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Telecommunications Management Architecture as a Strategic Position of Success

Hans Rudolf STUCKI, Berne

1 PTT Telecom and the free market

All over the world the telecommunication market is undergoing a change. The globalization and liberalization of the markets lead to heavy competition, and Switzerland is no exception. PTT Telecom – the telecommunications operator of the Swiss PTT – can face this challenge from its strong position as market leader; however, it must considerably improve the competitiveness of its products in many areas. The following should help to achieve this goal:

- a stronger market orientation of the entire enterprise, i.e. a more flexible adaptation of products and services to the customer requirements and the activities of competitors
- reaching and maintaining a high quality of the products and services at the most up-to-date technical state, where not the technically achievable but the customer needs are in the foreground
- competitive prices that cover costs at the same time

PTT Telecom has recognized these requirements and has begun to introduce measures at various levels:

1. The new organization (keyword: OFS-T, Optimization of the Management Structure in the Telecom domain) will create responsible profit centres which can act independently on the market.
2. An efficient, fully automated and integrated Telecommunications Management increases the efficiency in the areas of operation and customer support.

2 The Management of Telematic Services

The Telematic Services domain has taken on a leading role within PTT Telecom in a new orientation of the strategies and means for Telecommunications Management. The project *Network Management/Telematics (NM/TI)* has been set about chiefly from the point of view of the following question: How can the production of telematic services contribute to an increase in competitiveness?

The realization of the general marketing goals of PTT Telecom has lead to the establishment of the three strategic project goals of NM/TI (Fig. 1):

- improved control of the *service quality*
- increased *flexibility* in the use of all production means
- improved supervision, thus *lower production costs*

Steps in the following direction have been taken to reach these goals:

1. *Centralization* in certain areas of technical operation (e.g. by setting up operational centres for telematic services) will help to reduce personnel costs and will lead to a stronger concentration of specialist knowledge.
2. The creation of a uniform and transparent *architecture* for all management systems of Telematic Services will decrease production costs considerably. It also provides the technical requirements for enabling quick reaction to market needs.
3. The *flexibility* of this architecture against changes in the organization structure renders it generally applicable (for each Profit and Service Centre) – even outside the Telematic Services.

3 Architecture for Telecommunications Management

3.1 What does Architecture mean?

An *Architecture* supplies technical guide lines for the development and acquisition of complex systems (buildings, EDP Systems, etc.). Its goal is the harmonic cooperation of its individual parts within the whole complex. Therefore, it resembles a zone plan for the development

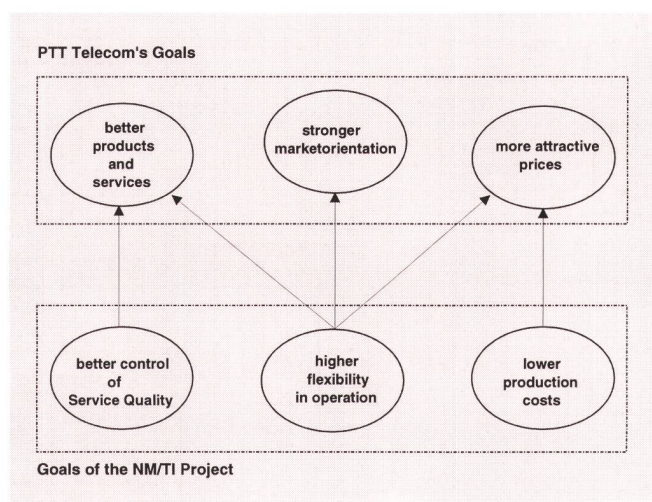
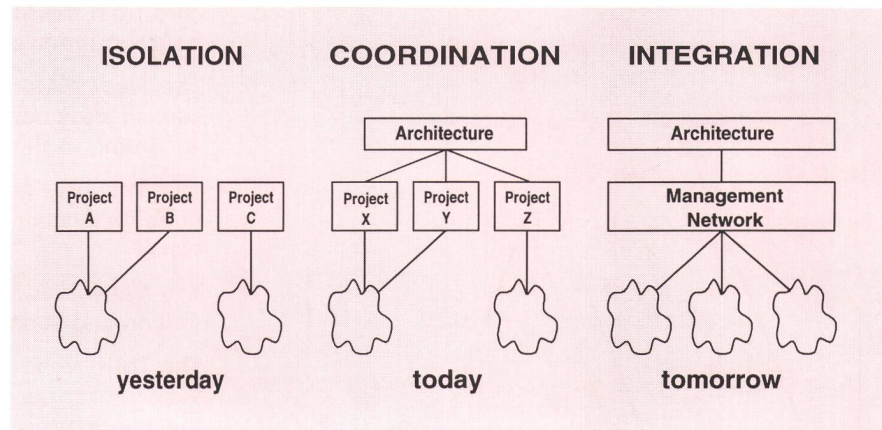


Fig. 1 Goals of the NM/TI Project

Fig. 2 From Isolation to Integration – Management Network



of an area: The individual proposed buildings must match each other, but details of construction are not laid down.

Such a zone plan has to be stable in order to provide planning security for the individual clients. But it must remain sufficiently flexible and allow for extension or adaption to changed circumstances in an orderly fashion.

What is relevant for a zone plan is also valid for the Telecommunications Management. Here the individual 'construction projects' are management applications, data and computer systems. The strategic goals mentioned above can only be reached by cooperation of these sectors and by a uniform system response to the users. Architecture for Telecommunication Management (*Management Architecture in short*), provides the necessary framework of rules, guide lines, concepts for modularity and interface definitions.

In particular, two points are important here:

- The individual intentions should progress in a coordinated and integrated way, thus increasing the efficiency and avoiding redundant developments.
- PTT Telecom will be set in a better position to determine the optimal set-up of their management infrastructure.

32 From Isolation to Integration

This is today's practice: New requirements for the technical management of services and networks will lead to a new user project. A system, separated from other projects, with its own individual user interface and data management is being developed onto newly acquired, specially defined hardware. Often only the taking into operation will reveal whether the system fits into its environment and which functions and data have been developed redundantly. Quite often, additional costly adaptations or interfaces are required.

That is where the architecture starts playing its role: The uniform determination of the information model will lead to uniform specifications, the fundamental requirement for compatible systems (Fig. 2).

The requirements, jointly developed with the users, are projected onto the application skeleton of the architecture. Data and functions are related to predefined (ge-

neric) applications according to clear rules. A realization strategy can be attached onto this: Decisions for make-or-buy, extension, new development. Everything with the certainty to fit and to be compatible. Redundancy between the applications is avoided from its onset.

33 PTT Telecom takes its core business more firmly in its hands

Competition for service providers is becoming more turbulent. To be able to offer new services, new networks, new technologies faster than the competitor can be a crucial market advantage. The architecture provides a frame for all innovations and shows clearly where applications and data bases have to be extended and how the new systems have to cooperate with the existing ones.

Therefore, PTT Telecom will take a more active role in the modelling of its future by determination and demand of a management architecture. The strategic core domain of Telecommunications Management will no longer be adapted to the product strategy of network suppliers, but will be set according to the own needs.

4 The Architecture Model

41 The Dimensions of Management Architecture

In order to achieve a long-lasting benefit, architecture must have a firm theoretical basis in the form of formal models as well as real means of structuring and guidelines for the realization of the required applications and systems.

For the Management Architecture, these components can be expressed in a three-dimensional model (Fig. 3).

Management Layers form a hierarchical structure of all the responsibilities of a Telecommunications Service Provider. Criteria for categorization are objects of the management, from the layer of the individual network elements to networks, services, customers and market sectors up to the entire business.

Functional areas denote the various duty domains of the Telecommunications Management.

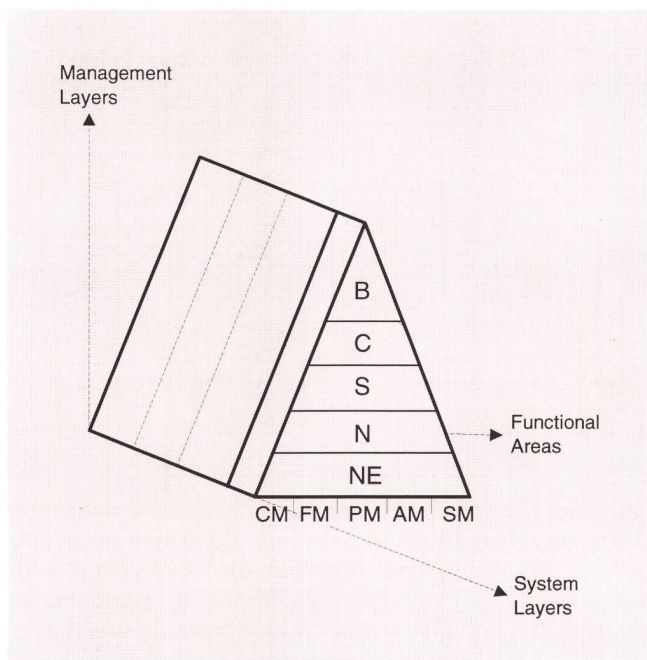


Fig. 3 Dimensions of a Management Architecture

- B Business Management
- C Customer Management
- S Service Management
- N Network Management
- NE Network Element Management
- CM Configuration Management
- FM Fault Management
- PM Performance Management
- AM Accounting Management
- SM Security Management

System Layers structure a Management System from the point of view of its producers in widely exchangeable layer, from the hardware layer to the specific end-user applications.

The *Management Systems* can now be positioned in this three-dimensional model. They present the realization of set administration functions and are connected to a *Management Network*.

411 Management Layers in the TMN⁺ Model

The *TMN⁺ Model* is based on the CCITT Recommendations to the 'Telecommunications Management Network' (*TMN*), which are accepted today by the PTT's as well as by the manufacturers. The model consists of five layers stacked on top of one another, the so-called *Management Layers*. In order to take the stronger *market orientation* of PTT Telecom into consideration and additionally to take the OFS concepts for the formation of market-sectors-oriented profit centres better into account, the four layers of TMN were extended by the *Customer Management Layer* (Fig. 4).

The *Business Management Layer* comprises the functions for the strategic and business management control of a profit centre, in particular the target guide lines, planning and controlling.

The *Customer Management Layer* comprises the areas Marketing and, in particular, a comprehensive customer

care from the sales preparation to the distribution support and the support after purchase.

The *Service Management Layer* comprises functions for service development and guarantees service provision according to the Service Level Agreement.

The *Network Management Layer* comprises all the functions for planning, administration and control of a network.

The *Network Element Management Layer* comprises operation and supervision of single network elements.

The TMN⁺ model corresponds to the requirements of a service provider on the open market: The customer and the entire provision of his support stand in the foreground. Profit Centres, Product Management and sales are taken into consideration, just as are production, operation of the networks and services.

412 Functional Areas

The Management Architecture resorts back to the *five Functional areas* of the ISO standardized system management when structuring the functions (Fig. 5).

The area *Configuration Management* (CM) is used for the installation, supervision and modification of objects inside an open system.

The area *Fault Management* (FM) comprises functions for the recognition, localization and repair of fault functions.

The area *Performance Management* (PM) supervises and controls the functioning to full capacity and the efficiency of the used resources.

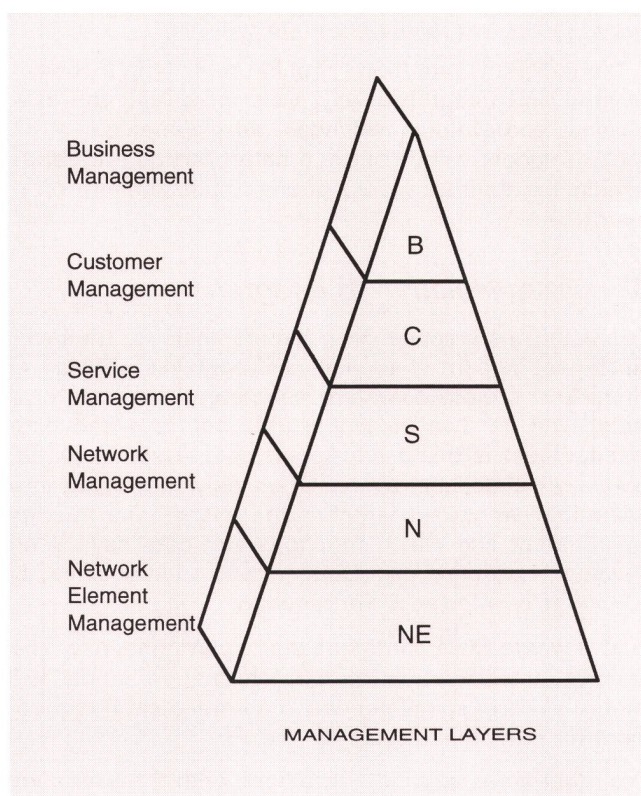


Fig. 4 TMN⁺ Model

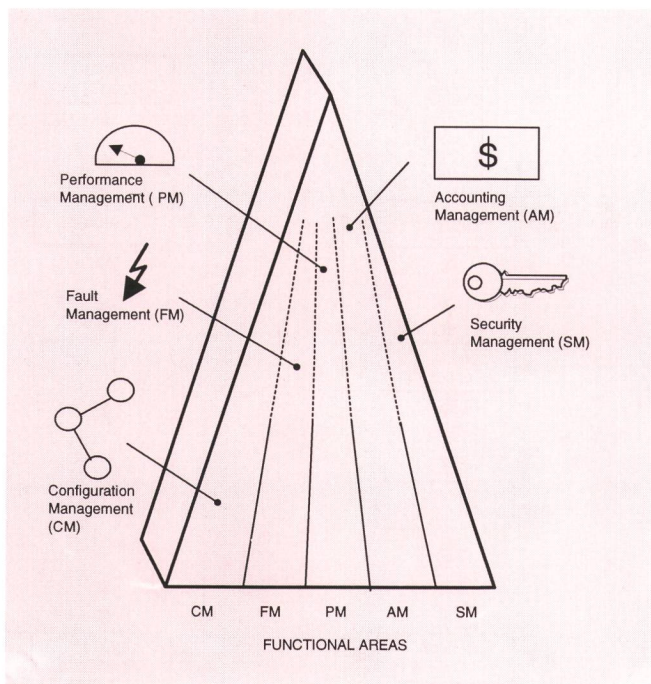


Fig. 5 Functional areas in the System Management according to OSI

The area *Accounting Management (AM)* allows for assigning the costs for using the resources to the appropriate users.

The area *Security Management (SM)* holds services ready for the realization of a security strategy in the open network and supervises events affecting security.

413 System Layers

Today Management Systems have to be designed in a modular way due to their high complexity. A uniform hierarchic structure is given by the system layers. Here it is distinguished between the application platform with its layers Hardware and System Software (mainly the operation system) and the User Support on one hand and the Management Applications on the other hand. The individual layers are separated by clearly defined interfaces, thus enabling their replacement without any undue effort. This is particularly important because higher layers generally have, according to experience, a longer lifetime than lower layers. Applications are generally in use for five to fifteen years, whereas one would like to take advantage of the technological progress in areas of hardware in much shorter intervals.

Moreover, resources can be more beneficially utilized jointly, and more standard products can be applied due to uniform platforms (Fig. 6).

42 The Information Model

Besides the functional aspects of Telecommunication Management the definition of the basic terms takes on special relevance.

The *Information Model* defines all the relevant terms, describes the objects, their attributes, and simple and multiple common relations respectively. It supplies the common language, is the turntable for all technical discussions and forms the starting point for the realization of Management Data Bases (Fig. 7).

5 Fundamental principles of Management Architecture

The definition of Management Architecture is guided by some basic principles which concern organizational as well as technical matters.

51 Focusing on Customers

The functions of the customer support and service development of the TMN⁺ Model are essential for the intended stronger customer orientation of PTT Telecom and for an aggressive marketing activity. Here the greatest need is to catch up in the system support and the progress automation. The inclusion of these topics into a uniform Management Architecture creates the necessary transparency from the customer requirements up to the amendment of the network element, from the marketing strategy up to the network extension planning (Fig. 8).

This enables an entire customer support (One-Stop Concepts): *One* partner consults the customer about the entire product supply (*One-Stop Shopping*), handles all the necessary installation steps (*One-Stop Installing*); the various individual services are charged to one common bill (*One-Stop Billing*); there is *one* common address for problems (*One-Stop Complaining*).

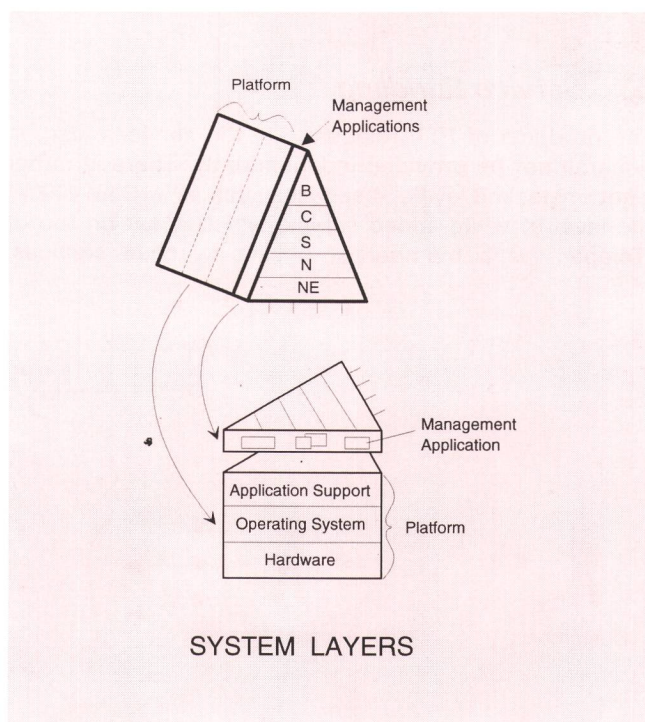


Fig. 6 System Layers

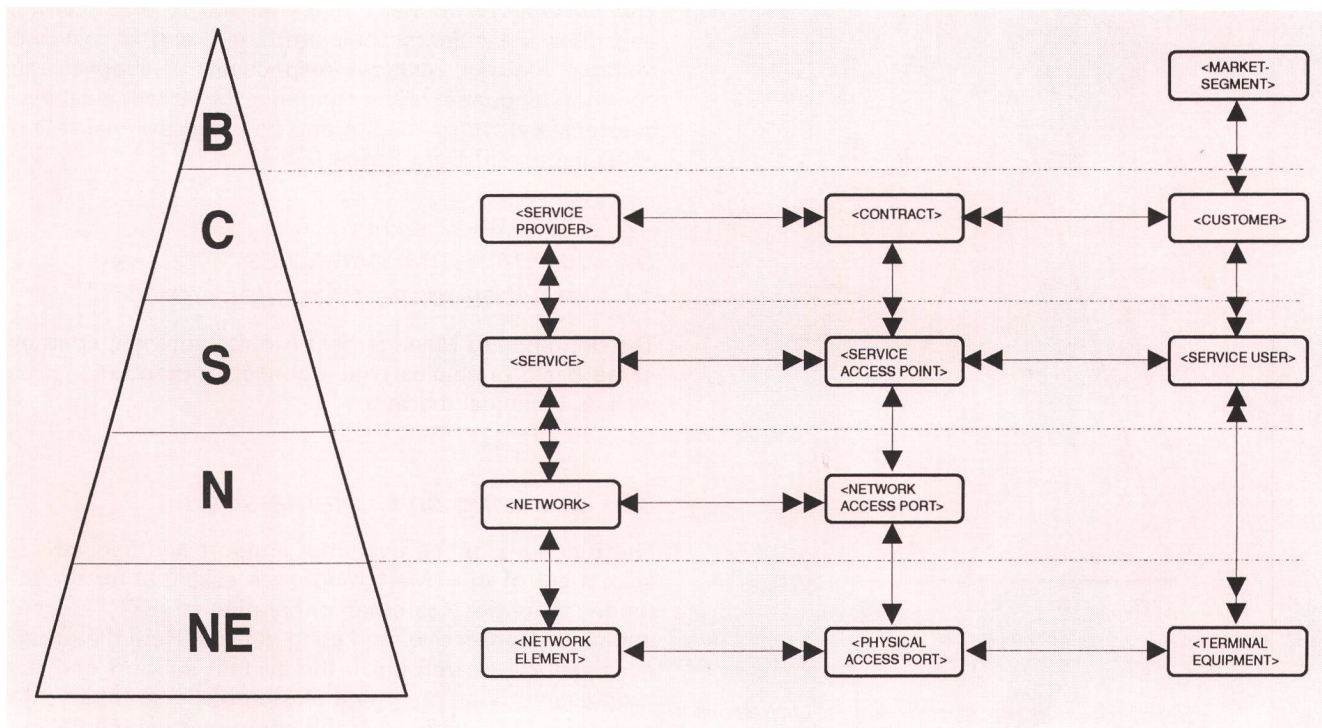


Fig. 7 Extract from the NM/TI Information Model

52 Independence of Location

Architecture is planned so that Management Applications can basically operate at different locations or can even be installed in a dispersed manner. A modification of the location for applications has no influence on its interfaces. Thus the architecture is applicable to Management Networks of any topology. Also the location of the application is independent of the location of its users. The users can get access no matter where their place of work is.

53 Service Bundling

The products of PTT Telecom, i.e. the services, can, in general, not be provided independently. There is rather a set of stacked levels of services such as 'arCom 400' at the level of value-added service which is set on top of 'Telepac' as a member of packet-switched services,

which again can use 'Leased Lines' as a transmission service. The architecture is basically designed for an arbitrary service level and can also be applied from one level to another. Connections between the levels are defined by technical and functional interfaces (Fig. 9).

54 Separation of Service Network and Management Network

Because an increasing number of companies, under the pressure of competition, have to concentrate nowadays on their core business, handing over the operation of their communication infrastructure to external companies (*Outsourcing*) becomes an attractive alternative.

The architecture offers the necessary flexibility through the principle of logical separation of the Management Network which interconnects all the Management Sys-

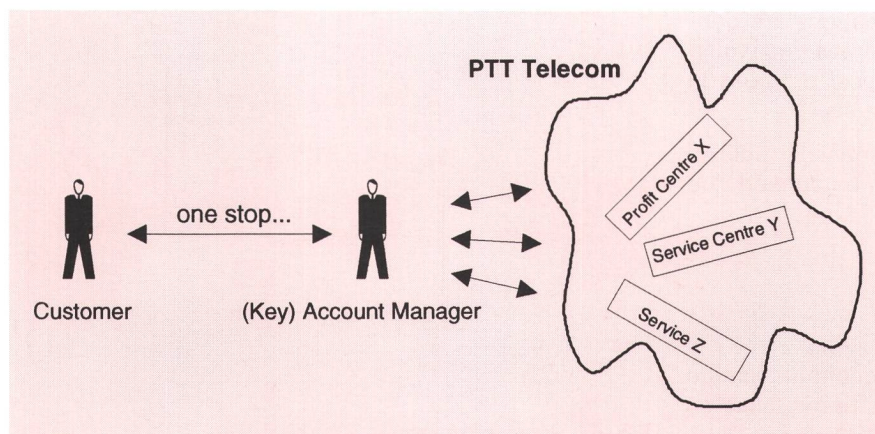


Fig. 8 Integral Customer Support

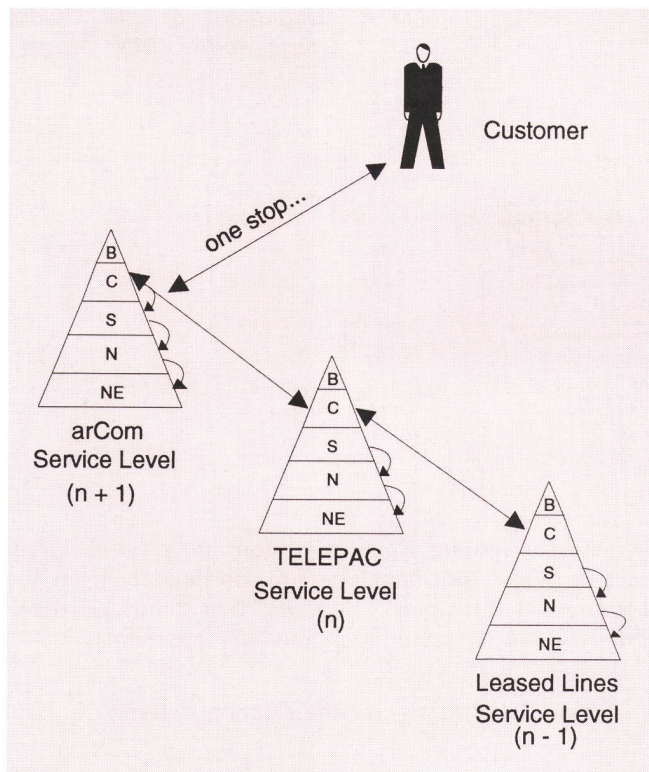


Fig. 9 Service Levels

tems from the network to be managed, denoted as Service Network or *Management Domain*. This separation facilitates the inclusion of private parts of the network of large customers into an integrated administration of their entire company communication. Thus the borders between public and private networks are becoming increasingly diffused.

The consequent implementation of the TMN⁺ Model also leads to a separate consideration of business units, marketing sectors, services and networks (Fig. 10).

Data and applications are assigned to one of the Management Layers. For instance, requests of customers for alterations which concern a Service Access Point are

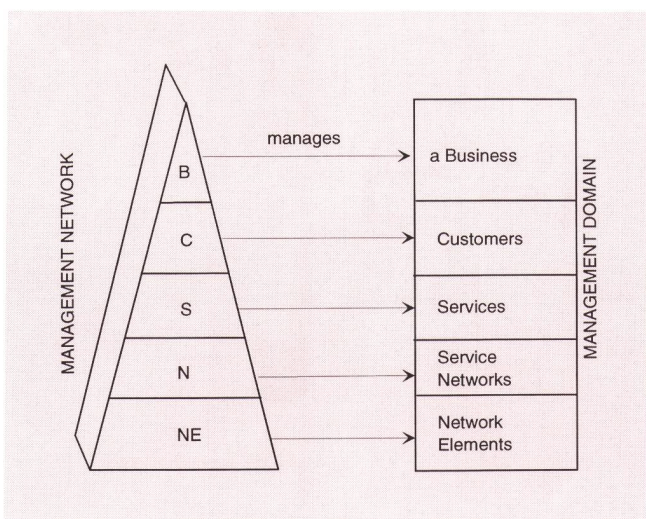


Fig. 10 Management Network and Administration Area

carried out by the Service Layer. If alterations at the network side are also concerned, then these are transferred to the Network Management by uniformly formulated Change Requests.

This functional decoupling offers a lot of freedom for the organization: Networks and their operation can be considered as a unit with clearly defined instructions to the outside world; services can use several networks and have uniform interfaces to them, which can also be secured by contracts. On which layer profit centres are defined – dependent on the market segment, on the service or on the network – has no more influence on the course of events in the operational area.

55 Separation of Applications and Platforms

The architecture assumes uniform platforms as the environment of the course of flow of events. It is distinguished between two classes of platforms: the *Administration Platform*, on which applications with no direct interface to the network and with no high real-time requirements are running, and the *Operations Platform* for the real-time applications close to the network (Fig. 11).

Mainly applications of the higher Management Layers (service provision, customer support and business management) run on the Administration Platform, whereas those of the lower layers (Network Element and Network Administration) are generally assigned to the Operations Platform.

The construction of the common platforms allows for an optimized use of the resources and is supported by the market trend of the functionally increasingly more powerful Standard Platforms. The general goal of Management Platforms is to provide as many of the support functions as possible, which can be used for various applications by bringing standard products into use.

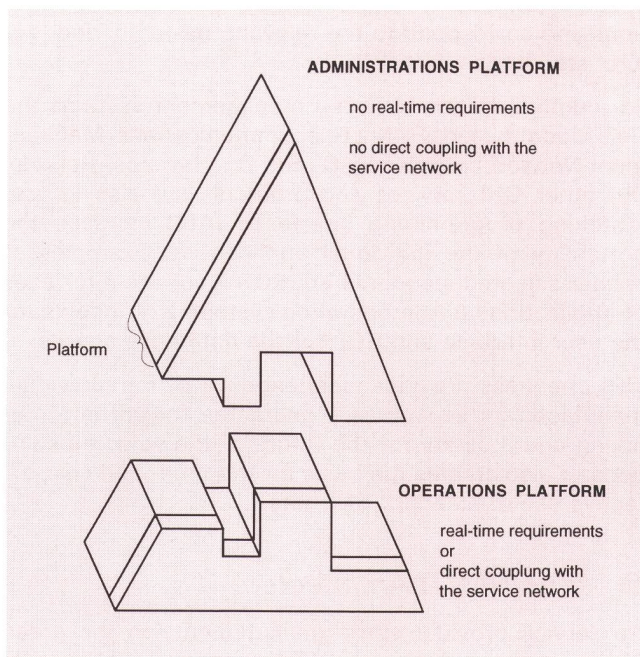


Fig. 11 Classes of Platforms

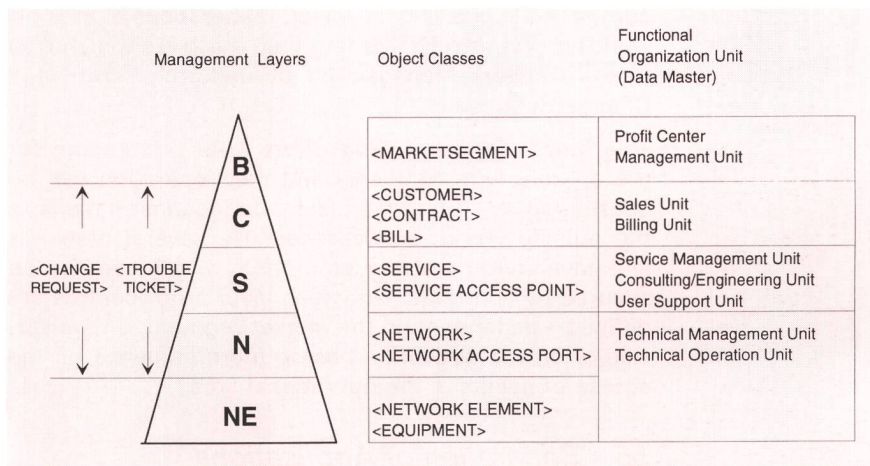


Fig. 12 Assignment of the Object Classes to the TMN+ Model

56 Object Orientation

Object orientation plays an important role in the design and the management of complex systems today. At the level of the architecture this means, in particular, a data modelling which takes real objects as a model and is, therefore, easier to understand than the current widely-used relational model. This way has been followed by CCITT and ISO, which have already standardized several object classes.

The objects form the stable element of the Management Applications. Thus Organization Units, by the affiliation to certain groups of objects (Data Masters), can be permanently set in place; the course of flow and supporting applications are defined 'around the objects' (Fig. 12).

57 Openness and Conformity to Standards

For each Management Application a uniform set of interfaces is defined in the architecture (Fig. 13).

These interfaces are supported by the Platform Functions and correspond to the relevant 'de-facto' and 'de-jure' standards.

For communication between management systems the OSI-Model-based TMN (Telecommunications Management Network) interfaces, Q_3 and Q_x , play a central role. But other OSI services and protocols are also in use. Matching programming interfaces (API) increase the portability of the individual applications. Examples of further selected standards are POSIX for the interfaces of applications to the operating system, X/Windows for the user interface and SQL for the data base access.

This openness provides independence of the individual manufacturers as well as a guarantee for correct interworking and a safety for the future of the selected solutions. It also creates the basis for the time- and cost-effective use of standard products.

6 The NM/TI Architecture

No service provider starts management 'on the green meadow' today. Also with PTT Telecom a great number of management systems exist, which represent a high

investment volume. Their migration into a future architecture is an important concern, particularly from the economical viewpoint. Therefore, two things were defined for the telecommunications management:

- an ideal architecture
- a migration strategy for the existing systems

In a first step of fixing the architecture, no consideration is taken of the current solutions for a particular purpose for individual networks. Therefore, the result is an *ideal*

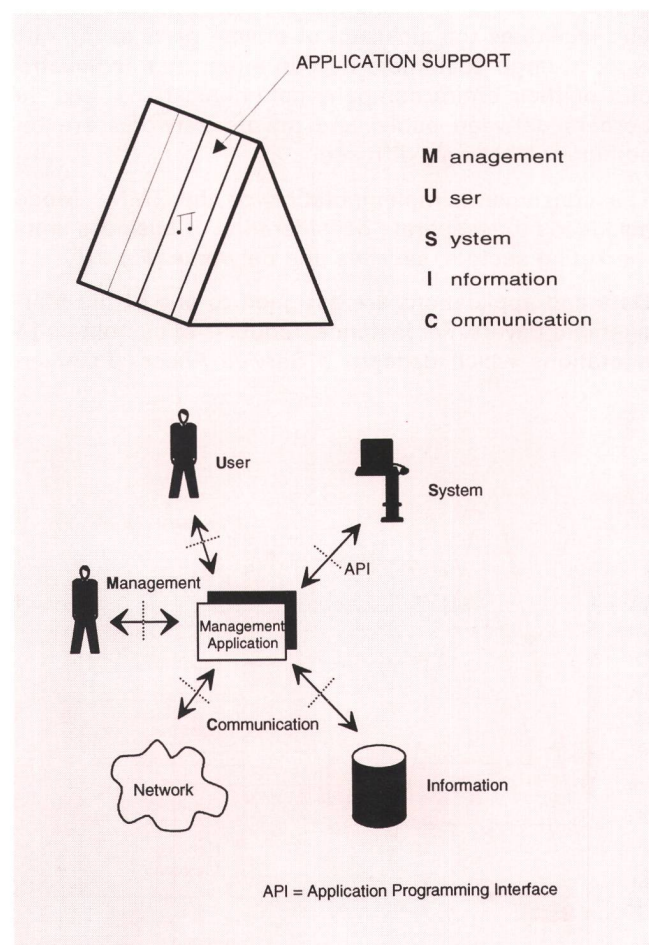


Fig. 13 Interfaces of a Management Application

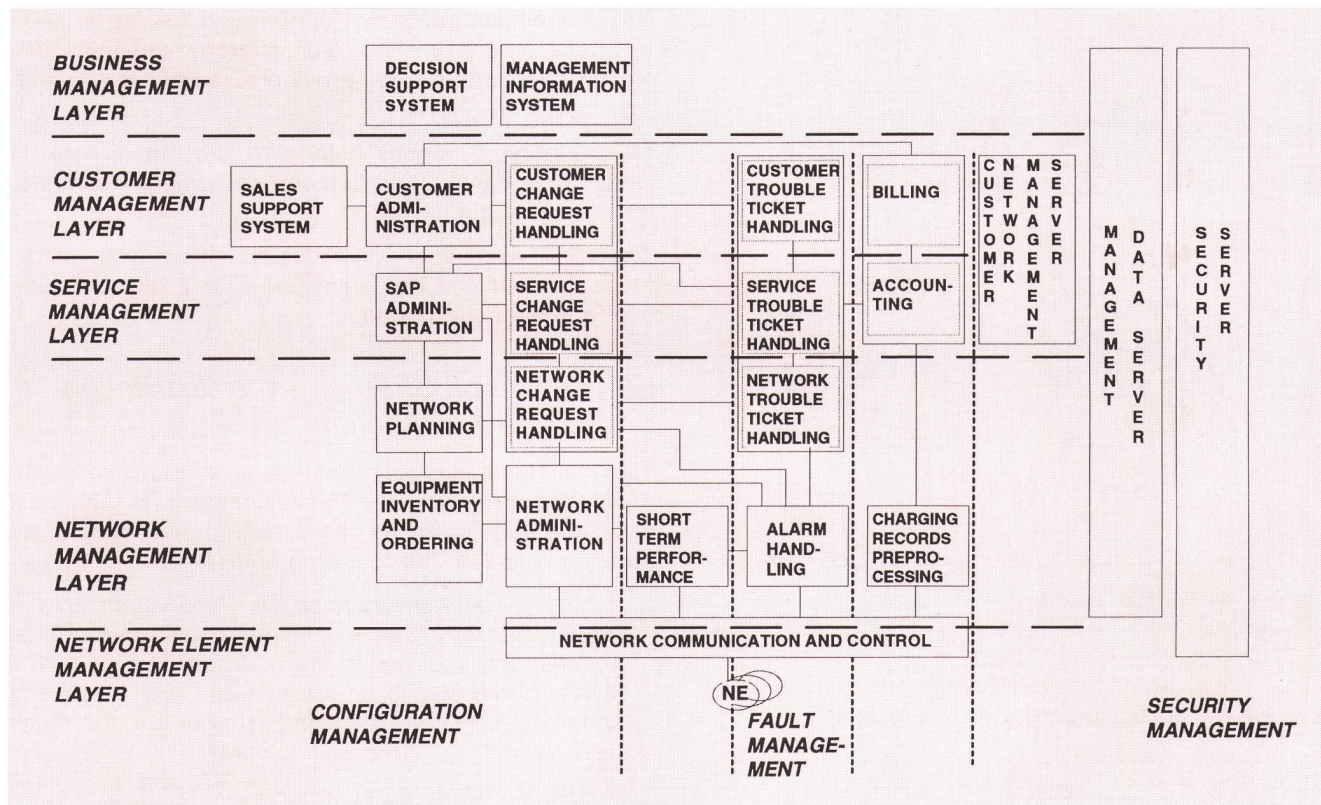


Fig. 14 NM/TI Ideal Architecture

architecture which is *universally applicable*, for any network, service, product area, for all profit and service centres.

61 Ideal NM/TI Architecture

611 Applications

Based on the requirements of operators and customers, all of the required functions were structured into single applications, and their interworking was described by their interfaces (Fig. 14).

612 Platforms

Administration Platform

General purpose computer systems are used for the Administration Platform, whereby the *Distributed Computing Environment of Open Software Foundation* (OSF DCE) plays an important role. It provides complete support functions for the distribution of applications and data. It is offered by the leading manufacturers and is based on the standards X/OPEN, CCITT and on well recognized industrial standards (Fig. 15).

At the level of operating systems for Administration Platforms Unix is used most commonly because of its openness, Open-VMS because of the current installations and MS-DOS.

In addition, OSF with its *Distributed Management Environment* (OSF DME) has defined a powerful tool box for

a distributed network and system management. It comprises generic management applications, administrative functions for the objects, support for the protocols CMIP and SNMP, interfaces for the Application Programming Interfaces, API, a uniform user interface as well as a development environment for the realization of special applications. It is generally assumed that the environment OSF DME will become an Industry Standard. First versions are announced for 1993. Looking forward to 1995, OSF DME could also become important for NM/TI.

Operations Platforms

In the NM/TI project the application of the products 'Enterprise Management Architecture' (EMA) from *Digital Equipment Corporation* (DEC) is foreseen for functions close to the network. On DECmcc (DEC Management Control Centre), the central product of EMA, a set of generic function, presentation and access modules will be available, and also a common data storage will be supported by an information memory (Management Information Repository).

This defines the technology of the standard operations platform for NM/TI. The functions of the EMA products, however, go beyond the actual platform and also present a tool box for the management applications (Fig. 16).

The architecture can, however, be equally well defined based on other products such as OSF DME, Open View from *Hewlett Packard* or TMOS from *Ericsson*.

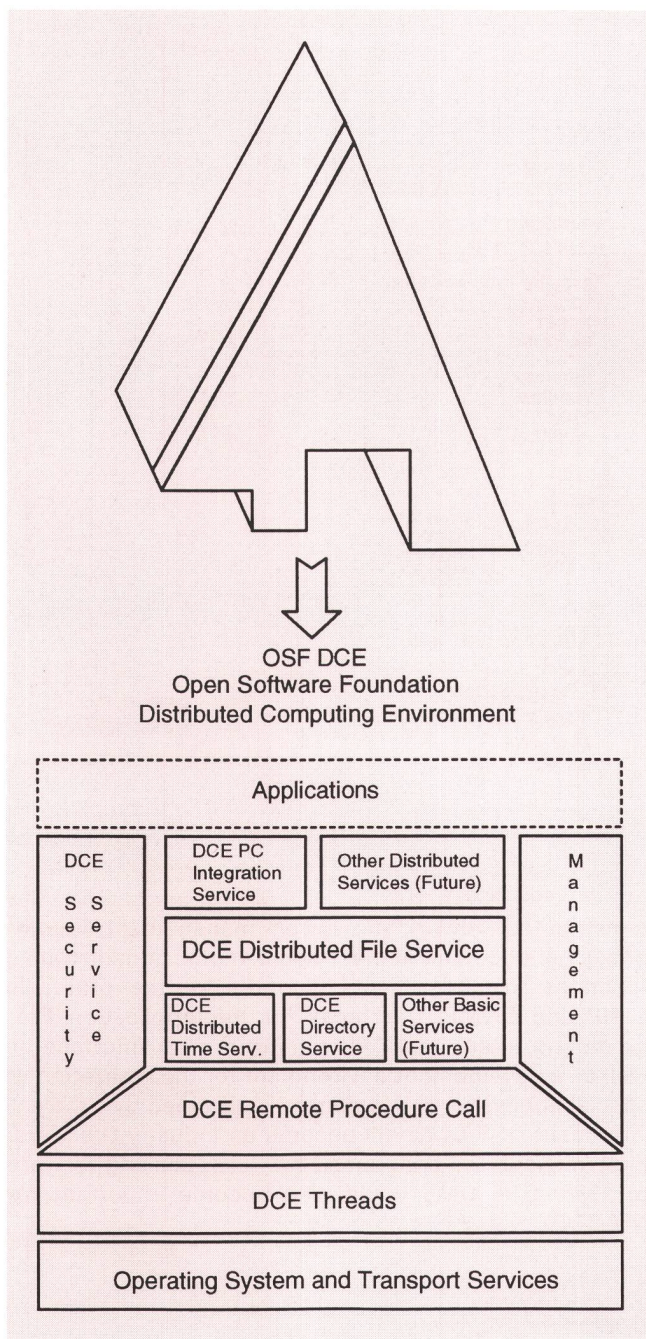


Fig. 15 Application of the Distributed Computer Environment of OSF
OSF DCE Open Software Foundation/Distributed Computing Environment

62 Open and Closed Area – the 'Real' Architecture

Independence from System Suppliers is an important goal for service providers and network operators for the acquisition of management solutions; therefore, it is a fundamental principle of the architecture.

Nevertheless, there will always be administrative domains which are strongly dependent on the technology of the network elements used and, therefore, should best be provided by the supplier of these network elements. These are described as *Closed Areas* of the

NM/TI Architecture. Their clear borders are very important for a long-term expansion strategy and the interworking between service providers and network manufacturers (Fig. 17).

All the other functions belong to the *Open Area*, in which open competition between the provider companies is encouraged.

The NM/TI Architecture includes definitions of the interfaces between the two areas, which will remain stable over a guaranteed period.

63 Migration Strategy – the Realization of the Architecture

The described ideal architecture is in principle applicable for any service area and any network. In the actual case, the application for the specific main focus of an area is made with the following steps:

- *Fixing the Function Area and the Observation Area*
The Observation Area is sketched based on the Ideal Architecture and the models: Which layers of the TMN+ Model should be considered? (Preferably all.) Which market sectors, which customer groups, which services, networks and technologies?
- *Positioning of the Requirements*
Are there specific needs of the services and networks under consideration which depart from the general case of the Ideal Architecture?
- *Mapping of today's Management Systems*
The existing service-specific Management Applications and Systems are analyzed: Which parts of the

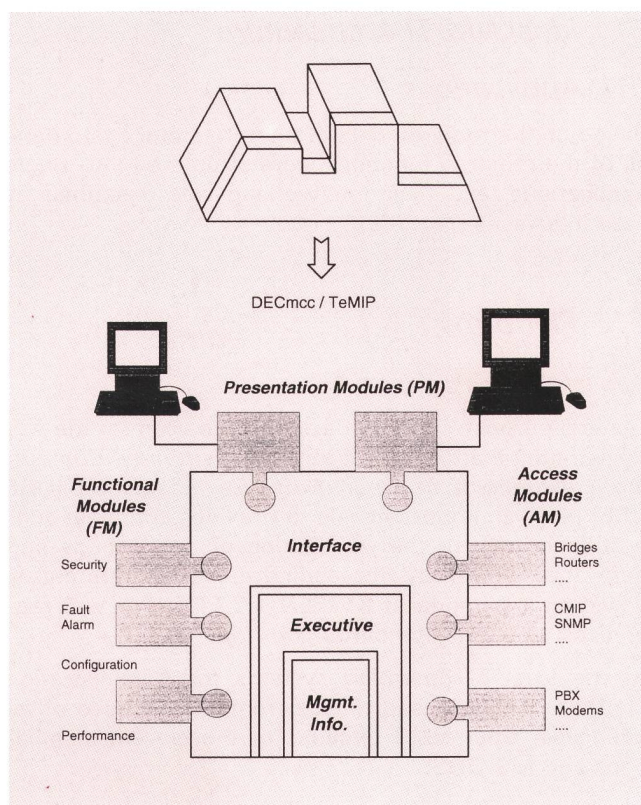


Fig. 16 Use of EMA Products

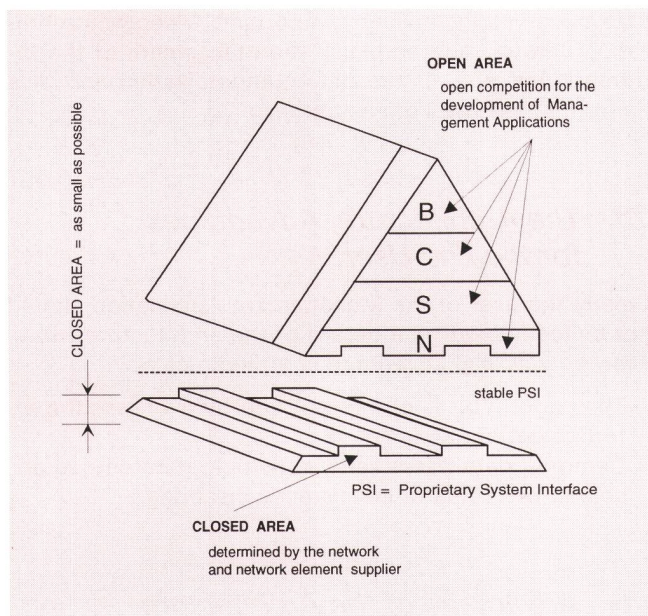


Fig. 17 Open and Closed Area

Ideal Architecture are covered? What is missing? What is, on the other hand, not considered by the Ideal Architecture? Also the used data are assigned to the objects.

– Strategy for Realization

Where do interarea applications and data bases have to be expanded? Which of the defined applications are to be modified, which ones are replaced? Where does it need to be compromised? Which applications have to be developed from scratch or are acquired? What about priorities and deadlines?

These steps are currently made with the NM/TI project for Telematic Services.

7 Working with the Architecture

The architecture provides support in the daily work of the various user groups: for those responsible in the organization of their profit centre, for the application planner and project leader, for the operator in the technical area, for the developer of Management Applications and indirectly also for the user (Fig. 18).

71 The Architecture: a Tool for the Manager and Organizer

The organization of complex companies must be able to adapt itself to rapidly changing requirements and environmental conditions. This requires a flexible organization model in which organizational units with their responsibilities can be presented in a clear way as well as the major functions and interactions between them.

In this way the NM/TI Architecture supports the ongoing reorganization work. Business units such as profit and service centres cooperate on the bases of contractual relations. The demands for services, requests for modifications and fault reports are *handled basically* in the

fications and fault reports are *handled basically* in the same way as for external customers. Also the provided services are billed in the same way.

72 The Architecture: a guide line for making a project

Definition of a project and Specifications

For each project, the requirements set by the user and the operator have to be clearly defined. This is achieved in most cases by drafting specifications.

In this phase the architecture is used as a guide line for the project leader, since the embedding of applications into their environment, requirements for their functional scope, user interface and quality already define a rough frame. In this way a construction unit consisting of one or several joint applications is realized in a project.

Due to the architecture requirements the draft specifications become much more defined than usual, since some development requirements (e.g. interfaces) can already be derived from the architecture.

Invitation for tenders and their evaluation

The relevant parts of an architecture document are enclosed with each invitation for the development of a management application. This leads to a more uniform invitation as well as to more uniform tenders. Thus the amount of work for the evaluation is considerably reduced.

Supervision of the development and approval of the results

For the *Project Controlling* and the accompanying quality assurance by PTT Telecom the architecture-based

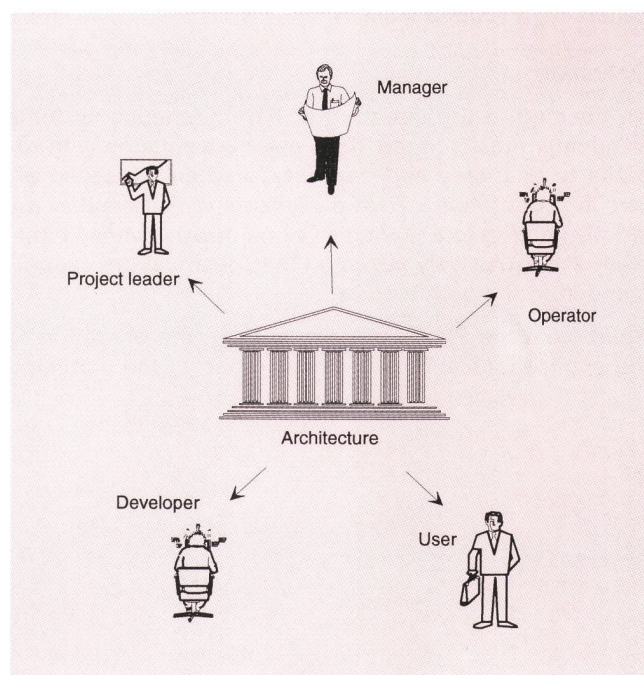


Fig. 18 User groups of the Architecture

project handbook supplies the necessary instructions and flow charts as well as standard structures for a uniform project documentation. This project handbook is in conformity with the higher guide lines for handling the project at the PTT.

73 *The Architecture: a Handbook for the Development*

The development becomes more efficient by the use of efficient platforms and common data bases. Various applications can be developed widely independently from each other on the basis of the distribution of its functions and on predefined interfaces.

The project handbook uniformly lays down the rough methods of development. The structure of the project documentation is widely standardized, thus facilitating the development as well as the supervision and approval considerably.

A major part of the scope of the functions – in particular the Network Management Layer – does not need to be developed again; it is obtained from the adaption of existing Management Systems to the architecture. For this purpose, *Migration Paths*, which cannot be by-passed by the developers of a single application, are predefined in the architecture. Erroneous and dead-end developments can thus be avoided.

74 *The Architecture: a Help in Operation*

Integration of Application and bringing into service

The integration of an application into a complex environment, as is present in a great deal of Management Platforms, is a difficult problem. Also, in this case, the architecture simplifies the problem by uniformity. The few standardized platforms with uniform environments (Fig. 13, MUSIC) for applications render the integration generally to routine tasks.

Operation

An opening in the direction of heterogeneous systems frequently means, apart from clear advantages with regards to economy and flexibility, also an increased effort for operation. This disadvantage is avoided by strictly limiting to a few types of platforms, whose interfaces are exclusively based on the specifications recommended in the architecture.

Apart from the Platform Management, the operation of the applications and the administration of the matching

data becomes increasingly important. A central organization unit for data administration takes care of the Information Model, of the data standardization and of a uniform data base administration.

75 *The Architecture: Advantages for the End User*

Clearly the user of the Management Application should not be loaded with the details of the architecture. However, he will take advantage in an indirect way:

- The uniform basis of the user interface lessens the effort of getting acquainted.
- Common data bases render multiple data entries obsolete, problems of consistency disappear.

76 *Advantage of the Architecture for the Customer*

All activities of PTT Telecom must of course aim at one goal: increase the attractiveness of the products and services for the customer. This is also achieved by a stable architecture for the Telecommunications Management, since the user needs can be responded to in a faster and more flexible way, either by means of tailored functions for the set of services or by individual price agreements.

Also the communication with PTT Telecom is simplified: The customer consultant knows the entire range of services of the PTT and can assemble an individual subset in an easier way. The provision of PTT Services can be done faster and is less prone to errors.

8 *Final Remarks*

PTT Telecom responds to the challenge of the liberalized market with a clear forward strategy. This also implies a more active role with the development and acquisition of computer systems for the technical operation. The requirement for a uniform and complete architecture creates the frame for an efficient and well coordinated further development of all Management Systems.

Such a Management Architecture was developed together with *Softlab AG* in the area of Teleinformatics of PTT Telecom. It defines a set of applications which run on open platforms conforming to the specifications. The principles of modularity used make this architecture applicable for other services and networks as well.

Zusammenfassung

Telekommunikations-Management-Architektur als strategische Erfolgsposition

Der Telekommunikationsmarkt ist weltweit im Umbruch, der Wettbewerb für Dienstanbieter wird turbulenter. Neue Dienste, Netze und Technologien schneller anzubieten als die Konkurrenz kann zum entscheidenden Marktvorteil werden. Dabei müssen die angebotenen Produkte und Dienstleistungen flexibel auf die individuellen Kundenbedürfnisse abgestimmt werden. Das erfordert leistungsfähige Systeme für die Administration von Kundenbeziehungen, für das Management der Dienste und für den Betrieb der Netze. Nur eine einheitliche Management-Architektur, die einen verbindlichen technischen Rahmen für die Beschaffung und Entwicklung von Anwendungen und Plattformen vorgibt, gewährleistet dafür eine wirkungsvolle und flexible Infrastruktur. Es werden die Grundprinzipien dieser Architektur und die konkrete Umsetzung im Bereich der Teleinformatikdienste vorgestellt.

Résumé

Structure de gestion pour le secteur des télécommunications: la clé du succès stratégique

Le marché des télécommunications est en pleine mutation et la concurrence entre les fournisseurs de services devient de plus en plus âpre. Le fait d'offrir de nouveaux services, réseaux et technologies plus rapidement que les concurrents procure un avantage décisif sur le marché. Pour ce faire, il faut que les produits et services soient adaptés aux besoins individuels de la clientèle, ce qui nécessite la mise sur pied de systèmes performants visant à gérer les services et les relations commerciales avec les clients, de même qu'à assurer l'exploitation des réseaux. Seule une structure de gestion uniforme, fournissant le cadre technique pour l'acquisition et le développement de plateformes et la mise en oeuvre d'applications, pourra garantir une infrastructure souple et efficace. Les principes de base de cette structure et son application concrète aux services télématiques sont décrits.

Riassunto

L'architettura del management delle telecomunicazioni: la strategia che porta al successo

Il mercato delle telecomunicazioni sta cambiando in tutto il mondo e la concorrenza è sempre più spietata. Offrire nuovi servizi, nuove reti e tecnologie più rapidamente della concorrenza può costituire un vantaggio decisivo sul mercato. A questo riguardo, le prestazioni e i prodotti offerti devono essere adattati flessibilmente alle esigenze individuali dei clienti. Ciò richiede sistemi efficienti per la gestione dei rapporti con i clienti, per il management dei servizi e per l'esercizio delle reti. Solo l'architettura del management uniforme, che offre le basi tecniche vincolanti per l'acquisizione e lo sviluppo di applicazioni e di piattaforme, assicura un'infrastruttura efficace e flessibile. L'autore presenta i principi fondamentali di questa architettura e la realizzazione nell'ambito dei servizi di teleinformatica.

Summary

Telecommunications Management Architecture as a Strategic Position of Success

The telecommunications market is radically changing worldwide, the competition for service providers is becoming restless. It can be of decisive advantage to offer new services, systems and technologies faster than the competitor. The offered products and services must thereby be flexibly adjusted to the individual needs of the customer. This requires efficient systems for the administration of customer relationships, for the management of the services and for the operation of the network. Only a uniform management architecture which allows a binding technical framework for the acquisition and development of applications and platforms guarantees an effective and flexible infrastructure. The author introduces the fundamental principles of this architecture and the concrete application in the field of teleinformatics services.