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SPIRITS Protocol Requirements

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1. Abstract

This Internet-Draft is written in response to the SPIRITS WG chairs' call for contributions to the future RFC on the SPIRITS protocol requirements. As such, it documents to consensus of the SPIRITS WG on the choice of SPIRITS transport protocol and lists general requirements as well as those pertinent to Intelligent Network (IN), Wireless IN, and the PSTN/Internet iNternetworking (PINT) building blocks.

2. Conventions used in this document

In examples, "C:", "P", and "S:" indicate lines sent by the client, gateway, and server respectively.

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#).

Unless otherwise qualified, the term PINT is used here not to refer to the present PINT services and protocol, but in reference to the scope

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of the generic PINT (vs. SPIRITS) service characteristic--being invoked from an IP network (vs. PSTN).

3. Introduction

This Internet-Draft is written in response to the SPIRITS WG chairs' call for contributions to the future RFC on the SPIRITS protocol requirements. As such, it documents to consensus of the SPIRITS WG on the choice of SPIRITS transport protocol and lists general requirements as well as those pertinent to Intelligent Network (IN), Wireless IN, and the PSTN/Internet iNternetworking (PINT) building blocks. The joint PINT/SPIRITS architecture (described in [\[1\]](#)) is depicted in Figure 1.

It is assumed that the Spirits Client is either co-located with the IN Service Control Function (SCF) or communicates with it (over the PSTN-specific interface D) in such a way so as to act on behalf of the PSTN/IN. (This assumption is confirmed by current implementations, as reported in [\[2\]](#).)

The SPIRITS services are invoked (and, subsequently, the SPIRITS protocol is initiated) when a message from a SPIRITS Client (located in the IN Service Control Point [SCP] or Service Node [SN]) arrives on interface C to the SPIRITS gateway. The Spirits gateway processes the message and, in turn, passes it on over the Interface B to the SPIRITS server. In most practically important cases, the request from a SPIRITS client is ultimately caused by a request from a Central Office (i.e., a telephone switch) sent to either the SCP or SN, although the Internet-based service initiation by these elements that had not been triggered by the Central Office is theoretically possible. (Definitely, none of the SPIRITS benchmark services are initiated in such a way, so for the purposes of the SPIRITS protocol development, it should be assumed that the service invocation was a direct result of an earlier action by the Central Office.)

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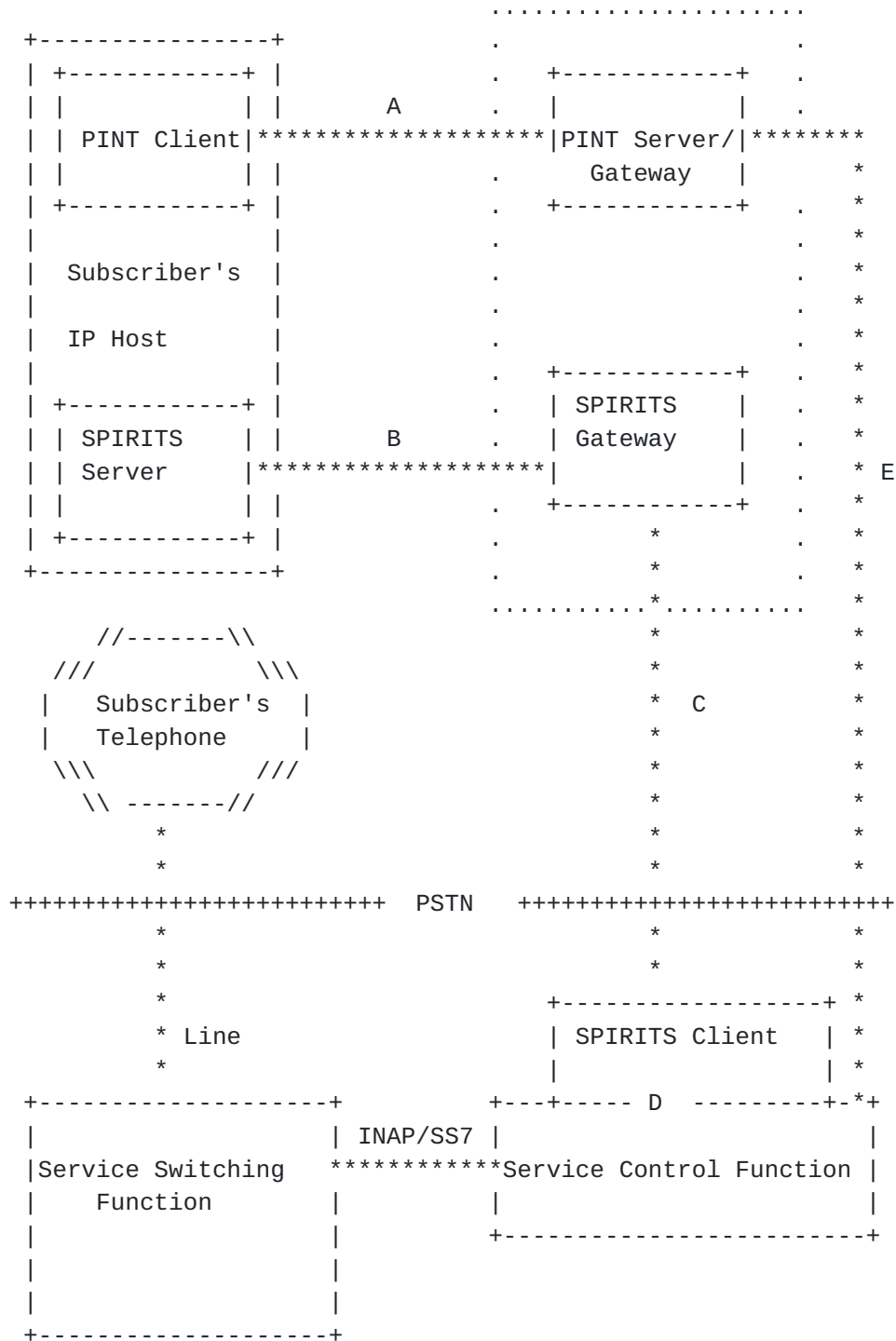


Figure 1. Joint PINT/SPIRITS Architecture

With PINT (and that also applies to the present PINT architecture and protocol as described in [3]), the service request to the PINT Server is always initiated by the PINT Client over the interface A. The PINT Server can either be co-located with the IN Service Control or a similar entity (referred to as "Executive System" by [3]) or

communicate with it over the PSTN-specific interface E.

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As Figure 1 shows, the PINT Client and SPIRITS Server are co-located in Subscriber's IP Host. In fact, both can be implemented to run as one process. No provision is made for interactions between the PINT Client and Spirits Server. Similarly, the PINT Server/PINT Gateway and SPIRITS gateway are assumed to be co-located, too. This assumption is convenient but not essential; the PINT Server could also be co-located with the SPIRITS Client. In either case, no specific provision is made to define interworking between either the PINT Server and Spirits Proxy or PINT Server and SPIRITS Client other than by listing the overall PINT-related requirements.

Since the wireless networks currently deployed worldwide are based on circuit switching, they are considered PSTN networks for the SPIRITS purposes. Adding SPIRITS type of services to wireless networks can allow new services to be developed (for example location information can be handled in the IP network).

Nevertheless, there are certain peculiarities of Wireless networks, which that force considerations to be made in the in the protocol requirements and in the SPIRITS architecture.

The particular Wireless IN standard development being considered here is CAMEL phase 3, standardised by the Third Generation Partnertship group (3GPP). The relevant service and architectural considerations and protocol requirements are presented later in this document. As far as the architecture is concerned, certain wireless events are generated by Home Location Register (HLR), which may but does not have to be part of the SSP. These events are communicated to Service Control, at which point they use the same mechanism for envoking SPIRITS services that the IN would.

The rest of this Internet-Draft addresses the general requirements, IN Requirements, specific Wireless IN requirements, PINT Requirements, the protocol development methodology, and security issues, in that order.

Based on the success of extending SIP for PINT ([2]) and, especially, the results of pre-SPIRITS implementations reported in [2], the Session Initiation Protocol (SIP) [7] has been chosen as the transport protocol for SPIRITS.

Thus, it is a requirement that specific SPIRITS-related parameters be carried in a manner consistent with SIP practices. In particular, Either Session Description Protocol (SDP) [8] or Multi-purpose Internet Mail Extensions MIME [5-6] is to be used for this purpose. Except for the proposed new SUBSCRIBE/NOTIFY mechanism [4], and extensions already defined in PINT, no SIP extensions to SIP are foreseen; instead the SPIRITS protocol is to rely on the above extension mechanisms.

It is by no means a requirement that any SPIRITS implementation automatically support PINT services. The SPIRITS protocol must be defined in a manner where, as the minimum, it can support only the

basic notification mechanism without relying on PINT services or otherwise relying on persistent interactions with PSTN. Nevertheless, it has been demonstrated [2] that combining PINT building blocks with those of SPIRITS is beneficial to building reach, enhanced PSTN/Internet services, so the SPIRITS protocol must meet the PINT-related requirements listed in [section 6](#) of this document.

One specific example demonstrating the application of the latter requirement, which is elaborated on further in this document, is as follows: Implementation of SUBSCRIBE/NOTIFY is not mandatory as far as the minimum SPIRITS protocol is concerned. Thus, the initial PSTN (Detection Point) notification will always arrive via the SIP INVITE method; however, to implement persistent interactions with the PSTN, the SUBSCRIBE method may be used to obtain further notifications to the PSTN events. Subsequently, these events will be reported on by means of the NOTIFY method.

5. IN Requirements

The interface immediately relevant to IN is that between the SPIRITS Client and SPIRITS Proxy (interface C). A typical message (which starts a SPIRITS service) looks like that:

C -> P: <Event Notification>, <Parameter-List (DP)>

The relevant events correspond to the detection points (DPs) of the IN Basic Call State Model (BCSM). The <Parameter-List> is a function of a specific DP; it contains the parameters relevant to it. The following requirements apply:

1) The list of the DPs to be covered encompasses those defined in the IN Capability Set 3 BCSM as well as those that relate to the Wireless IN (WIN) specified by the IMT 2000 project in ITU-T.

2) Not all parameters associated with such DPs are needed by the SPIRITS benchmark services, nor may all the parameters be needed in SPIRITS. The selection of the relevant parameters is part of the SPIRITS protocol definition.

3) It is desirable to avoid semantic overload of protocol messages. (One way to achieve that is to match each type of an event with a message that corresponds to it.) In case the SPIRITS protocol is designed as a set of extensions to another (existing) protocol with the defined message set, the syntax and semantics of the extensions should be defined with this requirement in mind.

4) The ITU-T Recommendations use the abstract syntax notation (ASN.1) to specify the semantics of the IN Application Protocol (INAP) parameters, which are expected to be binary-encoded. Neither the use of the ASN.1, nor the requirement for binary encoding are the typical

requirements for the IETF application protocols. Recognizing that, provisions must be made for careful specification of the conversion of the INAP parameters to text, which must preserve their original

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semantics. The actual conversion of the parameters is the function of the SPIRITS Client.

In order to issue an initial query (or a notification) to service control, a switch must have such a DP set. This can be done statically via service management (this particular action should be left to implementation and thus is considered outside of the scope of SPIRITS Protocol) or dynamically--but only for the purpose of a particular call--from the service control. In the latter case, it is part of the SPIRITS (or PINT) protocol to request the event notification from the service control. A work-in-progress SIP proposal [4] should be specifically considered. This function can be performed by either the Spirits Client or PINT Server, the distinction being further discussed in the next section. Assuming that it is performed by the SPIRITS Client, the relevant message should look like

C: SUBSCRIBE <Event> <Mode> <DP-specific parameters>,

where <Event> refers to a particular DP; <Mode> determines whether the Event Detection Point (EDP) is to be armed as EDP Request (EDP-R), EDP Notification (EDP-N), or TDP-R (the need for TDP-N is not foreseen); and the <DP-specific parameters> is the list of the values of the parameters associated with the EDP (for example, if the DP in question is O_No_Answer, then the value of the appropriate timer should be included in the list). Note that such a subscription may also originate at a) PINT Client or b) SPIRITS Proxy, either of which may (but does not have to) have a locally significant definition of the <Event>. In either case, it is the function of the SPIRITS Client to translate the definition of the Event into a particular DP (or set of DPs) when passing the message to Service Control. To summarize, for the case when PINT and SPIRITS events are defined in a way where they do not refer to the BCSM DPs, it is the function of the SPIRITS Client to define a mapping:

Event -> DP List,

for each event for which the PSTN notification is needed.

The list of CS-2 DPs envisioned in SPIRITS is

- origination_attempt_authorized (the SPIRITS service can control call attempts, (for example, to limit calls during specific time periods)
- collected_information and analyzed_information (for SPIRITS outgoing call screening)
- o_answer, o_term_seized, and t_answer (to release SPIRITS resources after the call is complete and perform relevant OA&M actions such as creating a record of

attempts to reach a party via various means like land-line
phone,
cell phone, SMS, paging.)

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- o_no_answer, route_select_failure, and t_no_answer (to re-route a call)
- o_busy (to re-route a call and for Internet Call Waiting)
- o_mid_call and t_mid_call (to assist a midcall action)
- o_abandon, o_disconnect, t_abandon, and t_disconnect (to terminate a SPIRITS service and release the resources and perform relevant OA&M actions such as creating a record of attempts to reach a party via various means like land-line phone, cell phone, SMS, paging.)

With that, the only DPs needed to implement the present SPIRITS milestone services are

- termination_attempt_authorized (needed for SPIRITS "milestone" services)
- facility_selected_and_available (could be used in SPIRITS Internet Caller-ID)
- t_busy (for Internet Call Waiting and Call Forwarding).

6. Wireless-IN-related Requirements

Wireless IN covers several types of "calls," which are neither circuit switched nor have an effect on circuit switched calls. For this reason, those are not considered in SPIRITS requirements. To further clarify this point, the types of "calls" not considered are

- USSD (Unstructured Supplementary Service Data)
- GPRS (General Packet Radio System)
- SMS (Short Message System)

The types of calls relevant to SPIRITS are as follows:

- a) Voice Calls. In this case no new DP is needed since CAMEL DPs are included in CS2. The only special case is "Not Reachable" (when it is detected that the mobile user is out of coverage or has switched off), which is mapped as a special cause in the Busy DP. Since the Busy DP parameters would be received (if a SPIRITS service has subscribed to Busy), it would be possible to distinguish a "busy" from a "not reachable" situation.

This translates into the requirement that one of the

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parameters in

the Event Notification message (from SPIRITS Client to SPIRITS Proxy, over the interface C) denotes the "cause" for the Busy Detection Point.

Another aspect of difference, when compared to PSTN, is setting

of static DPs. in CAMEL networks, this is done in the Home Location Register (HLR) (and copied to the VLR during location update). It is important to note this difference, even though it has no effect on SPIRITS protocol.

b) Mobility Management events. This allows a SPIRITS server to be notified of changes of location of a mobile user. The events would only be applicable to mobile users reachable through a Circuit

Switched network. To provide for this function, the subscription marks must be set in the subscriber's HLR. This is

equivalent to setting TDPs in the SSP. In this case the marks in the HLR (which are copied to the Visitor Location Register [VLR]

on location update) are not mapped into Trigger Detection Points.

As with TDP setting, this is outside of the scope of SPIRITS protocol.

In order to support this function in SPIRITS, the SPIRITS protocol

should be able to map the CAMEL specific operations into events notification to the SPIRITS client. Since the SCP receives

the information about the mobility state, this involves the C interface. (This is just an extension of the DP notification mechanism from the SPIRITS client to the SPIRITS gateway).

The events (which are not DP-related) which need notifications are

- Location Update in the same VLR service area.
- Location Update in another VLR service area.
- IMSI attach.
- MS initiated IMSI detach.
- Network initiated IMSI detach.

With this mechanism, the SPIRITS services can use the location information.

For example, the Internet Call Waiting service can re-direct the

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call
to a mobile phone.

c) Supplementary Services Notification.

This mechanism makes a SPIRITS server aware of a subscriber having invoked one of the following supplementary services: Explicit Call Transfer, Call Deflection, Call Completion on Busy Subscriber, or Multi-Party.

7. PINT-related Requirements

Before a SPIRITS service can be invoked, the relevant IP Host must be registered. Thus, Registration is an essential service (not yet addressed by PINT), which is initiated from the IP side. The registration information is ultimately used by the PSTN to authenticate the subscriber.

Depending on the model, this can be done in two ways with the present architecture:

1) The PINT Client issues the appropriate Register message over the interface A, which is then passed to by PINT server to the SPIRITS Proxy and SPIRITS Client:

PINT C.: -- REGISTER --> PINT S. [--> SPIRITS Proxy --> SPIRITS C.].
In this case the SPIRITS Client (co-located with the service control) is responsible for record keeping and the authentication.

2) The PINT Client issues the appropriate Register message to the PINT Server, which then passes this information to the PSTN service control "by magic".

The second model is much easier to handle, because it involves only one relevant interface ("A"); however it assumes no interworking between PINT and SPIRITS except that the SPIRITS Client finds "by magic" that a friendly and expecting IP Host is alive and well.

Finally, in the event PINT is not implemented, the SIP SUBSCRIBE mechanism can be used.

As noted in previous section, the existing SUBSCRIBE/NOTIFY PINT building blocks [3] must be extended for their use in SPIRITS for the purposes of setting DPs/getting DP event notifications. (A more general SIP mechanism for the same PINT-introduced block is described in [4]; it provides the necessary mechanism for specifying relevant events.) Conversely, the same building blocks for this functional capabilities can be used in both PINT and SPIRITS protocols. Note, however, that in SPIRITS the PSTN notification may arrive without a particular subscription to an event (in the case of a statically set

DP).

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8. Follow-up on Event Notifications

The requirements of this section are neither PINT-specific, nor IN-specific; their role is to outline the remaining element necessary for the delivery of the SPIRITS service, which is the reaction to the notification received.

In a particular scenario where

- a) The IP subscriber registers a SPIRITS service;
- b) A call triggering the SPIRITS service is received (and notification is sent); and
- c) The call disposition is performed by the end user,

the signalling flow is demonstrated in Figure 2.

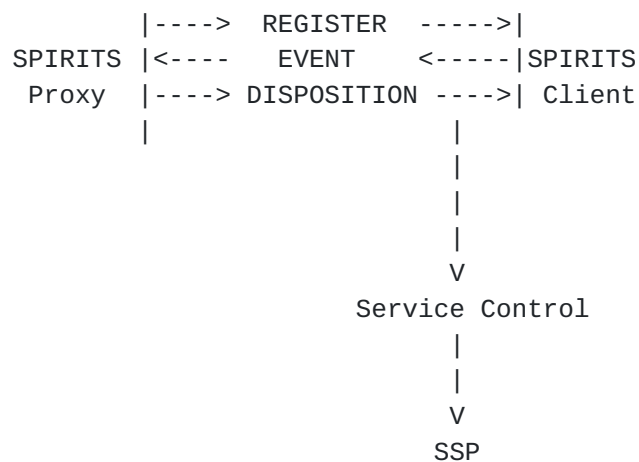


Figure 2: Sequence of SPIRITS actions

One of the following actions is required by benchmark services:

- a) Accept the incoming call.
- b) Reject the incoming call.
- c) Redirect the incoming call.
- d) Accept the call via VoIP (this particular item is outside of the scope of SPIRITS WG).

Accordingly, the SPIRITS protocol should define the following message types:

a) S->P: <Accept Call>

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b) S->P: <[Reject Call],[Cause]>

c) S->P: <[Redirect Call],[Redirection Destination]>

8. Methodology

To determine the MINIMUM SPIRITS protocol vocabulary (i.e., the set of messages), the PSTN events associated with each detection point of the Basic Call State Model should be examined. To date, the CS-2 BSCM has the richest set of DPs, although not all switching exchanges have implemented it.

To determine the MINIMUM information available to the SPIRITS client (this information is to be carried by the SPIRITS protocol from SPIRITS client to SPIRITS server), each DP-specific information elements needs to be examined.

Parameters should be event-specific, the following generic types of parameters are expected to be mandatory:

- timer (for no answer)
- midcall control info (for mid_call)
- number of digits (for collected_information)

10. Security Considerations

It is assumed that the interface C is between trusted entities. Thus, there are no particular IN-related or requirements to the protocol pertinent to this interface. The assumption that the PINT Client and SPIRITS Server are co-located dictates that the security considerations for the A and B interfaces are exactly same.

11. Acknowledgements

The authors are grateful to all participants in the SPIRITS group for the discussion that has been shaping this work. Many thanks go to Jorgen Bjorkner, Jim Buller, Lawrence Conroy, Soren Nyckelgard, and John Voelker for his incisive comments.

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