

ASAP  
Internet-Draft  
Intended status: Standards Track  
Expires: 18 March 2026

K. Inamdar  
S. Narayanan  
Unaffiliated  
C. Jennings  
Cisco Systems  
14 September 2025

Automatic Peering for SIP Trunks  
draft-ietf-asap-sip-auto-peer-31

Abstract

This document specifies a framework that enables enterprise telephony Session Initiation Protocol (SIP) networks to solicit and obtain a capability set document from a SIP service provider. The capability set document encodes a set of characteristics that enable easy peering between enterprise and service provider SIP networks.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <https://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on 18 March 2026.

Copyright Notice

Copyright (c) 2025 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Revised BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Revised BSD License.

## Table of Contents

1. Introduction . . . . .	3
2. Overview of Operations . . . . .	4
2.1. Reference Architecture . . . . .	4
2.2. Configuration Workflow . . . . .	6
2.3. Transport . . . . .	7
3. Conventions and Terminology . . . . .	8
4. HTTP Transport . . . . .	8
4.1. HTTP Methods . . . . .	8
4.2. Integrity and Confidentiality . . . . .	8
4.3. Authenticated Client Identity . . . . .	9
4.4. Encoding the Request . . . . .	11
4.5. Identifying the Request Target . . . . .	11
4.6. Generating the response . . . . .	13
5. State Deltas . . . . .	13
6. Encoding the Service Provider Capability Set . . . . .	14
7. Data Model for Capability Set . . . . .	14
7.1. Tree Diagram . . . . .	14
7.2. YANG Model . . . . .	16
7.3. Extending the Capability Set . . . . .	36
8. Processing the Capability Set Response . . . . .	37
9. Examples . . . . .	38
9.1. JSON Capability Set Document . . . . .	38
9.2. Example Exchange . . . . .	41
10. IANA Considerations . . . . .	42
11. Security Considerations . . . . .	42
11.1. OAuth Credentials . . . . .	42
11.2. Client-Server Communication . . . . .	43
12. Acknowledgments . . . . .	43
13. Informative References . . . . .	43
14. Normative References . . . . .	44
Authors' Addresses . . . . .	46

## 1. Introduction

The deployment of a Session Initiation Protocol [RFC3261] (SIP)-based infrastructure in enterprise and service provider communication networks is increasing at a rapid pace. Consequently, direct IP peering between enterprise and service provider networks is quickly replacing conventional methods of interconnection between enterprise and service provider networks. Currently published standards provide a strong foundation over which direct IP peering can be realized. However, given the sheer number of these standards, it is often not clear which behavioral subsets, extensions to baseline protocols and operating principles ought to be implemented by service provider and enterprise networks to ensure successful peering.

The SIP Connect technical recommendations [SIP-Connect-TR] aim to solve this problem by providing a central reference that promotes seamless peering between enterprise and service provider SIP networks. However, despite the extensive set of implementation rules and operating guidelines, interoperability issues between service provider and enterprise networks persist. This is in large part because service providers and equipment manufacturers aren't required to enforce the guidelines of the technical specifications and have a fair degree of freedom to deviate from them. Consequently, enterprise administrators usually undertake a fairly rigorous regimen of testing, analysis and troubleshooting to arrive at a configuration block that ensures seamless service provider peering. However, this workflow complements the SIP Connect technical recommendations, in that both endeavours aim to promote/achieve interoperability between the enterprise and service provider.

Another set of interoperability problems arise when enterprise administrators are required to translate a set of technical recommendations from service providers to configuration blocks across one or more devices in the enterprise network, which is usually an error prone exercise. Additionally, such technical recommendations might not be nuanced enough to intuitively allow the generation of specific configuration blocks.

This draft introduces a mechanism using which an enterprise network can solicit a detailed capability set from a SIP service provider; the detailed capability set can subsequently be used by automation or an administrator to generate configuration blocks across one or more devices within the enterprise network to ensure successful service provider peering.

## 2. Overview of Operations

This section provides a reference architecture against which the SIP Auto Peer framework may be implemented. Additionally, terms that are commonly used in the context of the document are defined. Lastly, considerations for the choice of network transport between enterprise and service provider telephony networks are discussed.

### 2.1. Reference Architecture

Figure 1 illustrates a reference architecture that may be deployed to support the mechanism described in this document. The enterprise network consists of a SIP-PBX, media endpoints (M.E.) and a Session Border Controller [RFC7092]. It may also include additional components such as application servers for voicemail, recording, fax etc. At a high level, the service provider consists of a SIP signaling entity (SP-SSE), a media entity for handling media streams of calls setup by the SP-SSE and a HTTPS [RFC9110] server.

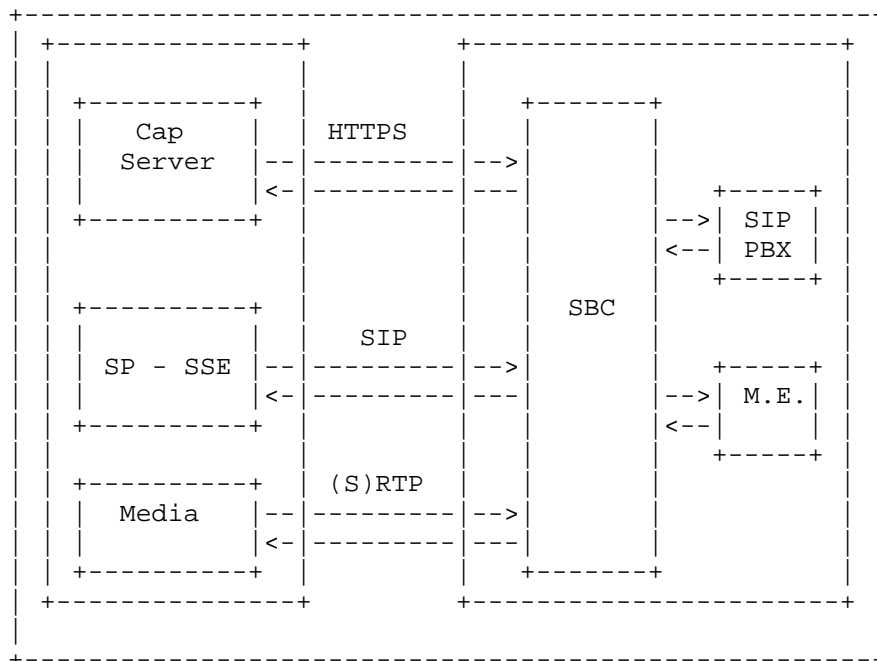


Figure 1: Reference Architecture

This draft makes use of the following terminology:

- \* **Enterprise Network:** A communications network infrastructure deployed by an enterprise which interconnects with the service provider network over SIP. The enterprise network could include devices such as application servers, endpoints, call agents and edge devices, among others.
- \* **Edge Device:** A device that is the last hop in the enterprise network and that is the transit point for traffic entering and leaving the enterprise. An edge device is typically a back-to-back user agent (B2BUA) [RFC7092] such as a Session Border Controller (SBC).
- \* **Service Provider Network:** A communications network infrastructure deployed by service providers. In the context of this draft, the service provider network is accessible over SIP for the establishment, modification and termination of calls and accessible over HTTPS for the transfer of the capability set document. The service provider network is also referred to as a SIP Service Provider (SSP) or Internet Telephony Service Provider (ITSP) network.
- \* **Call Control:** Call Control within a telephony networks refers to software that is responsible for delivering its core functionality. Call control not only provides the basic functionality of setting up, sustaining and terminating calls, but also provides the necessary control and logic required for additional services within the telephony network, such as, registration of endpoints, integration with application servers (voicemail, instant messaging, presence), among others.
- \* **Capability Server:** A server hosted in the service provider network, such that this server is the target for capability set document requests from the enterprise network.
- \* **Capability Set:** The term capability set (or capability set document) refers collectively to a set of characteristics within the service provider network, which when communicated to the enterprise network, provides the enterprise network the information required to interconnect with the service provider network. The various parameters that constitute the capability set relate to characteristics that are specific to signalling, media, transport and security. Certain aspects of interconnecting with service providers are out of scope of the capability set; for example, the access technology used to interconnect with service provider networks.

## 2.2. Configuration Workflow

A workflow that facilitates an enterprise network to solicit the capability set of a SIP service provider ought to take into account the following considerations:

- \* The configuration workflow must be based on a protocol or a set of protocols commonly used between enterprise and service provider telephony networks.
- \* The configuration workflow must be flexible enough to allow the service provider network to dynamically offload different capability sets to different enterprise networks based on the identity of the enterprise network.
- \* Capability set documents obtained as a result of the configuration workflow must be conducive to easy parsing by automation. Subsequently, automation may be used for the generation of appropriate configuration blocks on the edge element or across one or more elements in the enterprise network.

Taking the above considerations into account, this document proposes a Hypertext Transfer Protocol (HTTP)-based workflow using which the enterprise network can solicit and ultimately obtain the service provider capability set. The enterprise network creates a well formed HTTP GET request to solicit the service provider capability set. Subsequently, the HTTPS response from the SIP service provider includes the capability set. The capability set is encoded in JSON, thus ensuring that the response can be easily parsed by automation.

There are alternative mechanisms using which the SIP service provider can offload its capability set. For example, the Session Initiation Protocol (SIP) can be extended to define a new event package [RFC6665], such that the enterprise network can establish a SIP subscription with the service provider for its capability set; the SIP service provider can subsequently use the SIP NOTIFY request to communicate its capability set or any state deltas to its baseline capability set.

This mechanism is likely to result in a barrier to adoption for SIP service providers and enterprise networks as equipment manufacturers would have to first add support for such a SIP extension. A HTTPS-based approach would be relatively easier to adopt as most edge devices deployed in enterprise networks today already support HTTPS; from the perspective of service provider networks, all that is required is for them to deploy HTTPS servers that function as capability servers. Additionally, most SIP service providers require enterprise networks to register with them (using a SIP REGISTER

message) before any other SIP methods that initiate subscriptions (SIP SUBSCRIBE) or calls (SIP INVITE) are processed. As a result, a SIP-based framework to obtain a capability set would require operational changes on the part of service provider networks.

Yet another example of an alternative mechanism would be for service providers and enterprise equipment manufacturers to agree on YANG models [RFC6020] that enable configuration to be pushed over NETCONF [RFC6241] to enterprise networks from a centralised source hosted in service provider networks. The presence of proprietary software logic for call and media handling in enterprise devices would preclude the generation of a "one-size-fits-all" YANG model. Additionally, service provider networks pushing configuration to enterprises devices might lead to the loss of implementation autonomy on the part of the enterprise network.

### 2.3. Transport

To solicit the capability set of a SIP service provider, the edge element in an enterprise network generates a well-formed HTTP GET request. There are two reasons why it makes sense for the enterprise edge element to generate the HTTPS request:

1. Edge elements are devices that normalise any mismatches between the enterprise and service provider networks in the media and signaling planes. As a result, when the capability set is received from the SIP service provider network, the edge element can generate appropriate configuration blocks (possibly across multiple devices) to enable interconnection.
2. Given that edge elements are configured to "talk" to networks external to the enterprise, the complexity in terms of NAT traversal and firewall configuration would be minimal.

The HTTP GET request is targeted at a capability server that is managed by the SIP service provider such that this server processes, and on successfully processing the request, includes the capability set document in the response. The capability set document is constructed according the guidelines of the YANG model described in this draft. The capability set document included in a successful response is formatted in JSON. More details about the formatting of the HTTP request and response are provided in Section 4.

There could be situations wherein an enterprise telephony network interconnects with its SIP service provider such that traffic between the two networks traverses an intermediary SIP service provider network. This could be a result of interconnect agreements between the terminating and transit SIP service provider networks. In such

situations, the capability set provided to the enterprise network by its SIP service provider must account for the characteristics of the transit SIP service provider network from a signalling and media perspective. For example, if the terminating SIP service provider network supports the G.729 codec and the transit SIP service provider network does not, G.729 must not be advertised in the capability set. As another example, if the transit SIP service provider network doesn't support a SIP extension, for instance, the SIP extension for Reliable Provisional Responses as defined in RFC 3262, the terminating SIP service provider network must not advertise support for this extension in the capability set provided to the enterprise network. How a terminating SIP service provider obtains the characteristics of the intermediary SIP service provider network is out of the scope of this document; however, one method could be for the terminating SIP service provider to obtain the characteristics of the intermediary SIP service provider by leveraging the YANG model introduced in this document.

### 3. Conventions and Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

### 4. HTTP Transport

This section describes the use of HTTPS as a transport protocol for the peering workflow. This workflow is based on HTTP/1.1, and as such is compatible with any future version of HTTP that is backward compatible with HTTP/1.1 including HTTP/3 [RFC9114].

#### 4.1. HTTP Methods

The workflow defined in this document leverages the HTTP GET method and its corresponding response(s) to request for and subsequently obtain the service provider capability set document.

#### 4.2. Integrity and Confidentiality

Peering requests and responses are defined over HTTP [RFC9110]. However, due to the sensitive nature of information transmitted between client and server, it is required to secure HTTP communications using Transport Layer Security (TLS) [RFC8446]; therefore the enterprise edge element and the capability server MUST support TLS. When HTTP/3 is used, TLS is incorporated within QUIC. Additionally, the enterprise edge element and capability server MUST

support the use of the HTTPS URI scheme as defined in [RFC9110].

#### 4.3. Authenticated Client Identity

HTTP usually adopts asymmetric methods of authentication. For example, clients typically use certificate based authentication to verify the server they are talking to, whereas, servers typically use methods such as HTTP digest authentication or OAuth 2.0 [RFC6749] to authenticate clients. Though OAuth 2.0 is not an authentication protocol, it nonetheless allows for client authentication to be carried out with the use of OAuth tokens.

In the context of the SIP Auto Peer framework, OAuth 2.0 MUST be used to carry out client authentication. Enterprise edge elements could use the various grant types outlined in the OAuth 2.0 specification and supported by the service provider in order to obtain the capability set document. This draft does not mandate a specific grant type. The implementation of OAuth 2.0 to obtain the capability set are beyond the scope of this document. However, it provides an example of how an enterprise SBC could leverage the "Authorization Code Grant" (Section 4.1 of [RFC6749]) flow to acquire the capability set document from the service provider in Figure 2.

Using the "Resource Owner Password Credentials" grant type (Section 1.3.3 of [RFC6749]) requires the existence of a trust relationship between the resource owner (in this context, the administrator/enterprise network) and the client (in this context, an edge element such as an SBC). In SIP trunking deployments between enterprise and service provider networks, such a trust relationship between the administrator/resource owner/enterprise network and the client (edge element) already exists, as SIP trunk registration (and refreshing registrations) require credentials - typically a username and password, that are configured on the edge element by the administrator. However, it is important for the enterprise network administrator and service provider to factor in security issues associated with this grant type.

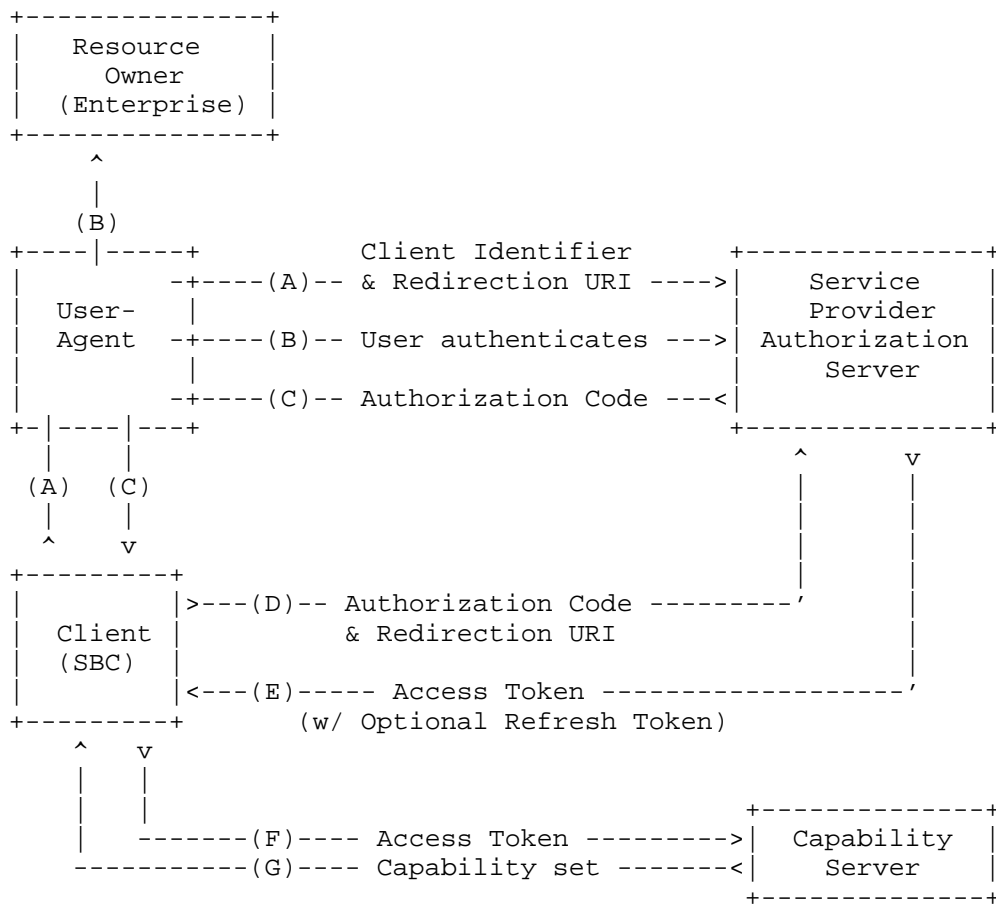


Figure 2: Client Authentication Mechanism

The flow illustrated in Figure 2 includes the following steps:

- A. The enterprise SBC (client) initiates the flow by directing the resource owner's (enterprise network administrator) user-agent to the authorization endpoint. The SBC includes its client identifier, requested scope, local state, and a redirection URI to which the authorization server will send the user-agent back once access is granted (or denied). As a precursor to the flow, the enterprise network administrator has already obtained a unique client identifier for their network and provided a redirection URI populated with a target within their network to obtain the authorization code.

- B. The authorization server within the service provider network authenticates the network administrator (via the user-agent) and establishes whether the network administrator grants or denies the client's access request.
- C. Assuming the network administrator grants access, the authorization server redirects the user-agent back to the enterprise SBC using the redirection URI provided earlier (in the request or during client registration). The redirection URI includes an authorization code and any local state provided by the client earlier.
- D. The enterprise SBC requests an access token from the authorization server's token endpoint by including the authorization code received in the previous step. When making the request, the enterprise SBC authenticates with the authorization server and includes the redirection URI used to obtain the authorization code for verification.
- E. The authorization server authenticates the enterprise SBC, validates the authorization code, and ensures that the redirection URI received matches the URI used to redirect the SBC in step (C). If valid, the authorization server responds back with an access token and, optionally, a refresh token.
- F. The enterprise SBC then contacts the capability server located in the service provider network with an HTTP GET request along with the access token to retrieve the capability set document.
- G. The capability server checks for a valid access token and returns the capability set document to the enterprise SBC. The service provider will host a unique document for each enterprise network that will peer with it.

#### 4.4. Encoding the Request

The edge element in the enterprise network generates a HTTP GET request such that the request-target is obtained using the procedure outlined in section 4.5. This document does not specify any content negotiation. The server MUST set the response content type header to the application/json media type.

#### 4.5. Identifying the Request Target

HTTP GET requests from enterprise edge elements MUST carry a valid request-target. The enterprise edge element might obtain the URL of the resource hosted on the capability server in one of two ways:

1. Manual Configuration
2. Discovery using the Webfinger Protocol

The complete HTTPS URLs to be used when authenticating the enterprise edge element (optional) and obtaining the SIP service provider capability set can be obtained from the SIP service provider beforehand and entered into the edge element manually via some interface - for example, a CLI or GUI.

However, if the resource URL is unknown to the administrator (and, by extension, to the edge element), the WebFinger protocol [RFC7033] and the 'sipTrunkingCapability' [RFC9409] link relation type may be leveraged assuming that the service SIP service provider has implemented WebFinger within their network and hosts the capability set at the respective location.

If an enterprise edge element attempts to discover the URL of the endpoints hosted in the ssp1.example.com domain, it issues the following request (line wraps are for display purposes only).

```
GET /.well-known/webfinger?
    resource=http%3A%2F%2Fssp1.example.com
    rel=sipTrunkingCapability
    HTTP/1.1
Host: ssp1.example.com
```

```
HTTP/1.1 200 OK
Access-Control-Allow-Origin: *
Content-Type: application/jrd+json
```

```
{
  "subject" : "http://ssp1.example.com",
  "links" :
  [
    {
      "rel" : "sipTrunkingCapability",
      "href" :
        "https://capserver.ssp1.com/capserver/capdoc.json"
    }
  ]
}
```

Once the target URI is obtained by an enterprise telephony network, the URI may be dereferenced to obtain a unique capability set document that is specific to that given enterprise telephony network. The ITSP may use credentials to determine the identity of the enterprise telephony network and provide the appropriate capability set document.

#### 4.6. Generating the response

Capability servers include the capability set documents in the body of a successful response. Capability set documents **MUST** be formatted in JSON. For requests that are incorrectly formatted, an example being an incorrect query parameter in the URI, the capability server must generate a "400 Bad Request" response for the incorrect request. If requests contain an invalid token, the capability server must generate a "403 Forbidden" response clearly indicating that this token does not have the permission to view the capability set document.

The capability server can respond to client requests with redirect responses, specifically, the server can respond with the following redirect responses:

1. 301 Moved Temporarily
2. 302 Found
3. 307 Temporary Redirect

The server **SHOULD** include the Location header field in such responses. If the Location header isn't included in the response, this can lead to the client being unable to find the capability set document, leading to a failure in the peering process or requiring manual intervention by an administrator.

#### 5. State Deltas

Given that the service provider capability set is largely expected to remain static, the work needed to implement an asynchronous push mechanism to encode minor changes in the capability set document (state deltas) is not commensurate with the benefits. Rather, enterprise edge elements can poll capability servers at pre-defined intervals to obtain the full capability set document. It is recommended that capability servers are polled every 24 hours.

## 6. Encoding the Service Provider Capability Set

In the context of this draft, the capability set of a service provider refers collectively to a set of characteristics which when communicated to an enterprise network, provides it with sufficient information to directly peer with the service provider network. The capability set document is not designed to encode extremely granular details of all features, services, and protocol extensions that are supported by the service provider network. For example, it is sufficient to encode that the service provider uses T.38 relay for faxing, it is not required to know the value of the "T38FaxFillBitRemoval" parameter.

The parameters within the capability set document represent a wide array of characteristics, such that these characteristics collectively disseminate sufficient information to enable direct IP peering between enterprise and service provider networks. The various parameters represented in the capability set are chosen based on existing practises and common problem sets typically seen between enterprise and service provider SIP networks.

## 7. Data Model for Capability Set

This section defines a YANG module [RFC7950] for encoding the service provider capability set. Section 7.1 provides the tree diagram, which is followed by a description of the various nodes within the module defined in this draft.

### 7.1. Tree Diagram

This section provides a tree diagram [RFC8340] for the "ietf-sip-auto-peering" module. The interpretation of the symbols appearing in the tree diagram is as follows:

- \* Brackets "[" and "]" enclose list keys.
- \* Abbreviations before data node names: "rw" means configuration (read-write), and "ro" means state data (read-only).
- \* Symbols after data node names: "?" means an optional node, "!" means a presence container, and "\*" denotes a list and leaf-list.
- \* Parentheses enclose choice and case nodes, and case nodes are also marked with a colon (":").
- \* Ellipsis ("...") stands for contents of subtrees that are not shown.

The data model for the peering capability document has the following structure:

```

module: ietf-sip-auto-peering
  +--ro sip-auto-peering
    +--ro index?          uint8
    +--ro variant          enumeration
    +--ro revision
      | +--ro not-before    uint32
      | +--ro location      inet:uri
    +--ro transport-info
      | +--ro transport*    enumeration
      | +--ro registrar* [host port]
      |   | +--ro host      union
      |   | +--ro port      inet:port-number
      | +--ro realms* [name]
      |   | +--ro name        string
      |   | +--ro username?   string
      |   | +--ro password?   ianach:crypt-hash
      | +--ro call-control* [host port]
      |   | +--ro host      union
      |   | +--ro port      inet:port-number
      | +--ro dns*          inet:ip-address
      | +--ro outbound-proxy* [host port]
      |   | +--ro host      union
      |   | +--ro port      inet:port-number
    +--ro call-specs
      | +--ro early-media?    boolean
      | +--ro signaling-forking? boolean
      | +--ro supported-methods* enumeration
      | +--ro caller-id
      |   | +--ro el64-format?    boolean
      |   | +--ro preferred-method? enumeration
      | +--ro number-range* [index]
      |   | +--ro index    uint16
      |   | +--ro type?    enumeration
      |   | +--ro count?   uint16
      |   | +--ro value*   string
    +--ro media
      | +--ro media-type-audio* [media-format]
      |   | +--ro media-format    enumeration
      |   | +--ro rate?          uint16
      |   | +--ro ptime?         uint8
      |   | +--ro parameter?     string
      | +--ro fax
      |   | +--ro protocol*    enumeration
      | +--ro rtp
      |   | +--ro rtp-trigger?    boolean

```

```

| | +--ro symmetric-rtp?    boolean
| | +--ro rtcp
| | | +--ro symmetric-rtcp?    boolean
| | | +--ro rtcp-feedback?    boolean
+--ro dtmf
| | +--ro payload-number?    uint8
| | +--ro iteration?        boolean
+--ro security
| | +--ro signaling
| | | +--ro secure?        boolean
| | | +--ro version*       enumeration
+--ro media-security
| | +--ro key-management*    enumeration
+--ro certificate-location?    inet:uri
+--ro secure-telephony-identity
| | +--ro stir-compliance?    boolean
| | +--ro certificate-delegation?    boolean
| | +--ro acme-directory?    inet:uri
+--ro extensions*            identityref

```

## 7.2. YANG Model

This section defines the YANG module for the peering capability set document. This module depends on existing YANG modules that provide common YANG data types [RFC6991] and system management [RFC7317].

```

<CODE BEGINS> file "ietf-sip-auto-peering@2025-09-14.yang"
module ietf-sip-auto-peering {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-sip-auto-peering";
  prefix "sipap";

  import ietf-inet-types {
    prefix "inet";
    reference
      "RFC 6991: Common YANG Data Types";
  }

  import iana-crypt-hash {
    prefix "ianach";
    reference
      "RFC 7317: A YANG Data Model for System Management";
  }

  organization
    "IETF ASAP (Automatic SIP trunking And Peering) Working Group";

  contact

```

"WG Web: <<https://datatracker.ietf.org/wg/asap/>>  
WG List: <<mailto:asap@ietf.org>>

Editor: Kaustubh Inamdar  
<<mailto:kaustubh.ietf@gmail.com>>

Editor: Sreekanth Narayanan  
<<mailto:sknth.n@protonmail.com>>

Editor: Cullen Jennings  
<<mailto:fluffy@iii.ca>>;

#### description

"Data model for encoding SIP Service Provider Capability Set

This YANG module defines a read-only data model intended for exchanging SIP service provider capabilities with enterprise networks. The data is published by service providers and consumed by enterprises via standard YANG-based interfaces (RESTCONF, NETCONF, etc.).

This module does NOT provide configuration capabilities - it serves purely as a standardized format for capability exchange. Service providers generate and host capability documents based on this schema, which enterprises retrieve and use to configure their SIP equipment.

Copyright (c) 2025 IETF Trust and the persons identified as authors of the code. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, is permitted pursuant to, and subject to the license terms contained in, the Revised BSD License set forth in Section 4.c of the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>).

This version of this YANG module is part of RFC XXXX (<https://www.rfc-editor.org/info/rfcXXXX>); see the RFC itself for full legal notices.

The key words 'MUST', 'MUST NOT', 'REQUIRED', 'SHALL', 'SHALL NOT', 'SHOULD', 'SHOULD NOT', 'RECOMMENDED', 'NOT RECOMMENDED', 'MAY', and 'OPTIONAL' in this document are to be interpreted as described in BCP 14 (RFC 2119) (RFC 8174) when, and only when, they appear in all capitals, as shown here.";

revision 2025-09-14 {

```
description "Initial version";
reference
  "NOTE TO RFC EDITOR: Please replace 'RFC XXXX' with the actual
  RFC number of this document when published, and delete this
  sentence. Also replace the revision with the date of publication
  of this document.
  RFC XXXX: Automatic Peering for SIP Trunks";
}

identity sip-extension {
  description
    "Base identity for SIP extensions/option tags as defined by IANA
    SIP Parameters registry.";
}

identity reliable-provisional-responses {
  base sip-extension;
  description
    "This extension indicates support for reliable provisional
    responses as defined in RFC 3262.";
  reference "RFC 3262";
}

identity session-timers {
  base sip-extension;
  description
    "This extension indicates support for session timers as defined
    in RFC 4028.";
  reference "RFC 4028";
}

identity replaces {
  base sip-extension;
  description
    "This extension indicates support for the Replaces header as
    defined in RFC 3891.";
  reference "RFC 3891";
}

identity path {
  base sip-extension;
  description
    "This extension indicates support for the Path header as defined
    in RFC 3327.";
  reference "RFC 3327";
}

grouping entity {
```

```
description
  "Grouping that provides a reusable list named 'entity', with each
  entry containing a host and a port.";

leaf host {
  type union {
    type inet:ip-address;
    type inet:domain-name;
  }
  description
    "IP Address or host name of the entity";
}

leaf port {
  type inet:port-number;
  description "Entity's port number.";
}
}

container sip-auto-peering {
  config false;
  description
    "Root container for SIP service provider capability data. This
    container holds read-only operational data that represents the
    capabilities and requirements of a SIP service provider.
    Enterprise networks retrieve this data to automatically configure
    their SIP trunking parameters.";

  leaf index {
    type uint8;
    description
      "Index for the peering-info document.";
  }

  leaf variant {
    type enumeration {
      enum v1_0 {
        description
          "Variant 1.0 of the capability set document is defined in
          this draft";
      }
    }
  }
  mandatory true;
  description
    "A node that identifies the version number of the capability
    set document. This draft defines the parameters for variant
    1.0; future specifications might define a richer parameter set,
    in which case the variant must be changed to 2.0, 3.0 and so
```

```
    on. Future extensions to the capability set document MUST also
    ensure that the corresponding YANG module is defined.";
}

container revision {
  description
    "A container that encapsulates information regarding the
    availability of a new version of the capability set document
    for the enterprise.";

  leaf not-before {
    type uint32;
    units "seconds";
    mandatory true;
    description
      "A node that identifies the unix epoch time at which the
      parameters in this capability set document are activated or
      considered valid. This node has been set to mandatory as it
      is the service provider's responsibility to inform when new
      peering settings take effect. Without being aware of a start
      time, the enterprise network will experience failures.";
  }

  leaf location {
    type inet:uri;
    mandatory true;
    description
      "A node that identifies the URL of a new revision of the
      service provider capability set document. Without this URL,
      an enterprise network wouldn't be aware of changes that have
      occurred in the service provider network.";
  }
}

container transport-info {
  description
    "A container that encapsulates transport characteristics of SIP
    sessions between enterprise and service provider networks.";

  leaf-list transport {
    type enumeration {
      enum tcp {
        description
          "Transmission Control Protocol";
      }
      enum tls {
        description
          "Transport Layer Security (over TCP)";
      }
    }
  }
}
```

```
    }
    enum udp {
        description
            "User Datagram Protocol";
    }
}
min-elements 1;
description
    "A list that enumerates the different Transport Layer
    protocols supported by the SIP service provider. Valid
    transport layer protocols include: UDP, TCP and TLS";
}

list registrar {
    key "host port";
    uses entity;
    max-elements 3;
    description
        "A list that specifies the transport address of one or more
        registrar servers in the service provider network. The
        transport address of the registrar can be provided using a
        combination of a valid IP address and port number, or a
        subdomain of the SIP service provider network, or the fully
        qualified domain name (FQDN) of the SIP service provider
        network. If the transport address of a registrar is specified
        using either a subdomain or a fully qualified domain name,
        the DNS element must be populated with one or more valid DNS
        server IP addresses.";
}

list realms {
    key "name";
    description
        "A container that encapsulates the set of realms or
        protection domains the SIP service provider is responsible
        for.";

    leaf name {
        type string;
        description
            "A node specifying the SIP service provider realm or
            protection domain. This node is encoded as a string; the
            value of this node must be identical to the value of the
            'realm' parameter in a WWW-Authenticate header field that
            the SIP service provider might send in response to requests
            that do not contain a valid Authorization header field.";
    }
}
```

```
leaf username {
  type string;
  description
    "A node that encodes the username for the given realm. The
    username is one of many inputs used by the enterprise
    network in generating the response parameter of the
    Authorization header field.";
}

leaf password {
  type ianach:crypt-hash;
  description
    "A node that encodes the password for the given realm. The
    password is one of many inputs used by the enterprise
    network in generating the response parameter of the
    Authorization header field. The password is stored as a
    cryptographic hash.";
}
}

list call-control {
  key "host port";
  uses entity;
  max-elements 3;
  description
    "A list that specifies the transport address of the call
    server(s) in the service provider network. The enterprise
    network must use an applicable transport protocol in
    conjunction with the call control server(s) transport address
    when transmitting call setup requests. The transport address
    of a call server(s) within the service provider network can
    be specified using a combination of a valid IP address and
    port number, or a subdomain of the SIP service provider
    network, or a fully qualified domain name of the SIP service
    provider network. If the transport address of a call control
    server(s) is specified using either a subdomain or a fully
    qualified domain name, the DNS element must be populated with
    one or more valid DNS server IP addresses. The transport
    address specified in this element can also serve as the
    target for non-call requests such as SIP OPTIONS.";
}

leaf-list dns {
  type inet:ip-address;
  max-elements 2;
  description
    "A list that encodes the IP address of one or more DNS
    servers hosted by the SIP service provider. If the enterprise
```

```
    network is unaware of the IP address, port number, and
    transport protocol of servers within the service provider
    network (for example, the registrar and call control server),
    it must use DNS NAPTR and SRV. Alternatively, if the
    enterprise network has the fully qualified domain name of the
    SIP service provider network, it must use DNS to resolve the
    said FQDN to an IP address. The dns element encodes the IP
    address of one or more DNS servers hosted in the service
    provider network. If however, either the registrar or call-
    control lists or both are populated with a valid IP address
    and port pair, the dns element can be omitted.";
  }

  list outbound-proxy {
    key "host port";
    uses entity;
    description
      "A list that specifies the transport address of one or more
      outbound proxies. The transport address can be specified by
      using a combination of an IP address and a port number, a
      subdomain of the SIP service provider network, or a fully
      qualified domain name and port number of the SIP service
      provider network. If the outbound-proxy list is populated
      with a valid transport address, it represents the default
      destination for all outbound SIP requests and therefore, the
      registrar and call-control lists can be omitted.";
  }
}

container call-specs {
  description
    "A container that encapsulates information about call
    specifications, restrictions and additional handling criteria
    for SIP calls between the enterprise and service provider
    network.";

  leaf early-media {
    type boolean;
    description
      "A node that specifies whether the service provider network
      is expected to deliver in-band announcements/tones before
      call connect. The 'P-Early-Media' header field can be used to
      indicate pre-connect delivery of tones and announcements on a
      per-call basis. However, given that signalling and media
      could traverse a large number of intermediaries with varying
      capabilities (in terms of handling of the 'P-Early-Media'
      header field) within the enterprise, such devices can be
      appropriately configured for media cut through if it is known
```

```
    before-hand that early media is expected for some or all of
    the outbound calls. This element is a boolean type, where a
    value of true signifies that the service provider is capable
    of early media. A value of false signifies that the service
    provider is not expected to generate early media.";
}

leaf signaling-forking {
    type boolean;
    description
        "A node that specifies whether outbound call requests from
        the enterprise might be forked on the service provider
        network that MAY lead to multiple early dialogs. This
        information would be useful to the enterprise network in
        appropriately handling multiple early dialogs reliably and in
        enforcing local policy. This element is a boolean type, where
        a value of true signifies that the service provider network
        can potentially fork outbound call requests from the
        enterprise. A value of false indicates that the service
        provider will not fork outbound call requests.";
}

leaf-list supported-methods {
    type enumeration {
        enum invite {
            description "Initiate a dialog or session.";
        }
        enum ack {
            description "Acknowledge final response to INVITE.";
        }
        enum bye {
            description "Terminate a dialog or session.";
        }
        enum cancel {
            description "Cancel a pending request.";
        }
        enum register {
            description "Register contact information.";
        }
        enum options {
            description "Query capabilities of a server.";
        }
        enum prack {
            description "Provisional acknowledgement.";
        }
        enum subscribe {
            description "Subscribe to an event.";
        }
    }
}
```

```
enum notify {
    description "Notify subscriber of an event.";
}
enum publish {
    description "Publish an event state.";
}
enum info {
    description "Send mid-session information.";
}
enum refer {
    description "Refer recipient to a third party.";
}
enum message {
    description "Instant message transport.";
}
enum update {
    description
        "Update session parameters within a dialog.";
}
}
description
    "A list that specifies the various SIP methods supported by
    the SIP service provider. The list of supported methods help
    to appropriately configure various devices within the
    enterprise network. For example, if the service provider
    enumerates support for the OPTIONS method, the enterprise
    network could periodically send OPTIONS requests as a keep-
    alive mechanism.";
}

container caller-id {
    description
        "A container that encodes the preferences of SIP service
        providers in terms of calling number presentation by the
        enterprise network. Certain ITSPs require that the calling
        number be formatted in E.164, whereas others place no such
        restrictions. Additionally, some ITSPs require that the
        calling number be included in a specific SIP header field,
        for example, the P-Asserted-ID header field or the From
        header field, whereas others place no restrictions on the
        specific SIP header field used to convey the calling
        number.";

    leaf e164-format {
        type boolean;
        description
            "A node that indicates whether the service provider
            requires the enterprise network to normalize the calling
```

```
        number into E.164 format. A value of true mandates the
        enterprise network to format calling numbers to E.164
        format, while a false leaves the formatting of the calling
        number up to the enterprise network.";
    }

    leaf preferred-method {
        type enumeration {
            enum p-asserted-identity {
                description
                    "Use the 'P-Asserted-Identity' header to determine
                     remote party identity.";
            }
            enum from {
                description
                    "Use the 'From' header to determine remote party
                     identity.";
            }
        }
        description
            "A node that specifies which SIP header MUST be used by the
             enterprise network to communicate caller information. The
             value of this node is a string that contains the name of
             the SIP header required to carry caller information.";
    }
}

list number-range {
    key index;
    description
        "A list that specifies the Direct Inward Dial (DID) number
         range allocated to the enterprise network by the SIP service
         provider. The DID number ranges allocated by the service
         provider to the enterprise network might be a contiguous or a
         non-contiguous block. The number ranges allocated to an
         enterprise can be communicated as a value or as a reference.
         For large enterprise networks, the size of the DID range
         might run into several hundred numbers. For situations in
         which the enterprise is allocated a large DID number range or
         a non-contiguous number range it is RECOMMENDED that the SIP
         service provider communicate this information by reference,
         that is, through a URL. The enterprise network is required to
         de-reference this URL in order to obtain the DID number
         ranges allocated by the SIP service provider. Refer to the
         example provided in Section 9.1.";

    leaf index {
        type uint16;
```

```
    description
      "Index for the number ranges.";
  }

  leaf type {
    type enumeration {
      enum range {
        description
          "Numbers specified as a range.";
      }
      enum collection {
        description
          "Numbers specified in the form of a collection.";
      }
      enum reference {
        description
          "Number range available at a URL.";
      }
    }
    description
      "A node that indicates whether the DID range
       is communicated by value or by reference. It can have a
       value of 'range', 'collection' or 'reference'.";
  }

  leaf count {
    when "../type = 'range' or ../type = 'collection'";
    type uint16;
    description
      "Indicates the size of the DID number range. This leaf MUST
       NOT be included when using the 'reference' type.";
  }

  leaf-list value {
    type string;
    description
      "A list that encapsulates the DID number range allocated
       to the enterprise. If the num-ranges 'type' is set to
       'range' or 'collection', the 'count' node MUST have a
       valid, non-zero, positive integer. If the number-range
       'type' value is set to 'range', then, the number in this
       field represents the first phone number of a DID range
       allocated to the enterprise. The value of subsequent
       numbers of the given DID range are obtained by adding one
       to the value of this field. The number of times we need to
       add one is indicated by the 'count' field.";
  }
}
```

```
}

container media {
  description
    "A container that is used to collectively encapsulate the
    characteristics of UDP-based audio streams. A future extension
    to this draft may extend the media container to describe other
    media types. The media container is also used to encapsulate
    basic information about Real-Time Transport Protocol (RTP) and
    Real-Time Transport Control Protocol (RTCP) from the
    perspective of the service provider network. At the time of
    writing this specification, video media streams aren't
    exchanged between enterprise and service provider SIP
    networks.";

  list media-type-audio {
    key "media-format";
    description
      "A list encoding the various audio media formats
      supported by the SIP service provider. The relative
      ordering of different media formats in the list indicates
      preference from the perspective of the service provider.
      Each element in the list begins with the encoding name
      of the media format, which is the same encoding name as
      used in the 'RTP/AVP' and 'RTP/SAVP' profiles. The
      encoding name is followed by the sampling rate for the
      encoding and the packetization time. Additionally, any
      other required and optional parameters for the given media
      format as specified when the media format is registered
      [RFC4855] are described the 'param' field.
      Given that the parameters of media formats can vary from
      one communication session to another, for example, across
      two separate communication sessions, the packetization
      time (ptime) used for the PCMU media format might vary
      from 10 to 30 ms, the parameters included in the format
      element must be the ones that are expected to be invariant
      from the perspective of the service provider. Providing
      information about supported media formats and their
      respective parameters, allows enterprise networks to
      configure the media plane characteristics of various
      devices such as endpoints and middleboxes.";

    leaf media-format {
      type enumeration {
        enum pcmu {
          description
            "PCMU format.";
        }
      }
    }
  }
}
```

```
        enum g722 {
            description
                "G722 format.";
        }
        enum g729 {
            description
                "G729 format.";
        }
    }
    description
        "The audio media format.";
}

leaf rate {
    type uint16;
    units "Hz";
    description
        "Sampling rate in Hz.";
}

leaf ptime {
    type uint8;
    units "milliseconds";
    description
        "Packetization time in milliseconds.";
}

leaf parameter {
    type string;
    description
        "Optional parameter for additional media details regarding
        the encoding.";
}
}

container fax {
    description
        "A container that encapsulates the fax
        protocol(s) supported by the SIP service provider. The fax
        container encloses a list (protocol) that enumerates
        whether the service provider supports t38 relay, protocol-
        based fax passthrough or both. The relative ordering of nodes
        within the lists indicates preference.";

    leaf-list protocol {
        type enumeration {
            enum pass-through {
                description
```

```
        "Protocol-based fax passthrough.";
    }
    enum t38 {
        description
            "T38 relay.";
    }
}
max-elements 2;
description
    "List indicating the different fax protocols supported by
    the service provider.";
}
}

container rtp {
    description
        "A container that encapsulates generic characteristics of RTP
        sessions between the enterprise and service provider
        network.";

    leaf rtp-trigger {
        type boolean;
        description
            "A node indicating whether the SIP service
            provider network always expects the enterprise network
            to send the first RTP packet for an established
            communication session. This information is useful in
            scenarios such as 'hairpinned' calls, in which the caller
            and callee are on the service provider network and
            because of sub-optimal media routing, an enterprise
            device such as an SBC is retained in the media path.
            Based on the encoding of this node, it is possible to
            configure enterprise devices such as SBCs to start
            streaming media (possibly filled with silence payloads)
            toward the address:port tuples provided by caller and
            callee. This node is a boolean type. A value of true
            indicates that the service provider expects the
            enterprise network to send the first RTP packet, whereas
            a value of false indicates that the service provider
            network does not require the enterprise network to send
            the first media packet. While the practise of preserving
            the enterprise network in a hairpinned call flow is
            fairly common, it is recommended that SIP service
            providers avoid this practise. In the context of a
            hairpinned call, the enterprise device retained in the
            call flow can easily eavesdrop on the conversation
            between the offnet parties.";
    }
}
```

```
leaf symmetric-rtp {
  type boolean;
  description
    "A node indicating whether the SIP service
    provider expects the enterprise network to use symmetric
    RTP as defined in [RFC4961]. Enforcement of this
    requirement by service providers on enterprise networks
    is typically useful in scenarios such as media latching
    [RFC7362]. This node is a boolean type, a value of true
    indicates that the service provider expects the
    enterprise network to use symmetric RTP, whereas a value
    of false indicates that the enterprise network can use
    asymmetric RTP.";
}
}

container rtcp {
  description
    "A container that encapsulates generic characteristics of
    RTCP sessions between the enterprise and service provider
    network.";

  leaf symmetric-rtcp {
    type boolean;
    description
      "A node indicating whether the SIP service
      provider expects the enterprise network to use symmetric
      RTCP as defined in [RFC4961]. This node is a boolean
      type, a value of true indicates that the service
      provider expects symmetric RTCP reports, whereas a
      value of false indicates that the enterprise can use
      asymmetric RTCP.";
  }

  leaf rtcp-feedback {
    type boolean;
    description
      "A node that indicates whether the SIP service
      provider supports the RTP profile extension for
      RTCP-based feedback [RFC4585]. Media sessions spanning
      enterprise and service provider networks, are rarely
      made to flow directly between the caller and callee,
      rather, it is often the case that media traffic flows
      through network intermediaries such as SBCs. As a result,
      RTCP traffic from the service provider network is
      intercepted by these intermediaries, which in turn can
      either pass across RTCP traffic unmodified or modify
      RTCP traffic before it is forwarded to the endpoint in
```

```
the enterprise network. Modification of RTCP traffic
would be required, for example, if the intermediary has
performed media payload transformation operations such
as transcoding or transrating. In a similar vein, for
the RTCP-based feedback mechanism as defined in
[RFC4585] to be truly effective, intermediaries must
ensure that feedback messages are passed reliably and
with the correct formatting to enterprise endpoints.
This might require additional configuration and
considerations that need to be dealt with at the time of
provisioning the intermediary device. This node is of
boolean type, a value of true indicates that the service
provider supports the RTP profile extension for
RTP-based feedback and a value of false indicates that
the service provider does not support the RTP profile
extension for RTP-based feedback.";
    }
  }
}

container dtmf {
  description
    "A container that describes the various aspects of
    DTMF relay via RTP Named Telephony Events. The dtmf
    container allows SIP service providers to specify two facets
    of DTMF relay via Named Telephony Events.";

  leaf payload-number {
    type uint8 {
      range "96..127";
    }
    description
      "Indicates the payload type number.";
  }

  leaf iteration {
    type boolean;
    description
      "A value of true indicates that the service provider supports
      RFC4733 while a value of false indicates that the service
      provider prefers RFC2833";
  }
}

container security {
  description
    "A container that encapsulates characteristics about encrypting
    signalling streams between the enterprise and SIP service
```

```
    provider networks.";

container signaling {
  description
    "A container that encapsulates the type of security protocol
    for the SIP communication between the enterprise SBC and the
    service provider.";

  leaf secure {
    type boolean;
    description
      "A node that specifies whether the service provider allows
      the use of TLS to secure SIP signalling messages between
      the enterprise and service provider network. This node is
      of boolean type, a value of true indicates that the service
      provider supports SIP sessions over TLS, whereas a value of
      false indicates that the service provider does not support
      SIP over TLS.";
  }

  leaf-list version {
    when "../secure = 'true'";
    type enumeration {
      enum tls_v1_2 {
        description
          "TLS version 1.2.";
      }
      enum tls_v1_3 {
        description
          "TLS version 1.3.";
      }
    }
    description
      "A list that specifies the version(s) of TLS supported.";
  }
}

container media-security {
  description
    "A container that describes the various characteristics of
    securing media streams between enterprise and service
    provider networks.";

  leaf-list key-management {
    type enumeration {
      enum sdes {
        description
          "Simplified Data Encryption Standard
```

```
        key management.";
    }
    enum dtls-srtp {
        description
            "SRTP keys managed using DTLS.";
    }
}
description
    "A list that specifies the key management method(s) used by
    the service provider. Possible values in this list include
    'SDES' and 'DTLS-SRTP'. A value of 'SDES' signifies that
    the SIP service provider uses the methods defined in
    [RFC4568] for the purpose of key management. A value of
    'DTLS-SRTP' signifies that the SIP service provider uses
    the methods defined in [RFC5764] for the purpose of key
    management.";
}
}

leaf certificate-location {
    type inet:uri;
    description
        "If the enterprise network is required to exchange SIP
        traffic over TLS with the SIP service provider, and if the
        SIP service provider is capable of accepting TLS connections
        from the enterprise network, it may be required for the SIP
        service provider certificates to be pre-installed on the
        enterprise edge element. In such situations, the certificate-
        location node is populated with a URL, which when
        dereferenced, provides a single PEM encoded file that
        contains all certificates in the chain of trust.";
}

container secure-telephony-identity {
    description
        "Encapsulates Secure Telephony Identity (STIR)
        characteristics.";

    leaf stir-compliance {
        type boolean;
        description
            "A node that indicates whether the SIP service
            provider is STIR compliant. This node is of boolean
            type, a value of true indicates that the SIP service
            provider is STIR compliant. A value of false indicates
            that the SIP service provider is not STIR compliant. A
            SIP service provider being STIR compliant has
            implications for inbound and outbound calls, from the
```

```
        perspective of the enterprise network.";
    }

    leaf certificate-delegation {
        type boolean;
        description
            "A node that indicates whether a SIP service
            provider that allocates one or more number ranges to an
            enterprise network, is willing to delegate authority to
            the enterprise network over that number range(s). This
            node is of boolean type, a value of true indicates that
            the SIP service provider is willing to delegate authority
            to the enterprise network over one or more number
            ranges. A value of false indicates that the SIP service
            provider is not willing to delegate authority to the
            enterprise network over one or more number ranges. This
            node MUST only be included in the capability set if the
            value of the stir-compliance leaf node is set to true.
            In order to obtain delegate certificates, the enterprise
            network must be made aware of the scope of delegation -
            the number or number range(s) over which the SIP service
            provider is willing to delegate authority. This
            information is included in the num-ranges container.";
    }

    leaf acme-directory {
        when "../certificate-delegation = 'true'";
        type inet:uri;
        description
            "A node that provides the URL of the directory object for
            delegate certificates using Automatic Certificate
            Management Environment (ACME) [RFC8555]. The directory
            object URL, when de-referenced, provides a collection of
            field name-value pairs. Certain field name-value pairs
            provided in the response are used to bootstrap the process
            the obtaining delegate certificates. This node MUST only be
            included in the capability set if the value of the
            certificate-delegation leaf node is set to true.";
    }
}

leaf-list extensions {
    type identityref {
        base sip-extension;
    }
    description
        "A list of SIP option tags (extensions) supported by the service"
```

provider network. Each extension is represented as an identity derived from the sip-extension base identity. This provides type safety and allows for proper validation of supported extensions.";

```
    }  
  }  
}  
<CODE ENDS>
```

### 7.3. Extending the Capability Set

There are situations in which equipment manufactures or service providers would benefit from extending the YANG module defined in this draft. For example, service providers could extend the YANG module to include information that further simplifies direct IP peering. Such information could include: trunk group identifiers, customer/enterprise account numbers, service provider support numbers, among others. Extension of the module can be achieved by importing the module defined in this draft. An example is provided below: Consider a new YANG module "vendorA" specified for VendorA's enterprise SBC. The "vendorA-config" YANG module is configured as follows:

```
module vendorA-config {
  namespace "urn:ietf:params:xml:ns:yang:vendorA-config";
  prefix "vendorA";

  description
    "Data model for configuring VendorA Enterprise SBC";

  revision 2020-05-06 {
    description "Initial revision of VendorA Enterprise SBC
      configuration data model";
  }

  import ietf-peering {
    prefix "peering";
  }

  augment "/peering:peering-info" {
    container vendorAConfig {
      leaf vendorAConfigParam1 {
        type int32;
        description "vendorA configuration parameter 1
          (SBC Device ID)";
      }

      leaf vendorAConfigParam2 {
        type string;
        description "vendorA configuration parameter 2
          (SBC Device name)";
      }
      description "Container for vendorA SBC configuration";
    }
  }
}
```

In the example above, a custom module named "vendorA-config" uses the "augment" statement as defined in Section 4.2.8 of [RFC7950] to extend the module defined in this draft.

## 8. Processing the Capability Set Response

This section provides a non-normative description of the procedures that could be carried out by the enterprise network after obtaining the SIP service provider capability set. On obtaining the capability set, the enterprise edge element can parse the various fields within the capability set and generate configuration blocks. For example, the configuration required to successfully register a SIP trunk with the SIP registrar hosted in the service provider network, the configuration required to ensure that fax calls are handled

appropriately, the configuration required to advertise only audio codecs supported by the SIP service provider, among many other configuration blocks. A configuration block generated for an almost identical SIP service provider capability set document is likely going to differ drastically from one vendor to the next.

Enterprise edge elements are usually capable of normalising mismatches in the signalling and media planes between the enterprise and service provider SIP networks. As a result, most, if not all of the configuration blocks required to enable successful SIP service provider peering might need to be added on the edge element. In situations wherein configuration blocks need to be distributed across multiple devices, some mechanism, that is out of scope of this document might be used to communicate the specific fields of capacity set and their corresponding value. Alternatively, a human administrator could go through the capability set document and configure the edge element (and if required, other devices in the enterprise network appropriately).

## 9. Examples

This section provides examples of how capability set documents that leverage the YANG module defined in this document can be encoded over JSON as well as the exchange of messages between the enterprise edge element and the service provider to acquire the capability set document. The service provider will create a unique document for each enterprise network that will peer with it.

### 9.1. JSON Capability Set Document

```
<CODE BEGINS> file "asap-example.json"
{
  "ietf-sip-auto-peering:sip-auto-peering":
  {
    "index": 0,
    "variant": "v1_0",
    "revision": {
      "not-before": 1742330340,
      "location":
        "https://capserver.example.org/capserver/capdoc.json"
    },
    "transport-info": {
      "transport": [
        "tcp",
        "tls",
        "udp"
      ],
      "registrar": [
```

```
{
  "host": "registrar1.voip.example.com",
  "port": 5060
},
{
  "host": "registrar2.voip.example.com",
  "port": 5060
}
],
"realms": [
  {
    "name": "voip.example.com",
    "username": "voip",
    "password": "$6$0oEJwExxp6U/FRFq$4RkL2lSSGLoKdfGjX4lQLFXo89gc0wtJs
KiBxg/BBz6aNwu7C.D3kRUwD7lvJm6rhaCdhSzVh/XfkkAUY2dTU0"
  }
],
"call-control": [
  {
    "host": "callServer1.voip.example.com",
    "port": 5060
  },
  {
    "host": "192.0.2.40",
    "port": 5065
  }
],
"dns": [
  "192.0.2.50",
  "192.0.2.51"
],
"outbound-proxy": [{
  "host": "192.0.2.35",
  "port": 5060
}]
},
"call-specs": {
  "early-media": true,
  "signaling-forking": false,
  "supported-methods": [
    "invite",
    "options",
    "bye",
    "cancel",
    "ack",
    "prack",
    "subscribe",
    "notify",
    "register"
  ]
}
```

```
],
"caller-id": {
  "e164-format": true,
  "preferred-method": "from"
},
"number-range": [
  {
    "index": 0,
    "type": "range",
    "count": 20,
    "value": [
      "19725455000"
    ]
  },
  {
    "index": 1,
    "type": "collection",
    "count": 2,
    "value": [
      "19725455000",
      "19725455001"
    ]
  }
]
},
"media": {
  "media-type-audio": [
    {
      "media-format": "pcmu",
      "rate": 8000,
      "ptime": 20
    },
    {
      "media-format": "g729",
      "rate": 8000,
      "ptime": 20,
      "parameter": "annexb"
    }
  ],
  "fax": {
    "protocol": [
      "t38",
      "pass-through"
    ]
  },
  "rtp": {
    "rtp-trigger": true,
    "symmetric-rtp": true
  }
}
```

```

    },
    "rtcp": {
        "symmetric-rtcp": true,
        "rtcp-feedback": true
    }
},
"dtmf": {
    "payload-number": 101,
    "iteration": false
},
"security": {
    "signaling": {
        "secure": true,
        "version": ["v1_2", "v1_3"]
    },
    "media-security": {
        "key-management": ["sdes", "dtls-srtp"]
    },
    "cert-location":
        "https://sipserviceprovider.com/certificateList.pem",
    "secure-telephony-identity": {
        "stir-compliance": true,
        "cert-delegation": true,
        "acme-directory": "https://sipserviceprovider.com/acme.html"
    }
},
"extensions": [
    "ietf-sip-auto-peering:reliable-provisional-responses",
    "ietf-sip-auto-peering:session-timers",
    "ietf-sip-auto-peering:replaces",
    "ietf-sip-auto-peering:path"
]
}
}
<CODE ENDS>

```

## 9.2. Example Exchange

This section is an informational example depicting the configuration flow that ultimately results in the enterprise edge element obtaining the capability set document from the SIP service provider. Assuming the enterprise edge element has been pre-configured with the request target for the capability set document or has dynamically found the request target, the edge element generates a HTTP GET request. This request can be challenged by the service provider to authenticate the enterprise.

```
GET /capdoc?trunkid=trunkent1456 HTTP/1.1
Host: capserver.sspl.com
Authorization: Bearer <clientToken>
```

The capability set document is obtained in the body of the response and is encoded in JSON.

```
HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: nnn
```

```
{
  "peering-info": ...
}
```

## 10. IANA Considerations

This document has no IANA actions.

## 11. Security Considerations

The capability set document contains sensitive information that must be protected from attackers. A capability set document leak can inflict considerable damage to both the enterprise as well as the service provider. An attacker that gains access to the capability set document can cause problems in multiple ways.

There are multiple attack points in the ASAP workflow. The sections below deal with the different points at which the workflow is vulnerable to attackers.

### 11.1. OAuth Credentials

In scenarios wherein client authentication is carried out using OAuth resource owner credentials, it is required to ensure that these credentials cannot be acquired by any unauthorized third-party. If acquired by an unauthorized third-party, these credentials may be used to obtain the capability set document from the SIP service provider and subsequently use the information in such a document to make unauthorized calls while posing as an enterprise telephony network that has legitimately paid for calling services from a SIP service provider.

## 11.2. Client-Server Communication

All communication used by the edge element to obtain the capability set document from the capability server MUST be secured using HTTPS. Failure to do so, results in the capability set document being transmitted over clear text, thus exposing sensitive information such as targets for trunks registration, targets for outbound calling requests and credentials used in building the Authorisation header field provided in response to authentication challenges.

## 12. Acknowledgments

We would like to thank those who provided detailed and thoughtful comments on this draft, especially Marc Petit-Huguenin, Paul Jones, Ram Mohan R, Nicola Serafini, Jonathan Rosenberg, Jon Peterson, Chris Wendt and Henning Schulzrinne. Additional thanks to Murray Kucherauw, Joel Halpern, Dan Harkins, テ詠ic Vyncke, Joerg Ott, Mahesh Jethanandani, Orie Steele, Harald Alvestrand and Ebben Aries for their reviews and feedback.

### 13. Informative References

- [RFC2833] Schulzrinne, H. and S. Petrack, "RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals", RFC 2833, DOI 10.17487/RFC2833, May 2000, <<https://www.rfc-editor.org/info/rfc2833>>.
- [RFC3261] Rosenberg, J., Schulzrinne, H., Camarillo, G., Johnston, A., Peterson, J., Sparks, R., Handley, M., and E. Schooler, "SIP: Session Initiation Protocol", RFC 3261, DOI 10.17487/RFC3261, June 2002, <<https://www.rfc-editor.org/info/rfc3261>>.
- [RFC4568] Andreasen, F., Baugher, M., and D. Wing, "Session Description Protocol (SDP) Security Descriptions for Media Streams", RFC 4568, DOI 10.17487/RFC4568, July 2006, <<https://www.rfc-editor.org/info/rfc4568>>.
- [RFC4585] Ott, J., Wenger, S., Sato, N., Burmeister, C., and J. Rey, "Extended RTP Profile for Real-time Transport Control Protocol (RTCP)-Based Feedback (RTP/AVPF)", RFC 4585, DOI 10.17487/RFC4585, July 2006, <<https://www.rfc-editor.org/info/rfc4585>>.
- [RFC4733] Schulzrinne, H. and T. Taylor, "RTP Payload for DTMF Digits, Telephony Tones, and Telephony Signals", RFC 4733, DOI 10.17487/RFC4733, December 2006, <<https://www.rfc-editor.org/info/rfc4733>>.

- [RFC4961] Wing, D., "Symmetric RTP / RTP Control Protocol (RTCP)", BCP 131, RFC 4961, DOI 10.17487/RFC4961, July 2007, <<https://www.rfc-editor.org/info/rfc4961>>.
- [RFC5764] McGrew, D. and E. Rescorla, "Datagram Transport Layer Security (DTLS) Extension to Establish Keys for the Secure Real-time Transport Protocol (SRTP)", RFC 5764, DOI 10.17487/RFC5764, May 2010, <<https://www.rfc-editor.org/info/rfc5764>>.
- [RFC7033] Jones, P., Salgueiro, G., Jones, M., and J. Smarr, "WebFinger", RFC 7033, DOI 10.17487/RFC7033, September 2013, <<https://www.rfc-editor.org/info/rfc7033>>.
- [RFC7092] Kaplan, H. and V. Pascual, "A Taxonomy of Session Initiation Protocol (SIP) Back-to-Back User Agents", RFC 7092, DOI 10.17487/RFC7092, December 2013, <<https://www.rfc-editor.org/info/rfc7092>>.
- [RFC7362] Ivov, E., Kaplan, H., and D. Wing, "Latching: Hosted NAT Traversal (HNT) for Media in Real-Time Communication", RFC 7362, DOI 10.17487/RFC7362, September 2014, <<https://www.rfc-editor.org/info/rfc7362>>.
- [RFC8555] Barnes, R., Hoffman-Andrews, J., McCarney, D., and J. Kasten, "Automatic Certificate Management Environment (ACME)", RFC 8555, DOI 10.17487/RFC8555, March 2019, <<https://www.rfc-editor.org/info/rfc8555>>.
- [RFC9114] Bishop, M., Ed., "HTTP/3", RFC 9114, DOI 10.17487/RFC9114, June 2022, <<https://www.rfc-editor.org/info/rfc9114>>.
- [RFC9409] Inamdar, K., Narayanan, S., Engi, D., and G. Salgueiro, "The 'sip-trunking-capability' Link Relation Type", RFC 9409, DOI 10.17487/RFC9409, July 2023, <<https://www.rfc-editor.org/info/rfc9409>>.
- [SIP-Connect-TR]  
"SIP Connect Technical Recommendation",  
<<https://www.sipforum.org/download/sipconnect-technical-recommendation-version-2-0/?wpdmdl=2818>>.

#### 14. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.

- [RFC4855] Casner, S., "Media Type Registration of RTP Payload Formats", RFC 4855, DOI 10.17487/RFC4855, February 2007, <<https://www.rfc-editor.org/info/rfc4855>>.
- [RFC6020] Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", RFC 6020, DOI 10.17487/RFC6020, October 2010, <<https://www.rfc-editor.org/info/rfc6020>>.
- [RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed., and A. Bierman, Ed., "Network Configuration Protocol (NETCONF)", RFC 6241, DOI 10.17487/RFC6241, June 2011, <<https://www.rfc-editor.org/info/rfc6241>>.
- [RFC6665] Roach, A.B., "SIP-Specific Event Notification", RFC 6665, DOI 10.17487/RFC6665, July 2012, <<https://www.rfc-editor.org/info/rfc6665>>.
- [RFC6749] Hardt, D., Ed., "The OAuth 2.0 Authorization Framework", RFC 6749, DOI 10.17487/RFC6749, October 2012, <<https://www.rfc-editor.org/info/rfc6749>>.
- [RFC6991] Schoenwaelder, J., Ed., "Common YANG Data Types", RFC 6991, DOI 10.17487/RFC6991, July 2013, <<https://www.rfc-editor.org/info/rfc6991>>.
- [RFC7317] Bierman, A. and M. Bjorklund, "A YANG Data Model for System Management", RFC 7317, DOI 10.17487/RFC7317, August 2014, <<https://www.rfc-editor.org/info/rfc7317>>.
- [RFC7950] Bjorklund, M., Ed., "The YANG 1.1 Data Modeling Language", RFC 7950, DOI 10.17487/RFC7950, August 2016, <<https://www.rfc-editor.org/info/rfc7950>>.
- [RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/info/rfc8174>>.
- [RFC8340] Bjorklund, M. and L. Berger, Ed., "YANG Tree Diagrams", BCP 215, RFC 8340, DOI 10.17487/RFC8340, March 2018, <<https://www.rfc-editor.org/info/rfc8340>>.
- [RFC8446] Rescorla, E., "The Transport Layer Security (TLS) Protocol Version 1.3", RFC 8446, DOI 10.17487/RFC8446, August 2018, <<https://www.rfc-editor.org/info/rfc8446>>.

[RFC9110] Fielding, R., Ed., Nottingham, M., Ed., and J. Reschke,  
Ed., "HTTP Semantics", STD 97, RFC 9110,  
DOI 10.17487/RFC9110, June 2022,  
<<https://www.rfc-editor.org/info/rfc9110>>.

#### Authors' Addresses

Kaustubh Inamdar  
Unaffiliated  
Email: [kaustubh.ietf@gmail.com](mailto:kaustubh.ietf@gmail.com)

Sreekanth Narayanan  
Unaffiliated  
Email: [sknth.n@protonmail.com](mailto:sknth.n@protonmail.com)

Cullen Jennings  
Cisco Systems  
Email: [fluffy@iii.ca](mailto:fluffy@iii.ca)