

SIP Trunking Manual

For Samsung OfficeServ

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1. Introduction

1.1. Overview

This document is written in order to give guidelines to whom may operate SIP (Session Initiation Protocol) functions equipped in OfficeServ system made by Samsung Electronics. Readers of this document are assumed to have the minimum knowledge in operating OfficeServ system for example, basic MMC settings, OfficeServ system configuration and etc. By using this document, readers can be acquainted with basic knowledge on SIP, and be able to handle OfficeServ's SIP trunking functions. As this document is mainly focusing on SIP operation in OfficeServ system, readers who want to have in-depth understanding on SIP general, should refer to RFC3261.

SIP trunking functions in OfficeServ have two categories: Basic functions and Supplementary functions.

Table 1. SIP Trunking Functions in OfficeServ System

Basic Functions	Supplementary Functions
<ul style="list-style-type: none"> • Registration • Basic Call Setup 	<ul style="list-style-type: none"> • Hold/Resume • Music on Hold • Consultation Call • Transfer (Consultation/Blind) • Call Waiting • Call Pickup • Call Forward (All/Busy/No-Answer) • Conference • Call Park • DND

Basic SIP trunking functions in OfficeServ were implemented based on SIP standard, and thus they have been working fine with other SIP user terminals or servers. However, SIP supplementary service functions were developed and tested mainly using BroadSoft Inc's Soft Switch (namely SIP server), and thus there may be some compatibility problems when interoperating with other SIP servers made by different vendors. Any incompatibility issue reports or suggestions will be counted on to make better OfficeServ SIP functions.

For now, this document deals with basic functions only. (Note: More detailed description for SIP supplementary functions in OfficeServ system will be included in the next release of this document.)

1.1.1. MCP S/W Version

SIP functions handled in this manual were featured from MCP v2.63 or later, therefore earlier versions of MCP S/W may not have the newly added SIP MMC options or different names for the same functions.

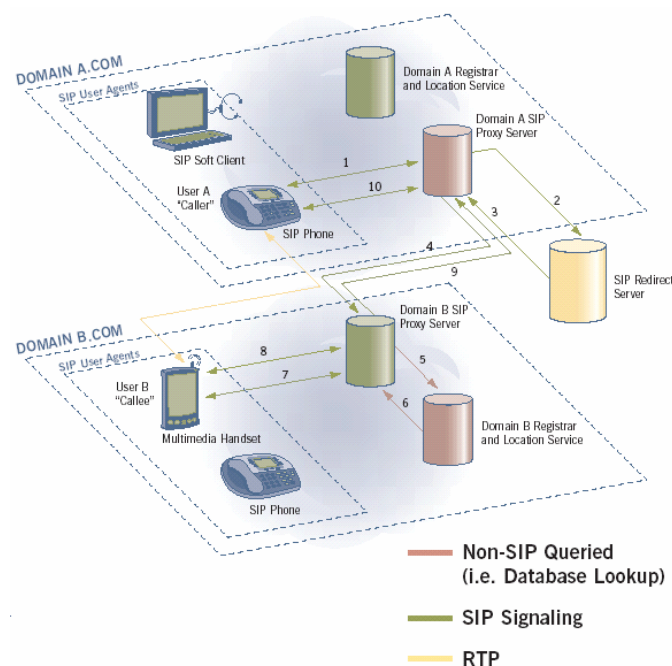
1.2. SIP (Session Initiation Protocol)

SIP is an application-layer control protocol that can establish, modify, and terminate multimedia sessions (conferences) such as Internet telephony calls. SIP can also invite participants to already existing sessions, such as multicast conferences. Media can be added to (and removed from) an existing session.

Standard SIP consists of mainly following 4 elements;

- **User Agent Client (UAC):** A user agent client is a logical entity that creates a new request. The role of UAC lasts only for the duration of that transaction. In other words, if a piece of software initiates a request, it acts as a UAC for the duration of that transaction. If it receives a request later, it assumes the role of a user agent server for the processing of that transaction.
- **User Agent Server (UAS):** A user agent server is a logical entity that generates a response to a SIP request. The response accepts, rejects, or redirects the request. This role lasts only for the duration of that transaction. In other words, if a piece of software responds to a request, it acts as a UAS for the duration of that transaction. If it generates a request later, it assumes the role of a user agent client for the processing of that transaction.
- **Registrar:** A registrar is a server that accepts REGISTER requests from UAC and places the information for location services.
- **SIP Server (or Proxy Server):** A server is a network element that receives requests in order to service them and sends back responses to those requests. Examples of servers are proxies, user agent servers, redirect servers, and registrars.

Figure 1. SIP Call Scenario



2. Registration

In IP telephony, to initiate a session from one UAC A to another UAC B, UAC A needs to know all the routing information such as UAC B's IP address and using port number and so on. Likewise, UAC B also needs to know UAC A's IP address and port number in order to have its response correctly delivered to UAC A.

SIP registration can be compared to registering email address. Let's take an example of sending and receiving an email through email server. When you want to send an email to your friend, each of you and your friend should have email address by which you can send and receive an email. As an email address needs to be registered to an email server, a SIP UAC has to be registered to SIP registrar. Therefore, registering a SIP UAC to a SIP registrar is like registering an email address to an email server. As in the case of email address, a registered UAC has its own URI-typed address called AOR or 'Address of Record'. (i.e., 2001@samsung.com)

Unlike email address, SIP UAC registration always comes with IP address to which SIP server can route SIP messages. This IP address is specified in 'Contact' header in SIP register message. In addition, each SIP registration has each expiration period for which its registration can be held valid. OfficeServ users can configure this expire time and it is set to 3600 seconds by default.

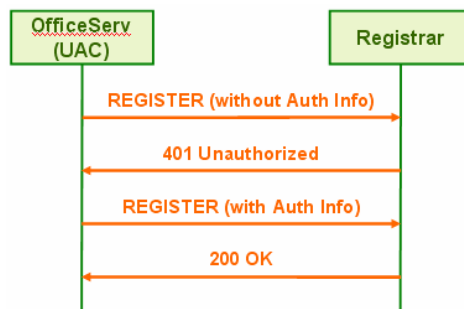
Finding a target UAC is done by co-work of SIP Proxy Server and Registrar. Once a SIP proxy received a message from sender UAC, then it will consult a SIP registrar to discover the location of the target UAC. However, in many cases, SIP proxy server and SIP registrar are implemented in a single SIP server. Therefore, in this document, we simply use a single term named 'SIP Server' to designate a server that has both registrar functions and proxy functions.

2.1. Registration Flow

Standard SIP registration procedure consists of 'Authentication' and 'Authorization'. Authentication is a UAC's request to SIP server for its identity verification, and authorization is a SIP server's confirmation on the authentication. Authentication and authorization are handled on a request-by-request basis with a challenge/response mechanism between UAC and SIP server.

These two processes are necessary for SIP server to allow only the valid UACs to join and play the game. Otherwise, there will be no way to prevent unauthorized SIP UAC from illegal system use.

Figure 2. Register Flow



As shown in above call flow, SIP registration process goes through 4 steps.

- i. UAC sends a Register message without authentication information.
- ii. SIP server gives back 401 response having authorization information.
- iii. Upon receiving a 401 response, UAC creates a Register message again which contains valid authentication information.
- iv. SIP server authorizes UAC's registration after confirming the authentication contained in the Register message.

2.2. Authentication and Authorization

Authentication and authorization are, in brief, about creating encryption value and matching the value between UAC and SIP server. This encryption value can be made from the composition of username, password, nonce values. Mean while username and password are shared by both UAC and SIP server, nonce value is created at SIP server side, and is transferred to UAC in 401 response message.

After receiving 401 response message, UAC creates an encryption value, using username, password and nonce as encryption seeds, and put it as 'response' parameter in the authorization header of the subsequent register message. If this response parameter value matches with an encryption value created by SIP server, SIP server finally authorizes the UAC's registration.

Among many authentication mechanisms, one of the most widely used is **MD5 digest algorithm**¹. This algorithm originated from HTTP's web authentication, which is normally used in logon processes of many web sites. The detailed explanation for the MD5 digest algorithm is beyond the scope of this document.

¹ By default, OfficeServ system uses MD5 digest algorithm. In 3GPP compatible environment, however, OfficeServ system switches to AKA algorithm for authentication. For now, this algorithm switch is done automatically depending on the value of vendor option in MMC837.

Although authentication and authorization are generally carried on normal registration flow in SIP, it is not a must. That is, some SIP Servers may not require UAC's authentication and instead, they may have simpler ways of filtering out invalid registration message. For example, they may check caller number; SIP Servers allow registrations with designated caller number only. Other example is that SIP Servers check domain name field in contact header in registration messages. More often than not, however, SIP Servers follow the recommended standard way of authentication and authorization procedure for security reasons.

2.3.Registration Types

There are two kinds of Registration. One is Individual Registration and the other is Representative Registration (or Trunk Registration). Though the latter is more widely used in industry, which one to use is totally depends on registrar's policy. In terms of UAC, it only needs to follow whichever registration method that SIP Registrar Requires, and OfficeServ system supports both of the registration methods. OfficeServ operator can specify registration type by selecting either 'Enable' or 'Disable' at 'REG PER USER' (or GW SERVICE at some earlier version of MCP) in MMC837. 'Enable' means Individual Registration and 'Disable' means Representative Registration.

2.3.2. Individual Registration

Individual Registration lets each individual user terminal attached to OfficeServ have its own registration data toward SIP server. This does not mean that each user terminal creates registration message and directly sends it to SIP server because many terminals other than 'SIP' terminals can not make SIP register message. So, OfficeServ creates each SIP message using pre-assigned registration information, and does the SIP registration process on behalf of each user terminal. Following shows the step by step Individual Registration.

i. Designate SIP Server.

First of all, OfficeServ should designate a valid SIP server to register to, and set the necessary data into its database as followings. Input data should be different according to the target SIP server.

```
MMC837: SIP SERVER
SIP SERVER ENABLE: Enable
SIP SERVER IP: 203.254.210.1
REG PER USER(or GW SERVICE): Enable (Individual Registration)
GW DOMAIN NAME: SAMSUNG070.COM (If not required, leave blank)
REG EXPIRE TIME: 3600
```

ii. Decide which user terminal uses which registration number and password.

A pair of registration number and password is normally pre-defined in SIP server and assigned onto OfficeServ. Let's assume that OfficeServ is assigned following two pairs of registration data from SIP server. Then, OfficeServ operator should store this data into database using MMC as below. The maximum number of the pair of individual registration data that OfficeServ can have is 100 (0~99).

MMC839: SIP USER
REG-01 USER NUM: 07070154610
REG-01 USER PASSWORD: 147369
REG-02 USER NUM: 07070154611
REG-02 USER PASSWORD: 147368

iii. Restart system. (Automatic)

After finishing storing new data in MMC839, OfficeServ automatically restarts SIP task to apply database modification. It takes approximately 10 seconds to restart.

2.3.3. Representative Registration

Representative Registration (or Trunk Registration) means that OfficeServ system does a single registration, which is shared by all the end user terminals attached to the OfficeServ. In this representative registration, end user terminal does not have to concern about its own registration.

Following are the sample MMC settings for Representative Registration. (Note: Unlike Individual Registration, Representative Registration uses a single pair of username and password data, which are stored into MMC837.)

i. Designate SIP Server.

First of all, OfficeServ should designate a valid SIP server to register to and set the necessary data into its database as followings. Input data should be different according to the target SIP server.

MMC837: SIP SERVER
SIP SERVER ENABLE: Enable
SIP SERVER IP: 203.254.210.1
REG PER USER(or GW SERVICE): Disable (Representative Registration)
GW DOMAIN NAME: SAMSUNG070.COM (If not required, leave blank)
REGIST T-GW NUM: 07070154610
REGISTER PSWD: 147369
REG EXPIRE TIME: 3600

ii. Restart system. (Automatic)

After finishing storing new data in MMC837, OfficeServ automatically restarts SIP task to apply database modification. It takes approximately 10 seconds to restart.

2.4. Other Options for Registration

2.4.4. Vendor Option

Vendor option is to specify a certain SIP Server made by a certain Vendor. Each SIP Server made by each different vendor has mostly same but slightly different specification for message formats, authentication algorithm, and call flows and etc. For this reason, OfficeServ reacts differently for each different SIP Server, and thus we

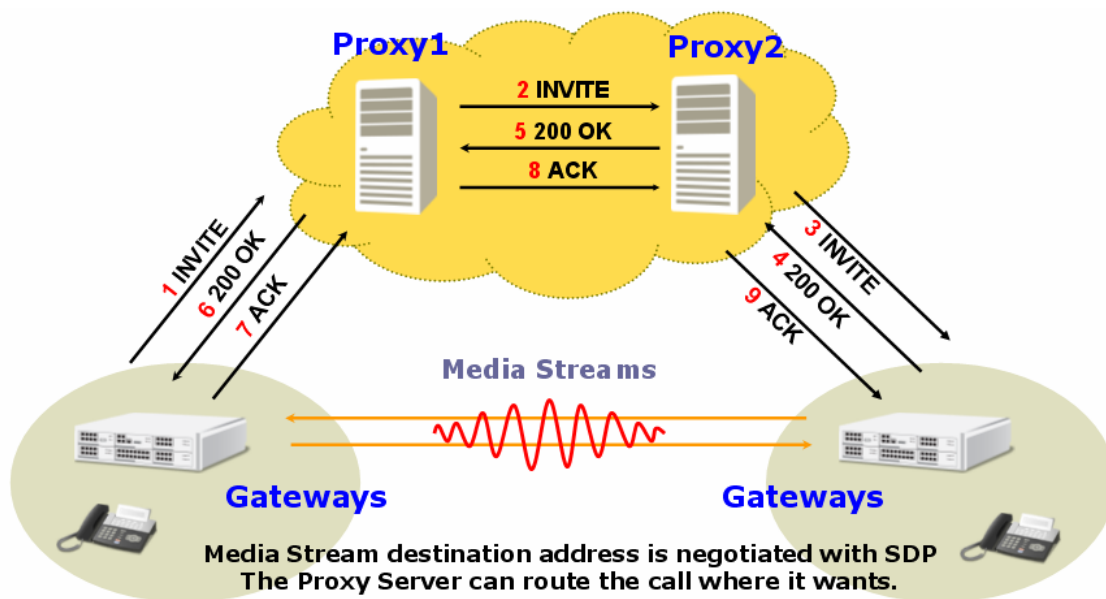
have the vendor option to specify a sip server vendor with which OfficeServ system has to interoperate.

3. Basic SIP Call

3.1. Basic Call Flow

Following figure shows a basic call flow in SIP when using 2 proxy servers. As shown in the figure, OfficeServ systems are acting as an UAC, and proxy servers have registrar server role as well. OfficeServ's SIP Basic Call Flow is fully compliant with RFC3261.

Figure 3. Basic SIP Call Flow



3.2. Making a SIP Call

When registering is done, OfficeServ is now ready to handle outbound/inbound SIP calls. To make a SIP outbound call from a user terminal, follow step by step instruction.

i. Assign valid registration data into corresponding user terminal.

Before making an actual SIP call, each registered SIP number should be mapped to internal user terminal number in OfficeServ. Otherwise, SIP server would not accept SIP outbound call which has internal user terminal's original internal number, and vice versa. Therefore, OfficeServ operator should make sure to map these numbers as following steps.

First, map the registration data for outbound call. Second, map the registration data for inbound call. For example, a user terminal number of 2001 and 2002 can be mapped to a registration number of 07070154610 and 07070154611 respectively as follows.

- Outbound Mapping between user terminal and registration number.

MMC323: SEND CLIP TABLE
2001: 07070154610
2002: 07070154611

- Inbound Mapping between user terminal and registration number.

MMC714: DID DIGIT
DGT 0707015610 1:2001
DGT 0707015611 1:2002

ii. Dial '805'.

This asks OfficeServ to assign any available SIP trunk channel. When successfully assigned, you can hear dial tone.

iii. Dial target SIP UAC number and push # button.

Attaching '#' at the end of the target UAC number is to give a sign that dialing is now finished and send Outbound SIP INVITE message.