Integrated Service Models on Alternative Management Architectures

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Abstract – **Network Management is needed to control and optimize the operation of the network and to respond to changing user requirements. Management includes the initialization, monitoring and modification of the network functions. All this functions are defined in the standards for the Telecommunications Management Networks – TMN.**
The Intelligent Network (IN) offers the most applicable architectural concept for effective and adaptive service creation and delivery.
One of the most important functions of the tele-communications networks for building an IN platform is the use of one-provider equipment. To avoid this disadvantage new ma-nagement principles for the IN are needed. TMN alone can not solve this problem.
This paper presents a modeling approach for integrated IN management protocol. The proposed solution includes a modification of the IN Application Protocol (INAP) implementing some typical for the Common Management Information Protocol (CMIP) functions. Particular models of many management service elements are developed using new Service Independent Blocks (SIB). The integration of the function in the IN management is based on the idea of Alternative Management Architectures creation, discussed in [1].

I. Introduction

Network management architectures provide designers with the ability to discuss management functions at a high level of abstraction and guide the design of management protocols and services. In this paper we assume that these architectures consist of: a set of architectural concepts; rules, describing how to use these concepts and models for designing specific class of systems [1].

All currently used management architectures, especially ISO, ITU-T and IETF architectures have been developed after the whole design of the network functions has been carried out. This is a demonstration of how important the management functions and leads to the idea of applying different architectural concepts for their design.

In this paper we propose a new method for the integration of the primary IN service functions with management service functions – basic service elements - is to be defined.

We also discus the principals of service creation, used in the Intelligent Networks [2] [3]. On this basis are developed models of some of the well known service elements (like ACSE – Association Control Service Element, CMISE – Commitment Management Service Element and ROSE – Remote Operation Service Element).

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II. TMN Management

According to ITU-T, the term TMN is used as an abbreviation for Telecommunications Management Network. The concept of TMN is defined by Recommendation M.30210 as follows: “a TMN is conceptually a separate network that interfaces a telecommunications network at several different points” [4].

Fig.1 shows the relationship between TMN and the managed telecommunication network. As connection points between the TMN and the telecommunications network are used Transmission Systems and Exchanges. Together they are connected to one or more Operations systems via Data communication network. The Operations systems perform most of the management functions; these functions may be carried out by human operators or executed automatically. Multiple Operations systems can perform single management function. In this case the Data communication network is used to exchange information between the operations systems.

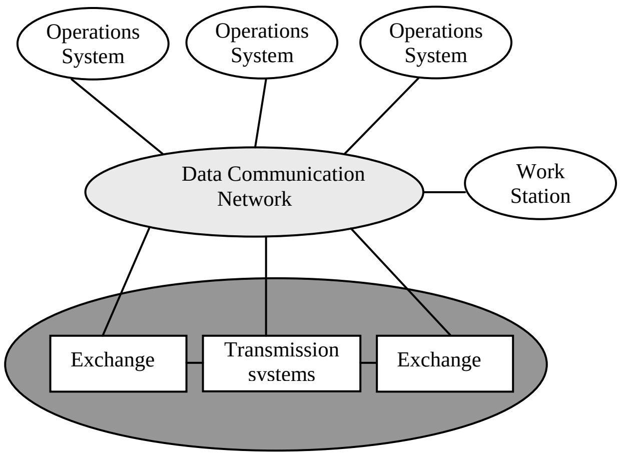

Fig. 1: General relationship of a TMN to a telecommunication network

III. Service creation in intelligent networks

The IN conceptual model interfaces the need of efficient creation of new services. From IN point of view, services are combination of features, composed of elementary building blocks called SIBs. The IN service scripts are linear decision trees as they are not allowed to contain loops. For this reason IN service scripts have less expressive power than programming language.

Special SIB called Basic Call Process (BCP) describes the call set up process. The points at which the call processing is interrupted and the service is triggered are called Points of Invitation (POIs). After finishing the processing of the service logic the last SIB returns the control back to the BCP in the so called Point of Return (POR). To illustrate how SIBs may be combined to build service logic script, the call forwarding service is considered.

Call forwarding (CF) service is built on one core feature: *call forwarding* allows user to unconditionally redirect incoming calls to another number. This service has two optional features: *call logging* allows a record to be inserted each time a call is received by a particular telephone number; *customer profile management* allows the subscriber to manage the service profile in real time. When modeling service logic two cases have to be considered: service activation and service execution.

Figure 2 shows a simplified version of a service script for the activation of CF service. For the sake of simplicity, Figure 1 shows only SIBs flow with corresponding comments, but not SIB parameters. The activation of the CF service begins with subscriber, dialing a special number, provided by the network operator. This number provides access to the management functions of the subscriber profile. Service logic is activated in BCP Address Analyzed POI.

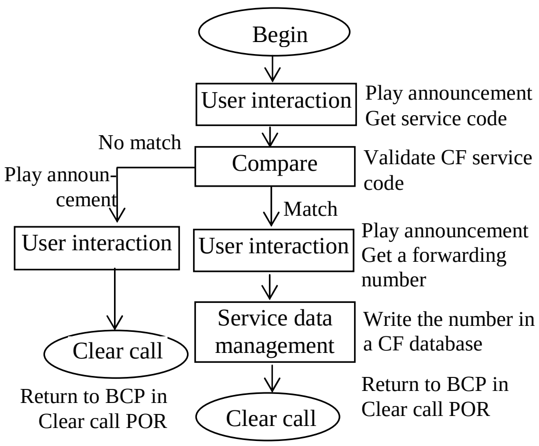

Fig. 2 Simplified service script for CF service activation

In essence, this service activation script performs the following actions:

- The user is asked for the service code and his input is received in the form of DTMF tones.
- The service code is verified against the CF service code.

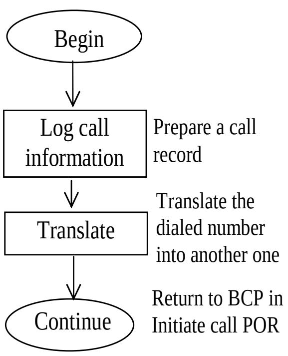

Fig. 3 Simplified service script for CF service execution

- If the received code is CF service code, the user is asked for a forwarding.
- The forwarding number is stored in the call forwarding database and the call is cleared.
- If the received code is not CF service code, the user is informed with an error message and the call is cleared.

Figure 3 shows a simplified version of a service script for CF service execution. The service logic is triggered in Address Collected POI.

IV. PROTOCOL INTEGRATION ASPECTS

The importance of integrated management systems development becomes apparent mostly because of the nonexistence of a unified management tool that could be used for different management applications – test equipment, protocol analyzers etc.

TMN provides functions like monitoring, control and coordination of the telecommunications resources. The core communication protocol in TMN is CMIP, which describes the syntax, the semantics and the time order of all message communications between the managing and the managed structures. CMIP uses ASN.1 (Abstract Syntax Notation One) data types and BER (Basic Encoding Rules) as well as GDMO (Guidelines for Definition of Managed Objects) for abstract description of the real resources in the managed networks.

The basic application protocol in the Internet Network is INAP. INAP as well as CMIP uses ASN.1 data types and BER. This allows the recognition of CMIP messages inside the IN – in form of communication primitives. The main reason why CMIP can not be used (without modification) in intelligent networks are the conceptual differences between IN and TMN.

The section below describes new models of an integrated protocol for intelligent networks management based on CMIP, example realization of new SIB's and enhancement of the Basic Call Process (BCP) in the Capability Set-1 (CS-1).

V. MODELS FOR INTEGRATED PROTOCOLS IN INTELIGENT NETWORKS MANAGEMENT

The model is developed, using the following method:

- New SIB's definition, according to Recommendation Q.1213;
- Model of interactions;
- Graphical representation of the developed service elements;

SIB "ACSE"

Definition: Control of network resources used by the connection between the managing structure (Manager) and the managed structure (agent) in order to perform the service element functions.

Operations: Receives Service Support Data and provides resource management. The result, returned after its execution is either positive (Success), or negative (Error). The element generates Call Instance Data or Error Cause respectively.

Graphical Representation (Figure 4)

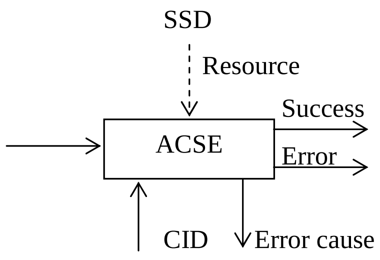

Fig. 4: Service Independent Block “ACSE”

SIB “ROSE”

Definition: This SIB is used to inform one managed structure about the operation of other managing structure.

Operations: This SIB performs the following operations:

- Acknowledgement;
- Operation result;
- Error notification;
- Operation reject.

Service Support Data: This service element uses the following service primitives:

RO-INVOKE . {request/indication}
RO-RESULT . {response/confirmation}
RO-ERROR . {request/indication}
RO-REJECT . {request/indication/response}

Graphical Representation (Figure 5)

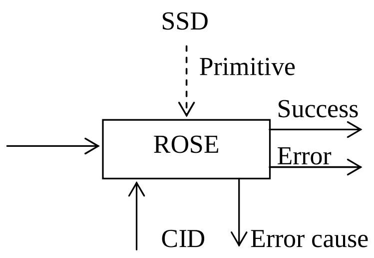

Fig. 5: Service Independent Block “ROSE”

SIB “CMISE”

Definition: This SIB is used for management.

Operations: This SIB performs the following operations using the corresponding primitives:

M-EVENT-REPORT . {request/indication} – reports an event – status change or error;

M-GET . {request/indication/response} – reads argument values;

M-CANCEL-GET . {request/indication/response} – stops reading;

M-SET . {request/indication/response} – sets argument value;

M-ACTION . {request/indication/response} – performs different actions over the managed object;

M-CREATE . {request/indication/response} – creates managed objects;

M-DELETE . {request/indication/response} – removes managed objects.

Graphical Representation (Figure 6)

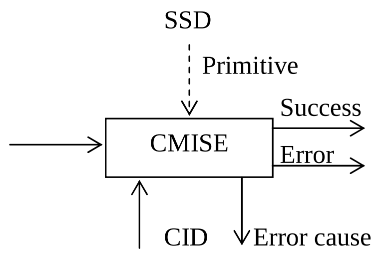

Fig. 6: Service Independent Block “CMISE”

Figure 7 and Figure 8 illustrate the distribution of the management functions when using ROSE SIB and of the CMISE SIB respectively.

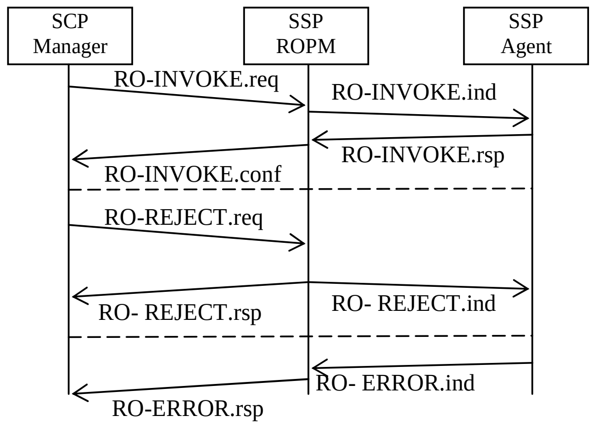

Fig. 7: Examples for the message interaction between IN – Functional blocks using Service Independent Block “ROSE”

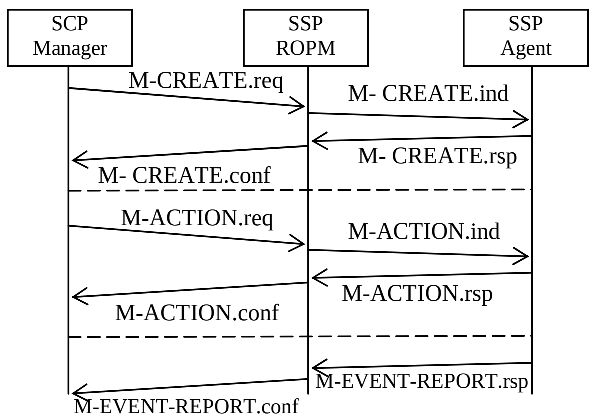

Fig. 8: Examples for the message interaction between IN – Functional blocks using Service Independent Block “CMISE”

One important SIB in the Intelligent network is the BCP (Basic Call Process) SIB – as introduced in part III. It is mandatory in all IN-services for establishing and releasing the connections in the Network. When integrated with management functions BCP starts the corresponding management service element. BCP contains two interface points called POI (Point of Initiation) and POR (Point of Return) – the first one indicates the request of IN service and the second – the termination of a particular management function.

The graphical presentation of BCP is shown on Figure 9.

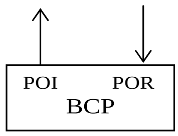

Fig. 9 Service Independent Block "BCP"

The proposed model for integration of the management service SIB ACSE with the primary functions of the Intelligent Networks is shown at Fig. 10.. Because of the limited space only this model will be presented. The other models are developed by implementing similar approach.

Upon receiving request for ACSE, through POI in BCP, a LOG - SIB is started, in order to collect initial data for the execution (when needed) of the new SIB's ROSE and CMISE. After that the ACSE is activated. ACSE has to check the available resources against those, needed for connection establishment. If enough resources are available, the Compare SIB is put in operation, which compares the initial data with the resources in order to negotiate the execution parameters of the requested service. When these parameters agree, the control is returned back to the BCP through the POR, carrying new data and again via the POI the management services ROSE and after that – CMISE are executed.

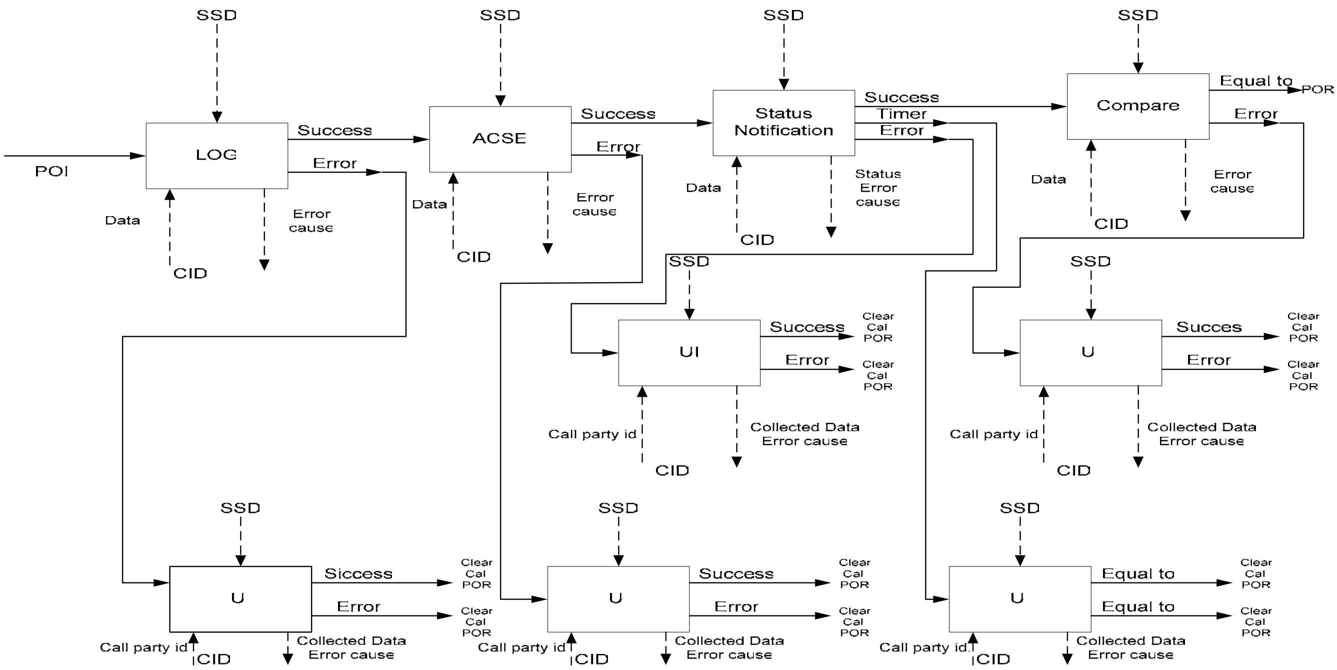

Fig. 10 Model of the management service ACSE

VI. Conclusions

The development of new integrated management functions in the application protocol INAP will bring out the necessity of new Service Independent Blocks – SIB's such as ACSE-SIB, CMISE-SIB and ROSE-SIB. These functions are defined as service elements in the management protocol CMIP in the TMN standards. This is the way to find how to integrate primary network functions (user services) with management functions in order to provide attractive services to the users.

These functions have to meet many different requirements resulting from the increasing user needs.

The models are not being validated because there are not enough suitable simulating tools, development of which is a subject of future work.

References

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