded level of details, while maintaining the simplicity of information structure

An organization structure can be represented in the form of five distinct layers (Figure 1). At the top we find the Chief Executive Officer, managing the Enterprise for the realization of a given set of objectives. Directly supporting the CEO is the strategic management layer – creating long term and tactical operating plans, including setting multi-disciplinary set of goals and objectives for anything that is done in the enterprise.

The two bottom layers of the hierarchy consist of the organizational infrastructure, business units and their enabling assets – resources, people (including their skill sets and experiences – their "know-how"), technology, machinery, etc.

Connecting the strategic layers to the enabling ones are the management delivery mechanisms, the business processes. Processes are the most effective way to manage an organization at any level and ultimately support its overall objectives.

2.1 The PDM (Process Design and Management) Methodology

Guiding business process modeling is not always an easy task. A number of methodologies have been developed and adopted

Fig. 1: Enterprise Pyramid

by enterprises, the most visible ones originate from information modeling. Perhaps most notably is the IDEF methodology, dating back to the seventies and originally commissioned by the US Air Force as a modeling tool for analyzing the functional aspect of systems. In developing FirstSTEP, Interfacing Technologies has given considerable attention to enable enterprises and business users adapt their own realities to the virtual environment without restriction to any rigorous methodology, unless it is their preferred choice. The high level framework offered with the FirstSTEP suite has therefore been designed to be complementary and supportive of most methodologies. It can be at best looked at as a guide to generate successful results and is based on extensive work done with several world-leading enterprises at different levels of implementation. The general framework for deploying "Process Design and Management" (PDM) has been evolved with the strong support of Interfacing Technologies services team and consulting partners. At its origin, the framework has been driven by re-engineering or renewal mandates. However, more and more enterprises are turning their improvement models into operational models. The general process improvement framework called *Result-Driven-Renewal* [7] provides overall guidance to the process of implementing initial and continuous improvement. Combined with PDM it enables enterprises achieve and maintain market leadership.
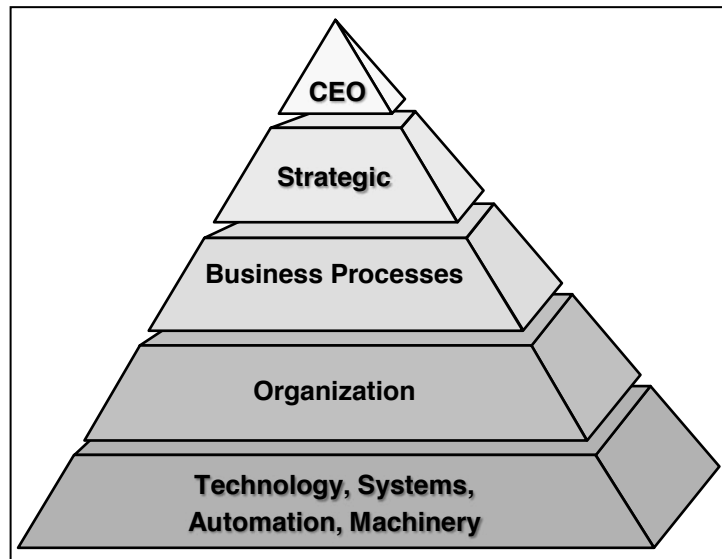
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The R-D-R is based on four renewal drivers:

- Mission: a statement of measurable and attainable goals,
- Measures: values of delivery to clients (quality, time, cost),
- Method: How to go about renewal:
    1) High level (top-down) scooping to identify opportunities for renewal,
    2) Fact-based (bottom-up) process engineering,
- Mandate: What to do for renewal:
    - Restructure the business to reduce cost, optimize use of resources, ...,
    - Refine the business to continuously improve operation,
    - Reinvent the process to improve competitiveness,
    - Replace technology to upgrade operation,
    - Refocus mission and vision of the business.

The PDM renewal life cycle can be described as a set of distinct tasks (Figure 2) . Starting with the definition of business vision and scope and the implementation of the project team (Focus Phase), the team will describe the current situation crating the AS-IS model (Describe Phase). The development of TO-BE models and their evaluation through simulation and pilots (Innovate Phase) will lead to the implementation of the final solution (Implement Phase). Its the Describe Phase and the Innovate Phase were business process modeling can be most beneficial. However contribution can be obtain in the other two phases as well.
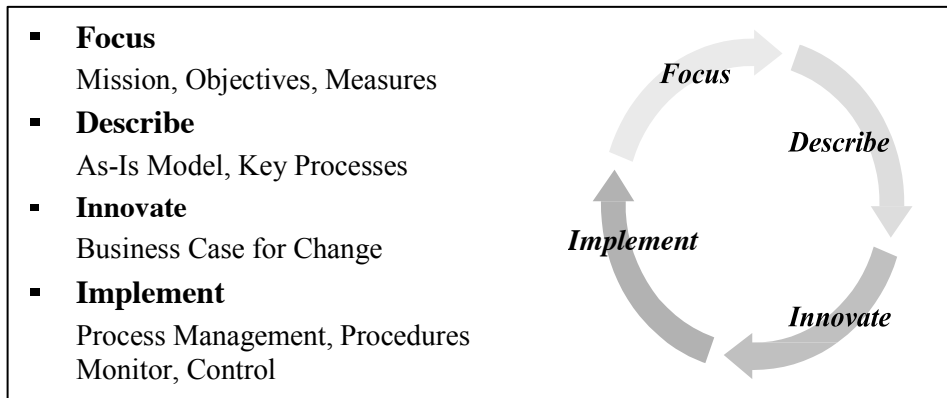
- **Focus**
  Mission, Objectives, Measures
- **Describe**
  As-Is Model, Key Processes
- **Innovate**
  Business Case for Change
- **Implement**
  Process Management, Procedures
  Monitor, Control

Fig. 2: Process Design and Management Methodology

High level models will support the scooping of mission and vision and models will be helpful in the Implementation Phase for training of personnel or for documentation of the 'real' implementation compared with the one defined in the final model of the Innovation Phase. The future of PDM is looking for live links to monitoring and knowledge management capabilities that the FirstSTEP suite is already providing.

2.2 The Business Process Construct

A process can be described as a value-chain to the customer, whether he is internal or external to the organization. Processes can be defined at many different levels and with various boundaries. To derive the important benefits that processes bring to the enterprise management infrastructure, we need to consider a number of important process characteristics:

1. **Process performance targets:** The performance targets are set at the strategic level to support the mission and the direction of the enterprise,
2. **Process boundaries:** Boundaries define the scope of the process and its beginning and end-points. Furthermore, they determine the relationship with other processes in parallel, or as subsets (sub-processes),
3. **Process Client:** The ultimate customer who will receive the value delivered by the process,

4. **Process triggering events and inputs:** These are more than just simple in-flow of objects into the process. These are the entities that trigger the set of events and activities that make up the process,

5. **Process outputs:** The products delivered by the process upon completion.

To construct an enterprise model that encompasses the above, we only need to consider five primary groups of objects:

- Processes, Activities, Materials/Information, Resources and Organizational units.

Processes will be decomposed into sub-processes or activities and both will employ resources to manipulate material and information in order to deliver value to the customer of the process. In the process models, resources will be assigned to activities and material and information are defined as the activity inputs and outputs. Figure 3 shows the most relevant information captured at the level of core process, sub-process and activities. Whereas goals and ownership are the most relevant information at the process level, resources (performer), input/output, time and cost are those required at activity level.
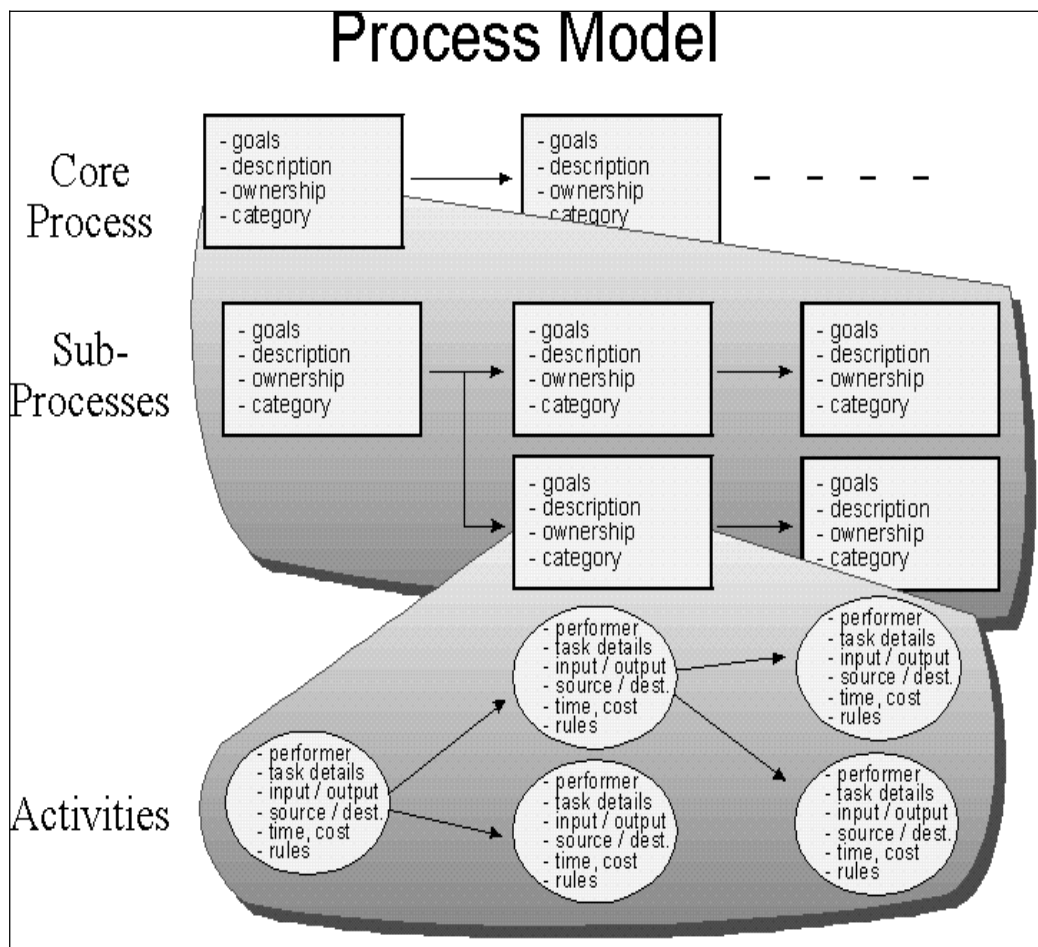

Fig. 3: Process Model Objects

Both processes and resources are related to the responsible organization units. Even with the process owner being uniquely defined the organization of resources implies that processes will move across organization boundaries. The model will allow to identify and highlight potential problem areas which may arise from those changes of responsibility.

Figure 4 shows the process model as represented in FirstSTEP. The Main (Core) process is decomposed into two sub-processes A and B which in turn are decomposed further into sub-processes (G) and activi-

ties (Q to P) for process A and activity Z for process B. This only illustrates that modeling has to be according to the need and while both processes may be equally complex in real life, the focus for the purpose of the modeling is on process A. Consequently all but the essential details have been omitted from process B.

The ability of decomposing large processes into smaller sub-processes provides the advantage of partitioning the work between several people, which on the one hand will be more knowledgeable on their part of the process and on the other hand allows to aggregate the different sub-processes into a comprehensive model of a core business. It also allows to follow a top-down approach by developing a skeleton model of the process and than decomposing the parts according to the specific needs for detailed information.

In addition, the different people involved will have a very good understanding of the different parts of the process and they will be able in a bottom-up mode to simplify the model for high level decision support, by identifying only major activities with the details inside.
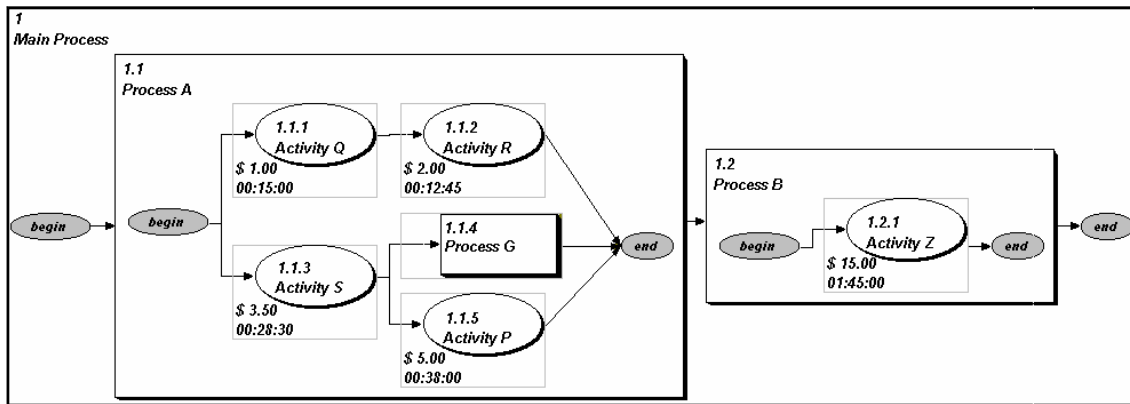

Fig. 4: FirstSTEP Process Map

The information in Figure 4 presented adjacent to the activity are activity cost and duration. Other information like resource, inputs/outputs may be selected for presentation as well.

To ease the model creation process FirstSTEP provides six different types of activities which exhibit predefined characteristics and capabilities:

- Receive Activity: acts as event; introduces new material into the process scenario,
- Transform Activity: converts inputs into outputs,
- Transport Activity: moves outputs from one resource to another one,
- Verify Activity: converts inputs into one of mutually exclusive outputs based on probability of occurrence,
- Ship Activity: removes outputs from the process scenario,
- Distribute Activity: takes output of one resource and gives duplicates to several resources.
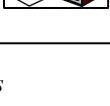
Fig. 5: Graphical Representation of Activity Types

These activities are represented by specific symbols to enable more easy recognition and understanding of the process model. Figure 5 shows two alternative graphical representations used in the FirstSTEP tool suite. In addition, user defined iconic representations are supported as well.

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3   The FirstSTEP Suite of Tools

FirstSTEP is a comprehensive business process management tool giving business people the power to design, document, analyze, refine, incrementally improve and make a clear business case for process change. FirstSTEP ensures that all of Business Process Improvement or Reengineering projects' pertinent information is captured and well organized for analysis. FirstSTEP guides the user into taking a disciplined analytical look at the process in order to build a realistic model of the activities of the enterprise. FirstSTEP is not just a process charting tool since its processes are "live" entities for which behavior is defined and dynamically evaluated during a simulation. Processes are linked to resources, departments, business objects and business rules creating a realistic representation of the enterprise rather than an isolated picture of process flow. Such a realistic model enables simulation of the behavior of a process under various dynamic conditions (input volumes based on probability distributions, resource availability and different rules).

Different phases of business process management are supported by a comprehensive set of FirstSTEP tools. These include:

- FirstSTEP Designer: To model, simulate and analyze business processes
- FirstSTEP Viewer: To distribute, validate and test models
- FirstSTEP Charter for Visio®: To create process models
- FirstSTEP Designer for Unicenter® TNG™: To monitor business processes.

3.1   FirstSTEP Designer

The Designer provides all functionality needed to model, analyze and simulate a process. It consists of five main components to help in the construction and analysis of the model (see Figure 6):

1) MODELING AND MAPPING TOOLS allow the business analyst to define the key processes and activities, and associated business objects of both existing and "to be" models of the organization. The FirstSTEP model may be analyzed at many levels of detail allowing for a multifaceted view of the scenario. Users may also use FirstSTEP Charter for Visio to capture the business processes that can be imported to FirstSTEP Designer for analysis and simulation.

2) BUSINESS TEMPLATES contain the group definitions for activities, resources, materials (business objects which are entities being inputs/outputs to activities), icons and calendars that are common to a specific industry or sector. FirstSTEP can thus be customized to various types of enterprises (i.e., financial, healthcare, government, manufacturing, etc.). Similarly, it can be customized to every organization and for every model allowing the user to define the attributes of common or similar objects only once.

3) PROCESS SIMULATION engine provides a dynamic environment of the enterprise, enabling the author to gauge the performance of the processes and resources. The FirstSTEP simulation ani-
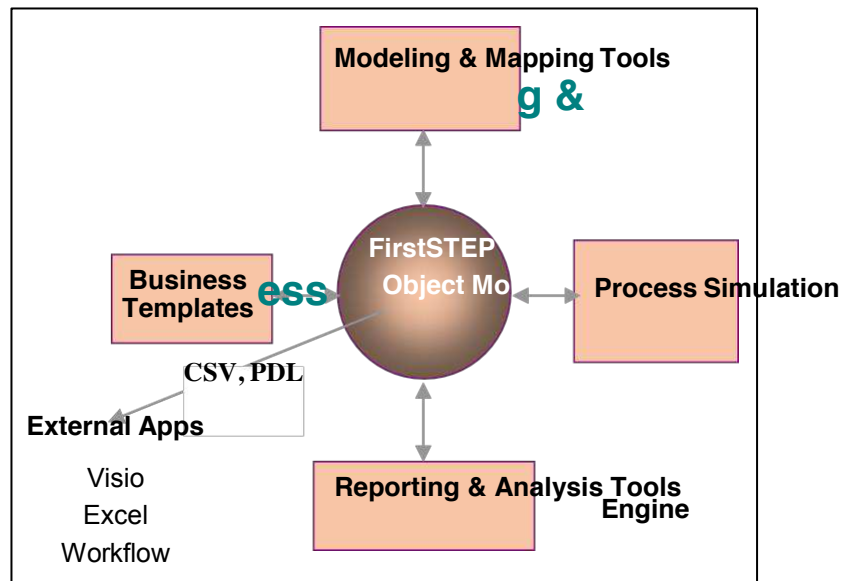

Fig. 6: FirstSTEP Designer

mates resource use and material flow for a clear understanding of process dynamics. Analysis of the simulation statistics determines if the process goals have been met, highlighting scheduling conflicts, delays in the process, resource allocation requirements, etc. The simulation is based on discrete events using a probabilistic model of both sequential and concurrent processes.

4) The REPORTING AND ANALYSIS FACILITY provides the necessary tools to evaluate the modeled process. Numerous reports are provided on the process performance, workflow information, and resource utilization both for the enterprise model and simulation runs. Process sensitivity analyses can determine process cycle times, and resource capacity requirements. The report data can be printed or exported to files and spreadsheets for further analysis.

5) The FirstSTEP OBJECT REPOSITORY is a file-based system where all FirstSTEP classes and objects (entities that together form the complete model) are stored, including the simulation statistics. Objects in one model can easily be moved to another model through drag and drop operations.

In addition, FirstSTEP provides file import/export capabilities for other tools and application supporting the CSV (Comma Separated Value) and PDL (or WPDL) (Workflow Process Definition Language) formats.

3.2   FirstSTEP Viewer

The Viewer allows for enterprise wide distribution and validation of process models created by the First-STEP Designer or by Charter for Visio. Thereby it supports the communication across organizational boundaries providing a common representation of processes. Users may review and test the model modifying the scenario, but they may not change the structure of the model itself.

3.3   FirstSTEP Charter for Visio®

This add-on to the Visio graphic tool enables users to view edit or create FirstSTEP models in Visio and capture all information essential for process analysis. Model created in this popular environment may be transferred to FirstSTEP Designer to take advantage of its analysis and simulation capabilities. The link is bi-directional, allowing models created in Designer to be sent to Charter for complete presentation freedom and advanced HTML display of process hierarchies, swimlane view and other components.

3.4   FirstSTEP Designer for Unicenter® TNG™

Computer Associates Unicenter TNG is an integrated enterprise management solution for IT resource management. With FirstSTEP linked to Unicenter TNG it becomes possible to achieve real time monitoring of business processes and to manage IT in regard to actual changes in business processes.

Through the Unicenter TNG WorldView API FirstSTEP receives all resource and application information and automatically will create the business process view and the value added stream objects in the Unicenter TNG repository. Therefor, both IT and business people will have a common view on the process.

3.5   Relation to standards

The FirstSTEP Model schema used by all members of the FirstSTEP Tool Suite originates in the International Standard Organization model of the manufacturing enterprise [8, 9] and resembles a very close relationship with CIMOSA [2]. Its application areas of Business Process Design, Simulation of What-IF scenarios, and even its more recent applications of monitoring and management, corresponds well to the upper levels of the CIMOSA system life cycle oriented process model. Therefore, the schema also conforms to the relevant European and international standards of enterprise engineering and integration [10-12]. The following analysis supports this statement rather positively (see Tables 1 and 2).

Tables 1 relates the FirstSTEP modeling framework to the one defined in ISO [10a], CEN [11] and CIMOSA. GERAM (Generalised Enterprise Reference Architecture and Methodologies) is a generalization of the three main reference architectures available in the early 1990s (CIMOSA, GRAI/GIM, PERA).

GERAM has been developed by the IFAC/IFIP Task Force on Architectures for Enterprise Integration. It has been the major input for the ISO standard [10].

Table 1: Modeling Framework Comparison - Model Views

ENV 40003, GERAM (Annex A of ISO 15704)	FirstSTEP	CIMOSA
Function	Process View (static) Process View (dynamic)	Function View (static) Function View (dynamic;)
Information	Material View	Information View
Resource	Resource View	Resource View
Organization	Organization View	Organization View

Table 2: Modeling Construct Comparison (CIMOSA entries in Parenthesis are construct components)

ENV 12204	FirstSTEP	CIMOSA
General Definitions		
not defined	Modeling View, Template View	Engineering Environment, Operation Environment
Modeling Constructs - Function View related (static)		
Enterprise Activity	Scenario, Activity Types (6)	Domain, Enterprise Activity (Types 28), (Functional. Operation)
Modeling Constructs - Function View related (dynamic)		
Business Process, Event, Sequential Relationships	Process Receive, (Process Entries), Event Profile Generator (Resource Links)	Process, Event, (Behavioral Rules)
Modeling Constructs - Organization View related		
Organizational Unit	Organization Entity	Organization Cell, Organization Unit, (Organization Element)
Modeling Constructs - Information View related		
Enterprise Object, Product, Order, Object View, Relation	Material Forms	Enterprise Object, Object View, (Info. Element) Relation,
Modeling Constructs - Resource View related		
Capability Set, Resource	active Resource passive Resource	Capability Set, (Capability), Resource/Functional Entity, (Resource Comp.)
total number of constructs.		
12	9	11

The relation of the FirstSTEP modeling constructs to those defined by CEN [10] and CIMOSA is shown in Table 2. Again a large degree of compliance exists. Differences to the ENV 12 204 exist mainly in the terminology.

FirstSTEP provides already activity types, which goes beyond the standard and which significantly enhances its modeling capability, especially in view of the non IT specialist user. CIMOSA in its technical specifications [13] lists 28 potential activity types which cover management, operation and support activities.

A specialty of FirstSTEP is its use of a specific activity type 'Receive' for creating the event functionality. This has certain advantages in model simulation but may not always be perceived natural by business people.

The process behavior is modeled in FirstSTEP through Resource links. There are some differences between the CIMOSA domain construct and the FirstSTEP scenario concept. The domain construct allows definition of the area to be modeled by identifying the relations (events and objects exchanged) with the environment. From these definition of objects entering and leaving the domain functionalities and processes are derived. FirstSTEP uses the scenarios for a general textual description of the business area to be modeled

4 Application

Since its introduction into the market FirstSTEP has been used in a wide range of industries and across the world:

> Finance, Insurance & Health Care, the Public Sector, Transportation & Communication, Management & Technology Consulting, Manufacturing and Retail and Education and Training.

Applications have been in administrative areas of the business as well as in the their core processes. To illustrate the work and to identify key benefits obtained by the clients a recent application is described in the following section.

4.1 America Online business case

America Online, Inc., the Internet content provider leader, has been experiencing a tremendous growth during the last years. This has encouraged the company to undertake a continuous improvement effort of its operations to support its growth. The need for a structured improvement pattern has rendered the justification of all initiatives necessary. Work was conducted in the second half of 1998 within the department of Financial Services to build the business case for a technology improvement initiative based on the process construct.
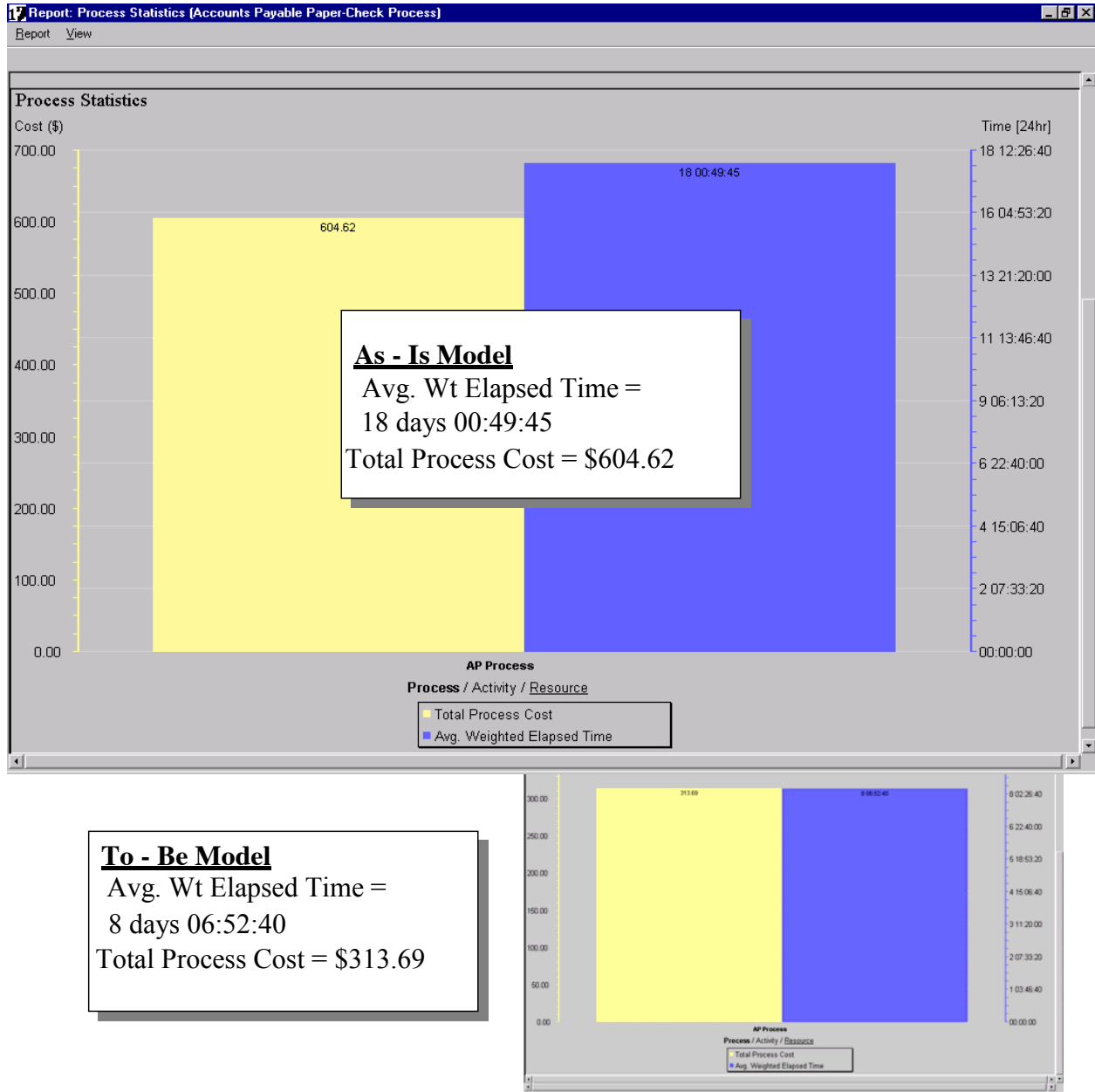
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Process Statistics

As - Is Model
Avg. Wt Elapsed Time =
18 days 00:49:45
Total Process Cost = $604.62

To - Be Model
Avg. Wt Elapsed Time =
8 days 06:52:40
Total Process Cost = $313.69

Figure 6 AOL Application Results

The expense reimbursement process was chosen as the pilot one. This process comprises the steps taken from the moment an employee fills in an expense reimbursement, or AOL receives a vendor invoice, till the time that the payment is processed. Currently it is predominantly a manual, time-consuming process that provides no flexibility to the customer, internal or external. Under the improvement proposal AOL is to introduce an electronic system where the process customer is offered the option of receiving directly into his/her account the amount due. This, in turn, is expected to result in better and more efficient service levels. The challenge in this case was that the proposed framework is an IT based solution supporting a business process. AOL's objective was to analyze the feasibility of the proposed electronic fund transfer (EFT) process and measure its benefits, in terms of elapsed time, total operating cost, resource utilization levels and customer satisfaction. A comparative study was conducted using the FirstSTEP process management tool. This included:

- The process mapping of the current mode of operations as well as the EFT process, thus creating the As-Is and the To-Be models respectively.
- The simulation of both process models, followed by the analysis of the results obtained.

The use of the FirstSTEP tool offered AOL a rigorous mapping approach. This resulted in accurately capturing all cost and times contributors in the as-is model. Furthermore, it helped shape the desired EFT process. In this way, potential problem areas were identified prior to implementation, avoiding costly and disruptive refinements later. Also, the analysis of the business process helped in the better design of the final IT solution, by depicting the links between the two.

Through the use of the FirstSTEP simulator, AOL was able to capture the impact of the EFT process through all the desired metrics. Accordingly, the following benefits were captured for the introduction of the EFT process, considering a weekly volume of transactions:

- The elapsed time was reduced by 55%, leading to clear customer satisfaction,
- The total operating costs were reduced by 30%,
- The critical resources were freed for up to 51% of their time allocated to this process.

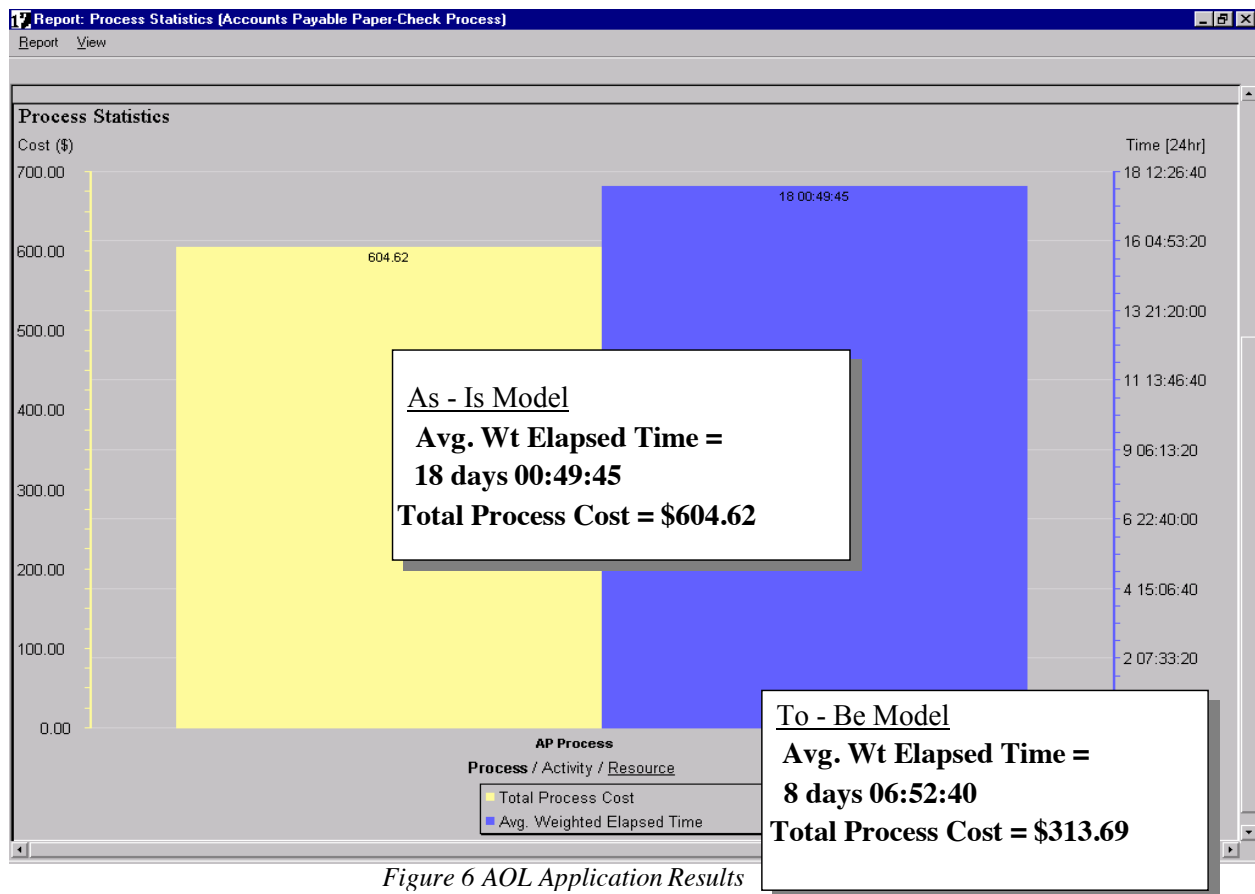Figure 6 shows an example of the result of such an analysis.

Figure 6 AOL Application Results

5   Conclusions

The initial Enterprise Modeling research work that commenced at the beginning of this decade with the sponsorship of the National Research Council of Canada and a group of Canadian companies has led to a very comprehensive modeling environment that is gaining wide acceptance in the industry and as well in the academic sector.

What started as an initiative to support Manufacturing Enterprises, turned to be based on a holistic view of enterprises encompassing all aspects of operations. Thus, the resulted technology, marketed today under the brand name FirstSTEP by Interfacing Technologies Corporation (www.interfacing.com), is applicable to any industry sector adopting process design, improvement and management. By coincidence and perhaps through some early collaboration between researchers across the ocean, the ISO factory model [8, 9] based FirstSTEP closely resembles the CIMOSA modeling approach. Interfacing Technologies maintains a group of researchers collaborating with groups like CIMOSA, PRIMA and other research institutes, including, whenever possible, similar research groups at other leading software organizations.

The view to the future and its associated research is to strive for wider acceptance of operational modeling concepts by world enterprises, better applications for simulation technology and total management by processes that includes knowledge repository and management.

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7   Authors' Biography

Levi, Meir H.

Meir H. Levi, cofounder and the current CEO of Interfacing Technologies Corporation, has been the engine behind the conceptualization and development of the FirstSTEP® Toolkit, the comprehensive enterprise modeling, simulation and business process management suite.

With Engineering & Master degrees from the Technion, Haifa, Israel & McGill University, Montreal, Canada, Meir Levi started his career in 1984 managing manufacturing simulation projects and ERP/MRP software applications. He is the current President of Interfacing Technologies and as such still very much involved in the field of enterprise engineering and integration. With over 15 years of research work in Enterprise Software Applications, Enterprise Modeling and Business Process Management Meir Levi is one of today's world experts in the field.

Klapsis, Marios P.

Marios P. Klapsis has over five years of experience in the area of business process management. He has managed many projects in process analysis and business transformation for a number of companies in the manufacturing and services industries internationally. He has been providing consulting services for Interfacing Technologies for four years, including training in the area of business process management, initial client mentoring as well as complete process modeling and analysis to major corporations. He is currently heading Interfacing Technologies' Professional Services department.

Marios P. Klapsis has been teaching at McGill University for the last five years for the Department of Management & Career Studies. He is a graduate of McGill University in Mechanical Engineering (B.Eng. and M.Eng.). He is currently a Ph.D. candidate in process analysis at McGill University, concentrating on the coordination of information in business processes.