
InnoMedia ESBC SIP Header Manipulation Rules

An InnoMedia Application Note

October, 2013

To find out more about InnoMedia, visit us at www.innomedia.com

Table of Contents

Introduction	4
SHMR Structure.....	5
Header Rules.....	5
Header Rule Example.....	6
Element Rules	7
Example of elements in a SIP message	8
SIP Header Parsing Groups	8
Variable values always start with \$.....	9
Examples for the change-to-value fields:	9
The usage of escape character (backslash \) in “equal-value” and “change-to-value”	9
Setting the Match Value	10
Example 1: Store element components and display them	11
Example 2: Substituting an existing parameter and adding a new one	12
Guidelines for Header and Element Rules	13
Multiple headers of the same matching type.....	14
Regular Expressions	14
Escaped character set	15
Back Reference Syntax.....	16
Examples of Back Reference	16
Referencing Rule Values	16
Example 3: Removing headers.....	16
Example 5: Manipulating a Header.....	18
Example 6: Storing and Using Header Parameters	19
Example 7: Manipulating the Display Name	21
Example 8: Manipulating Element Parameters	22
Example 9: Accessing Data from Multiple Headers of the Same Type	24
Status-Line Value Matching and Manipulation.....	27
Setting the Header Name	27
Setting the Element Type.....	27
Example 10: Remove + sign from the P-Associated-URI.....	27
Example 11: Adding Contact Header to 180 and/or 183	28
Manipulating MIME Types in SIP Message Bodies	30
Setting the header-rule.....	30
Setting the element-rule.....	30
Example 12: Removing lines from SDP.	30
Example 13: Change and Remove Lines from SDP	32

Processing SHMR Rule Set: 34
Example 14: Resolving IOT with ICE-enabled devices in hosted services: Removing ICE attributes
from the SDP in INVITE and 183..... 34



INTRODUCTION

One of the fundamental problems experienced by operators wishing to deploy voice services to enterprise customers that have existing SIP-based IP-PBX's is that of SIP incompatibilities and interoperability issues between the operator's SIP servers and the enterprise's SIP-PBX. This problem is exacerbated by the fact that the SIP protocol is quite 'loose' due to standards proliferation with often multiple RFC's providing similar features. In addition, different features are sometimes supported on different devices and individual implementation differences can also cause problems.

For the operator, they have a number of choices to deal with this problem. They can restrict rollout to only those customers with 'approved' enterprise equipment – but this of course limits their addressable customer base. Another choice is to tailor key elements in their network such as a core SBC to interoperate with dozens of different makes and models of PBX's. This can be very cumbersome and costly both in terms of manpower and time.

The InnoMedia ESBC addresses the problem of SIP incompatibility through a variety of different methods:

1. By providing SIP-PBX and Trunk SIP profiles which allow the operator to simply select the appropriate choices on the LAN and WAN sides of the device and the ESBC is then responsible for providing SIP interoperability between both sides.
2. In addition, the characteristics of each of these profiles can be edited via the GUI to tweak parameters in order to provide the operator with greater granularity in ensuring interoperability, or to modify operational behaviour. These parameters include registration modes, SIP timers, SIP header usage and formats, security features etc.
3. SIP Error Response codes can be mapped both in the LAN \Rightarrow WAN and WAN \Rightarrow LAN directions
4. To provide even finer control of SIP messages traversing through the device, the InnoMedia ESBC allows the user to create SIP Header Manipulation Rules (SHMR).

The SHMR function is the focus of this document. It consists of a sophisticated scripting language that can be used to create scripts that modify SIP message contents both at the LAN/WAN ingress and egress in the following directions:

- ESBC WAN interface, inbound
- ESBC WAN interface, outbound
- ESBC LAN interface (NAT-Voice port), inbound
- ESBC LAN interface (NAT-Voice port), outbound

SHMR can be used to modify SIP headers, parameters as well as SDP contents. Regular expressions also allow complex matching rules to be constructed. Another feature of the SHMR function is multi-level programmability which enables rules to reference each other and pass parameters between them.



This document discusses the structure of the SHMR scripting language by describing the rules available as well as the regular expressions that can be used within these rules. The descriptions are augmented through the use of numerous examples which offer context to the discussions as well as providing sample scripts which can be used as a starting point for developing the customer's own SHMR rules.

SHMR STRUCTURE

The following constructs can be used within SHMR scripts:

- Objects: headers and header elements. (Headers are SIP headers, and header elements include all subparts of a header, such as header values, header parameters, and URI parameters)
- Rules: header rules and element rules
- Processes
- Regular expressions for matching and giving a new value to an object.

Header Rules

Parameters	Value	Descriptions
header-rule		
name	user-defined	Name of this header-rule
sip-method	INVITE, REGISTER, ACK, etc.	SIP method to match for this rule
sip-header	To, From, ...	The name of the header to which this rule applies. The name that is entered here must match a header name.
	@status-line	For sip response only
	request-uri	For request URI only
message	request	sip request message type
	reply	sip reply message type, such as 1xx, 2xx,...
	any	Either request or reply message types
process	add	Adding a new header.
	delete	Deleting an existing header
	manipulate	Element of this header will be manipulated according to the element rules configured
	store	Storing the result
	none	No process, the default value.
	sip-manip	Processing SHMR rule set, with one SIP manipulation subroutine executing another SIP manipulation subroutine.
equal-value		The value to be matched with the header value.
change-to-value		The new value to be assigned to the header value.

Header Rule Example

This rule stores parts of a User-Agent header within an INVITE message for later use.

```

sip-manipulation
name    modCustomHdr
       header-rule
           name            UserAgentSearch
           message         request
           sip-method      INVITE
           sip-header      User-Agent
           equal-value     "(ESBC9380-4B-) (.+)"
                               ## back reference and regular expression
           process         store
           change-to-value

```

```

INVITE sip:14084321021@10.20.7.77 SIP/2.0
Via: SIP/2.0/UDP 10.20.40.146:5060;branch=z9hG4bK-d8754z-452905411f61a2bf-1---
d8754z-;rport
Max-Forwards: 70
Contact: <sip:9193824001@10.20.40.146:5060>
To: <sip:14084321021@10.20.7.77>
From: "9193824001"<sip:9193824001@10.20.7.77>;tag=7b525ef2
Call-ID: ODgxYmFmNzE2NjMxYzIwOTVlOWQyN2YxNTdlNGY2YTU.
CSeq: 1 INVITE
Session-Expires: 1800
Min-SE: 90
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, REFER, REGISTER, SUBSCRIBE, INFO,
PRACK, UPDATE
Content-Type: application/sdp
Supported: timer
User-Agent: ESBC9380-4B-2.0.12.40-Patch1
Privacy: none
P-Preferred-Identity: "9193824001"<sip:9193824001@10.20.7.77>;tag=7b525ef2
Content-Length: 237

```

Note:

- header value is the literal value "ESBC9380-4B-2.0.12.40-Patch1
- .+ regular expression. A match of any char, one or more times.

Element Rules

Element rules perform operations on the elements of a header. Header elements include all subparts of a header, excluding the header name.

Parameters	Value	Descriptions
element-name (name)	user-defined	Name of this element rule
element-parameter-name (parameter-name)	user-defined	
	application/sdp	Used for SDP messages
type	header-param	Parameter portion of the sip header
	header-value	Value of the header
	uri-display	Display portion of the header value
	uri-user	User portion of the sip URI
	uri-host	Host portion of the sip URI
	uri-port	Port number portion of the sip URI
	uri-param	Parameter of the sip URI
	status-code	Status code of the response line. String, ranging from 100-699. Used with sip reply messages.
process	mime	Used with SDP messages
	add	Adding a new element.
	substitute	Substituting the existing value with a new one.
	remove-element	Removing the specified element if it exists. Based on the equal-value if entered.
	remove-header	Removing the specified header, if it exists
	store	Storing the element.
equal-value	none	No action being taken. The default value.
	user-defined	The value to be matched against the element value. An expression can be entered that includes a combination of literal values, pre-defined variables and operators.
change-to-value	user-defined	An expression can be used that includes a combination of literal values, variables, and operators.

Note:

- 1 keyword "element-parameter-name" can be substituted with "parameter-name"
- 2 keyword "element-name" can be substituted with "name"

Example of elements in a SIP message

From: "UserDisplayName-4112"<sip:8263004112@172.16.1.212:5060;user=phone>;tag=5cb7678-0-13c4-6006-58760-2f19ffed-58760

Message element	of type	Value
From	sip-header	
"UserDisplayName-4112"	uri-display	
8263004112	uri-user	
172.16.1.212	uri-host	
5060	uri-port	
user	uri-param	phone
tag	header-param	5cb7678-0-13c4-6006-58760-2f19ffed-58760
"UserDisplayName-4112"<sip:8263004112@172.16.1.212:5060;user=phone>;tag=5cb7678-0-13c4-6006-58760-2f19ffed-58760	header-value	

SIP Header Parsing Groups

Group Name	Available Element Types	SIP Headers
Generic Group	header-value	Call-ID, Content-Encoding, Content-Length, Via, Subject, Authorization, WWW-Authenticate, Proxy-Authenticate, Authentication-Info, Record-Route, Route, Service-Route, History-Info, Diversion, Replaces, In-Reply-To, Warning, User-Agent, Server, Timestamp, Date
Content-Type Group	mime	Content-Type
Status Line Group	status-code	@status-line
Component Parsing Group	uri-display, uri-user, uri-host, uri-port, uri-param, header-param, header-value	Contact, From, To, P-Preferred-Identity, P-Asserted-Identity, Remote-Party-ID, request-uri, Refer-To, ...

Variable values always start with \$

Valid reserved variables are:

Parameter	Description
\$CRLF	SHMR resolves CRLF to /r/n
\$LOCAL_IP	IP address of the SIP interface on which the message was received for inbound manipulation; or sent out on for outbound manipulation.
\$REMOTE_IP	IP address the message was received from for inbound manipulations; or sent out to for outbound manipulation.
\$LOCAL_PORT	local UDP or TCP port value
\$REMOTE_PORT	far-end UDP or TCP port value

Operator	Description
+	Append the value to the end. For example: "esbc"+"shmr" generates "esbcshmr"
+^	Prepend the value. For example: "esbc"+^"shmr" generates "shmrresbc"
-	Subtract at the end. For example: "5623567"-567" generates "5623"
-^	Subtract at the beginning. For example: "5623567"-^56" generates "23567"

Examples for the change-to-value fields:

\$STRING+shmr

\$STRING+"the feature is shmr"

\$STRING+"the feature is \shmr\""

Note that \ is the escape character.

\$STRING-^567+^789

The usage of escape character (backslash \) in "equal-value" and "change-to-value"

Literal values can be used with double quotes to avoid confusion. It is necessary to escape all double quotes and back slashes that are part of a literal value, and enclose the literal value in double quotes. The SHMR quoting rules follows those of the Unix Shell.

For a text string or Regular Expression (RE) of "equal-value" and "change-to-value", the lexical analyzer uses **quoting** to remove the special meaning of certain reserved characters or words for SHMR:

1. Single quotes: enclosing characters in the single quotes preserves the literal value of each characters;
2. Double quotes: enclosing characters in the single quotes preserves the literal value of each characters, with the exception of character backslash\ which retains its special meaning when followed by \, ", "";

equal-value " (\\+) (8163001[0-9]{3}|8163006[0-9]{3}|8163009[0-9]{3}) "

```
change-to-value      "\+8163001000"
```

In the above example, the double quotes is used for RE for **equal-value**. One backslash \ before plus sign + is needed for PCRE, and the SHMR lexical analyzer needs another backslash \ for \+

For a simple regular expression of no variables, relationship or logical operations, it is suggested to use the single quotes for simplicity purpose.

Setting the Match Value

In SIP header and element rules, the **equal-value** parameter can be set with Boolean operators:

Boolean Operator	Description
&	And
	Or

SHMR evaluates these Boolean expressions from left to right, and does not support any grouping mechanisms that might change the order of evaluation.

For example:

Expression: A & B | C (where A=true, B=false, C=true).
 Result as follows: A & B = false; false | true = true.

SIP Message for Examples 1-7

```
INVITE sip:14084321021@172.16.100.220;calltype=01;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248834;rport=5060
Max-Forwards: 70
Contact: "UserName-001"<sip:9193824001@172.16.16.210:5060;transport=udp>;calltype=05
To: <sip:14084321021@172.16.100.220;user=phone>
From: "UserDisplayName"<sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Remote-Party-ID: "UserName"<sip:001@172.16.16.210:5060;transport=udp>;calltype=05
Call-ID: 11-3ff421b0-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Proprietary: A SIP UA is proprietary header
Privacy: none
Supported: replaces, path
User-Agent: SHMR-Test/v2.0 Enabled
P-Preferred-Identity: "UserName-001"<sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Content-Length: 266

v=0
o=- 535830960 535830960 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
m=audio 10000 RTP/AVP 18 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
```



Example 1: Store element components and display them

```
# Back reference syntax method is applied here. It will be described in later section.
# $<header rule name>.$<element rule name>.$<value>

sip-manipulation
  name                               StoreAndShowParameters
#####
  header-rule
    name                               FromHeader
    message                             request
    sip-method                           INVITE
    sip-header                           From
    equal-value
    change-to-value
    process                               store

  element-rule
    name                               StoreFromHeaderVal
    type                               header-value
    parameter-name
    equal-value
    change-to-value
    process                               store

  element-rule
    name                               StoreHeaderParam
    type                               header-param
    parameter-name                       tag
    equal-value
    change-to-value
    process                               store

  element-rule
    name                               StoreURIUser
    type                               uri-user
    parameter-name
    equal-value
    change-to-value
    process                               store

  element-rule
    name                               StoreURIHost
    type                               uri-host
    parameter-name
    equal-value
    process                               store
#####
  header-rule
    name                               ShowHeaderValue
    message                             request
    sip-method                           INVITE
    sip-header                           Show1
    equal-value
    change-to-value                       $FromHeader.$StoreFromHeaderVal.$0
    process                               add
#####
  header-rule
    name                               ShowElementValue
    message                             request
    sip-method                           INVITE
    sip-header                           Show2
    equal-value
    change-to-value                       $FromHeader.$StoreHeaderParam.$0
    process                               add

#####
  header-rule
    name                               ShowElementValue2
    message                             request
    sip-method                           INVITE
```



```

sip-header Show3
equal-value
change-to-value $FromHeader.$StoreURIUser.$0
process add
#####
header-rule
name ShowURI-Host
message request
sip-method INVITE
sip-header Show4
equal-value
change-to-value $FromHeader.$StoreURIHost.$0
process add
    
```

Result

```

INVITE sip:14084321021@172.16.100.220;calltype=01;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248834;rport=5060
Max-Forwards: 70
Contact: "UserName-001" <sip:9193824001@172.16.16.210:5060;transport=udp>;calltype=05
To: <sip:14084321021@172.16.100.220;user=phone>
From: "UserDisplayName" <sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Remote-Party-ID: "UserName" <sip:001@172.16.16.210:5060;transport=udp>;calltype=05
Call-ID: 11-3ff421b0-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Proprietary: A SIP UA is proprietary header
Privacy: none
Supported: replaces, path
User-Agent: SHMR-Test/v2.0 Enabled
P-Preferred-Identity: "UserName-001" <sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Content-Length: 258
Show1: "UserDisplayName" <sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Show2: AC1010D213C4-805E23E40
Show3: 9193824001
Show4: 172.16.100.220

v=0
o=- 535830960 535830960 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
m=audio 10000 RTP/AVP 18 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
    
```

Example 2: Substituting an existing parameter and adding a new one

```

#Example 2
#manipulate To header: change uri-param transport to tcp
#
#
#
sip-manipulation
name param-substitution

header-rule
name ContactManip
equal-value
message request
sip-method INVITE
sip-header Contact
equal-value
change-to-value
    
```



```

process                manipulate
element-rule
  name                 chgTransport
  type                 uri-param
  parameter-name       transport
  process              substitute
  equal-value
  change-to-value     "tcp"
element-rule
  name                 adduriparam
  type                 uri-param
  parameter-name user
  process              add
  equal-value
  change-to-value     "phone"
element-rule
  name                 addLANIP
  type                 header-param
  parameter-name       LAN-IP
  equal-value
  change-to-value     $LOCAL_IP
  process              add
    
```

In this example, if the IP address of the SIP interface (\$LOCAL_IP) is and the ESBC receives the following Contact header:

Result

```

INVITE sip:14084321021@172.16.100.220;calltype=01;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248834;rport=5060
Max-Forwards: 70
Contact: "UserName-001"
<sip:9193824001@172.16.16.210:5060;transport=tcp;user=phone>;calltype=05;LAN-IP=127.0.0.1
To: <sip:14084321021@172.16.100.220;user=phone>
From: "UserDisplayName" <sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Remote-Party-ID: "UserName" <sip:001@172.16.16.210:5060;transport=udp>;calltype=05
Call-ID: 11-3ff421b0-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Proprietary: A SIP UA is proprietary header
Privacy: none
Supported: replaces, path
User-Agent: SHMR-Test/v2.0 Enabled
P-Preferred-Identity: "UserName-001" <sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Content-Length: 259

v=0
o=- 535830960 535830960 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
m=audio 10000 RTP/AVP 18 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
    
```

Guidelines for Header and Element Rules

Each header rule and each element rule have a set of parameters that can be configured to identify the header parts to be manipulated and in what way they should be changed. The parameter that



can take regular expression values is **equal-value**. This parameter is used to define groupings that you want to store, match against and manipulate.

Generally, a header rule will be used to **store** what you want to match, and then subsequent rules will operate on this stored value. Because header rules and element rules are applied sequentially, it is important to note that a given rule performs its operations on the results of all the rules that are entered before it. For example, Rule 1 must be created with the process **store** for the Contact header before Rule 2 can use the stored value from the Contact header.

Header and element rules share the following guidelines:

- References to groupings that do not exist result in an empty string.
- References to an element rule name alone result in a Boolean check of whether the expression matched or not.

A maximum of ten matches are allowed for a regular expression. Match 0 (grouping 0) is always the match of the entire matching string; subsequent numbers are the results for other groups that match.

Multiple headers of the same matching type

If multiple headers exist of the same header name, the ESBC stores the value where they can be referenced with index value as the following syntax:

```
$<header-rule name>[index]
```

The first instance is indexed as 0, the second is as 1, and so on. If not specifying the index value, it applies to all headers of the same matching type.

Indexing characters	Description
~ or 0	The first stored header.
^	The last stored header
*	All stored headers

REGULAR EXPRESSIONS

SHMR uses regular expressions to provide the flexibility to dynamically search and edit headers for patterns.

Note: the ESBC SHMR users PCRE (PERL Compatible Regular Expressions) as the RE engine. To learn more about PCRE regular expressions, please visit the following web sites:

<http://www.regular-expressions.info/>

<http://en.wikipedia.org/wiki/PCRE>

Most characters are literal, ordinary characters and they present their actual value in the pattern. Some characters have a special meaning and they instruct the RE engine to treat the characters in designated ways. The following table describes these “metacharacters.”

Escaped character set

SHMR allows the user to search for values that cannot be entered directly.

Characters	Description
\f	form feed, 0x0C
\n	terminating lines (Windows uses \r\n; Unix uses \n)
\r	carriage return, 0x0D
\t	to match a tab character 0x09
\v	vertical tab, 0x0B
\d	any digit number, 0~9 any digit
\w	any letter, or digit, or underline, i.e., A~Z, a~z, 0~9, _

+ - + ^ - ^ & | \ () . \$^
“

Character	Name	Description
{ }	left brace right brace	Begins an interval range, ended with }. Identifying how many times the previous single chars or group in parentheses must repeat. <ul style="list-style-type: none"> {m, n} where the char/group must appear at least m up to n times. E.g., “ba{1,3}” is equivalent to “ba”, “baa”, or “baaa” {m} where the char/group must appear exact m times. E.g., “\w{2}” is equivalent to “\w\w”; a{5} is equivalent to “aaaaa” {m,} where the char/group must appear at least m times. E.g., “\w\d{2,}” is equivalent to “a12”, “_456”, or “M12344”...
.	dot	Matches any character, including a space. It will match one char, but there must be one char to match.
*	star	Matches zero or more preceding char (0, 1, or any number) of times. Equivalent to {0,}. Such as “\^*b” is equivalent to “b”, “^^^b”... Typically used with a dot in a format such as .* to indicate that a match for any character, 0 or more times.
+	plus	Matches one or more of the preceding character. Used for quantifications. Equivalent to {1,}. Such as “a+b” is equivalent to “ab”, “aab”, “aaab”... .+ a match for any char, 1 or more times.
?	question mark	The preceding char or group in parenthesis can appear not at all or only once.
^	caret	Acts as an anchor to represent the beginning of a string.
\$	dollar sign	Acts as an anchor to represent the end of a string.
[]	Left bracket Right bracket	One and only one of the chars in the bracketed class must appear for a match. A – (dash) in between to char designates a range. For example: [a5@] matching either “a” or “5” or “@” [a-z] is one of char in the range of the lower case alphabet letters. [^a-c0-3]: any char except “a” or “b” or “c”, “0” ~”3”



(left parenthesis	Creating a group. For example: "(sip+urp)-(u+rp)" is evaluated as "sip"
)	right parenthesis	

For example, SHMR treats the string `\+1688` as `+1688`. Note that it is also necessary to escape the escape character itself.

Back Reference Syntax

It is possible to use a back reference syntax in the change-to-value parameter for header and element rules, denoted by `$0`, `$1`, `$2`, etc.

Examples of Back Reference

Example 1:

Expression: `SIP(T)(.+)`
String: `SIPTrunk`
Matches: `$0` `SIPTrunk`
`$1` `T`
`$2` `runk`

Example 2:

Expression: `.*(;tgid=(.+)).*`
String: `sip:+14087892001@redlab.com;user=phone SIP/2.0; tgid=Trunk1`
Matches: `$0` `sip:+14087892001@redlab.com;user=phone SIP/2.0; tgid=Trunk1`
`$1` `;tgid=Trunk1`
`$2` `Trunk1`

Referencing Rule Values

Groupings can also be referenced in an element rule by using this syntax:
`<header rule name>.$<element rule name>.$<value>`

Example 3: Removing headers

```
# Example 3: removing and substitute headers
# 1. Removes the Proprietary header if it matches the pattern rule.
# 2. Stores the defined pattern rule for the privacy header.
# 3. Substitute the Privacy header value, if the pattern rule from above is a match.

sip-manipulation
  name removeHeader
  header-rule
    name          removeProprietary
    sip-header    Proprietary
    message       request
    sip-method    INVITE
    process       delete
    equal-value   "^A SIP UA.*"
    change-to-value
```



```

header-rule
  name          StorePrivacy
  sip-header    Privacy
  message       request
  sip-method    INVITE
  process       store
  equal-value   "^none (.+)"
  change-to-value

header-rule
  name          ChangePrivacy
  sip-header    Privacy
  message       request
  sip-method    INVITE
  process       manipulate
  equal-value   "$StorePrivacy"
  change-to-value

element-rule
  name          ChangePrivacyVal
  type          header-value
  parameter-name
  equal-value
  change-to-value  "yes"
  process        substitute

```

Result

```

INVITE sip:4808580112@10.10.0.5:5060;user=phone SIP/2.0;tgid=Trunk1
From: "UserDisplayName"<sip:8263004112@172.16.1.212:5060;user=phone>;tag=5cb7678-0-13c4-6006-58760-2f19ffed-58760
To: <sip:14808580112@172.19.113.220:5060>
Call-ID: 5c50df0-0-13c4-6006-58760-13b78457-58760
CSeq: 1 INVITE
Allow: INVITE, BYE, CANCEL, ACK, INFO, OPTIONS, SUBSCRIBE, NOTIFY, REFER, REGISTER, UPDATE
P-Preferred-Identity: "UserName-5400"<sip:8263005400@172.16.1.212:5060;user=phone>;tag=5cb7678-0-13c4-6006-58760-2f19ffed-58760
Diversion: "UserName-5400" <sip:8263005400@172.16.1.212:5060>;reason=user-busy; counter=3
Diversion: "UserName-5411" <sip:8263005411@172.16.1.213:5060>;reason=user-busy; counter=1
Privacy: yes
Max-Forwards: 70
Supported: timer, replaces, info
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
User-Agent: ESBC-9580-2.0.12.40
Via: SIP/2.0/UDP 172.19.113.212:5060;rport;branch=z9hG4bK-58760-1598cf54-5a209472-5cf7428
Contact: "UserName-5400"<sip:8263005400@172.16.1.212:5060;user=phone>
Session-Expires: 3600;refresher=uac
Content-Type: application/sdp
Content-Length: 180

```

Example 4: Manipulating the Request URI

```

# Example 4: Manipulating the Request URI
# (1) Storing the URI parameter calltype in the Request URI.
# (2) If the pattern matches, it adds a new header ShowCallType
#     profile) with the header value abstracted from calltype in the request URI.
# (3) Deleting calltype URI parameter if it matches the pattern

sip-manipulation
  name          ProcessCallType

  header-rule
    name          RequestURIHD
    message       request
    sip-method    INVITE
    sip-header    request-uri
    process       store
    comparison-type  pattern-rule
    equal-value
    change-to-value

  element-rule

```

	name	calltypeParam
	parameter-name	calltype
	type	uri-param
	process	store
	equal-value	"01"
	change-to-value	
header-rule	name	ChangeCallType
	message	request
	sip-method	INVITE
	sip-header	request-uri
	process	manipulate
	equal-value	
	change-to-value	
	element-rule	
	name	StoreParam
	parameter-name	calltype
	type	uri-param
	process	substitute
	equal-value	\$RequestURIHD.\$calltypeParam
	change-to-value	"05"
header-rule	name	addShowHD
	message	request
	sip-method	INVITE
	sip-header	ShowCallType
	process	add
	equal-value	\$RequestURIHD.\$calltypeParam
	change-to-value	\$RequestURIHD.\$calltypeParam.\$0

Result

```

INVITE sip:4089040515@108.92.17.175:5060;maddr=108.92.17.175;transport=udp SIP/2.0
From: "UserDisplayName" <sip:8263004112@172.16.1.212:5060;user=phone>;tag=5cb7678-0-13c4-6006-58760-2f19ffed-58760
To: <sip:14808580112@172.19.113.220:5060>
Call-ID: 5c50df0-0-13c4-6006-58760-13b78457-58760
CSeq: 1 INVITE
Allow: INVITE, BYE, CANCEL, ACK, INFO, OPTIONS, SUBSCRIBE, NOTIFY, REFER, REGISTER, UPDATE
P-Preferred-Identity: "UserName-5400"
<sip:8263005400@172.16.1.212:5060;user=phone>;tag=5cb7678-0-13c4-6006-58760-2f19ffed-58760
Diversion: "UserName-5400" <sip:8263005400@172.16.1.212:5060>;reason=user-busy; counter=3
Diversion: "UserName-5411" <sip:8263005411@172.16.1.213:5060>;reason=user-busy; counter=1
Proprietary: A SIP UA proprietary header
Privacy: none
Max-Forwards: 70
Supported: timer, replaces, info
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
User-Agent: ESBC-9580-2.0.12.40
Via: SIP/2.0/UDP 172.19.113.212:5060;rport;branch=z9hG4bK-58760-1598cf54-5a209472-5cf7428
Contact: "UserName-5400" <sip:8263005400@172.16.1.212:5060;user=phone>
Session-Expires: 3600;refresher=uac
Content-Type: application/sdp
Content-Length: 0
ShowCallType: 01

```

Example 5: Manipulating a Header

```

##Example 5: Manipulating a Header
##For this manipulation rule, SHMR stores the pattern matches for the Proprietary
##header, and replaces the value of the Proprietary header with a combination of the stored
##matches and new content.

sip-manipulation

```

name	ProprietaryManip
header-rule	
name	PropSearch
sip-header	Proprietary
message	request
sip-method	INVITE
process	store
equal-value	"(A SIP) (.*) (header)"
change-to-value	
header-rule	
name	PropManip
sip-header	Proprietary
message	request
sip-method	INVITE
process	manipulate
equal-value	
change-to-value	
element-rule	
name	ChgHeaderValue
type	header-value
parameter-name	hdrVal
process	substitute
equal-value	\$PropSearch
change-to-value	\$PropSearch.\$1 + "PBX " + \$PropSearch.\$3

Result

```

INVITE sip:14084321021@172.16.100.220;calltype=01;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248834;rport=5060
Max-Forwards: 70
Contact: "9193824001" <sip:9193824001@172.16.16.210:5060;transport=udp>
To: <sip:14084321021@172.16.100.220;user=phone>
From: "9193824001" <sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Call-ID: 11-3ff421b0-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Proprietary: A SIP PBX header
Privacy: none
Supported: replaces, path
User-Agent: SHMR-Test/v2.0 Enabled
P-Preferred-Identity: "9193824001" <sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Content-Length: 257

v=0
o=- 535830960 535830960 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
m=audio 10000 RTP/AVP 18 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15

```

Example 6: Storing and Using Header Parameters

```

#Example 6: Storing and display header Parameters
#This manipulation rule stores the value of the header parameter, tag, from the
#P-Preferred-Identity header.
#It also creates a new header P-ITag with the header

```

```
#value from the stored information resulting from the first rule.

sip-manipulation
  name                               PPITagDisplay
  header-rule
    name                               StorePPI
    message                             request
    sip-method                           INVITE
    sip-header                           P-Preferred-Identity
    equal-value
    change-to-value
    process                               store

    element-rule
      name                               headerPPI
      type                               header-param
      parameter-name                     tag
      equal-value
      change-to-value
      process                               store

  header-rule
    name                               newHeader
    message                             request
    sip-method                           INVITE
    sip-header                           PPITag
    equal-value                           $StorePPI.$headerPPI
    change-to-value                       $StorePPI.$headerPPI.$0
    process                               add
```

Result

```
INVITE sip:14084321021@172.16.100.220;calltype=01;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248834;rport=5060
Max-Forwards: 70
Contact: "UserName-001" <sip:9193824001@172.16.16.210:5060;transport=udp>
To: <sip:14084321021@172.16.100.220;user=phone>
From: "UserDisplayName" <sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Call-ID: 11-3ff421b0-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Proprietary: A SIP UA is proprietary header
Privacy: none
Supported: replaces, path
User-Agent: SHMR-Test/v2.0 Enabled
P-Preferred-Identity: "UserName-001" <sip:9193824001@172.16.100.220>;tag=AC1010D213C4-
805E23E40
Content-Length: 257
PPITag: AC1010D213C4-805E23E40

v=0
o=- 535830960 535830960 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
m=audio 10000 RTP/AVP 18 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
```

Example 7: Manipulating the Display Name

```
# Example 7: Manipulating the Display Name
# For this manipulation rule, it stores the display name from the
# Contact header. It replaces the latter part of the original display name
# with a new string. Then it also replaces the From header's display name with "ProfLoadTest"
# if it matches "sipp"

sip-manipulation
  name                                CHDisplayParam

  header-rule
    name                                storeContact
    message                              request
    sip-method                          INVITE
    sip-header                          Contact
    equal-value
    change-to-value
    process                              store

    element-rule
      name                                displayName
      type                                uri-display
      parameter-name                      display
      equal-value                          "(" (UserName) (\-) (.*) (\)"
      change-to-value
      process                              store

  header-rule
    name                                CHDisplay
    message                              request
    sip-method                          INVITE
    sip-header                          Contact
    equal-value
    change-to-value
    process                              manipulate

    element-rule
      name                                CHDisplayName
      type                                uri-display
      parameter-name                      display
      equal-value                          $storeContact.$displayName
      change-to-value
      process                              $storeContact.$displayName.$1+$storeContact.$displayName.$2+" Main"+\"

  header-rule
    name                                CHFrom
    message                              request
    sip-method                          INVITE
    sip-header                          From
    equal-value
    change-to-value
    process                              manipulate

    element-rule
      name                                FromDisplay
      type                                uri-display
      parameter-name                      display
      equal-value                          UserDisplayName
      change-to-value                      "ProfLoadTest"
      process                              substitute
```

Result

```
INVITE sip:14084321021@172.16.100.220;calltype=01;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248834;rport=5060
Max-Forwards: 70
```

```

Contact: "UserName Main" <sip:9193824001@172.16.16.210:5060;transport=udp>
To: <sip:14084321021@172.16.100.220;user=phone>
From: "ProfLoadTest" <sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Call-ID: 11-3ff421b0-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Proprietary: A SIP UA is proprietary header
Privacy: none
Supported: replaces, path
User-Agent: SHMR-Test/v2.0 Enabled
P-Preferred-Identity: "UserName-001" <sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Content-Length: 257

v=0
o=- 535830960 535830960 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
m=audio 10000 RTP/AVP 18 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
    
```

Example 8: Manipulating Element Parameters

```

### Example 8: Manipulating Element Parameters
#1. From the Contact header, stores the display name, user name, URI parameter transport,
# and header parameter calltype
#2. Replace the URI display portion of Remote-Party-ID with the value obtained in 1,
# the display name.
#3. Add an URI parameter, src, with the value obtained in 1, the user id.
#4. Change the URI parameter, transport, of Contact Header in 1, to the value "tcp"
#5. Remove the header parameter, calltype from the Contact Header.

sip-manipulation
    name                               ElementParamManip

    header-rule
        name                             StoreContact
        message                           request
        sip-method                         INVITE
        sip-header                         Contact
        equal-value
        change-to-value
        process                             store

    element-rule
        name                             DisplayContact
        type                               uri-display
        parameter-name                     display
        equal-value
        change-to-value
        process                             store

    element-rule
        name                             UserContact
        type                               uri-user
        parameter-name                     user
        equal-value
        change-to-value
        process                             store
    
```



```

element-rule
  name
  type          URIParam
  parameter-name uri-param
  equal-value   transport
  change-to-value
  process       store

element-rule
  name
  type          HDPParam
  parameter-name header-param
  equal-value   calltype
  change-to-value
  process       store

header-rule
  name          RPIParams
  message       request
  sip-method    INVITE
  sip-header    Remote-Party-ID
  equal-value
  change-to-value
  process       manipulate

element-rule
  name          URIDisplayParam
  type          uri-display
  parameter-name display
  match-val-type any
  equal-value
  change-to-value $StoreContact.$DisplayContact.$0
  process       substitute

element-rule
  name          URIParam
  type          uri-param
  parameter-name src
  comparison-type case-sensitive
  equal-value
  change-to-value $StoreContact.$UserContact.$0
  process       add

header-rule
  name          CHContact
  message       request
  sip-method    INVITE
  comparison-type case-sensitive
  sip-header    Contact
  equal-value
  change-to-value
  process       manipulate

element-rule
  name          CHUriParam
  type          uri-param
  parameter-name transport
  equal-value   $StoreContact.$URIParam
  change-to-value "tcp"
  process       substitute

element-rule
  name          RemoveHeaderParam
  type          header-param
  parameter-name calltype
  comparison-type pattern-rule
  match-val-type any
  equal-value   $StoreContact.$HDPParam
  change-to-value
  process       remove-element

```

SIP Message for Example 8

```

INVITE sip:14084321021@172.16.100.220;calltype=01;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248834;rport=5060
Max-Forwards: 70
Contact: "UserName-001"<sip:9193824001@172.16.16.210:5060;transport=udp>;calltype=05
To: <sip:14084321021@172.16.100.220;user=phone>
From: "9193824001"<sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Remote-Party-ID: "RPI"<sip:001@172.16.16.210:5060>
Call-ID: 11-3ff421b0-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Supported: replaces, path
User-Agent: SHMR-Test/v2.0 Enabled
Content-Length: 266

v=0
o=- 535830960 535830960 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
m=audio 10000 RTP/AVP 18 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15

```

Result

```

INVITE sip:14084321021@172.16.100.220;calltype=01;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248834;rport=5060
Max-Forwards: 70
Contact: "UserName-001" <sip:9193824001@172.16.16.210:5060;transport=tcp>
To: <sip:14084321021@172.16.100.220;user=phone>
From: "9193824001" <sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Remote-Party-ID: "UserName-001" <sip:001@172.16.16.210:5060;src=9193824001>
Call-ID: 11-3ff421b0-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Supported: replaces, path
User-Agent: SHMR-Test/v2.0 Enabled
Content-Length: 255

v=0
o=- 535830960 535830960 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
m=audio 10000 RTP/AVP 18 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15

```

Example 9: Accessing Data from Multiple Headers of the Same Type


```

#Example 9 Process PPI Header
## 1.Check if the first Diversion Header exists and uri-user part is valid and within rages
## 2.If either 1, then keep the value of PPI rue part, otherwise replace it with the main AOR.
## 3. There are multiple Diversion Headers, abstract the first Diversion Header.

sip-manipulation

header-rule
    name                StoreDiversion
    message              request
    sip-method           INVITE
    sip-header           Diversion
    equal-value
    change-to-value
    process              store

    element-rule
        name              hdrVal
        type              header-value
        element-parameter-name hdrVal
        equal-value       "(.*<sip:\\\+)(91938200[0-9]{2})(@.*)"
        change-to-value
        process           store

#####
header-rule
    name                ReplacePPIUserIFNotMatch
    message              request
    sip-method           INVITE
    sip-header           P-Preferred-Identity
    equal-value
    change-to-value
    process              manipulate

    element-rule
        name              ReplacePPIUserMain
        type              uri-user
        element-parameter-name user
        equal-value       !$StoreDiversion[0].$hdrVal
        change-to-value   "\+13036667000"
        process           substitute

```

SIP Message for Example 9

```

INVITE sip:14084321021@172.16.100.220;calltype=01;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248834;rport=5060
Max-Forwards: 70
Contact: "UserName-001"<sip:9193824001@172.16.16.210:5060;transport=udp>;calltype=05
To: <sip:14084321021@172.16.100.220;user=phone>
From: "UserDisplayName"<sip:+9193820001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Diversion: "D1" <sip:+9393333333@172.19.113.210:5060>;reason=user-busy; counter=3
Diversion: "D2" <sip:+9193824005@172.19.113.212:5060>;reason=user-busy; counter=1
Call-ID: 11-3ff421b0-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Proprietary: A SIP UA is proprietary header
Privacy: none
Supported: replaces, path
User-Agent: SHMR-Test/v2.0 Enabled
P-Preferred-Identity: "UserName-001"<sip:+9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Content-Length: 266

v=0
o=- 535830960 535830960 IN IP4 172.16.16.210

```

```
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
m=audio 10000 RTP/AVP 18 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:8 PCMA/8000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
```

Result

```
INVITE sip:14084321021@172.16.100.220;calltype=01;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248834;rport=5060
Max-Forwards: 70
Contact: "UserName-001" <sip:9193824001@172.16.16.210:5060;transport=udp>;calltype=05
To: <sip:14084321021@172.16.100.220;user=phone>
From: "UserDisplayName" <sip:+9193820001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Diversion: "D1" <sip:+9393333333@172.19.113.210:5060>;reason=user-busy; counter=3
Diversion: "D2" <sip:+9193824005@172.19.113.212:5060>;reason=user-busy; counter=1
Call-ID: 11-3ff421b0-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Proprietary: A SIP UA is proprietary header
Privacy: none
Supported: replaces, path
User-Agent: SHMR-Test/v2.0 Enabled
P-Preferred-Identity: "UserName-001" <sip:+13036667000@172.16.100.220>;tag=AC1010D213C4-805E23E40
Content-Length: 258

v=0
o=- 535830960 535830960 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
m=audio 10000 RTP/AVP 18 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:8 PCMA/8000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
```

STATUS-LINE VALUE MATCHING AND MANIPULATION

SHMR is able to change the status code in SIP response headers or the Request-URI in a request.

Setting the Header Name

Parameters	Value	Descriptions
sip-header	@status-line	

Setting the Element Type

In this element rule, set the **type** parameter to either one of the following values which will only have an impact on the status-line.

Special element parameter	Value	Descriptions
type	status-code	Designating the status code of the response line; accepts strings ranging from 100 to 699.

Example 10: Remove + sign from the P-Associated-URI.

1. This SHMR script removes the “+” sign from the URI-User part of P-Associated-URI headers in the 200OK response of REGISTER Message. For this particular IOT configurations, we may apply this rule to ESBC-SHMR WAN-ingress rule.

```
#Example 10
##Process 200 OK response
# Removing the + sign from the URI-user part of P-Assocoated-URI.

sip-manipulation
  name                               DelPlus
  description
  header-rule
    name                               Is200OK
    sip-header                          @status-line
    message                              reply
    equal-value
    change-to-value
    methods
    process                              store

    element-rule
      name                               is200Code
      type                               status-code
      equal-value                          200
      change-to-value
      process                              store

  header-rule
    name                               check_cseq
    header-name                          CSeq
    message                              reply
    equal-value
    new-value
    methods
    process                              store
```

```

element-rule
  name          isReg
  type          header-value
  equal-value   "(\\d+) REGISTER"
  change-to-value
  process       store

header-rule
  name          StorePAU
  message       reply
  sip-header    P-Associated-URI
  equal-value   $Is200OK.$is200Code & $check_cseq.$isReg
  change-to-value
  process       store

element-rule
  name          userNamePAU
  type          uri-user
  element-parameter-name user
  equal-value   "(^\\+)([0-9]+)"
  process       substitute
  change-to-value $2

```

SIP Message for Example 10

```

SIP/2.0 200 OK
Via: SIP/2.0/UDP 192.168.1.91:5060;branch=z9hG4bK-d8754z-1aaf18912180a6ff-1
Contact: <sip:+14084325450@192.168.1.91:5060;user=phone>;expires=3600
To: "14084325450"<sip:+14084325450@192.168.1.1;user=phone>;tag=220fc433
From: "14084325450"<sip:+14084325450@192.168.1.1;user=phone>;tag=4c8c47fc
Call-ID: ZTA5MGIyZTEyMwY4YmIwMjQ2NjAxM2NiY2RlNWZlN2I.
CSeq: 4 REGISTER
User-Agent: eSBC-8328-2.0.11.72
Content-Length: 0
P-Associated-URI:<sip:+19193824001@ims.com>

```

Result

```

SIP/2.0 200 OK
Via: SIP/2.0/UDP 192.168.1.91:5060;branch=z9hG4bK-d8754z-1aaf18912180a6ff-1
Contact: <sip:+14084325450@192.168.1.91:5060;user=phone>;expires=3600
To: "14084325450"<sip:+14084325450@192.168.1.1;user=phone>;tag=220fc433
From: "14084325450"<sip:+14084325450@192.168.1.1;user=phone>;tag=4c8c47fc
Call-ID: ZTA5MGIyZTEyMwY4YmIwMjQ2NjAxM2NiY2RlNWZlN2I.
CSeq: 4 REGISTER
User-Agent: eSBC-8328-2.0.11.72
Content-Length: 0
P-Associated-URI:<sip:19193824001@ims.com>

```

Example 11: Adding Contact Header to 180 and/or 183

```

#This script adds contact header to 180 or 183 reply messages.
#some sip PBX does not have contact header in 18x and hence there are issues with inbound
calls to the sip PBX.
sip-manipulation
  name          addContactHeader

  header-rule
    name          hasContact
    msg-type       reply
    methods
    header-name    Contact
    match-value
    new-value
    action         store

  header-rule

```

```

        name                ToHeader
        msg-type            reply
        methods
        header-name        To
        match-value
        new-value
        action              store

        element-rule
            name            ToHeaderUser
            type            uri-user
            parameter-name  user
            match-value
            new-value
            action          store

    header-rule
        name                is18x
        msg-type            reply
        methods
        header-name        @status-line
        match-value
        new-value
        action              store

        element-rule
            name            is18xCode
            type            status-code
            parameter-name
            match-value    "18[0-9]"
            new-value
            action          store

    header-rule
        name                addContact
        msg-type            reply
        methods
        header-name        Contact
        action              add
        match-value        !$hasContact & $is18x.$is18xCode
        new-value          "<sip:" + $ToHeader.$ToHeaderUser.$0 + "@" + $REMOTE_IP +
":." + $REMOTE_PORT + ">"

```

SIP Header for Example 11

```

SIP/2.0 180 Ringing
Via: SIP/2.0/UDP 10.20.40.146:5060;received=10.20.40.146;branch=z9hG4bK-d8754z-
5c7275bd6852a01b-1---d8754z-;rport=5060
Record-Route: <sip:10.20.7.77;lr>
To: <sip:14084321021@10.20.7.77>;tag=0A143DF413C4-8051DBF80
From: "9193824001"<sip:9193824001@10.20.7.77>;tag=02bd944f
Call-ID: NTAxMDI3MzgxZDQxY2IyNWNiNjg1NmQ5NDQwMMDMzODc.
CSeq: 1 INVITE
Server: SIP-6328-2Re-v4.2.77-14084321021/v2.0 Enabled
Content-Length: 0

```

Result

```

SIP/2.0 180 Ringing
Via: SIP/2.0/UDP 10.20.40.146:5060;received=10.20.40.146;branch=z9hG4bK-d8754z-
5c7275bd6852a01b-1---d8754z-;rport=5060
Record-Route: <sip:10.20.7.77;lr>
To: <sip:14084321021@10.20.7.77>;tag=0A143DF413C4-8051DBF80
From: "9193824001" <sip:9193824001@10.20.7.77>;tag=02bd944f
Call-ID: NTAxMDI3MzgxZDQxY2IyNWNiNjg1NmQ5NDQwMMDMzODc.
CSeq: 1 INVITE
Server: SIP-6328-2Re-v4.2.77-14084321021/v2.0 Enabled
Content-Length: 0
Contact: sip:14084321021@127.0.0.1:5060

```

MANIPULATING MIME TYPES IN SIP MESSAGE BODIES

The body of SIP messages or a specific content type within the body can be manipulated using regular expressions.

Setting the header-rule

Parameters	Value	Descriptions
sip-header	Content-Type	SIP method to match for SIP message body

Setting the element-rule

element parameter	Value	Descriptions
type	mime	
element-parameter-name (parameter-name)	application/sdp	
process	find-replace-all	Searching for a particular string and the replacing of all matches for that type.

How it works:

For each regular expression match within the supplied string, SHMR substitutes the new value for that match. As in the case for removing a certain attribute within the content type of **application/sdp**, SHMR needs to search the content multiple times.

- SDP can have multiple media lines, and
- The SIP message body can contain more than one application/sdp.

Note:

- find-replace-all is only applicable for MIME attachments. Do not use this action for other elements.
- When you use find-replace-all, you cannot use the following parameter-type values: uri-param-name, uri-header-name, and header-param-name.

Example 12: Removing lines from SDP.

In this example, SHMR is configured to remove all rtpmap with h.26x video attributes from SDP. The following examples are based on this sample SIP INVITE:

```

### Example 12: Remove rtpmap video codecs, H.26x lines from SDP
#   a=rtpmap:98 H264/90000

sip-manipulation
    name                RemovertpmapSDP
    description          removertpSDP

    header-rule
        name            SDPManip
        message          request
        sip-method       INVITE
        sip-header       Content-Type
        equal-value
        change-to-value
        process          manipulate

    element-rule
        name            Remrtpmap
        type             mime
        parameter-name  application/sdp
        equal-value     "(a=rtpmap:)([0-9]{1,3})( H[0-
9]{1,3})(.*) (\\n|\\r\\n)"
        change-to-value
        process          find-replace-all

```

SIP Message for Example 12

```

INVITE sip:14086365429@172.16.100.220;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248821;rport=5060
Max-Forwards: 70
Contact: "9193824001"<sip:9193824001@172.16.16.210:5060>
To: <sip:14086365429@172.16.100.220;user=phone>
From: "9193824001"<sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Call-ID: 8-3fff2fb2-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Supported: replaces, path
User-Agent: SIP-6308-SL2-v10.3.5-9193824001/v2.0 Enabled
P-Preferred-Identity: "9193824001"<sip:9193824001@172.16.100.220>
Content-Length: 266

v=0
o=- 530526130 530526130 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
m=audio 10000 RTP/AVP 18 0 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:8 PCMA/8000
a=rtpmap:98 H264/90000
a=rtpmap:100 H263a/9000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15

```

Result

```

INVITE sip:14086365429@172.16.100.220;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248821;rport=5060
Max-Forwards: 70
Contact: "9193824001"<sip:9193824001@172.16.16.210:5060>
To: <sip:14086365429@172.16.100.220;user=phone>
From: "9193824001"<sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Call-ID: 8-3fff2fb2-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp

```

```
Supported: replaces, path
User-Agent: SIP-6308-SL2-v10.3.5-9193824001/v2.0 Enabled
P-Preferred-Identity: "9193824001"<sip:9193824001@172.16.100.220>
Content-Length: 266

v=0
o=- 530526130 530526130 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
m=audio 10000 RTP/AVP 18 0 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:8 PCMA/8000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
```

Example 13: Change and Remove Lines from SDP

In this sample of changing and removing lines from the SDP, the goal is to convert the PCMA codec to PCMU.

```
### Example 13: Changing codec PCMA to PCMU in SDP
#a=rtpmap:8 PCMA/8000
#a=rtpmap:0 PCMU/8000

sip-manipulation
  name chg-g711

  header-rule
    name CodecManip
    message any
    sip-method
    sip-header Content-Type
    equal-value
    change-to-value
    process manipulate

  element-rule
    name pcmatopcmu
    type mime
    parameter-name application/sdp
    equal-value "(a=rtpmap:)(8 PCMA/8000(\\n|\\r\\n))"
    change-to-value $1 + "0 PCMU/8000" + $3
    process find-replace-all
```

SIP Message for Example 13

```
INVITE sip:14086365429@172.16.100.220;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248821;rport=5060
Max-Forwards: 70
Contact: "9193824001"<sip:9193824001@172.16.16.210:5060>
To: <sip:14086365429@172.16.100.220;user=phone>
From: "9193824001"<sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Call-ID: 8-3fff2fb2-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Supported: replaces, path
User-Agent: SIP-6308-SL2-v10.3.5-9193824001/v2.0 Enabled
P-Preferred-Identity: "9193824001"<sip:9193824001@172.16.100.220>
Content-Length: 266

v=0
o=- 530526130 530526130 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
```




```
t=0 0
m=audio 10000 RTP/AVP 18 0 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=rtpmap:98 H264/90000
a=rtpmap:100 H263a/90000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
```

Result

```
INVITE sip:14086365429@172.16.100.220;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248821;rport=5060
Max-Forwards: 70
Contact: "9193824001"<sip:9193824001@172.16.16.210:5060>
To: <sip:14086365429@172.16.100.220;user=phone>
From: "9193824001"<sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Call-ID: 8-3fff2fb2-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Supported: replaces, path
User-Agent: SIP-6308-SL2-v10.3.5-9193824001/v2.0 Enabled
P-Preferred-Identity: "9193824001"<sip:9193824001@172.16.100.220>
Content-Length: 266

v=0
o=- 530526130 530526130 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
m=audio 10000 RTP/AVP 18 0 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=rtpmap:98 H264/90000
a=rtpmap:100 H263a/90000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
```



Processing SHMR Rule Set:

Example 14: Resolving IOT with ICE-enabled devices in hosted services: Removing ICE attributes from the SDP in INVITE and 183

Basically, the ESBC executes SHMR rules in a top-down manner unless multiple Rule-Sets are defined within a script. Each Rule Set is defined by the designation of “sip-manipulation” at the start of each rule set in the script. At the time a script is imported, it requires the following for successful import of the script:

- the identification of the Rule-Set that the SHMR engine executing first (in case it has multiple Rule-Sets), and
- the rules to be applied.

If there is an intention to execute other Rule-Sets that are defined within the script, then the next rule-set can be called within this first rule-set by the parameter “new-value” and referencing the next rule-set “sip-manipulation” name.

On the ESBC SHMR GUI page, the “**Main Rule Name**” is defined to specify the initial rule-set that the ESBC will execute. If the Main Rule Name is left blank, the ESBC starts from the beginning of the script file.

```
##Example 14
##Process Removing ICE attributes if the User-Agent header includes the string "ICE....."
## 1. Check INVITE, and 183 SIP methods which include SDP
## 2. If the User-Agent header (INVITE), or Server header (183) contain string such as
"ICE...",
## then stripping ICE attribute in SDP.
## 3. INVITE: Change the User-Agent header to "NoICE..."
## 4. 183: Change the Server header to "NoICE..."

##Stripping ICE Attribute: a=ice..., and a=candidate... from SDP

sip-manipulation
  name                strippingICEAttribute

  header-rule
    name              ICEManip
    message           any
    sip-method        Content-Type
    sip-header        Content-Type
    equal-value
    change-to-value
    process           manipulate

  element-rule
    name              emptyICE
    type              mime
    parameter-name    application/sdp
    equal-value       "(a=ice)(.*\n|\r\n)"
    change-to-value
    process           find-replace-all

  element-rule
    name              emptyCandidate
    type              mime
    parameter-name    application/sdp
    equal-value       "(a=candidate)(.*\n|\r\n)"
    change-to-value
    process           find-replace-all

###Check if the User-Agent header contains string as "ICE..."
sip-manipulation
```

```

name                                CHKUserAgentINVITEand183

header-rule
  name                                CHKUserAgent
  message                             request
  sip-method                          INVITE
  sip-header                          User-Agent
  equal-value
  change-to-value
  process                              store

  element-rule
    name                                ICEVal
    type                                header-value
    parameter-name
    equal-value                        "(^ICE) (.*)"
    change-to-value
    process                              store

header-rule
  name                                RemovingICE
  message                             request
  sip-method                          INVITE
  sip-header                          User-Agent
  equal-value
  change-to-value
  process                              manipulate
  element-rule
    name                                ChgUserAgent
    type                                header-value
    parameter-name
    equal-value                        $CHKUserAgent.$ICEVal
    change-to-value                    "NoICE"+ $CHKUserAgent.$ICEVal.$2
    process                              substitute

header-rule
  name                                strippingICE
  message                             request
  sip-method                          INVITE
  sip-header                          Content-Type
  equal-value
  change-to-value
  process                              manipulate
  element-rule
    name                                callstrippingICEAttribute
    type                                mime
    parameter-name                      application/sdp
    equal-value                          $CHKUserAgent.$ICEVal
    change-to-value                      strippingICEAttribute
    process                              sip-manip

#####
header-rule
  name                                is183
  message                             reply
  sip-method                          @status-line
  sip-header
  equal-value
  change-to-value
  process                              store
  element-rule
    name                                is183Code
    type                                status-code
    parameter-name
    equal-value                          183
    change-to-value
    process                              store

header-rule
  name                                CHKServerName
  message                             reply

```



```

sip-method
sip-header                Server
equal-value
change-to-value
process                    store
element-rule
  name                     SVRICEVal
  type                     header-value
  parameter-name
  equal-value              "(^ICE) (.*)"
  change-to-value
  process                  store

header-rule
  name                     ChangeServerNameFm183
  message                  reply
  sip-method
  sip-header               Server
  equal-value
  change-to-value
  process                  manipulate
  element-rule
    name                   chgServerName
    type                   header-value
    parameter-name
    equal-value             $CHKServerName.$SVRICEVal
    change-to-value        "NoICE" + $CHKServerName.$SVRICEVal.$2
    process                 substitute

header-rule
  name                     strippingICE183
  message                  reply
  sip-method
  sip-header               Content-Type
  equal-value
  change-to-value
  process                  manipulate
  element-rule
    name                   183callstrippingICEAttribute
    type                   mime
    parameter-name
    equal-value             $is183.$is183Code & $CHKServerName.$SVRICEVal
    change-to-value        strippingICEAttribute
    process                 sip-manip

```

SIP Message for Example 14

```

INVITE sip:14084321021@172.16.100.220;user=phone SIP/2.0
Via: SIP/2.0/UDP 172.16.16.210:5060;branch=z9hG4bKac1010d25060-435248834;rport=5060
Max-Forwards: 70
Contact: "9193824001"<sip:9193824001@172.16.16.210:5060>
To: <sip:14084321021@172.16.100.220;user=phone>
From: "9193824001"<sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
Call-ID: 11-3ff421b0-9909a851@ac1010d2
CSeq: 1 INVITE
Accept: application/sdp
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Supported: replaces, path
User-Agent: ICE-v10.3.5-9193824001/v2.0 Enabled
P-Preferred-Identity: "9193824001"<sip:9193824001@172.16.100.220>
Content-Length: 266

v=0
o=- 535830960 535830960 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
a=ice-pwd:asd88fgpdd777uzjYhaqZg

```



```
a=ice-ufrag:8hhY
m=audio 10000 RTP/AVP 18 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
a=candidate:1 1 UDP 2130706431 10.0.1.1 8998 typ host
a=candidate:2 1 UDP 1694498815 192.0.2.3 45664 typ srflx raddr

=====

SIP/2.0 183
Via: SIP/2.0/UDP 172.16.100.220:5060;branch=z9hG4bK-d8754z-6bc81f9604fe517b-1---d8754z-
;received=172.16.100.220;rport=5060
Contact: "9193824001" <sip:9193824001@172.16.16.210:5060>
To: <sip:9193824001@172.16.100.220>;tag=AC1010D213C4-805E23E40
From: "14084321021" <sip:14084321021@172.16.100.220>;tag=0d10972c
Call-ID: ZDgyZjFlNTFiMTE2ZDczMmJkNzcwY2RjMTE4MjllZjA.
CSeq: 1 INVITE
Allow: ACK, BYE, CANCEL, INVITE, NOTIFY, OPTIONS, PRACK, REFER, REGISTER, UPDATE
Content-Type: application/sdp
Server: ICE-SL2-v10.3.5-9193824001/v2.0 Enabled
Content-Length: 219

v=0
o=- 547059630 547059630 IN IP4 172.16.16.210
s=InnoMedia SIP Call
c=IN IP4 172.16.16.210
t=0 0
a=ice-pwd:asd88fgpdd777uzjYhagZg
a=ice-ufrag:8hhY
m=audio 10000 RTP/AVP 8 101
a=rtpmap:8 PCMA/8000
a=ptime:20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
a=candidate:1 1 UDP 2130706431 10.0.1.1 8998 typ host
a=candidate:2 1 UDP 1694498815 192.0.2.3 45664 typ srflx raddr
```



	<input checked="" type="checkbox"/> Enable
Main Rule Name	CHKUserAgentINVITEand183 (Case Sensitive)
	<input type="button" value="Import"/> <input type="button" value="Export"/> <input type="button" value="Delete"/> <input type="button" value="Verify"/>
Content of Rules	<pre> ##Process Removing ICE attributes if the User-Agent header includes the string "ICE....." ## 1. Check INVITE, and 183 SIP methods which include SDP ## 2. If the User-Agent header (INVITE), or Server header (183) contain string such as "ICE...", ## then stripping ICE attribute in SDP. ## 3. INVITE: Change the User-Agent header to "NoICE..." ## 4. 183: Change the Server header to "NoICE..." ##Stripping ICE Attribute: a=ice..., and a=candidate... from SDP sip-manipulation name strippingICEAttribute header-rule name ICEManip message any sip-method sip-header Content-Type equal-value change-to-value process manipulate </pre>

