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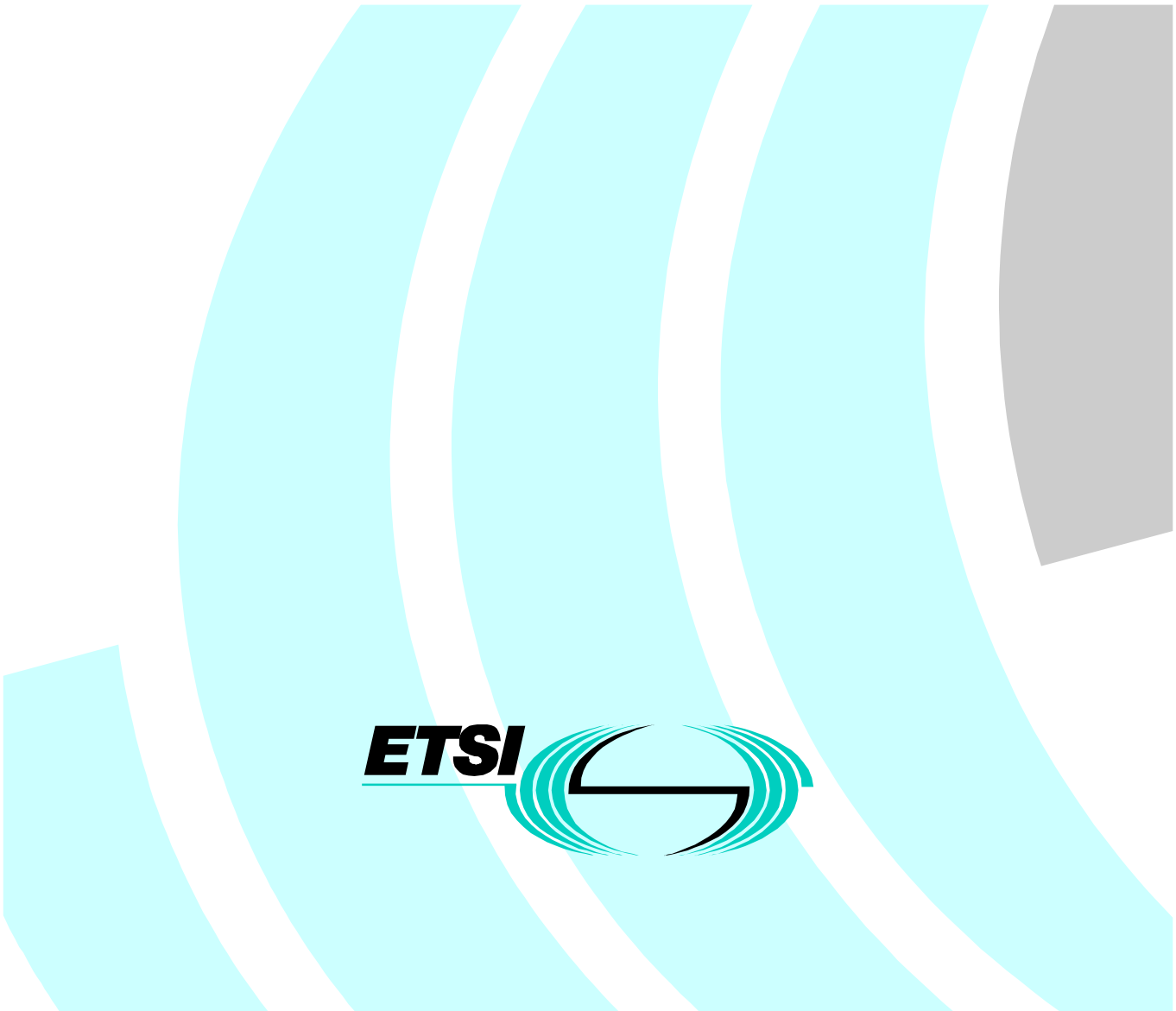
*ETSI Guide*

**Intelligent Network (IN);**
**Security aspects of Switching Control Function (SCF) -**
**Service Switching Function (SSF)**
**interconnection between networks;**
**Part 1: Capability Set 1 (CS1) based operations**



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# Contents

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# Foreword

This ETSI Guide (EG) has been produced by ETSI Technical Committee Services and Protocols for Advanced Networks (SPAN).

The present document is part 1 of a multi-part EG covering the Intelligent Network (IN); Security aspects of Switching Control Function (SCF) - Service Switching Function (SSF) interconnection between networks, as identified below:

**Part 1: "Capability Set 1 (CS1) based operations";**

Part 2: "Capability Set 2 (CS2) based operations".

# Introduction

Under IN CS1 and CS2, the IN SCP to SSP relationship, or Service Control to Switch, is confined to a single network operator's domain and may actually be physically co-located as an SSCP. To optimize performance, the switch requires little security, particularly if implemented within a 'single unit' or SSCP. By not using the local processor for security, switch performance may be optimized toward call processing with security and network protection measures provided at the Service Control Point.

In the case of inter-connected networks, direct implementation of the Inter-network Control to Switch relationship would require appropriate security and authentication measures to be provided and managed at each SSF.

Within a single network, potential conflict between multiple SCFs is avoided by their management within a common domain. When two networks are interconnected two (or more) SCFs in different domains can potentially control the same resource (SSF). Then some secure resource allocation and management procedure must be deployed. Suitable mechanisms have not yet been standardized. Network operators may prefer the option of utilizing the established inter-network SCF to SCF security procedures and route inter-network service switching signalling messages via each Network's Service Control Point. In this case appropriate security and authentication measures would be provided and managed at each SCF.

# 1 Scope

The present document describes security aspects in conjunction with the interconnection of two IN structured networks. The present document concentrates on the SCF - SSF interconnection.

The purpose of the present document is to describe the security aspects of interconnection of SCF to SSF. The operations considered in this interconnection are a subset of CS1. For the time being CAMEL is the only application of SCF - SSF interconnection, therefore the present document considers only CAMEL phase 1 operations. A later edition may also consider other CS1 operations.

Future parts of the present document will investigate the security aspects of operation sets that are a subset of CS2 and CS3.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ITU-T Recommendation Q.1228 (1997): "Interface Recommendation for intelligent network Capability Set 2".

[2] ETSI ETR 232: "Security Techniques Advisory Group (STAG); Glossary of security terminology".

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**masquerade ("spoofing"):** pretence of an entity to be a different entity. This may be a basis for other threats like unauthorized access or forgery

**unauthorized access:** entity attempts to access data in violation to the security policy in force

**eavesdropping:** breach of confidentiality by monitoring communication

**loss or corruption of information:** integrity of data (transferred) is compromised by unauthorized deletion, insertion, modification, reordering, replay or delay

**replay of information:** repetition of previously valid commands and responses with the intention of corrupting service or causing an overload

**repudiation:** denial by one of the entities involved in a communication of having participated in all or part of the communication

**forgery:** entity fabricates information and claims that such information was received from another entity or sent to another entity

**denial of service:** prevention of authorized access to resources or the delaying of time critical operations

**unauthorized activity:** attacker performs activities for which he has no permission or which are in contradiction of an interconnect agreement

## 3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

| | |
|---|---|
| BCSM | Basic Call State Model |
| CAMEL | Customized Applications for Mobile Enhanced Logic |
| CCF | Call Control Function |
| CS1 | Capability Set 1 |
| CS2 | Capability Set 2 |
| CS3 | Capability Set 3 |
| DP | Detection Point |
| IN | Intelligent Network |
| INAP | Intelligent Network Application Part |
| ITU | International Telecommunications Union |
| PSTN | Public Switched Telecommunications Network |
| SCF | Service Control Function |
| SCP | Service Control Point |
| SDF | Service Data Function |
| SRF | Specialized Resource Function |
| SSCP | Service Switching Control Point |
| SSF | Service Switching Function |
| SSP | Service Switching Point |
| TCAP | Transaction Capabilities Application Part |
| TDP-R | Trigger Detection Point - Request |

# 4 Functionality

## 4.1 SSF

The SSF is the Service Switching (SS) function, which, associated with the CCF, provides the set of functions required for interaction between the CCF and a service control function (SCF). It:

a) extends the logic of the CCF to include recognition of service control triggers and to interact with the SCF;

b) manages signalling between the CCF and the SCF;

c) modifies call/connection processing functions (in the CCF) as required to process requests for IN provided service usage under the control of the SCF (ITU-T Recommendation Q.1228 [1]).

## 4.2 SCF

The SCF is a function that commands call control functions in the processing of IN provided and/or custom service requests. The SCF may interact with other functional entities to access additional logic or to obtain information (service or user data) required to process a call/service logic instance. It:

a) interfaces and interacts with service switching function/call control function, Specialized Resource function (SRF) and Service Data Function (SDF) functional entities;

b) contains the logic and processing capability required to handle IN provided service attempts (ITU-T Recommendation Q.1228 [1]).

## 4.3 SSF-SCF Interconnection

General (ITU-T Recommendation Q.1228 [1]):

- a relationship between the SCF and SSF is established either as a result of the SSF sending a request for instruction to the SCF, or at the request of the SCF for initiation of a call or for some non call-related reason;
- a relationship between a SCF and a SSF is normally terminated at the request of the SCF. The SSF may also terminate the relationship (e.g. in error cases);
- for IN CS-1, a single SCF may have concurrent relationships with multiple SSFs. A single SSF may only have a relationship with one SCF at a time for any given call. Note that this refers to control as opposed to monitor relationships;
- when the SSF receives call-related IEs from the SCF, it substitutes these IEs for the corresponding call information, and retains all other call information. This applies to ALL call processing-related messages;
- SSF - SCF interconnection could be used to enable operators to use other operators' IN platform. Because SSF - SCF interconnection may also be allowed to service providers with limited resources, security is of paramount interest regarding the availability demands of the SSF service.

Figure 1 shows an internetworking scenario SCF-SCF and SCF - SSF based on the CAMEL Phase 1 Operations. In practice it is necessary to add security facilities to each SCF and SSF involved in the inter-domain communication.

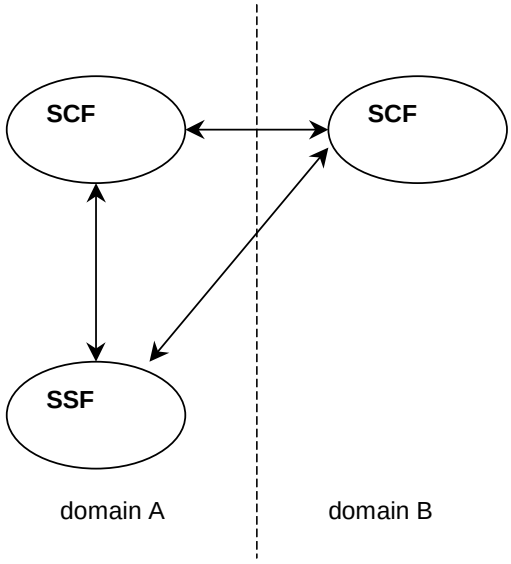


**Figure 1: SCF - SSF Interconnection**

Because security is important when allowing other operators to connect to an SSF it is necessary to limit the number of operations allowed on the SSF. As a starting point we have taken the CAMEL phase 1 subset of CS-1 minus the MAP operations, which are not applicable to this PSTN model. This results in the following subset of CS-1 operations.

**Table 1: CS-1 operations between SSF and SCF**

| No. | CS-1 operation | Direction |
|---|---|---|
| 1 | InitialDP | SSF -> SCF |
| 2 | Connect | SCF -> SSF |
| 3 | ReleaseCall | SCF -> SSF |
| 4 | EventReportBCSM | SSF -> SCF |
| 5 | RequestReportBCSMEvent | SCF -> SSF |
| 6 | Continue | SCF -> SSF |
| 7 | ActivityTest | SCF -> SSF |

Next, a short description will be provided of each operation, together with the parameters and possible security remarks.

# 5 Security considerations of operations

## 5.1 initialDP

**Function:** This operation is sent by the SSF after detection of a TDP-R in the BCSM, to request the SCF for instructions to complete the call.

**Parameters:** serviceKey, calledPartyNumber, callingPartyNumber, callingPartysCategory, originalCalledPartyID, locationNumber, forwardCallIndicators, bearerCapability, eventTypeBCSM, redirectingPartyID, redirectionInformation, iPAvailable, iPPSPCapabilities, cGEncountered, additionalCallingPartyNumber, serviceInteractionIndicators, highlayerCompatibility.

**Security issues:** The SSF and SCF have already entered a signalling procedure (TCAP). One of the security risks could be that an other SCF hyjacks this session and takes over the control.

## 5.2 connect

**Function:** This operation is used to request the SSF to perform the call processing actions to route a call to a specific destination. To do so, the SSF may use destination information from the calling party (e.g. dialled digits) and existing call set-up information (e.g. route index to a list of trunk groups) depending on the information provided by the SCF.

**Parameters:** destinationRoutingAddress, correlationID, scfID, cutAndPaste, callingPartyNumber, routeList, callingPartysCategory, originalCallingPartyID, redirectingPartyID, redirectionInformation, alertingPattern, serviceInteractionIndicators.

**Security issues:** It shall not be possible for any SCF to perform this operation outside its jurisdiction. If this operation is performed by an unauthorized party, resources can be allocated that are needed otherwise therefore compromising the network integrity.

## 5.3 releaseCall

**Function:** This operation is used to tear down by the SCF an existing call at any phase of the call for all parties involved in the call. This operation may not be sent to an assisting SSF, except in the case of hand-off procedure.

**Parameters:** Cause.

**Security issues:** It shall not be possible for any SCF to release Calls that are outside their jurisdiction. If this operation is performed by an unauthorized party, calls can be tear down without proper authorization. This is a Denial of Service attack.

## 5.4 eventReportBCSM

**Function:** This operation is used to notify the SCF of a call related event previously requested by the SCF in a RequestReportBCSMEvent operation. The monitoring of more than one event could be requested with a RequestReportBCSMEvent operation, but each of these requested events is reported in a separate EventReportBCSM operation.

**Parameters:** eventTypeBCSM, eventSpecficInformationBCSM, legID, miscCallInfo.

**Security issues:** No security issues identified.

## 5.5 requestReportBCSMEvent

**Function:** This operation is used to request the SSF to monitor for a call-related event (e.g., BCSM events such as busy or no answer), then send a notification back to the SCF when the event is detected.

**Parameters:** eventTypeBCSM, monitorMode, legID, dPSpecificCriteria, numberOfDigits, applicationTimer.

**Security issues:** The monitoring of events can have two negative sideffects: The usage of resources and confidentiality. The resources needed (flooding). Confidentiality is jeopardized when there is a risk of unauthorized monitoring of call-traffic.

## 5.6 continue

**Function:** This operation is used to request the SSF to proceed with call processing at the DP at which it previously suspended call processing to await SCF instructions. The SSF continues call processing without substituting new data from the SCF.

**Parameters:** (none).

**Security issues:** It may be a problem when an SCF sends a random 'continue' message to an SSF. An unauthorized SCF sends a 'continue' message before the authorized SCF does therefore disturbing the Call State Model sequence.

## 5.7 activityTest

**Function:** This operation is used to check for the continued existence of a relationship between the SCF and SSF. If the relationship is still in existence, then the SSF will respond. If no reply is received, then the SCF will assume that the SSF has failed in some way and will take the appropriate action.

**Parameters:** (none).

**Security issues:** Because the SSF has to respond to this message, some system resources are used (processing power, network bandwith). This can have a possible impact on the functioning of the system as a whole.

# 6 Security countermeasures

From the operations involved in SCF - SSF interconnection denial of service attack (deliberate or inadvertently) is the most important threat. Other threats identified are: masquerading, man-in-the-middle attack, replay of information and unauthorized reading of information. Therefore the following security countermeasures are proposed.

## 6.1 Topology

Careful design of the network can enhance the security already provided. This can be achieved by:

- physical limitations with respect to connecting networks;
- limiting the functionality to what is minimum needed.

## 6.2 Authentication

The originator or calling party needs to be authenticated before network management commands or queries can be processed.

The authentication information needs to be protected during transit, processing and storage.

The source address may also need to be authenticated in the case of critical messages.

## 6.3 Access control

All interfaces to the SSF and SCF need to be protected by means of access control measure. These may include the Operating Systems or systems controlling the SSF or SCF.

There shall be different access control measures depending on the entity wishing to access the resource.

Access to auditing facilities or mechanisms shall be enforced.

## 6.4 Integrity

Message integrity controls shall be in place to detect changes to message content.

New hardware/software shall meet all the specified requirements. This can be achieved by a variety of methods which are outside the scope of the present document.

## 6.5 Confidentiality

In case of sensitive data it shall be possible to secure transmitted data to make it uninterpretable by unauthorized third parties for example by encryption.

## 6.6 Non Repudiation

In case of a dispute between two interconnected parties all actions performed within a mutual agreed timespan by both parties shall be provable.

## 6.7 Accountability and auditing

All (security) events shall be recorded in a sufficient amount of detail.

All the above recorded information shall be stored for a specified amount of time without any loss of information or integrity.

## 6.8 Network security management

Effective management controls shall be in place to prevent denial of service attacks or congestion.

Intrusion detection controls shall also be in place to combat attacks when they occur. In addition to this the auditing function shall keep track of all steps or procedures undertaken by the intruder.

## 6.9 Testing and operation maintenance

Parties are recommended to include in the interoperability testing security aspects.

Parties are recommended to consider in the agreed operations and maintenance procedures issues related with security aspects.

If any other CS1 operations are introduced for SCF - SSF interconnection similar investigations have to be performed.

# Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.


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# History

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