

SDPng Transition
draft-ietf-mmusic-sdpng-trans-02.txt

Status of this memo

This document is an Internet-Draft and is subject to all provisions of [Section 10 of RFC2026](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

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".

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/1id-abstracts.txt>

To view the list Internet-Draft Shadow Directories, see <http://www.ietf.org/shadow.html>.

Distribution of this document is unlimited.

This document is a product of the Multiparty Multimedia Session Control (MMUSIC) working group of the Internet Engineering Task Force. Comments are solicited and should be addressed to the working group's mailing list at mmusic@ietf.org and/or the authors.

Abstract

The Session Description Protocol (SDP) is today widely used in the Internet to announce as well as negotiate multimedia sessions and exchange capabilities. Having originally been designed for session announcements only, as opposed to announcements and capabilities negotiation announcements, native SDP lacks numerous features to be applicable in many session scenarios. Numerous extensions have been developed to circumvent SDP's shortcomings -- but they have also repeatedly shown its inherent limitations. A successor protocol -- termed "SDPng" for the time being -- is developed to address the aforementioned needs of Internet applications in a more structured manner. With the huge installed base of SDP-based applications, a migration path needs to be developed to move from SDP to SDPng over time. This document outlines how this migration can be achieved: in

general as well as for the various IETF control protocols that

potentially make use of SDP and SDPng.

1. Introduction

SDP is now widely used within the Internet community to describe media sessions and, in a limited fashion, system capabilities relating to (multi)media sessions, for a variety of application scenarios: session announcements, interactive session setup, capability assessment and remote control of media streams. All but the first of these are rather different from what SDP was originally designed for -- but all of them share the idea of setting up and configuring media streams. Over time, its wide range of uses has revealed numerous shortcomings -- most of which stem from the fact that SDP has been used for lack of a better alternative and its semantics have been re-interpreted to make it fit the respective scenarios' needs. In many cases, workarounds (typically called "extensions") for those shortcomings could be found which are often rather cumbersome. While this practice has extended SDP's lifetime and provided at least a suitable basis for numerous applications, in parallel, a successor protocol -- currently referred to as "SDPng" -- has been developed.

It is worthwhile noting that the aforementioned applications' needs are sufficiently similar for a single description protocol to take care of them if it was designed for this purpose from the beginning. As a lesson learned from SDP, any further expansion in scope should be avoided where no clear fit can be seen -- and specific (different) solutions should be developed instead.

The design of SDPng takes into account the requirements arising from the above application scenarios and puts particular emphasis on protocol extensibility and modularization of extensions, at the same time keeping the core description format simple. SDPng uses a different (more expressive) syntax than SDP does and hence is not backward compatible at the syntax level. Nevertheless, the concepts of SDPng take into account the migration issues from SDP to SDPng by providing straightforward mappings between the two formats where possible and try to maximize compatibility from a semantics perspective.

The current revisions of SDP and SDPng are documented in

- o [draft-ietf-mmusic-sdp-new-11.txt](#) [1] and
- o [draft-ietf-mmusic-sdpng-05.txt](#) [2].

For SDP, a number of additional features are defined in the following documents that need to be taken into account:

- o the offer/answer scheme of interpreting and matching media session descriptions to negotiate media sessions to be used in

- call or conference in a single round-trip ([RFC 3264](#) [6]);
- o full support for IPv6 as network layer protocol ([RFC 3266](#) [12]);
 - o SDP extensions to allow selecting ATM virtual circuits as additional network protocol and specifying ATM-specific parameters ([RFC 3108](#) [3]);
 - o SDP extensions to support TDM as additional network protocol and specify the TDM-specific parameters ([draft-taylor-mmusic-sdp-tdm-00.txt](#) [9])
 - o a general extension to deal with connection-oriented transport protocols such as TCP ([draft-ietf-mmusic-sdp-comedia-04.txt](#) [8]);
 - o an extension to support SCTP as media transport protocol in addition to UDP and TCP ([draft-fairlie-mmusic-sdp-sctp-00.txt](#) [7]);
 - o an SDP extension to explicitly specify RTCP port number to enable the necessary expressiveness for NAT traversal ([draft-ietf-mmusic-sdp4nat-02.txt](#) [10]);
 - o a mechanism (media identification, "mid") for naming and grouping ("group") SDP media lines according to one or more criteria, e.g. for the purpose of lip-synchronization or for identifying media sessions carrying the same content ([draft-ietf-mmusic-fid-05.txt](#) [4]);
 - o the capability to indicate which media sessions shall be mapped into the same resource reservation context ([draft-ietf-mmusic-reservation-flows-00.txt](#) [13]);
 - o an extension to allow expression of simultaneous capabilities across media sessions and formats ([draft-andreasen-mmusic-sdp-simcap-05.txt](#) [5])
 - o attributes for passing parameters of a keying protocol (such as MIKEY) as part of a session description ([draft-ietf-mmusic-kmgt-ext-05.txt](#) [11]);
 - o support for conveying cryptographic parameters as part of a session description ([draft-baughner-mmusic-sdpmediasec-00.txt](#) [15]); and
 - o a mechanism to explicitly specify the sources allowed to provide input to media sessions ([draft-ietf-mmusic-sdp-srcfilter-01.txt](#) [16]).

- o a simple language to provide instructions to media mixers on which incoming media streams shall be combined to produce which outgoing ones (and possibly how they shall be combined, draft-

```
camarillo-mmusic-source-sink-00.txt [14]);
```

This document outlines a migration path from SDP to SDPng, starting from a short overview of the current application scenarios. In the next step, we highlight which design decisions taken for SDPng should simplify a smooth migration and describe how mappings between the two description formats can be performed at an abstract level. We then address procedural issues for integrating SDP and SDPng into the various protocols relying on those media description formats. Finally, we summarize work items on the agenda for SDPng.

2. Application Scenarios

The following session control protocols that make use of SDP have been standardized in the IETF so far:

1. SDP was originally developed to announce (Mbone-based) multimedia sessions via session directories using the Session Announcement Protocol (SAP) -- but other mechanisms for disseminating the session descriptions (such as HTTP, SMTP, NNTP, etc.) are conceivable as well.

The major property of this application scenario is that the creator of the session description defines a (set of) fixed choice(s) for all media types in a conference and the conference participants have no way to influence these. If they support at least one of the codecs for a particular media type they can participate in this media session, otherwise they cannot. There is no interaction between sender(s) and receiver(s) to negotiate the media stream codecs and parameters.

This scenario is referred to as "announcement".

2. Another use of SDP is in conjunction with the Real-Time Streaming Protocol (RTSP). In RTSP, SDP is used to convey descriptions of a media stream interactively requested to be played from a server (or recorded by a server). SDP itself is not used for capability negotiation, not even for the addresses to be used; those are negotiated within RTSP and may override the addresses specified as part of SDP.

This scenario is referred to as "retrieval".

3. With SIP, SDP is used to propose media stream configurations and choose out of these (i.e. enable a subset of these). By proposing and accepting media stream configurations, endpoints use SDP to implicitly describe their capabilities and carry out a negotiation procedure on the media streams to use.

In the context of SIP, specific meanings (including required

extensions) have been defined for use of SDP with unicast addresses, for connection-oriented transports, and for certain media level attributes (such as the direction attribute send-

only, receive-only, and inactive).

Numerous extensions have been proposed to extend SDP to better suit SIP's needs. Besides a description of the offer/answer model, these extensions particularly include the ability to describe simultaneous capabilities and to group media stream semantically.

This scenario is referred to as "offer/answer".

4. SDP is used to convey the capability descriptions of a MEGACO media gateway (MG) to its media gateway controller (MGC) as well as for the MGC to instruct the MG where to send media streams to and from where to receive media streams, including codec and parameter choice.

For this purpose, SDP has been modified/extended to some degree to fit the MEGACO needs.

This scenario is referred to as "gateway control".

It should be noted that the original SDP concept already provided an extension mechanism to cover other network types than IPv4 and IPv6; however, specific extensions have only been defined recently for ATM and are now under discussion for TDM. Extensions to other transport (including radio interfaces or next generation wireless networks) as well as to new types of session descriptions (e.g. electronic program guides) are conceivable.

3. Mapping SDP to SDPng

On a transition path from SDP to SDPng, allowing for a somewhat straightforward mapping of (parts of) one description format onto the other is of crucial importance. SDPng has been designed in way that allows many of the session description features of SDP to be easily mapped onto the SDPng format and vice versa -- except that SDPng is more expressive than SDP and hence information loss is not unlikely to occur when doing the reverse mapping. The final mapping rules between SDP and SDPng to be drawn up shall ensure that when mapping SDP to SDPng and then back to SDP will produce an SDP that is functionally identical to the one originally fed into the mapping process. Note that the use of a number of SDP extensions (FID, SIMCAP) may be implied in this mapping process, depending on the use of SDP. The mapping rules will ensure that no information loss will occur when translating from SDP to SDPng.

The SDPng design uses a structure of four sections: definitions, potential or actual configurations, constraints and session attributes. Of these, the "Configurations" and "Session Attributes" sections map well onto the current SDP. The

"Definitions" and "Constraints" sections provide additional structure which is not directly expressible in SDP.

- o At the media description level, the Potential and Actual Configurations specified in the "Configurations" section maps well to media descriptions ("m=", possibly "c=", and associated attributes ("a=") lines).
- o At the session description level, the SDP session parameters are largely reflected in the "Session Attributes" section of SDPng. The attributes proven suitable for session announcements have been used as the basis when defining SDPng.

In SDPng, media descriptions are explicitly tagged with identifiers and thus are easily referenced for semantically grouping media streams (e.g. to describe alternative audio in different languages, media streams to be synchronized, or media streams to carry the same information simultaneously but with different encodings) -- as has been defined for SDP in a limited fashion by the "fid" attribute set. SDPng allows even to more formally describe the syntax of individual or compound media streams in the "Session Attributes" section. Furthermore, SDPng supports a superset of additional constraints that may be realized by the "simcap" extensions for SDP in the "Constraints" section.

Additional address families such as ATM or TDM bearers, next generation wireless network bearers, DVB channels, etc. can be incorporated into SDPng by defining the appropriate extensions for the SDPng transports.

Similarly, new codecs can be added by just defining new codec specifications or defining entire new classes of applications to be described as new content types ("codec") to be carried in a media session (including e.g. text, fax, slide presentations, shared editors, etc). If necessary, sophisticated parameter structures can be supported (even though the authors believe that simplicity is key to interoperability here). This is similar to, but more structured than, the definition of new codec attributes in MIME registrations for SDP.

It is expected that the MIME namespace for codecs will be mapped into the SDPng namespace, and a consistent mapping from SDP "a=fmtp:" attributes to SDPng codec parameters will be defined.

By means of its conceptual differentiation into Potential and Actual Configurations, SDPng supports both indicating a system's capabilities (without specifying transport addresses) separately from the instantiation of a particular media stream as well as conveying capability descriptions and instantiation proposals at the same time -- thereby providing a good fit for all the above session control scenarios: the "announcement" and "retrieval" scenarios will just

use rather fixed Actual Configurations. The "offer/answer" model will use use Actual Configuration but use them to negotiate media streams in a two-way handshake but may in addition use Potential Configurations to indicate capabilities that shall not be used

immediately. The "gateway control" scenario will use both: Potential Configurations to describe an MG's capabilities and Actual Configurations for setting up media sessions at MGs as well as retrieving information about currently active media sessions. This differentiation is not directly expressible in SDP, although various extensions can be used to overload SDP semantics to achieve at least part of this effect.

Finally, while the short-term SDPng specification aims at supporting only the widespread offer/answer model for capability negotiation, a future extension will also allow for content-independent negotiation of session parameters by defining collapsing/intersection rules. In particular, SDPng will take into account the need for multicast-based distributed calculation of joint capabilities into account for those rules (but note that it is **not** intended as a generic format for describing conference state information). Such functionality is not covered by current SDP -- but there is also no perceived urgent demand so that this sophisticated functional component of SDPng is left to a future protocol extension. The base SDPng protocol will provide the necessary flexibility, however.

4. Integration with Session Control Protocols

This section outlines for each of the session control protocols described above how SDP and SDPng can be used in parallel and indicates how a suitable transition could be achieved.

4.1. Session Announcement Protocol (SAP)

There are two revisions of SAP specified, version 0 which is implemented in a number of experimental tools, and version 1 which is defined in [RFC 2972](#).

SAPv0:SAPv0 does not support a mechanism to identify the content type of a session announcement but implicitly assumes SDP. Proper parsers will note that the contents of the SAPv0 message does not begin with a "v=" line and hence will ignore the entire announcement. SDPng contents MAY be identified by the character sequence "<sdpng" in the beginning of the announcement body, but this is NOT RECOMMENDED. Instead, SAPv1 SHOULD be used, since it contains an explicit payload identifier.

SAPv1:In SAPv1, an explicit payload type field (containing a MIME type) is available and SHOULD be used to differentiate between SDP and SDPng contents. Two approaches are conceivable: Either multipart MIME message is used with two parts containing the same session descriptions -- one expressing it in SDP and the other in SDPng. Alternatively, two alternate session announcements may be used (being properly distinguished by the

SDP "o=" field and the SDPng equivalent).

It is RECOMMENDED that implementations recognize the MIME multipart/alternative type in SAPv1 announcements, allowing for

a simple transition to SDPng.

It should be noted that current session directory implementations only support SDP. Nevertheless, using the SAP Message Identifier Hash and the source address, they should be able to perform session deletions and modifications properly -- even without understanding the format contained in the SAP message body.

For the introduction of SDPng, session announcements SHOULD be made "bi-lingual", i.e. in SDP and SDPng. If a SAP announcer for some reason knows that all its potential audience will support SDPng, the SDP announcement SHOULD be omitted.

It should be noted that, for IPv4-based multicast sessions, session directories still may rely on parsing the session specifications to avoid clashes in the multicast address space. Introducing a new session description language will prevent older implementations from continuing this practice successfully -- assuming that only SDPng announcements are used and/or that old implementations do not support MIME multipart/alternative message bodies. This use of SAP is deprecated, of course.

4.2. Real-Time Streaming Protocol (RTSP)

RTSP uses SDP to provide presentation descriptions (with a presentation comprising one or more media sessions), typically communicated from the server to the client (for playing) and in the opposite direction for recording. The presentation description may also include initialization data for the various media streams and URLs to be used for controlling the entire presentation as well as the individual media sessions. Transport parameters -- such as IP addresses, port numbers, etc. -- are conveyed as part of RTSP header fields.

RTSP uses the Content-Type: header field to indicate the format of the enclosed entity. This provides a straightforward means for distinguishing SDP and SDPng-based presentation descriptions. In addition, the Accept: header SHOULD be used by the client, to indicate which content types it supports. If the client specifies both SDP and SDPng as acceptable, the server SHOULD provide only the SDPng-based presentation description.

If the client does not indicate a particular Content-Type: the server can, theoretically, use MIME multipart bodies (e.g. "multipart/alternative") to convey both description types simultaneously. However, it is generally not expected that today's RTSP clients and servers will be able handle multipart bodies. Hence, if no hint is provided by the client by means of the Accept: header, the server MUST provide only an SDP description.

In general, it would be preferable to have the servers migrate to always supporting both description formats, thus enabling the clients to choose. The servers SHOULD indicate SDPng support by means of

suitable header fields whenever possible.

Finally, RTSP makes special provision to interworking with firewalls by including the crucial transport parameters in a separate RTSP header field `_in_addition_` to the presentation description. This practice in principle allows to change the presentation description format without having to worry about the operation of firewalls and similar devices.

4.3. Session Initiation Protocol (SIP)

The use of SDP with SIP follows the offer/answer model and is described in [6]. It is key to the (efficiency of the) offer/answer model that a complete capability exchange and media stream instantiation be carried out in one round-trip -- which is supported by SDP. While SDPng allows to separate capability exchange from media session instantiation, those two pieces are also easily integrated in a single step.

SIP also uses a Content-Type: header to indicate the nature of data carried in its message body; and SIP explicitly calls for supporting MIME multipart message bodies. While, again, the use of MIME multipart/alternative would in principle be possible (from a theoretical perspective), issues regarding the actual implementation of multipart/alternative in SIP entities have been raised. As backward compatibility has to be achieved, a different approach is suggested:

A SIP UAC MAY use an SDPng message body in a SIP INVITE (or other) message. If the SIP UAS does not support SDPng, it will return a "415 Unsupported Media Type" response to the UAC and indicate acceptable content types in the Accept: header (probably including "application/sdp"). The SIP UAC MUST then retry INVITE (or other) message using the indicated session description language. The SIP UAC SHOULD cache knowledge about which peers did not understand SDPng as session description formats for a limited amount of time (e.g. several days) so that extra round-trips for session setup are only incurred infrequently. Whenever a peer has sent an SDPng description (or it is known from other means that the peer supports SDPng), this information SHOULD also be cached.

The SIP Accept: header can be exploited to determine the capability of a peer to understand SDPng in addition (or instead) plain SDP. Methods such as OPTIONS MAY be used to determine a peer's support for SDPng. However, a peer's capabilities may not be known when the first message is sent which may introduce an extra round-trip if including SDP and SDPng in the initial INVITE message is not an option. Further approaches to make a UA's support for SDPng known ahead of time should be explored.

A number of SDP extensions have been motivated by SIP-based applications and these need to be accommodated in SDPng as well. Features such as "simcap" and "FID" are inherently supported by

SDPng; proper definitions for connection-oriented media need to be fully understood and then incorporated. Key management attributes as defined in [11] need to be included (not just for SIP) and so may need to be general mechanisms to signal security capabilities [11] [15] and indicate their optional or mandatory use. The same applies to quality of service parameters [13] (which are largely also motivated by SIP but are also useful with control protocols).

Numerous extensions to SDP have been developed for the purpose of supporting certain SIP requirements -- actually most of those listed in [section 1](#). fall into this category. The following paragraphs address how those are handled by and mapped to SDPng.

IPv6 is natively supported by SDPng. For other network protocols -- such as ATM and TDM, which have only come up in the context of MEGACO, see below -- similar SDPng packages need to be defined that provide the same information as the corresponding SDP extensions.

Support for connection-oriented media in general will be supported in SDPng using a similar parameterization. Support for SCTP will be equivalent to the approach taken for SDP as the parameters are comparable.

SDP's explicit RTP port number parameter (that helps with NAT traversal) is inherently available in the RTP transport specification of SDPng.

Media session identification is also provided by the SDPng spec by means of naming attributes in the potential as well as actual configurations. The "Session Attributes" section of SDPng is meant to provide meta-information about the media sessions such as grouping of lip synchronization, indicating streams semantics, etc. This section is also the place to express media "mixing" attributes as discussed in [14]. QoS parameterizations for SDPng are developed separately as package enhancements and are still under discussion.

Simultaneous capabilities are dealt with by the Constraints section of SDPng where restrictions across several components as well as within a single component can be expressed.

Security parameters have not yet been developed for the SDPng specification. The intention is to define a separate security package (similar to codec and transport definitions). Security parameters may be provided in the definition section for later reference from within the component specification or may be specified inline in a component.

Indicating permissible sources for unicast and particularly multicast media sessions is already covered in the basic SDPng transport

specification.

In summary, most of the newly developed SDP attributes and their usages have either been considered in the SDPng base specification

and the transport packages or will be added additional attributes or as separate packages.

Note that the above discussions are not just applicable to SIP but may be used in a broader scope (e.g. with RTSP or MEGACO).

4.4. Media Gateway Control Protocol (MEGACOP)

The MEGACO specification already supports two different encodings for capability and media stream descriptions: a text-based variant based upon (a modified) SDP and a binary representation of the same information set. MGCs are required to implement both encodings while MGs have the choice to pick either or both. Differentiation between the protocol encoding variants is done using different port numbers: 2944 for the text-based and 2945 for the binary encoding.

Unfortunately, within the text-based encoding, there is no means to differentiate several description formats. SDP messages are carried as an "octet string" without any type identifier. Defining a third port number for this further differentiation does not seem to be appropriate, particularly since the message encoding is still a text format.

The remaining means for distinction is that an SDP specification would start with a "v=0" line while an SDPng document would begin with an "<sdpng" part.

[Editor's Note: MEGACOP also supports a binary encoding for SDP messages; current practice seems to favor the text encoding for SDP and hence we will not address the binary encoding.]

Within the context of MEGACO, various extensions to SDP have been defined, addressing its use for capability description and also defining support for further network types (presently, ATM and TDM). Capability descriptions are inherently supported by SDPng. To add support for further networks, the respective parameters need to be defined as network-specific SDNng packages.

5. SDPng and Middleboxes

Middleboxes (e.g. firewalls, NATs, NAPT's) are of significant importance for many deployment scenarios for SDP-based signaling protocols. The SDP description typically carries addressing parameters for media sessions which may be invalidated by middleboxes: by firewalls because they block packet destined at the respective addresses and by NA(P)Ts because they change the addresses that must actually be used.

A number of approaches have been devised to deal with currently deployed and, eventually, future middleboxes: 1) co-locating a proxy

for the respective signaling protocol(s) with a middlebox, 2) using extra protocols to determine the presence and the mode of operation of a NA(P)T (which does not work for firewalls), and 3) the

definition of a control protocol for middleboxes. While approach 1) is entirely up to the manufacturers of middleboxes, 2) and 3) are subject to IETF standardization in the MIDCOM WG.

- 1) Proxies that are incorporated in middleboxes to parse and (in case of NATs) possibly alter the contents of session descriptions exchanged in the signaling path will need to implement SDPng in the future. For a (potentially long) interim period, both SDP and SDPng need to be supported by such devices.
- 2) If entities involved in the respective signaling path use MIDCOM protocols (such as STUN) to determine the presence of a NAT and its mode of operation, it is up to these entities to include the correct addressing information in the SDP or SDPng session descriptions. NATs continue to operate as before and do not require any changes because of a migration from SDP to SDPng.
- 3) If local signaling servers or other entities use a MIDCOM protocol to configure a firewall or NAT to allow certain media streams to pass through, again, no changes need to be made to MIDCOM-enabled firewalls. The migration from SDP to SDPng is transparent to them; only the involved signaling component need to support -- but they would need to do so anyway.

6. Directing the Evolution of SDP

With the transition from SDP to SDPng, there is the question of the evolution of SDP, and legacy systems which use it.

The SDP specification [[1](#)] is stable, and mostly corrects errors in the original specification, with the addition of very few new features. The revision is expected to be published as a proposed standard RFC shortly, obsoleting [RFC 2327](#).

A number of extensions to SDP for use in offer/answer scenarios are also available. These include grouping [[4](#)] and capability negotiation [[5](#)], which have recently been approved as proposed standard RFCs, bringing minimal capability/alternative descriptions to SDP.

Related is the SDP offer/answer model for SDP, published as [RFC3264](#) [[6](#)]. This defines the model used to complete the steps of a negotiation using SDP. A similar mode of operation will be provided for SDPng for baseline operation with SIP (and possibly RTSP).

All these are subsumed into SDPng, so there should be no further need for development in these areas; applications with requirements that are not met by these specifications should use SDPng.

There have recently been proposals to add quality of service negotiation for SDP and, similarly, we expect other extensions to be

proposed over time. Due to the well-known limitations of SDP, we do not believe it appropriate to continue development of more elaborate extensions: for negotiation, for QoS, for security, and for other

general-purpose or application-specific needs.

The exceptions to this rule are clearly the addition of security features to SDP (which are required for many current SDP deployment scenarios) as well as minor extensions for media session attributes (e.g. indicating the use of joint vs. separate resource reservations as documented in [17]).

Overall, new work should be done in the framework of SDPng where applications and their requirements for (new) expressiveness in end-to-end exchanges to negotiate and configure media sessions will hopefully act as a driver for that process.

7. IANA Considerations

The transition from SDP to SDPng will require IANA to define new parameter registries, which will be created and populated as SDPng evolves. This memo does not, in itself, require any action by IANA.

8. Security Considerations

Since SDPng performs largely the same role as SDP+extensions, it is not expected that there will be significant new security considerations as a result of the transition. The security considerations section of [2] provides further details.

During the transition process it is likely that dual descriptions will be common. There is a potential for inconsistency between definitions, which may have unintended consequences if one part of the system, for example a middlebox, interprets the SDP format whilst another interprets the SDPng format definition.

9. Author's Addresses

Joerg Ott <jo@tzi.org>
Universitaet Bremen
MZH 5180
Bibliothekstr. 1
D-28359 Bremen
Germany
tel:+49-421-201-7028
sip:jo@tzi.org

Colin Perkins <csp@csp Perkins.org>
USC Information Sciences Institute
3811 North Fairfax Drive, Suite 200
Arlington, VA 22203
USA

tel:+1-703-812-3705

Ott/Perkins

[Page 13]

10. References

- [1] Mark Handley, Van Jacobson, Colin Perkins, "SDP: Session Description Protocol," Internet Draft [draft-ietf-mmusic-sdp-new-11.txt](#), Work in Progress, November 2002.
- [2] Dirk Kutscher, Joerg Ott, Carsten Bormann, "Session Description and Capability Negotiation", Internet Draft [draft-ietf-mmusic-sdpng-05.txt](#), Work in Progress, July 2002.

For SDP, numerous additional documents need to be taken into account:

- [3] 3108 R. Kumar and M. Mostafa, "Conventions for the use of the Session Description Protocol (SDP) for ATM Bearer Connections," [RFC 3108](#), May 2001.
- [4] Gonzalo Camarillo, Jan Holler, Goran AP Eriksson, Henning Schulzrinne, "Grouping of media lines in SDP," Internet Draft [draft-ietf-mmusic-fid-06.txt](#), Work in Progress, February 2002.
- [5] F. Andreasen, "SDP Simple Capability Declaration," [RFC 3407](#), October 2002.
- [6] Jonathan Rosenberg and Henning Schulzrinne, "An Offer/Answer Model with SDP," [RFC 3264](#), June 2002.
- [7] Robert Fairlie-Cuninghame, "Guidelines for specifying SCTP-based media transport using SDP," Internet Draft [draft-fairlie-mmusic-sdp-sctp-00.txt](#), Work in Progress, May 2001.
- [8] David Yon, "Connection-Oriented Media Transport in SDP," Internet Draft [draft-ietf-mmusic-sdp-comedia-04.txt](#), Work in Progress, July 2002.
- [9] Tom Taylor, "Conventions for the use of the Session Description Protocol (SDP) for Digital Circuit Connections," Internet Draft [draft-taylor-mmusic-sdp-tdm-01.txt](#), Work in Progress, April 2002.
- [10] Christian Huitema, "RTCP attribute in SDP," Internet Draft [draft-ietf-mmusic-sdp4nat-02.txt](#), Work in Progress, February 2002.
- [11] Jari Arkko, Elisabetta Carrarra, Fredrik Lindholm, Mats Naslund, and Karl Norrman, "Key Management Extensions for SDP and RTSP," Internet Draft [draft-ietf-mmusic-kmgmt-ext-05.txt](#), Work in Progress, June 2002.
- [12] Sean Olson, Gonzalo Camarillo, Adam Roach,

- [13] G. Camarillo (ed), W. Marshall (ed), J. Rosenberg, "Integration of Resource Management and SIP", Internet Draft [draft-ietf-sip-](#)

manyfolks-resource-03.txt, Work in Progress, November 2001.

- [14] G. Camarillo, H. Schulzrinne, and E. Burger, "The source and sink attributes for the Session Description Protocol", Internet Draft [draft-camarillo-mmusic-source-sink-00.txt](#), Work in Progress, September 2002.
- [15] Mark Baugher, "SDP Security Descriptions for Media Streams", Internet Draft [draft-baugher-mmusic-sdpmediasec-00.txt](#), Work in Progress, September 2002.
- [16] B. Quinn and R. Finlayson, "SDP Source-Filters", Internet Draft [draft-ietf-mmusic-sdp-srcfilter-01.txt](#), Work in Progress, July 2002.
- [17] G. Camarillo and A. Monrad, "Mapping of Media Streams to Resource Reservation Flows", Internet Draft [draft-ietf-mmusic-reservation-flows-00.txt](#), Work in Progress, October 2002.

11. Full Copyright Statement

Copyright (C) The Internet Society (2002). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

