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TECHNICAL SPECIFICATION

**Digital cellular telecommunications system (Phase 2+);
Universal Mobile Telecommunications System (UMTS);
LTE;
Telecommunication management;
Communication Surveillance (CS)
Integration Reference Point (IRP);
Information Service (IS)
(3GPP TS 32.352 version 13.0.0 Release 13)**

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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y   the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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Introduction

The present document is part of a TS-family covering the 3rd Generation Partnership Project: Technical Specification Group Services and System Aspects; Telecommunication management, as identified below:

TS 32.351:   "Communication Surveillance (CS) Integration Reference Point (IRP); Requirements";

TS 32.352:   "Communication Surveillance (CS) Integration Reference Point (IRP); Information Service (IS)";

TS 32.356:   "Communication Surveillance (CS) Integration Reference Point (IRP); Solution Set (SS) definitions".

The present document is part of a TS-family defining the Telecommunication Management (TM) of 3G systems.

The TM principles are described in 3GPP TS 32.101 [1]. The TM architecture is described in 3GPP TS 32.102 [2].

The other specifications define the interface (Itf-N) between the managing system (manager), which is in general the Network Manager (NM) and the managed system (agent), which is either an Element Manager (EM) or the managed NE itself. The Itf-N is composed of a number of Integration Reference Points (IRPs) defining the information in the agent that is visible for the manager, the operations that the manager may perform on this information and the notifications that are sent from the agent to the manager. Communication Surveillance IRP (CSIRP) is one of these IRPs with special function.

To ensure the availability and reliability of the management, an automatic surveillance of the communication between NM and the managed system are required. CSIRP is defined as a capability to achieve this goal.

1 Scope

The present document defines the Information Service (IS) part of the Communication Surveillance IRP (CSIRP). It describes the semantics of the information and the interactions visible across Itf-N in a protocol independent way. The information is specified by means of Information Object Classes (IOCs) and the interactions by means of operations and notifications. The present document does not specify the syntax (encoding) of the information.

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. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1]   3GPP TS 32.101: "Telecommunication management; Principles and high level requirements".

[2]   3GPP TS 32.102: "Telecommunication management; Architecture".

[3]   Void

[4]   3GPP TS 32.351: "Telecommunication management; Communication Surveillance (CS) Integration Reference Point (IRP): Requirements".

[5]   3GPP TS 32.622: "Telecommunication management; Configuration Management (CM); Generic network resources Integration Reference Point (IRP): Network Resource Model (NRM)".

[6]   3GPP TS 32.312: "Telecommunication management; Generic Integration Reference Point (IRP) management: Information Service (IS)".

[7]   3GPP TS 32.311: "Telecommunication management; Generic Integration Reference Point (IRP) management: Requirements".

[8]   3GPP TS 32.302: "Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP): Information Service (IS)".

[9]   3GPP TS 32.150: "Telecommunication management; Integration Reference Point (IRP) Concept and definitions".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions defined in 3GPP TS 32.101 [1], 3GPP TS 32.102 [2], 3GPP TS 32.351 [4] and the following apply.

IRPVersion: See 3GPP TS 32.311 [7].

3.2 Abbreviations

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

CMIP	Common Management Information Protocol
CORBA	Common Object Request Broker Architecture
CS	Communication Surveillance
CSIRP	Communication Surveillance Integration Reference Point
DN	Distinguished Name
EM	Element Manager
IRP	Integration Reference Point
IOC	Information Object Class
IS	Information Service
NE	Network Element
NM	Network Manager
NRM	Network Resource Model

4 System Overview

4.1 System Context

The general definition of the System Context for the present IRP is found in 3GPP TS 32.150 [9] subclause 4.7.

In addition, the set of related IRP(s) relevant to the present IRP is shown in the two diagrams below.
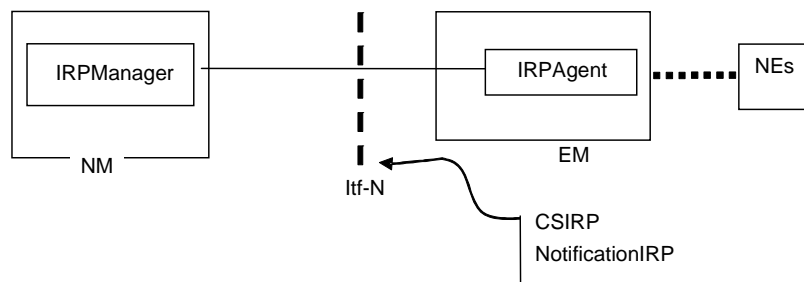
Figure 4.1: System Context A
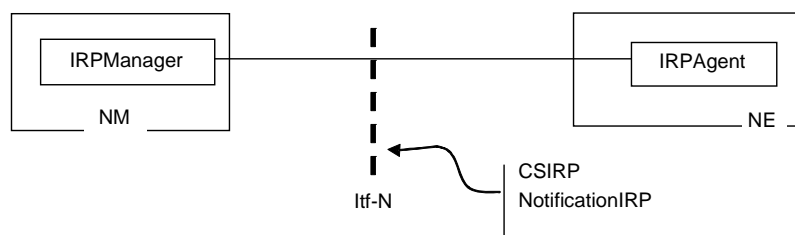
Figure 4.2: System Context B

4.2 Compliance rules

For general definitions of compliance rules related to qualifiers (Mandatory/Optional/Conditional) for *operations*, *notifications and parameters* (of operations and notifications) please refer to 3GPP TS 32.102 [2].

5 Information Object Classes (IOCs)

5.1 Information entities imported and local labels

Label reference	Local label
3GPP TS 32.622 [5], information object class, `Top`	Top
3GPP TS 32.622 [5], information object class, `IRPAgent`	IRPAgent
3GPP TS 32.622 [5], information attribute, `systemDN`	systemDN
3GPP TS 32.622 [5], information object class, `GenericIRP`	GenericIRP
3GPP TS 32.312 [6], information object class, `ManagedGenericIRP`	ManagedGenericIRP

5.2 Class diagram

5.2.1 Attributes and relationships

This clause introduces the set of Information Object Classes (IOCs) that encapsulate information within the `IRPAgent`. The intention is to identify the information required for the CSIRP implementation of its operations. This clause provides the overview of all support object classes in UML. Subsequent clauses provide more detailed specification of various aspects of these support object classes.
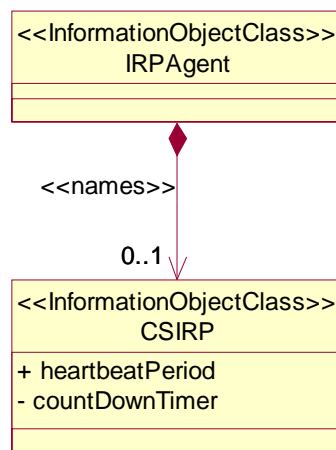
5.2.2   Inheritance
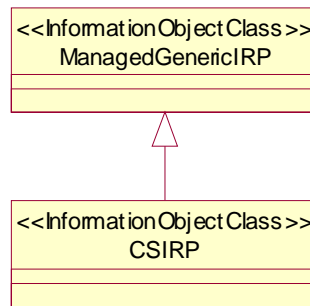
5.3   IOCs definition

5.3.1   CSIRP

5.3.1.1   Definition

This information object represents a capability that can emit heartbeat notification periodically. The emission frequency is controlled by an attribute named heartbeatPeriod. The notifications are submitted to NotificationIRP that will distribute them to NtfSubscriber(s) according to their related NtfSubscription(s). In addition, the CSIRP provide a method for IRPManager to trigger a heartbeat notification at any time. The IOC CSIRP inherits from the IOC ManagedGenericIRP specified in 3GPP TS 32.312 [6]. There shall be at most one CSIRP instance per IRPAgent instance.

The heartbeat notifications are submitted via established notification subscriptions, to IRPManagers. The distribution of notifications is subject to the status of the related established notification subscription. For example, the IRPManager will not be able to receive the heartbeat notification if the notification subscription state is suspended or if the notification filter is in effect that discards heartbeat notification. See Annex A for more information.

5.3.1.2   Attributes

Attribute name	Visibility	Support Qualifier	Read Qualifier	Write Qualifier
heartbeatPeriod	+	M	M	M
countDownTimer	-	M	-	-

5.3.1.3   Notification

Name	Qualifier	Notes
notifyHeartbeat	M	See clause 6.5.1.

5.4   Information attributes definition

This clause defines the semantics of the Attributes used in Information Object Classes (IOCs).

5.4.1   Definitions and legal values

Attribute Name	Definition	Legal Values
heartbeatPeriod	It specifies the time between two emissions of heartbeat notifications. A value of zero implies there is no heartbeat emission. The unit is minute.	Type: Integral numeric value Range: value range of heartbeat period is from 5min to 60min, 0 is also a legal value.
countDownTimer	It represents the current value of a count down timer.	

6 Interface definition

6.1 Class diagram representing interfaces

The following diagram depicts the interfaces of the CSIRP IOC with their corresponding operations.
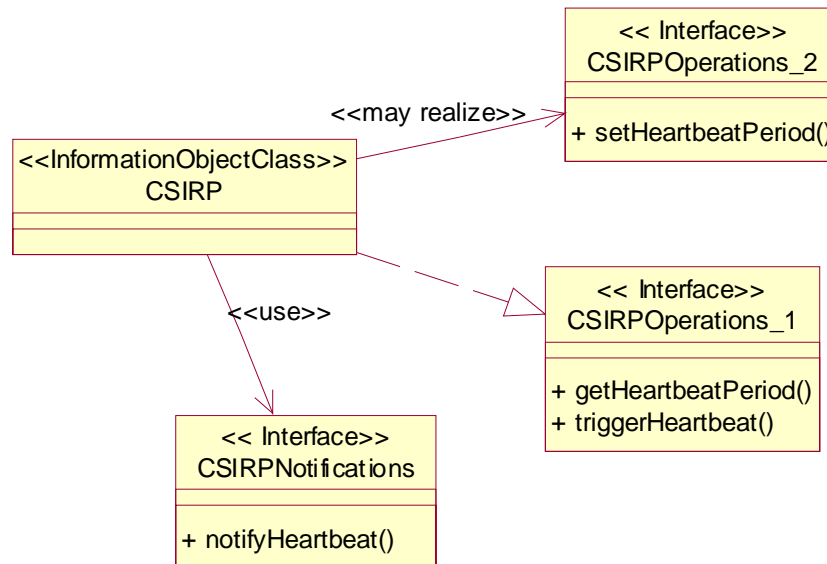
6.2 Generic rules

- **Rule 1:** each operation with at least one input parameter supports a pre-condition valid_input_parameter which indicates that all input parameters shall be valid with regards to their information type. Additionally, each such operation supports an exception operation_failed_invalid_input_parameter which is raised when pre-condition valid_input_parameter is false. The exception has the same entry and exit state.

- **Rule 2:** Each operation with at least one optional input parameter supports a set of pre-conditions supported_optional_input_parameter_xxx where "xxx" is the name of the optional input parameter and the pre-condition indicates that the operation supports the named optional input parameter. Additionally, each such operation supports an exception operation_failed_unsupported_optional_input_parameter_xxx which is raised when (a) the pre-condition supported_optional_input_parameter_xxx is false and (b) the named optional input parameter is carrying information. The exception has the same entry and exit state.

- **Rule 3:** each operation shall support a generic exception operation_failed_internal_problem that is raised when an internal problem occurs and that the operation cannot be completed. The exception has the same entry and exit state.

6.3 Interface CSIRPOperations_1 (M)

6.3.1 Operation `getHeartbeatPeriod` (M)

6.3.1.1 Definition

IRPManager invokes this operation to obtain the current heartbeat period.

6.3.1.2 Input parameters

There is no input parameter.

6.3.1.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
heartbeatPeriod	M	CSIRP.heartbeatPeriod	
status	M	ENUM (Operation succeeded, Operation failed)	

6.3.1.4 Pre-condition

There is no pre-condition.

6.3.1.5 Post-condition

There is no post-condition.

6.3.1.6 Exceptions

There is no exception.

6.3.2 Operation `triggerHeartbeat` (M)

6.3.2.1 Definition

The IRPManager invokes this operation to solicit a `notifyHeartbeat` notification. After the successful completion of the operation, the IRPAgent shall emit the `notifyHeartbeat` notification as specified in clause 6.4.1 immediately. One notification shall be emitted as follows:

a) one notification to the soliciting IRPManager; or

b) one notification to each of the subscribed IRPManagers.

If the operation fails the notification shall not be emitted.

One of the two options above shall be chosen depending on system performance considerations.

Before invoking this operation, the soliciting IRPManger should make sure it has subscribed the `notifyHeartbeat` notification.

6.3.2.2 Input parameters

Parameter Name	Qualifier	Matching Information	Comment
managerIdentifier	M	String	The identifier for the triggering IRPManager.

6.3.2.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
status	M	ENUM (Operation succeeded, Operation failed)	

6.3.2.4 Pre-condition

validManagerIdentifier.

Assertion Name	Definition
validManagerIdentifier	The input managerIdentifier is valid.

6.3.2.5 Post-condition

There is no post-condition.

6.3.2.6 Exceptions

Name	Definition
invalidManagerIdentifier	**Condition:** The input parameter of managerIdentifier is not valid. **Returned Information:** The output parameter status. **Exit state:** Entry State

6.4 Interface CSIRPOperations_2 (O)

6.4.1 Operation `setHeartbeatPeriod` (M)

6.4.1.1 Definition

The IRPManager invokes this operation to set the `heartbeatPeriod`.

As a consequence and indicative of successful completion of the operation the IRPAgent shall emit the `notifyHeartbeat` specified in clause 6.4.1 immediately and continue to emit based on the newly specified `heartbeatPeriod`, to all established notification subscriptions of all subscribed IRPManagers.

If the `heartbeatPeriod` specified is the same as the current value in IRPAgent, the operation shall fail.

6.4.1.2 Input parameters

Parameter Name	Qualifier	Information Type	Comment
heartbeatPeriod	M	CSIRP.heartbeatPeriod	

6.4.1.3 Output parameters

Parameter Name	Qualifier	Matching Information	Comment
status	M	ENUM (Operation succeeded, Operation failed)	

6.4.1.4 Pre-condition

validHeartbeatPeriod AND noconflictingHeartbeatPeriod.

Assertion Name	Definition
validHeartbeatPeriod	The valid heartbeatPeriod as defined in clause 5.4.1 (Definitions and legal values).
noconflictingHeartbeatPeriod	The heartbeatPeriod specified is not same as the current value in IRPAgent.

6.4.1.5 Post-condition

heartbeatPeriodChanged AND `notifyHeartbeatEmitted`.

Assertion Name	Definition
heartbeatPeriodChanged	CSIRP.heartbeatPeriod and CSIRP.countDownTimer are both set to input parameter heartbeatPeriod. CSIRP.countDownTimer begins to start counting down.
notifyHeartbeatEmitted	CSIRP emits the notifyHeartbeat specified in clause 6.4.1 to all subscribed IRPManagers.

6.4.1.6 Exceptions

Name	Definition
invalidHeartbeatPeriod	**Condition:** The input parameter of heartbeatPeriod is not within the allowed range. **Returned Information:** The output parameter status. **Exit state:** Entry State
conflictingHeartbeatPeriod	**Condition:** The input parameter of heartbeatPeriod is same as the current value in IRPAgent. **Returned Information:** The output parameter status. **Exit state:** Entry State

6.5 Interface CSIRPNotifications (M)

6.5.1 Notification `notifyHeartbeat` (M)

6.5.1.1 Definition

The subscribed IRPManager instances are notified that the resources supporting the communication path between the Notification IRPAgent and the notification receiving IRPManager are working.

6.5.1.2 Input parameters

Parameter Name	Qualifier	Matching Information	Comment
objectClass	M, Y	CSIRP.objectClass.	Notification header - see [8]. It shall carry the CSIRP class name.
objectInstance	M, Y	CSIRP.objectInstance.	Notification header - see [8]. It shall carry the DN of the CSIRP.
eventTime	M, Y	--	Notification header - see [8].
notificationId	O, N	--	Notification header - see [8].
systemDN	C, Y	--	Notification header - see [8].
notificationType	M, Y	"notifyHeartbeat"	Notification header - see [8].
heartbeatPeriod	M, N	CSIRP.heartbeatPeriod	
locator	M, N	--	This parameter, together with the knowledge of Notification IRPAgent system internal configuration, can determine the communication path used by this notification (see Annex B for more information). IRPAgent assigns its value.
triggerFlag	M, N	ENUM {IRPManager, IRPAgent}	If this notification is triggered by NM positively by invoking "triggerHeartbeat" operation, the value of this parameter shall be "IRPManager", otherwise, it shall be "IRPAgent".
managerIdentifier	M, N	String	If the value of triggerFlag is "IRPManager", this field is the same as the value of input parameter "managerIdentifier" of "triggerHeartbeat" operation; If the value of triggerFlag is "IRPAgent", this field is null.

6.5.1.3 Triggering Event

6.5.1.3.1 From-state

`heartbeatPeriodCountDownZero OR heartbeatPeriodReset OR heartbeatTriggeredByNM.`

Assertion Name	Definition
countDownTimerZero	CSIRP.countDownTimer becomes zero.
heartbeatPeriodReset	CSIRP.heartbeatPeriod is set, to a new or same value, by setHeartbeatPeriod operation.
heartbeatTriggeredByNM	NM invoke "triggerHeartbeat" operation to trigger "notifyHeartbeat" notification positively.

6.5.1.3.2 To-state

`countDownTimerMayReset.`

Assertion Name	Definition
countDownTimerMayReset	When this notification is triggered by triggerHeartbeat operation, no effects on CSIRP.countDownTimer. For normal notifyHeartbeat notification, CSIRP.countDownTimer is set to CSIRP.heartbeatPeriod.

Annex A (normative):
IRPAgent behaviour regarding the sending of heartbeat notification

Table A.1 specifies the IRPAgent behaviour regarding the sending of heartbeat notification in relation to the `subscribe` operation defined in Notification IRP.

Table A.1:

Subscription	NotificationIRP supports the emission of heartbeat
subscribe("no notificationCategory specified")	Send heartbeat and notifications supported by the IRPAgent such as notifications defined in Alarm IRP and in BasicCM IRP, etc.
subscribe("notificationCategory indicating xxxIRP where "xxx" is not "CSIRP" and is "Alarm", "BasicCM", etc.)	Send notifications defined in xxxIRP.
subscribe("notificationCategory indicating CSIRP")	Send heartbeat notifications.
subscribe("notificationCategory indicating CSIRP and xxxIRP")	Send heartbeat and notifications defined in xxxIRP.

Based on table A.1, when IRPManager subscribe 1) PMIRP, CSIRP and 2) BasicCMIRP, AlarmIRP and CSIRP with the same manager reference in turn, two subscriptions can only get one notifyHeartbeat notification according to definition of subscribe operation in NotificationIRP (3GPP TS 32.302 [8]).

In case IRPManager would like to receive notifyHeartbeat notification for each subscription, different manager reference should be chosen.

Annex B (informative): Identification of a failed communication path

B.1 Background

This discussion is applicable to the CORBA SS (that uses the OMG Notification Service) and other technology that uses similar notification technique as the OMG Notification Service.

For CS IRP to be useful, the IRPManager needs to know:

ITEM-1: The number of communication paths used between the IRPManager and the Notification IRPAgent for a particular notification subscription.

ITEM-2: The communication path used by a particular received heartbeat notification.

If the IRPManager does not have the knowledge of ITEM-1 above, it would not know if it has missed heartbeat notifications and therefore, could not detect communication path failure, except the case of all communication paths failure.

If the IRPManager have the knowledge of ITEM-1 but does not have knowledge of ITEM-2, it could detect that there has been a communication path(s) failure but would not be able to determine the identity of the failed communication path(s).

To address how IRPManager can have the knowledge of ITEM-1 and ITEM-2, we first characterize all possible Notification IRPAgent internal configurations. It is noted that the internal configuration is not a subject for standardization. The discussion on system characterization here is to clarify the types of configurations that are meaningful to support the current CS IRP specification.

B.2 Notification IRPAgent Internal Configuration

We characterize four internal configurations for Notification IRPAgent.

Config-1: The Notification IRPAgent uses one OMG Notification Channel for all supported `notificationCategories`.

Config-2: It uses one OMG Notification Channel for one supported `notificationCategory`. For example, it uses Channel 1 for Alarm IRP only and it uses Channel 2 for PM IRP only (see diagram below).

Config-3: It uses more than one OMG Notification Channel to support one `notificationCategory`.

Config-4: This is a hybrid of config-1 and config-2. Some OMG Channels are, individually, supporting one `notificationCategory` while some OMG Channels are, individually, supporting more than one `notificationCategory`.

B.3 The failed communication paths identification process

ITEM-1 Knowledge

The IRPManager should obtain this knowledge at IRPManager and Notification IRPAgent installation times.
The IRPManager cannot obtain this knowledge via standardized IRP operation at run-time.

ITEM-2 Knowledge

Config-1:

When IRPManager has successfully subscribed for heart beat, the IRPManager expects 1 heartbeat per heartbeat period. Absence of heartbeat during the heartbeat period plus IRPAgent knowledge of its own configuration allows IRPAgent to determine the communication path that has failed.

The IRPAgent shall use the `locator` parameter and the `locator` parameter may contain no information.

Config-2:

When IRPManager has successfully subscribed for heart beat, the IRPManager expects n heartbeat per heartbeat period. The IRPManager knows the value of n because n equals to the number of `notificationCategories` subscribed. When IRPManager receives less than n heartbeat per heartbeat period, it knows the exact number but not the identification of the failed communication path(s). The received `locator` values received and the IRPAgent knowledge of the Notification IRPAgent internal configuration enables the identification of the failed communication path(s).

For example, the IRPAgent pushes `notifyHeartbeat` with `locator`="channel 1" on CP-A1 and CP-B1 and pushes `locator`="channel 2" on CP-B2 and CP-A2. When IRPManager-B, using subscription ID=3 and expecting two heartbeats per period, receives one `notifyHeartbeat,` detects/knows that one communication path has failed. The entity that knows:

(a) The `locator` (say =="channel 1") of the received `notifyHeartbeat`

(b) The subscription ID involved and

(c) The IRPAgent knowledge of the Notification IRPAgent system configuration

will be able to identify the failed communication path (i.e. in this case, CP-B2).

The IRPAgent shall use the `locator` parameter. The value of "channel 1" is an example. IRPAgent could choose any other identification.

Config-3 and config-4:

There is no recommendation on how IRPManager can obtain answers for ITEM-1 and ITEM-2. This is for further study.

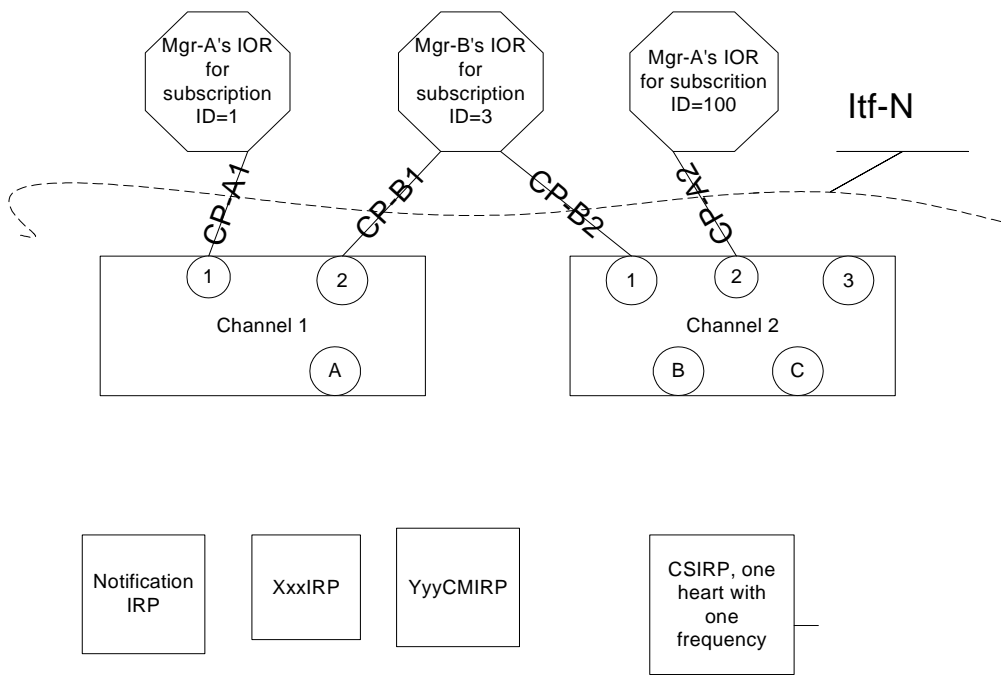The information provided through the locator parameter (empty, content) does not indicate the used configuration.

Figure B.1: Hypothetical IRPAgent internal configuration supporting CS IRP

Annex C (informative): Change history

Change history								
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Cat**	**Old**	**New**
Dec 2003	SA_22	SP-030633	--	--	Submitted to TSG SA#22 for Information	--	1.0.0	
Jun 2004	SA_24	SP-040245	--	--	Submitted to TSG SA#24 for Approval	--	2.0.0	6.0.0
Mar 2005	SA_27	SP-050179	0001	--	Apply Generic System Context – Align with TS 32.150	F	6.0.0	6.1.0
Mar 2006	SA_31	SP-060093	0002	--	Correct the name of attribute "hearbeatperiod"	F	6.1.0	6.2.0
Mar 2006	SA_31	SP-060089	0003	--	Update referenced list to include specification referenced	F	6.1.0	6.2.0
Dec 2006	SA_34	SP-060708	0004	--	Add missing Notification Table for CSIRP	F	6.2.0	6.3.0
Jun 2007	SA_36	--	--	--	Automatic upgrade to Rel-7 (no CR) at freeze of Rel-7. Deleted reference to CMIP SS, discontinued from R7 onwards.	--	6.3.0	7.0.0
Dec 2008	SA_42	--	--	--	Upgrade to Release 8	--	7.0.0	8.0.0
Dec 2009	-	-	-	-	Update to Rel-9 version (MCC)	-	8.0.0	9.0.0
Mar 2011	-	-	-	-	Update to Rel-10 version (MCC)	-	9.0.0	10.0.0
2012-09	-	-	-	-	Update to Rel-11 version (MCC)		10.0.0	**11.0.0**
2014-10	-	-	-	-	Update to Rel-12 version (MCC)		11.0.0	**12.0.0**
2016-01	-	-	-	-	Update to Rel-13 version (MCC)		12.0.0	**13.0.0**

History

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