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SERIES Q: SWITCHING AND SIGNALLING
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Interface Recommendation for Intelligent Network Capability Set 4: Common aspects

ITU-T Recommendation Q.1248.1

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ITU-T Recommendation Q.1248.1

Interface Recommendation for Intelligent Network Capability Set 4: Common aspects

Summary

The Q.1248.x family of ITU-T Recommendations defines the Intelligent Network (IN) Application Protocol (INAP) for IN Capability Set 4 (IN CS-4). This definition is based upon IN CS-3 Q.1238.x (2000) family of ITU-T Recommendations and upon the general rules for INAP provided in ITU-T Rec. Q.1208, and is consistent with the scope of IN CS-4 as defined in ITU-T Rec. Q.1241.

In addition to the features supporting IN CS-3, the Q.1248.x family Recommendations provides general extensions to the CS-3 INAP in support of IN CS-4 target services;

Within the Q.124x series of ITU-T Recommendations, the Q.1248.x family of ITU-T Recommendations describes the protocol realizing the Q.1241 Distributed Functional Plane (DFP) in a service and vendor implementation independent manner, as constrained by the capabilities of the embedded base of network technology. This provides the flexibility to allocate distributed functionality into multiple physical network configurations and to evolve IN from IN CS-4 to some future CS-N.

The Q.1248.x family of ITU-T Recommendations describes the Intelligent Network modelling of each Functional Entity (FE) and their relationships as defined as part of the DFP. It also defines the INAP (Intelligent Network Application Protocol) required for the communication of functional entities when they are located in different physical entities.

Intelligent Network Capability Set 4 (IN CS-4) supports the following functional entities:

- Service Switching Function (SSF);
- Service Control Function (SCF);
- Specialized Resource Function (SRF);
- Service Data Function (SDF);
- Call-Unrelated Service Function (CUSF);
- Service Management Function (SMF).

Each of the interfaces defined between the functional entities is defined in a separate Recommendation in the Q.1248.x series:

- ITU-T Rec. Q.1248.1 Describes the common aspects of IN including an overview of each FE. It also describes aspects of the protocol that are common to all interfaces, including services assumed from lower layers, IN security information and the common data types used on all the interfaces.

The interfaces and the description of the functional entities in relation to those interfaces are defined in:

- ITU-T Rec. Q.1248.2 SSF-SCF interface.
- ITU-T Rec. Q.1248.3 SCF-SRF interface.
- ITU-T Rec. Q.1248.4 SCF-SDF interface.
- ITU-T Rec. Q.1248.5 SDF-SDF interface.

- ITU-T Rec. Q.1248.6 SCF-SCF interface.
- ITU-T Rec. Q.1248.7 SCF-CUSF interface.

This Recommendation includes an electronic attachment containing the ASN.1 definitions for the CS-4 common aspects.

Source

ITU-T Recommendation Q.1248.1 was prepared by ITU-T Study Group 11 (2001-2004) and approved under the WTSA Resolution 1 procedure on 13 July 2001.

Keywords

IN CS-4, INAP.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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ITU-T Recommendation Q.1248.1

Interface Recommendation for Intelligent Network Capability Set 4: Common aspects¹

1 Scope

This Recommendation provides a brief introduction to the modelling of IN CS-4 Functional Entities (FE). It also describes aspects of the protocol that are common to all interfaces. This includes physical examples of interface interconnection, services assumed from lower layers (e.g. TCAP), IN security information and the common data types used on all the interfaces.

2 References

2.1 Normative references

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

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¹ This Recommendation includes an electronic attachment containing the ASN.1 definitions for the CS-4 common aspects.

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3 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

AAL	ATM Adaptation Layer
AC	Application Context
ACN	Application Context Negotiation
ACSE	Application Control Service Element
AD	Adjunct
ADSI	Analogue Display Service Interface Server
AE	Application Entity
AEI	Application Entity Invocation
AESA	ATM End System Address
AOC	Advice Of Charge
APCI	Application Protocol Control Information
APDU	Application Protocol Data Unit
API	Application Process Instance
API	Application Programming Interface
ASE	Application Service Element
ASR	Automatic Speech Recognition
ATM	Asynchronous Transfer Mode
BCC	Basic Call Control
BCM	Basic Call Manager
BCP	Basic Call Process
BCSM	Basic Call State Model
BCUP	Basic Call Unrelated Process
BCUSM	Basic Call Unrelated State Model
BGID	Business Group Identity
BICC	Bearer Independent Call Control
BNCM	Basic Non-Call Manager
BRC	Bearer Controller
BRI	Basic Rate Interface
CAC	Carrier Access Code
CCAF	Call Control Agent Function
CCF	Call Control Function
CDP	Customized Dialling Plan
CDVT	Cell Delay Variation Tolerance
CHA	Component Handler
CID	Call Instance Data

CM	Call Manager
CMIS	Common Management Information System
CPH	Call Party Handling
CS	Call Segment
CS	Capability Set
CSA	Call Segment Association
CSCV	Call Segment Connection View
CSM	Call Segment Model
CUG	Closed User Group
CUSF	Call-Unrelated Service Function
CUSP	Call-Unrelated Service Point
CVS	Connection View State
DAP	Directory Access Protocol
DET	Determination (charging)
DFP	Distributed Functional Plane
DHA	Dialogue Handler
DLE	Destination Local Exchange
DN	Directory Number
DN	Distinguished Name
DP	Data Part
DP	Detection Point
DPC	Destination Point Code
DSA	Directory System Agent
DSL	Distributed Service Logic
DSP	Directory System Protocol
DSS1	Digital Subscriber Signalling No. 1 Protocol
DSS2	Digital Subscriber Signalling No. 2 Protocol (Broadband)
DTMF	Dual Tone Multi-Frequency
DUA	Directory User Agent
EDP	Event Detection Point
EDP-N	Event Detection Point – Notification
EDP-R	Event Detection Point – Request
EUI	Extended User Interface Server
FE	Functional Entity
FEA	Functional Entity Action
FEAM	Functional Entity Access Manager
FIM	Feature Interactions Manager

FPLMTS	Future Public Land Mobile Telecommunications Systems
FRL	Facility Restriction Level
FSM	Finite State Machine
GEN	Generation (charging)
GFP	Global Functional Plane
GSL	Global Service Logic
GSS	Generic Security Service
GT	Global Title
GULS	Generic Upper Layer Security
GVNS	Global Virtual Network Service
HLSIB	High-Level Service Independent Block
IAF	Intelligent Access Function
IBI	Inter BCSM Interface
IEC	International Electrotechnical Commission
IN	Intelligent Network
INAP	Intelligent Network Application Protocol
INCM	IN Conceptual Model
INDB	IN Data Base
INDBMS	IN Data Base Management System
IN-SM	IN Switching Manager
IN-SSM	IN Switching State Model
IP	Intelligent Peripheral
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
ISUP	Integrated Services Digital Network-User Part
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
LE	Local Exchange
MACF	Multiple Association Control Function
MPC	Multiple Point of Control
MSR	Message Storage and Retrieval
MTP	Message Transfer Part
NAP	Network Access Point
NCM	Non-Call Manager
NEF	Network Element Function
NFA	Network Functional Architecture
NM	Network Manager



NSAP	Network Service Access Point
OCCRUI	Out-Channel Call-Related User Interaction
OCCUUI	Out-Channel Call-Unrelated User Interaction
OFC	Off-line Charging (billing/accounting information)
OLE	Originating Local Exchange
OLI	Originating Line Information
ONC	On-line Charging (user access information)
OSF	Operations System Function
OSI	Open Systems Interconnection
OUT	Output
PE	Physical Entity
PIC	Point In Call
PM	Personal Mobility
POC	Point Of Control
POI	Point Of Initiation
POR	Point Of Return
POS	Point Of Synchronization
PRI	Primary Rate Interface
PSTN	Public Switched Telephony Network
PTNX	Private Telecommunications Network Exchange
QoS	Quality of Service
RCP	Resource Control Part
RDN	Relative Distinguished Name
REG	Registration (charging)
RFP	Resource Function Part
RLF	Radio Link Function
ROS	Remote Operations
ROSE	Remote Operations Service Element
ROA	Recognized Operating Agency
SACF	Single Association Control Function
SAO	Single Association Object
SAP	Service Access Point
SCCP	Signalling Connection Control Part
SCE	Service Creation Environment
SCEF	Service Creation Environment Function
SCEP	Service Creation Environment Point
SCF	Service Control Function

SCF FSM	Service Control Function Finite State Machine
SCFID	Service Control Function Identifier
SCME	Service Control Function Management Entity
SCME FSM	Service Control Function Management Entity Finite State Machine
SCP	Service Control Point
SCSM	Service Control Function Call State Model
SDF	Service Data Function
SDF FSM	Service Data Function Finite State Machine
SDL	Specification and Description Language
SDME	Service Data Function Management Entity
SDP	Service Data Point
SDSM	Service Data Function Call State Model
SDSS	Server Display and Script Services
SESE	Security Exchange Service Element
SF	Service Feature
SIB	Service-Independent Building Block
SIP	Session Initiation Protocol
SL	Service Logic
SLCP	Service Logic Control Program
SLEE	Service Logic Execution Environment
SLEM	Service Logic Execution Manager
SLMP	Service Logic Management Program
SLP	Service Logic Processing Program
SLPI	Service Logic Processing Program Instance
SM	Service Manager
SMAF	Service Management Access Function
SMF	Service Management Function
SMP	Service Management Point
SMS	Service Management System
SN	Service Node
SPC	Single Point of Control
SRF	Specialized Resource Function
SRF FSM	Specialized Resource Function Finite State Machine
SRME	Specialized Resource Function Management Entity
SRSF	Specialized Resource Function Call State Model
SS	Service Subscriber
SS7	Signalling System No. 7



SSCP	Service Switching and Control Point
SSD	Service Support Data
SSF	Service Switching Function
SSF FSM	Service Switching Function Finite State Machine
SSME	Service Switching Function Management Entity
SSME FSM	Service Switching Function Management Entity Finite State Machine
SSN	SCCP Subsystem Number
SSP	Service Switching Point
ST	Signalling Termination
STI	Service Trigger Information
STUI	Service-To-User Information
SU	Service User
TC	Transaction Capabilities
TCAP	Transaction Capabilities Application Part
TDP	Trigger Detection Point
TDP-N	Trigger Detection Point-Notification
TDP-R	Trigger Detection Point-Request
TMN	Telecommunications Management Network
TTS	Text-to-Speech Synthesis
UNI	User-Network Interface
UPT	Universal Personal Telecommunication
URL	Uniform Resource Locator
USI	User Service Information
UTSI	User-To-Service Information
VC	Virtual Channel
VP	Virtual Path
VPN	Virtual Private Network

4 Scope of IN Distributed Functional Plane for Capability Set 4

The scope of the IN Distributed Functional Plane (DFP) architecture and supporting protocol for IN Capability Set 4 (IN CS-4) is driven by the requirements of the services desired for IN CS-4, and constrained by the capabilities of the embedded base of network technology. The functionality required to support IN CS-4 services includes functionality to provide:

- end-user access to call/service processing;
- call-related service invocation and control;
- end-user interaction with service control;
- service management;
- Call Party Handling;

- internetworking;
- security;
- Out-Channel User Interaction;
- call-unrelated service invocation and control; and
- feature interactions.

Each of these aspects is addressed below.

4.1 End-user access

End-user access to call/service processing is provided via the following access arrangements²:

- analogue line interfaces;
- ISDN BRI and PRI;
- traditional trunk and SS7 interfaces; and
- any interface using call signalling procedures that are compatible with the BCSM (e.g. SIP-based interfaces).

4.2 Call-related service invocation and control

Call/service processing builds upon the current call processing infrastructure of existing digital exchanges. It does so by using a generic model of existing call control functions to process basic two-party calls, then adding service switching functions to invoke and manage IN service logic. This generic model is known as the Basic Call State Model (BCSM). Once invoked, IN service logic is executed under the control of service control functions, in conjunction with service data functions. With this distributed approach to call/service processing, the existing call control function retains ultimate responsibility for the integrity of calls, as well as for the control of call processing resources. The following call/service processing constraints apply:

- a) Call control and service switching functionality are tightly coupled; thus, the relationship between SSF and CCF is not standardized.
- b) A call is either between two or more end users that are external to the network and addressable via a directory number or combination of directory number and bearer capability, or a call is between one or more end users and the network itself.
- c) A call may be initiated by an end user, or by a SCF within the network on behalf of an end user. To supplement a call, IN service logic may either be invoked by an end user served by an IN exchange, or by the network on behalf of an end user.
- d) A call may span multiple exchanges. As such, each exchange only controls the portion of the call in that exchange – call processing is functionally separated between exchanges. IN service logic invoked on IN exchanges in such inter-exchange calls are managed independently by each IN exchange.
- e) Existing exchanges can be viewed as having two functionally separate sets of call processing logic that coordinate call processing activities to create and maintain a basic two-party call. This functional separation is provided between the originating portion of the call and the terminating portion of the call. This functional separation should be maintained in an IN exchange to allow IN service logic invoked on the originating portion of the call (i.e. on behalf of the calling party) to be managed independently of IN service logic invoked on the terminating portion of the call (i.e. on behalf of the called party).

² This does not preclude the use of these interfaces to support access from private or mobile networks.

- f) It is desirable to allow multiple IN-supported service logic instances to be simultaneously active for a given end user. It is also recognized that non-IN service logic will continue to exist in the network. As such, service feature logic instances mechanisms should:
- determine which service logic to invoke for a given service request. This mechanism should select the appropriate IN-supported service logic or non-IN-supported service logic, and block the invocation of any other service logic for that particular service request;
 - ensure that simultaneously active IN-supported service logic instances adhere to the single-ended restriction on service processing.
- g) The distributed approach and added complexity of call/service processing requires mechanisms for fault detection and recovery, allowing graceful termination of calls and appropriate treatments for end users.

4.3 End-user interaction

End-user interaction with the network to send and receive information is provided by service switching and call control resources, augmented by specialized resources. These specialized resources are controlled by service control functionality, and are connected to end users via call control and service switching functionality.

4.4 IN service management functionality

IN service management functionality is used to provision and manage the service control functionality, service data functionality, specialized resource functionality and the combined service switching/call control functionality in the network, outside of the context of call/service processing. The IN management functions are modelled according to the TMN functional architecture.

ITU-T Rec. M.3010 specifies the functional information and physical architectures that support the TMN management services. A TMN management function is the smallest part of the TMN management service as perceived by the user of the service. It will generally consist of a sequence of actions on a defined managed object or objects. The TMN management functions are described in ITU-T Rec. M.3400.

Many of the IN management functions are not IN-specific but can be mapped onto TMN management functions and reused for IN purposes.

Furthermore, the TMN uses OSI system management functions. These functions provide generic management controls and capabilities which can be used by specific TMN management services and functions. As a consequence of what is described above, a set of managed objects which are defined in the different system management functions, can be identified and reused for IN purposes.

In particular one can point out: "Summarization Function" (ITU-T Rec. X.738), "Workload Monitoring Function" (ITU-T Rec. X.739), "Event Management Function" (ITU-T Rec. X.734), "Alarm Reporting Function" (ITU-T Rec. X.733) and "Performance Management Function" (ITU-T Rec. Q.822).

4.5 Call Party Handling

Call Party Handling (CPH) is the ability to manage various parties' involvement in a call. CPH capabilities rely on an abstract model of call and connection processing activities, maintained by the SSF, in terms of call and connection states. They provide IN services with the ability to add, delete, join and/or separate parties bearer channels from the other parties involved in a call.

4.6 Internetworking

This capability set identifies the SCF-SDF, SCF-SCF, SMF-SMF and SDF-SDF relationships for internetworking purposes. Distributed service logic, but not distributed service control, is supported. Additionally, internetwork management interactions and distributed data handling processes are supported.

4.7 Security

Security is supported through the provision of a number of security-assisting functions. A security-assisting function requires the cooperation of two or more functional entities. The security-assisting functions support both internal network operations and interworking between two or more networks. Security features do not automatically guarantee network integrity, but rather they provide some of the tools in order to allow secured systems to be built.

4.8 Out-Channel User Interaction

The "Out-Channel Call-Related User Interaction" (OCCRUI) and the "Out-Channel Call-Unrelated User Interaction" (OCCUUI) network aspects are used to provide IN services with the ability to request the transparent transfer of information between a User and a Service Logic.

The term "user" refers to any application process which may reside in physical entity connected to the network (e.g. an ISDN terminal, a SCP or any equipment which may be connected to the network through a PRI or trunk line).

4.9 Call-unrelated service invocation and control

This capability enables IN-supported service logic instances to be invoked outside the context of a call. It may be required for services/service features such as message waiting indication and registration of the user location.

Call-unrelated service processing builds upon the current call-unrelated processing infrastructure of existing digital exchanges. It does so by using a generic model of existing call-unrelated activities, then adding call-unrelated service functions to invoke and manage IN service logic. This generic model is known as the Basic Call-Unrelated State Model (BCUSM).

Call-unrelated processing and call-unrelated service functionality are tightly coupled; thus, the relationship between CUSF and CCF is not standardized.

4.10 Feature Interaction

Feature Interaction mechanisms are means to manage feature/service interference situations which have been recognized prior to service deployment. Use of these mechanisms is a network operator option.

4.11 Distributed Functional Model

Figure 1 identifies the IN DFP model for IN CS-4. This figure is provided here as a reference, and is used to show the relevant interfaces on which the protocol in ITU-T Rec. Q.1248 is provided. For detailed descriptions of the functional entities, one should refer to ITU-T Rec. Q.1241.

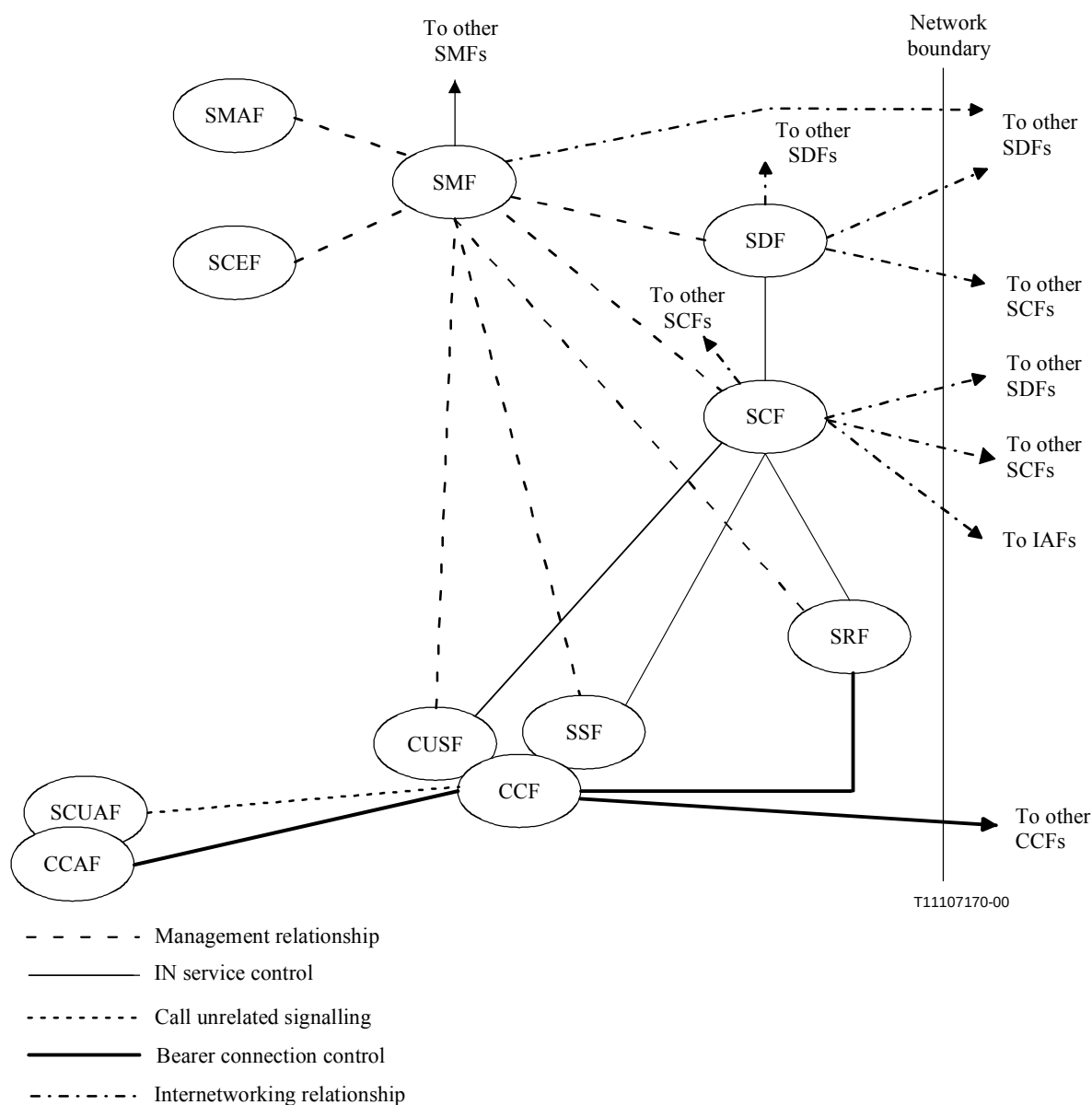


Figure 1/Q.1248.1 – IN CS-4 DFP architecture

4.12 Communication model

For the purpose of communication, each Functional Entity (FE) includes a Functional Entity Access Manager (FEAM) which provides the necessary functionality to support the exchange of information with other FEs. This includes:

- a) establishing and maintaining the interfaces to other FEs using the appropriate underlying communication mechanism;
- b) passing and queuing (when necessary) the messages received from other FEs to other components of the FE; and
- c) formatting, queuing (when necessary), and sending to other FEs the messages received from other components of the FE.

On the following IN interfaces, interactions between a pair of communicating FEs are defined and specified using the Remote Operations (ROS) paradigm defined in ITU-T Rec. X.880:

- SSF-SCF interface;
- SCF-SRF interface;

- SCF-SDF interface;
- SDF-SDF interface;
- SCF-SCF interface;
- SCF-CUSF interface.

In such cases, the FEAM is modelled as a *ROS-Object* whose class definition includes the list of *contracts* used over each of the IN interfaces it supports. Each *contract* is in turn defined as a set of operation *packages*, each of which includes one or more *operations* supporting the elementary interactions between the involved FEs.

The internal behaviour of each FE is modelled using one or more Finite State Machines (FSMs) which are interfaced with the FEAM.

This communication model does not assume any particular physical realization. It remains valid when two FEs are co-located in the same equipment or communicate through a network. At the Physical Plane, when two communicating FEs are located in different physical entities (PE), each contract is realized by an application-context using the Transaction Capabilities (TC) or using the ROSE capabilities. In addition to TC, the application-context includes a set of Application Service Element (ASE) each of which embodies the knowledge of an operation package. This is further explained in clause 7.

The communication model used on interfaces to the SMF is not subject to standardization.

5 FE models

This clause provides a general description of each of the functional entities identified in the Distributed Functional Plane. Detailed descriptions of the functional entities are provided in the Q.1248.x family of ITU-T Recommendations. In case of discrepancy between this clause and these Recommendations, the latter take precedence.

5.1 Call Control Function/Service Switching Function (CCF/SSF) models

5.1.1 General

A model of the CCF/SSF is shown in Figures 2 and 3. Figure 2 shows the CCF/SSF model for a single-ended service logic instance related to a calling or called party. Figure 3 shows the CCF/SSF model for separate single-ended service logic instances related to the calling and called parties on the same call. The functional separation serves to isolate single-ended service logic instances related to the calling party from single-ended service logic instances related to the called party for the same call. The purpose of the models is to provide a framework for the understanding of call modelling with respect to the CCF/SSF.