



## **How To Guide**

### **Generic Header Manipulation**

For the Ingate SIParators® and Firewalls using software release 4.9.0 or later.

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## Revision History:

Revision	Date	Author	Comments
1	2010-11-03	Scott Beer	
2	2010-11-16	SB and KES	First Release

# 1 Introduction

Contained within this Generic Header Manipulation feature is the ability to Add – Change – Remove “ANY” SIP Header. The purpose of this feature is to provide additional Interoperability features at the SIP Protocol Header level. Many IP-PBX, Service Providers, and overall SIP devices require the use of many different uses of various SIP Headers. There becomes an instant difference in one vendors deployment and another vendors deployment when it becomes advantageous for the Ingate to add in the additional SIP Header requirements.

This is done in Forward To type of fields at the following locations within the Ingate:

- 1) SIP Traffic – Dial Plan
  - a. Forward To – Reg Expr
- 2) SIP Traffic – Routing
  - a. User Routing – Forward To
  - b. Static Registrations – Forward To
- 3) SIP Trunk – Trunk 1-4 pages
  - a. Main Trunk Line – Username and Forward To
  - b. PBX Lines – Username and Forward To PBX Account
  - c. SIP Lines – Username and Forward To SIP Account

## SIP Traffic – Dial Plan

Forward To [\(Help\)](#)

Name	Subno.	Use This ...	... Or This			... Or This	Delete
		Account	Replacement URI	Port	Transport	Reg Expr	
Asterisk	1	16139630933@asterisk.ingate.com			-		<input type="checkbox"/>
Bandwidth.com	1	-			-	sip:+\$1@216.82.1	<input type="checkbox"/>
	2	-			-	sip:+\$1@216.82.1	<input type="checkbox"/>

## SIP Traffic – Routing

Administration Basic Configuration Network Rules and Relays SIP Services **SIP Traffic** Failover Virtual Private Networks Quality of Service Logging and Tools About

SIP Methods Filtering Local Registrar Authentication and Accounting SIP Accounts Dial Plan **Routing** SIP Status IDS/IPS Status SIP Test SIP Test Status

Static Registrations [\(Help\)](#)

Requests To User	User	sip/sips	Transport	Delete Row
username@sip.of	user@FQDN.com	sip	UDP	<input type="checkbox"/>

User Routing [\(Help\)](#)

User	Alias	Restrict Incoming Callers	Forward		Send To Voice Mail
			Action	To	
6038214571@209.249.3.100		No	Forward	11201@10.51.77.	
19284041133@72.5.80.155		No	Forward	9284041133@10.	
0288893690@apollo.engin.com.au		No	Forward	sip:\$(to.user)@10	
6783972184@sipconnect-fca.atl0.cbeyond.net		No	Forward	6783972184@10.	

## SIP Trunk – Trunk 1-4

Administration Basic Configuration Network Rules and Relays SIP Services SIP Traffic **SIP Trunks** Failover Virtual Private Networks Quality of Service Logging and Tools About

SIP Trunks **Trunk 1** Trunk 2 Trunk 3 Trunk 4

**Main Trunk Line**

No.	Reg	Used when not defined below	Outgoing			Authentication		Incoming		Ext.
			Display Name	Username	Identity	User ID	Password	Incoming Trunk Match	Forward to	
1	No						Change Password			

**PBX Lines**

No.	Reg	From PBX Number/User	Outgoing			Authentication		Incoming		Ext.	Delete Row
			Display Name	Username	Identity	User ID	Password	Incoming Trunk Match	Forward to PBX Account		
4	No						Change Password				<input type="checkbox"/>

Add new rows 1 rows.

**SIP Lines**

No.	Reg	From SIP Number/User	Outgoing			Authentication		Incoming		Ext.	Delete Row
			Display Name	Username	Identity	User ID	Password	Incoming Trunk Match	Forward to SIP Account		
2	No						Change Password				<input type="checkbox"/>

### Example of Generic Header Manipulation

For example, when a Service Provider requires the use of a P-Asserted-Identity Header and the IP-PBX is unable to provide this SIP Header, the Ingate can add in a P-Asserted-Identity Header. As seen here:

```
INVITE sip:6135551212@209.216.177.59:5060 SIP/2.0
Via: SIP/2.0/UDP 209.249.3.100:5060;branch=z9hG4bK9624349
To: <sip:6135551212@209.249.3.56:5060>
From: <sip:5035551111@209.249.3.100>;tag=3462103187-665679
Supported: timer, 100rel
Call-ID: 2165939-3462103187-665672@NXT02.broadvox.net
CSeq: 1 INVITE
Allow: INVITE, BYE, OPTIONS, CANCEL, ACK, REGISTER, PRACK, UPDATE
Max-Forwards: 69
Session-Expires: 3600;refresher=uac
Contact: <sip:5035551111@209.249.3.100:5060>
Content-Type: application/sdp
Content-Length: 249
```

The additional header changes to...

```
INVITE sip:6135551212@209.216.177.59:5060 SIP/2.0
Via: SIP/2.0/UDP 209.249.3.100:5060;branch=z9hG4bK9624349
To: <sip:6135551212@209.249.3.56:5060>
From: <sip:5035551111@209.249.3.100>;tag=3462103187-665679
Supported: timer, 100rel
Call-ID: 2165939-3462103187-665672@NXT02.broadvox.net
CSeq: 1 INVITE
Allow: INVITE, BYE, OPTIONS, CANCEL, ACK, REGISTER, PRACK, UPDATE
Max-Forwards: 69
Session-Expires: 3600;refresher=uac
Contact: <sip:5035551111@209.249.3.100:5060>
P-Asserted-Identity:<sip:5035551111@64.156.174.74:5060>
Content-Type: application/sdp
Content-Length: 249
```

## 2 Regular Expressions

SIP Traffic – Dial Plan – Forward To – Reg Expr, here you may enter expressions for the Dial Plan, used to define where and how the firewall should forward the request using the Dial Plan. You can also define a regular expression that refers to Reg Exp sub expressions on the corresponding row in the Matching Request-URI table.

Name	Use This ...					... Or This Reg Expr	Delete
	Prefix	Head	Tail	Min. Tail	Domain		
Inbound			-			sip:+1(.*)@12.12	<input type="checkbox"/>
Outbound			-			sip:(.*)@10.51.77	<input type="checkbox"/>

Sub expressions are numbered in the order of their starting parenthesis and referred to as \$number. In the expression, (sip:(.+)@ingate.com), which matches any Request-URI like sip:user@ingate.com, there are two referable sub expressions: sip:user, which is referred to as \$1, and user, which is referred to as \$2. You can always refer to the entire Request-URI with \$0, as long as the match in the Matching Request-URI table was made using a Reg Exp.

Name	Subno.	Use This ...			... Or This			Delete
		Account	Replacement URI	Port	Transport	... Or This Reg Expr		
Asterisk	1	16139630933@asterisk.ingate.com			-		<input type="checkbox"/>	
Bandwidth.com	1	-			-	sip:+\$1@216.82.1	<input type="checkbox"/>	
	2	-			-	sip:+\$1@216.82.1	<input type="checkbox"/>	

Similarly, in SIP Trunks – Trunk 1-4 – Main Trunk Lines/PBX Lines/SIP Lines - Incoming Trunk Match column and the Forward To column. The Incoming Trunk Match follows the same behavior as Matching Request URI, and the Forward To's follow the same rules as above. In the Incoming Trunk Match you may enter expressions for the R-URI, and in the Forward To you can define regular expressions that refer to the Incoming Trunk Match.

Administration											
SIP Trunks											
Main Trunk Line											
No.	Reg	Used when not defined below	Outgoing			Authentication		Incoming			
			Display Name	Username	Identity	User ID	Password	Incoming Trunk Match	Forward to	Ext.	
1	No						<a href="#">Change Password</a>				<input type="checkbox"/>
PBX Lines											
No.	Reg	From PBX Number/User	Outgoing			Authentication		Incoming			Delete Row
			Display Name	Username	Identity	User ID	Password	Incoming Trunk Match	Forward to PBX Account	Ext.	
4	No						<a href="#">Change Password</a>				<input type="checkbox"/>
Add new rows: 1 rows.											
SIP Lines											
No.	Reg	From SIP Number/User	Outgoing			Authentication		Incoming			Delete Row
			Display Name	Username	Identity	User ID	Password	Incoming Trunk Match	Forward to SIP Account	Ext.	
2	No						<a href="#">Change Password</a>				<input type="checkbox"/>

## 2.1.1 Examples of Basic Regular Expressions

Here are some basic examples of some standard Regular Expressions to be used in either Forward To column of the Dial Plan or SIP Trunk pages. (without the use of the Generic Header Manipulation)

### Using Proxy

```
sip:$1@192.168.1.1  
sip:$1@example.com
```

### Adding Port

```
sip:$1@192.168.1.1:5060  
sip:$1@example.com:5060
```

### Adding B2BUA

```
sip:$1@192.168.1.1;b2bua  
sip:$1@example.com;b2bua
```

### Adding Prefix

```
sip:+$1@192.168.1.1  
sip:+$1@example.com
```

### Adding Transport

```
sip:$1@192.168.1.1;transport=TCP  
sip:$1@example.com;transport=UDP
```

### Adding From Header

There are a number of additional variables that can be used with From Header replacement. Please consult HELP or Reference Manual for additional instructions.

```
sip:$1@192.168.1.1;from="sip:$(from.user)@1.2.3.4"  
sip:$1@example.com;from="sip:$(from.user)@1.2.3.4"
```

### Adding Any Combination

This is an example of adding Transport, Port, B2BUA and From Header

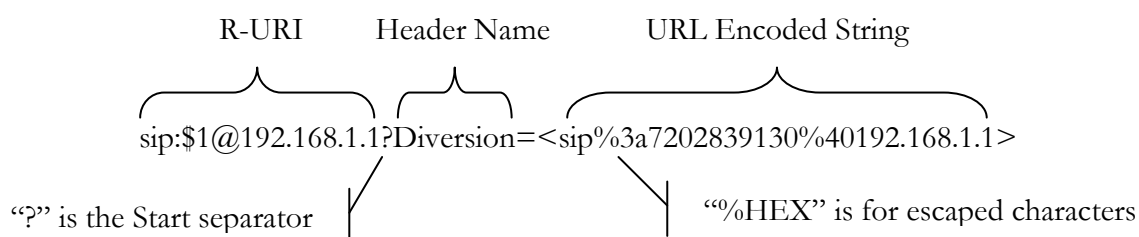
```
sip:$1@192.168.1.1:5060;transport=TCP;b2bua;from="sip:$(from.user)@1.2.3.4"  
sip:$1@example.com:5060;transport=TCP;b2bua;from="sip:$(from.user)@1.2.3.4"
```

### 3 Generic Header Manipulation

The Generic Header Manipulation feature has been added to the configuration using to Add/Change/Remove any SIP header to all SIP Requests passing through the Ingate SIParator now have the ability through configuration using the grammar for the header field component in a SIP URI using '?', '=', '%', and '&', as described in RFC 3261. Header fields for usage in SIP messages are put at the end of a SIP URI after a '?'. The header is written on the form header\_name=header\_value and additional headers are separated by a '&'. Within the Header Value, characters that not allowed in this header component (url encoded string) according to RFC 3261 must be escaped with %HEX construction where HEX is the 2-digit hexadecimal number representing the escaped character.

The headers are added at the end of the Regular Expression URI, and "?" is added in front as a separator. And "&" is used as a separator between headers if there are more than one. The header value needs to be url encoded, and a header can be removed by using a special value, "\_\_remove".

Example:



This Generic Header Manipulation feature is done within the context of the Regular Expressions found within the following locations within the Ingate:

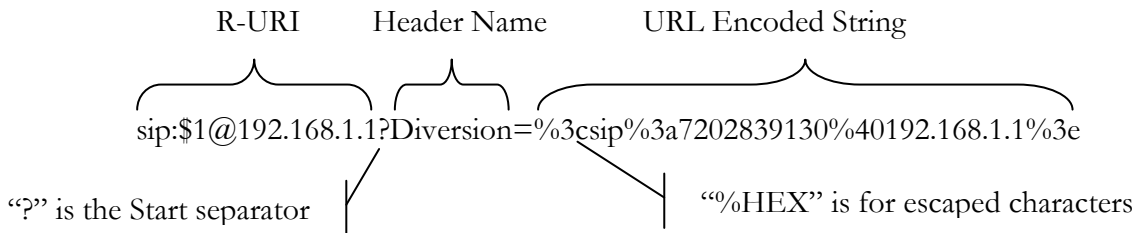
- 1) SIP Traffic – Dial Plan
  - a. Forward To – Reg Expr
- 2) SIP Traffic – Routing
  - a. User Routing – Forward To
  - b. Static Registrations – Forward To
- 3) SIP Trunk – Trunk 1-4 pages
  - a. Main Trunk Line – Username and Forward To
  - b. PBX Lines – Username and Forward To PBX Account
  - c. SIP Lines – Username and Forward To SIP Account

### 3.1 Adding or Replacing a Header

In the following section, if a specified header field is already present in the incoming SIP request, the header is replaced, if a specified header field is NOT present in the incoming SIP request, the header field is added.

Forward To <a href="#">(Help)</a>							
Name	Subno.	Use This ...	... Or This			... Or This	Delete
		Account	Replacement URI	Port	Transport	Reg Expr	
+ Asterisk	1	16139630933@asterisk.ingate.com			-		<input type="checkbox"/>
+ Bandwidth.com	1	-			-	sip:+\$1@216.82.4	<input type="checkbox"/>
	2	-			-	sip:+\$1@216.82.4	<input type="checkbox"/>

In the Regular Expression field, after the URI ([sip:\\$1@Host\\_Domian](#)), a ‘?’ separator is added to indicate the start of the Generic Header Manipulation feature. Then the Header Name is identified, then a ‘=’ is used to indicate what the Header Value will be, then the Header Value is provided as a URL Encoded String. Any addition Headers needed are separated with a ‘&’. As seen here.



### Adding and Replacing Header Examples

#### Add P-Assert Identity Header

```
sip:$1@192.168.1.1?P-Asserted-Identity=<url_encoded_string>
sip:$1@example.com?P-Asserted-Identity=<url_encoded_string>
```

#### Adding Privacy Header

```
sip:$1@192.168.1.1?Privacy=<url_encoded_string>
sip:$1@example.com?Privacy=<url_encoded_string>
```

#### Adding Diversion Header

```
sip:$1@192.168.1.1?Diversion=<url_encoded_string>
sip:$1@example.com?Diversion=<url_encoded_string>
```

#### Adding Multiple Headers

```
sip:$1@192.168.1.1?P-Asserted-Identity=<url_encoded>&Diversion=<url_encoded>
sip:$1@example.com?P-Asserted-Identity=<url_encoded>&Diversion=<url_encoded>
```

#### Used in conjunction with Current 4.8.1 Features

```
sip:$1@192.168.1.1;b2bua;from="Anonymous@10.182.0.178"?P-Asserted-Identity=<url_encoded_string>&Privacy=id
```

### 3.1.1 Header Value (URL Encoded Strings)

Knowledge of specific header values are beneficial in understanding how to write the string value for the specific header name. RFC 3261 states within the Header Value characters that not allowed in this header component (url encoded string). These characters must be escaped with %HEX construction where HEX is the 2-digit hexadecimal number representing the escaped character.

Some examples for escaped ASCII characters commonly needed:

Character	HEX Value
@	%40
:	%3a
;	%3b
,	%2c
<	%3c
>	%3e
Spaces	+

### Examples of Header Value

As seen in the “Adding Header Examples”, replace <url\_encoded\_string> with the new header value. The user and host can be changed as needed. The < > are required under some conditions. Refer to RFC 3261 section 20.10.

#### Add P-Assert Identity Header

```
sip:$1@192.168.1.1?P-Asserted-Identity=%3csip%3a7202839130%40192.168.1.1%3e
```

```
sip:$1@192.168.1.1?P-Asserted-Identity=%3csip%3a7202839130%40example.com%3e
```

#### Adding Diversion Header

```
sip:$1@192.168.1.1?Diversion=%3csip%3a7202839130%40192.168.1.1%3e
```

```
sip:$1@example.com?Diversion=%3csip%3a7202839130%40192.168.1.1%3e
```

### 3.1.2 Variable Substitution in the Header Value

The Ingate stores a range of variables from other more standard headers. These variables can be used to move specific values from other headers into the Header Value (URL Encoded String). Here is a list of variables that can be used for substitution:

```
ruri.user = User part from Request-URI
ruri.host = Host part from Request-URI
to.user = User part from To Header
to.host = Host part from To Header
from.user = User part from From Header
from.host = Host part from From Header
pcpid.user = User part from P-Called-Party-ID Header
pcpid.host = Host part from P-Called-Party-ID Header
rawhdr.<header name> = For any specified header
header_name.user = User part of SIP URI of header "header_name".
header_name.host = Host part of SIP URI of header "header_name".
hdr.header_name = The complete header value of header "header_name".
hdr.header_name[2] = The complete header value of 2nd occurrence of header
"header_name".
ip.<interface> = The IP address of network interface "eth1", example: " ip.eth1 "
```

These variables are added by indicating a \$(variable) into the Header Value.

### Examples of Header Value

#### Add P-Assert Identity Header

```
sip:$1@192.168.1.1?P-Asserted-Identity=%3csip%3a$(from.user)%40192.168.1.1%3e
sip:$1@192.168.1.1?P-Asserted-Identity=%3csip%3a$(from.user)%40example.com%3e
```

#### Adding Diversion Header

```
sip:$1@192.168.1.1?Diversion=%3csip%3a$(from.user)%40192.168.1.1%3e
sip:$1@example.com?Diversion=%3csip%3a$(from.user)%40192.168.1.1%3e
```

## 3.2 Multiple Occurrences and Replacing Only

Another feature available is that header fields can be indexed using angle brackets so that one can refer to the n:th occurrence of a certain header. The variables listed above in the Variable Substitution can be indexed with angle brackets [x].

In the following section with the use of Indexing, if a specified header field is already present in the incoming SIP request, the header is replaced, if a specified header field is NOT present in the incoming SIP request, the header field is NOT added. When indexing headers, only replacement operations will be performed if the header exists in the message, no headers will be added. Use a '\*' as index to refer to all header fields with same name.

If a variable is unknown or does not exist in a message, the specific header that was subject for modification will be left untouched.

Breakout Example:

```
sip:$1@example.com
?User-Agent=$(hdr.user-agent)
&Contact=sip:foo%40$(ip.eth4)%3buser%3dphone
&Organization=mycompany
&Privacy=__remove
&Diversion[1]=sip:$(diversion[1].user)%401.1.1.1
```

Explanation of each Reg Expr component:

**sip:\$1@example.com**

This is the Request URI, \$1 is to use the first variable from the Matching Request URI field in the SIP Traffic – Dial Plan page.

**?User-Agent=\$(hdr.user-agent)**

The User-Agent header will be kept unchanged (the Ingate will change User-Agent to the Ingate when in B2BUA)

**&Contact=sip:foo%40\$(ip.eth4)%3buser%3dphone**

Assuming the IP address of eth4 is 1.2.3.4, the Contact Header is replaced with  
Contact: sip:foo@1.2.3.4;user=phone

**&Organization=mycompany**

The header Organization is added as Organization: mycompany

**&Privacy=\_\_remove**

Here the Privacy header field will be removed.

**&Diversion[1]=sip:\$(diversion[1].user)%401.1.1.1**

IF (and only IF) a Diversion header exists, the domain/host part of it will be replaced with 1.1.1.1.

### **3.3 Removing a Header Name**

Any Header can also be removed from the SIP Request. This is done by starting with the Generic Header Manipulation separator ‘?’ , then define the Header Name to be removed, followed by a ‘=’, the \_\_remove. (two underscores, then “remove”)

#### **Examples of Header Value**

##### **Removing Privacy Header**

sip:\$1@192.168.1.1?Privacy=\_\_remove

sip:\$1@example.com?Privacy=\_\_remove

sip:\$(ruri.user)@\$(ruri.host)?Privacy=\_\_remove