

Process oriented Approach to Develop Provider accepted Management Tools

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Abstract

More and more operators of IT resources evolve towards service providers offering IT services. In this role a service provider needs new concepts and new service management tools providing IT services. In this paper a process oriented approach to derive demands on IT service management tools is presented. The starting point is given by the processes that have to be carried out running a networked system. The better a management tool supports these processes the more useful it is from the viewpoint of the provider and hence, the more accepted the tool is by the IT service provider. The process model describing the IT operation of a distributed networked system stems from an industrial project which goal was to introduce a process oriented quality management system into a complex IT environment. The method developing management tools presented in this paper has been successfully applied to various fields of IT management.

1. Introduction

In the last few years two main trends have influenced the operation of information technology (IT): First the information has become a strategic factor of a corporation beside labour supply, capital etc. Second a lot of mainframes have been replaced by networked systems because of lower hardware costs and more flexibility. The disadvantage of networked systems is the higher cost to operate the decentralized systems instead of a centralized mainframe. Concepts including security, performance, accounting etc. have been given up by introducing networked systems. Now the IT service provider of a networked system has to rebuild these concepts using a lot of employees [6].

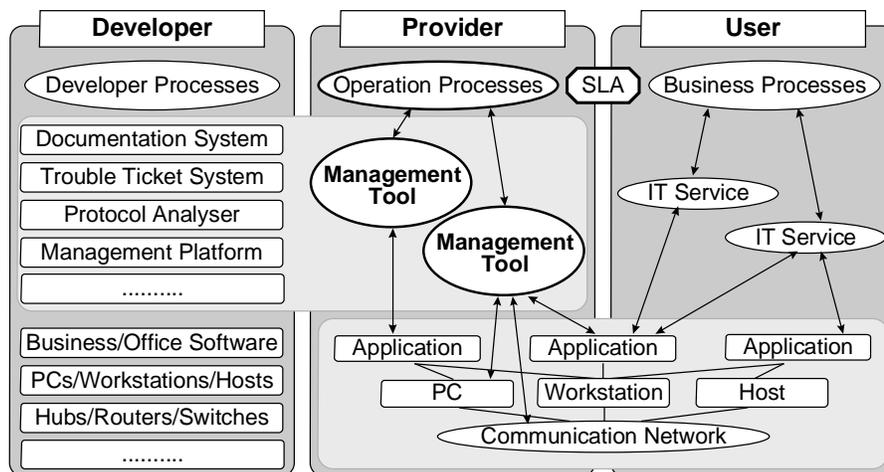


Figure 1: Roles and views of a networked system

Figure 1 shows the scenario providing a networked system: The main roles around the networked system are the developer, the provider and the user. All of these have different views of the networked system. The developer has the view of components of the networked system, e.g. network, systems or application elements like business or office software, hubs, routers or switches and PCs, workstations or hosts. There are developers which offer management tools, too. Examples of management tools are protocol analysers, documentation systems, trouble ticket systems, management platforms etc. An user of IT has the view of IT services. These are application and communication services which the user needs to process information in business processes. Therefore the user defines requirements about the IT services which are laid down in service level agreements (SLAs). A service level agreement includes a description of a service, the availability, performance, quality, accounting etc. The aim of the service provider is to operate the networked system in such a way to satisfy the service level agreements fixed with the users. To be effective and efficient the provider has to structure the processes [3, 4] and to use management tools operating the networked system. But the available management tools today do not satisfy the requirements of the IT service provider. Therefore it is necessary to develop provider accepted management tools. A prerequisite developing provider accepted tools is the sufficient understanding of the operation of a networked system.

2. Process Model of IT Operations

When implementing IT services the provider is used to think in processes including tasks, roles and support aids like management tools [1]. Therefore process models are an adequate approach to describe the operations of a networked system. The knowledge about IT operations can not be derived from a theoretical theorem but must be produced analysing existing IT providers. In collaboration with industrial partners a process model called **Information Technology Operation Process Model (ITOP Model)** has been derived describing the operation of a networked system.

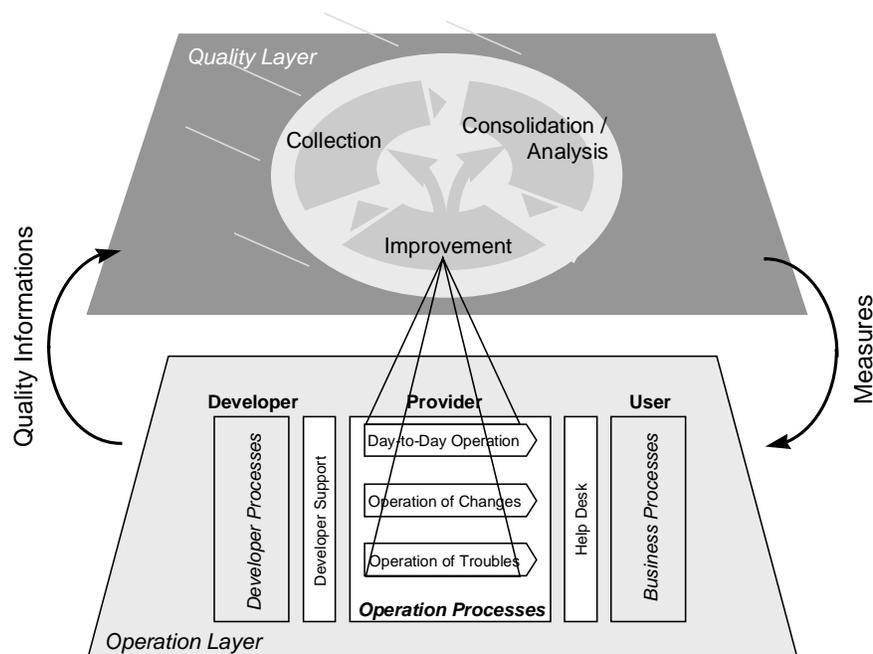


Figure 2: Information Technology Operation Process Model (ITOP Model)

Figure 2 shows an overview of the ITOP Model. There are two main layers: The operation layer and the quality layer. The operation layer describes processes to operate the networked

system effectively. The quality layer controls the operation processes to satisfy the requirements of an IT user fixed in service level agreements.

The operation layer contains an interface to the developer called **Developer Support**. This specified interface allows the provider to get information and help about special application, network or system components. Another interface is the **Help Desk**. This interface specifies the way how the user can communicate and cooperate with the IT service provider. Between these two interfaces the operation processes provide required IT services:

- **Day-to-Day Operation:** This process describes routine actions. In a 24 hour operation which is the normal case in professional IT environments the operation has to be organized in shifts. Besides the main action of monitoring the networked system data backup and (re)configuration of components are further actions of the Day-to-Day Operation.
- **Operation of Troubles:** During the Day-to-Day Operation deviations such as intermediate or total failures of network or system components are remarked. If these failures cannot be solved by applying some routine action as part of the Day-to-Day Operation (e.g. reset of the component) a trouble ticket is generated. The process is structured according to discrete support levels. If a trouble cannot be diagnosed and solved on one support level it is escalated to a next higher level.
- **Operation of Changes:** This process guarantees a planned and coordinated implementation of complex manipulations of the networked system called changes. In particular planning and coordination of a change minimize the risk that something unexpected happens (e.g. failures or negative influence on neighbored components).

A process of the quality layer is the **Audit Cycle** which at first gathers quality informations from the operation layer. In a second phase the information is analysed and correlated. In the following phase measures are taken to improve the processes at the operation level.

A detailed specification of the processes defines roles cooperating with each other and the necessary management information. Also the process model allows the definition of **Process oriented Means (PoM)** from the view of an IT provider which specify provider accepted management tools without depending on a special technology. For instance [25] models the process **Operation of Changes** and describes a list of PoMs.

3. Demands on Provider accepted Management Tools

The ITOP Model and the specification of PoMs allow the developer to realize provider accepted management tools. After analysing the operation of different networked systems including very large telecommunication and data networks there are a lot of demands on provider accepted management tools. Some of these demands are listed below.

- **Modularity:** Depending on the IT service provider or the IT scenario a process can differ [7]. There could be additional actions requiring additional PoMs. A tool environment will only be accepted if management tools can be configured according to the PoMs needed. Therefore the management tool environment must be modular enough to add or delete management tools. This is necessary to substitute legacy tools through new and better tools, too. The description of PoMs given by the provider specifies the management applications.
- **Communication and cooperation:** To support the execution of a process as a whole the management tools used by the roles have to cooperate; e.g. they have to exchange process relevant information and data. Therefore (standardized) interfaces have to enable the communication between management tools supporting the roles. The groupware approach [11] offers the fundamental (technical) cooperation of applications. But the use of these applications supporting roles in the context of a process e.g. **Operation of Changes** is not defined by the groupware approach [2].

- Coordination:** A fundamental aspect to execute a process efficiently is the coordination of the communication and cooperation between application tools and roles considering the definition of the process. So coordination is the act of managing interdependencies between activities [9]. The workflow management approach models these interdependencies between applications and roles in the context of a detailed workflow at the build time. At the run time a workflow is the way the process has to follow [7]. An exception handling called ad-hoc workflow by the **Workflow Management Coalition (WfMC)** is very difficult or not supported by workflow management systems (available today) [5]. But the investigation of the process **Operation of Changes** results that the process cannot be defined in detail at the build time. Exceptions are the norm. Vice versa the groupware approach [11] e.g. a distributed form editor supports the (technical) cooperation, but the systems don't support how to use these groupware applications efficiently in the context of a process. Therefore the roles need a guidance to work efficiently but flexibly enough. Generally it is possible to model guidelines with fundamental relationships between applications and roles and certain synchronization points at the build time. In some detail scenarios it would be possible to model case based workflows, too. At the run time the guideline must offer the flexibility to handle exceptions in details. This concept is named the **Guided Cooperation Concept (GCC, Figure 3)** [18].

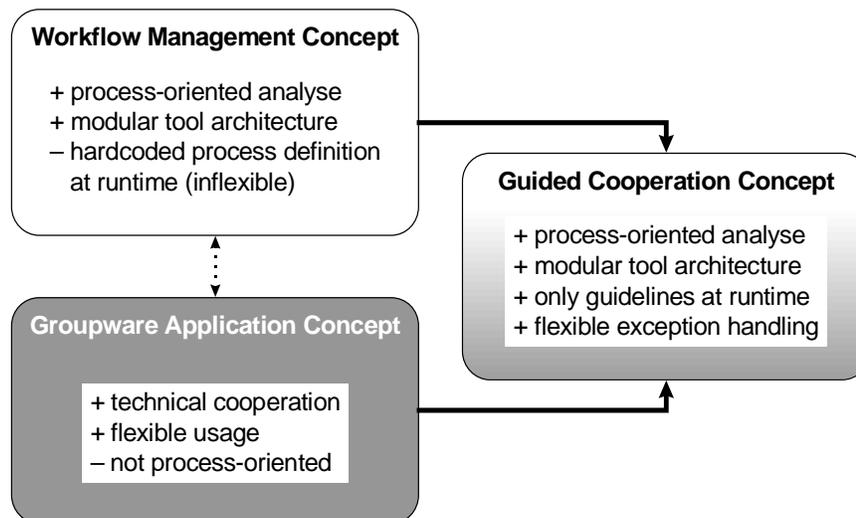


Figure 3: Guided Cooperation Concept (GCC)

A provider accepted management tool set has to take into account these demands. The migration from available management tools to more provider accepted tools could be described as follows.

4. Process oriented Management Platform

The investigation of the process **Operation of Changes** and the PoMs lead to a provider accepted tool set to support the execution of changes. The demands influence the architecture of this tool set named **Cooperative IT Change Control (CICC)** [1]. Figure 4 shows an overview of the architecture of CICC.

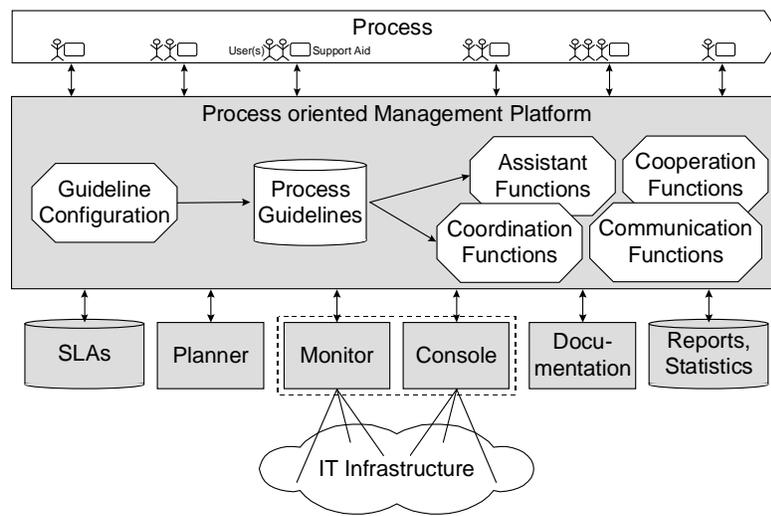


Figure 4: Process oriented management platform

The better the management tools support the process the more useful they are from the viewpoint of the provider and hence, the more accepted the tools are by the IT provider. Therefore the aim is to integrate the management tools into the process. This could be realized by a process oriented management platform shown in Figure 4. The platform and the tool environment support the following functions:

- The **communication and cooperation functions** provide the fundamental mechanisms of a distributed application environment to manage a networked system. The platform contains the technical mechanisms to transport information. This information is necessary to manage the networked system and to support the cooperation of remote roles. Therefore there are two kinds of communication directions: The first one is a *vertical* communication between the application modules involved as PoMs in the process and the networked system. This communication direction is often supported by management tools or mechanisms like network and systems management protocols enabling an application to monitor (and control) the networked system. Examples for such protocols are the simple network management protocol (SNMP) and the common management information protocol (CMIP). The second kind of communication mechanisms supports the *horizontal* communication and cooperation between roles using the distributed management application modules. These communication mechanisms, as for example email, www, ftp or middleware like CORBA, use the networked system only as a transport medium. The platform allows to integrate tools into CICC using these communication mechanisms.
- Considering the process oriented approach the platform supports functions to guide the provider roles executing the process. Therefore important functions are the **assistant functions**. These functions provide a role oriented view of the process e.g. **Operation of Changes** and support the role to execute the necessary tasks efficiently. The desktop of an assistant consists a list of scheduled tasks, a role specific overview of the process **Operation of Changes** and task specific forms to interact with the role. Also there is the possibility to handle exceptions using other management tools. This flexibility realizes the Guided Cooperation Concept (GCC).
- The **coordination functions** has demanded from the process, too. These functions provide the assistant functions described before. They coordinate the (technical) communication and cooperation between the management tools, schedule the tasks to be executed and dispatch the tasks to the responsible roles. Typical examples of coordination functions are calendar and agent functions. Additionally there are functions to trigger an automated action if it is predefined.

- Other functions are the **guideline configuration** to define and customize guidelines describing the process and a **guideline repository** to gather the guidelines of a special provider. These functions help to configure the management tool environment CICC depending on the provider scenario. Supporting a learning process a **history function** logs the current state of the process e.g. **Operation of Changes**. The logging data protocols the executed changes. These experiences could be used for further changes and help to adapt and improve the configuration of the process guidelines [20].
- The **management application** tools or modules specified as PoMs are integrated in the process oriented management platform. Examples of management applications are tools to monitor and control the networked system. These tools are known by the network and systems management and often are parts of integrated network and systems platforms like HP Openview, Cabletron Spectrum and Tivoli TME. Other important management tools supporting the process **Operation of Changes** are a database containing the service level agreements which have to be fulfilled by the process **Operation of Changes**, a planner to consider the operational tasks and the distribution of human resources. Also important to execute the **Operation of changes** is the management tool describing the current configuration of the networked system implementing the PoM **configuration documentation**. To support decisions reporting tools evaluate and condense management relevant informations and present the results as statistics. These management applications should be viewed as examples only. The list of tools [25] has to be customized depending on the provider scenario.

To be effective and efficient in fulfilling the service level agreements in the process **Operation of Changes** it is necessary to integrate the management tools into the process. The process oriented management platform supports a tool based integration.

5. Implementation Experiences

The realization of a provider accepted management tool environment, like CICC, could be done in different ways. Investigations of IT service providers have shown that the main criterion to differentiate realizations from each other is how to integrate the management tools into the process. Also there could be recognized a migration from paper based to tool based process oriented management platforms. The following steps show a possible migration way when realizing such a management platform. Each step results a tool environment implementing a special issue of tool integration.

1. A prerequisite for managing a networked system effectively and efficiently is the transparency of the provider processes such as **Operation of Changes**. The description of the processes guides how to run the networked system. Often there are paper based quality handbooks produced by certification projects [12]. These handbooks [13, 14] describe the processes and activities and refer to forms and management tools which have to be used. Certainly there is not a technical integration of management tools into the process. Projects in collaboration with industry have shown that the acceptance of quality handbooks isn't very high among employees because of overwhelming maintenance and implementation in details. The experience is that the knowledge about the process e.g. **Operation of Changes** must become closer to the use of management tools to accept the process guidelines as an advantage.
2. The next step is to migrate the paper based handbook to a tool based process description. Because of intuitive use web technologies are very propagated [19]. An important advantage is the efficient maintenance of the process information offered by a web server. Special web technologies like Active Server Pages (ASP) [15] also allow to integrate man-

agement tools into the process description. In this case the web technology is the process oriented management platform shown in Figure 4. The guidelines are defined and implemented by e.g. HTML-editors and can be enriched by pictures and multimedia functions like conference systems etc.

A web based prototype of CICC was implemented considering the demands of a service provider. As examples management tools like a change order form [16] realized by a JAVA applet or the PoMs configuration documentation and state information have been implemented. The applets in turn write informations into a database connected to the WWW. Another module of CICC is the classifier which supports the provider to classify the requested changes. A central management tool and module of CICC is the planner. To fulfill the demands of the description of the change schedule and the task schedule MS Project was extended and integrated into the CICC environment. This shows the possibility to use legacy tools to manage a networked system. Experiences made in this step are increasing acceptance of web technologies because of high flexibility and intuitive use. But a bottleneck could be the centralized database which saves and transfers management information. Also it is not easy to integrate legacy management tools like MS Project or other management tools into the web based management platform [22].

3. Keeping the advantages of web technologies and improving the disadvantages we are working on a next step of a process oriented management platform. The main functions of the platform support the communication and cooperation between the roles executing the processes and using management tools. A preferred technology implementing such distributed application environments is the Common Object Request Broker Architecture (CORBA) of the Object Management Group (OMG). This middleware offers the necessary flexibility to integrate (legacy) management tools depending on the provider processes. In order to implement the coordination functions the CORBA platform has to be expanded. Offering assistant functions the front end would be a web browser because of intuitive use, too. The text versions of the web based process descriptions are translated into a more formal object oriented description of the process [19]. The actions e.g. of the process **Operation of Changes** are described as so called task objects with specified input and output objects. Considering flexibility relationships between the task objects are not hard coded and could be changed on demand to handle exceptions. These task descriptions are saved in a guideline repository. The coordination functions read these guidelines and execute them. The prototype of a CORBA based version of CICC is still under construction. It is being implemented in a project in collaboration with an industrial partner.

6. Conclusion

The evolution of IT operators towards IT service providers is going on. Therefore the need to support processes providing the IT services will become greater and greater. The approach outlined in this paper has not only been applied to the field of IT changes. Two further successful projects which should be mentioned are:

1. Design and implementation of a management solution to determine the network and system availability of a distributed system used in a large enterprise [24].
2. Tool Support of a telco provider to search for security attacks in the digital switched network [17, 23].

Throughout all projects which cover different aspects of IT management in different IT environments a top-down approach starting from the operational process a provider has to go

through, was applied. All projects ended with tool implementations that hit the providers' demands and fit into the environment where the tools are applied.

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