Welcome to Acme Packet TechTalk!

Lots to cover today! We will begin the presentation promptly at 11:01 am ET.

Configuring Header Manipulation Rules - Part 1

January 2013

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Welcome to TechTalk!

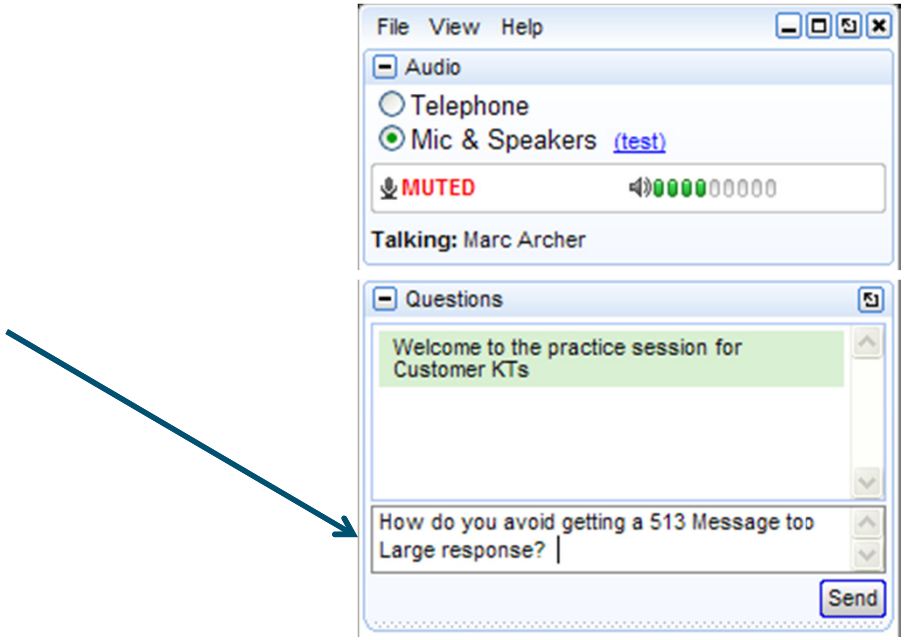
- Each webinar in our series will offer a blend of the following:
  - Feature education;
  - Configuration best practices;
  - Troubleshooting guidance; and
  - Log analysis
- Sessions will be very technical in nature, and targeted towards an audience of system operators and network engineers
- Our goal today is to pass along field experience with signaling protocols, interoperability requirements, and network topologies to you!

Logistics

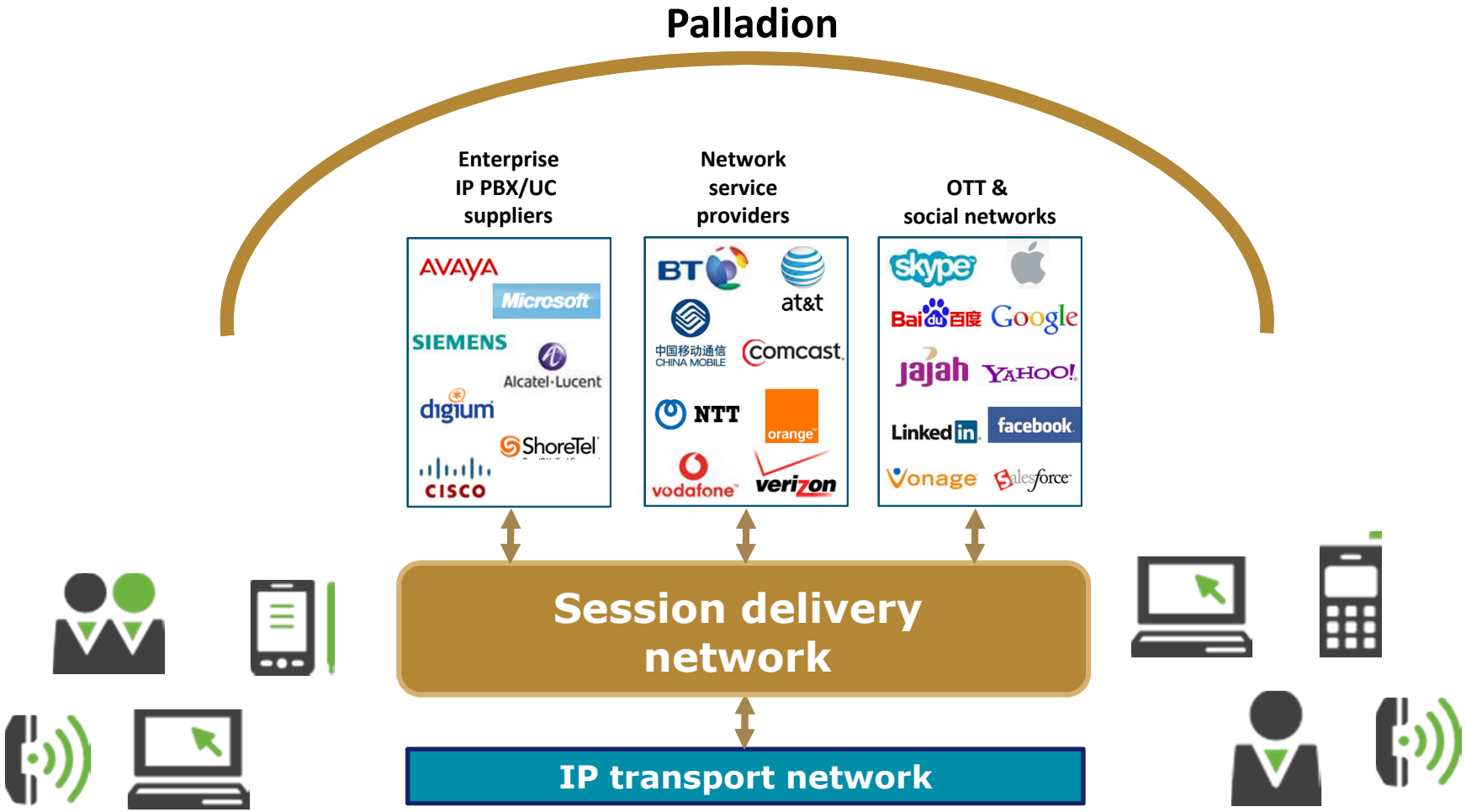
- To preserve the user experience, we will mute all participant phone lines
- Expect 50 minutes of presentation followed by 10 minutes of Q&A
- To submit a question, please use the GoToWebinar "Questions/Chat" window
  - You can access this by clicking on "Show Control Panel" on the right side of your screen
  - At the end of our presentation, we will answer as many questions as possible
- An evaluation form will be emailed to you after the webinar. We appreciate your feedback!

Questions

- Use the *GoToWebinar* "Questions/Chat" window to ask the moderator a question… Time permitting, it will be addressed



Session Delivery Networks for end-to-end IP communications



Session Delivery Network solutions encompass eight product categories

Session border controller	Controls sessions at borders
Session manager	Manages subscriber access & interfaces to application servers (A-SBC + IMS CSCFs + BGCF)
Multiservice security gateway	Secures session delivery (data & voice) over untrusted networks
Diameter session controller	Enables LTE data & voice session roaming
Session-aware load balancer	Scales session control at borders (SBC, MSG & PEC)
Session routing proxy	routes sessions to/from access & interconnect borders
Application session controller	Empowers Web 2.0 applications to control sessions
Session recorder	Provides session recording utility for SDN

Introduction

Agenda – Part 1 (January 16th)

- HMR fundamentals
- Working with header elements
- Using built-in variables
- A mini primer on regular expressions
- HMR strategies and best practices
- Two sample HMRs of varying complexity
- Q&A

Agenda – Part 2 (February 13th)

- Recap of HMR Part 1
- HMR operations
- HMR for SDP
- Testing your HMRs using SIPp
- Testing your HMRs using test-sip-manipulation
- Three sample HMRs of varying complexity
- Q&A

HMR fundamentals

What is "HMR"?

- HMR originally stood for Header Manipulation Rules, but today it's far more than that
- HMR provides the ability to manipulate SIP, through configuration
- Manipulate: add, delete, replace, copy, move, reject, log
- Manipulate what?
  - SIP headers, parameters, URIs, parts of URIs
  - SIP MIME bodies: SDP, XML, ISUP, *anything*
  - SIP-I/SIP-T ISUP messages, parameters, and fields
- And more…
  - Copy from SIP into CDR fields
  - Route messages based on any SIP field
  - Reject requests based on any SIP field
  - Change response code numbers based on specific fields

Note: one item HMR cannot change is the SIP method itself, e.g. HMR cannot change an OPTION to an INVITE. Use Acme Packet SPL for that!

Why use HMR?

- The problem:
  - There are numerous proprietary implementations of SIP
  - There are numerous "bugs" in SIP implementations
  - The SBC can't natively support interworking every software version of every product of every vendor to every other one

- The solution:
  - Give the operator as much control as possible, to define their own behavior for their needs
  - Without constantly upgrading the SBC
  - Without constant Enhancement Requests
  - Without waiting

HMR in the SBC

- HMR can be done on either the inbound message (in-manipulationid) or the outbound message (out-manipulationid)
  - In both cases the SBC behaves as if it actually received that changed message, or sent the unchanged one
- Inbound:
  - HMR is essentially a pre-processing activity – it occurs after a very small list of tasks (like DDoS, parsing, etc.)
- Outbound:
  - HMR is essentially a post-processing activity and is done right before message is sent
  - After SIP-NAT, number normalization, response mapping, etc.
- HMR rules can be applied to session-agent, realm, or sip-interface for either direction

The sip-manipulation object

- Only one sip-manipulation gets applied to a message on inbound, and only one on outbound
  - sip-manipulations can be called from a session-agent, realm or sip-interface
  - A session-agent manipulation overrides all others, a realm overrides sip-interface
  - For a proxied SIP message there can be up to 12 "configuration slots" where you can invoke HMR but for a B2BUA, only FOUR HMRs can take effect (in/out on received message, and in/out on proxied message)

sip-manipulation contents

```
sip-manipulation
    name                    changeMyName
    description             change James to Jimmy
    header-rule
        name                    modifyRequestURI
        header-name             request-uri
        action                  manipulate
        comparison-type         case-sensitive
        match-value
        msg-type                request
        new-value
        methods                 INVITE
        element-rule
            name                    modName
            parameter-name
            type                    uri-user
            action                  replace
            match-val-type          any
            comparison-type         pattern-rule
            match-value             James
            new-value               Jimmy
```

This **HEADER RULE** will operate on the request URI. It will trigger the sub-rule modName each time the message being manipulated is an INVITE request.

Note that header-rule and element-rule names cannot be all upper case… That's reserved for internal variables.

This **ELEMENT RULE** will operate on the user portion of the request URI. It will replace regular expression matches of the string "James" with the string "Jimmy".

header-rules and element-rules

- A sip-manipulation can have any number of header-rules
  - Each header-rule name must be unique in a sip-manipulation and limited to a maximum of 24 characters
  - Each header-rule operates on one header, but multiple header-rules can operate on the same header

- A header-rule can have any number of element-rules
  - Each element-rule name must be unique within a header-rule and limited to a maximum of 24 characters
  - Each element-rule operates on one component of the header, but multiple element-rules can operate on the same component

How many header-rules and element-rules do I need?

- Each header-rule permits one "action" to be conducted against one single header
  - For each required header action you will need one header-rule
  - Recall that a header-rule can reference other header-rules within the same sip-manipulation rule set
  - A header-rule can also call another sip-manipulation outside of the current rule set
    - set the header-rule action to be *sip-manip*
    - *new-value* is used to hold the name of the sip-manipulation to be invoked
    - Don't forget to specify a header name to invoke the header-rule! We recommend the use of "To", "From" or "Cseq" as these are most likely exist in the sip header context

- Each element-rule permits one "action" to be conducted against one single header element
  - For each required header element action you will need one element-rule

Example 1: very simple case

- You want to remove a header, for example P-Asserted-Identity, from all messages going to endpoints in the access realm
- You can do this on inbound or outbound, but for this example, outbound makes more sense
- Example HMR:

```
sip-manipulation
    name                out_rem_PAI
    Description         "This HMR deletes the PAI header"
    header-rule
        name                    delPAI
        header-name             P-Asserted-Identity
        action                  delete
        comparison-type         case-sensitive
        match-value
        msg-type                request
        new-value
        methods
```

Example 2: a bit more complex

- Removing a P-Associated-URI from any response to a REGISTER request, but only if it's a tel-URI
  - Here we will need a comparison-type of pattern-rule to trigger the regular expression specified in the match-value

```
sip-manipulation

    name            delPAUwithTelURI
    description     "This HMR deletes PAU headers with a tel-URI"
    header-rule
        name                delPAU
        header-name         P-Associated-URI
        action              delete
        comparison-type     pattern-rule
        match-value         ^<tel:
        msg-type            reply
        new-value
        methods             REGISTER
```

Example 3: HMR, the real deal

```
sip-manipulation
     name                copyFrom
     description
     header-rule
          name                getFrom
          header-name         From
          action              store
          comparison-type     pattern-rule
          match-value
          msg-type            request
          new-value
          methods             INVITE
          element-rule
               name                getUser
               parameter-name
               type                uri-user
               action              store
               match-val-type      any
               comparison-type     pattern-rule
               match-value         ^\+?[0-9]+
               new-value
```

```
header-rule
     name                modPAI
     header-name         P-Asserted-Identity
     action              manipulate
     comparison-type     case-sensitive
     match-value
     msg-type            request
     new-value
     methods             INVITE
     element-rule
        name              modName
        parameter-name
        type              uri-user
        action            replace
        match-val-type    any
        comparison-type   boolean
        match-value       $getFrom.$getUser
        new-value         $getFrom.$getUser.$0
```

Can you figure out what this HMR does?
We'll see it again later in the presentation!

Working with header elements

Conditional execution of rules

- Every *top-level* rule (header-rule, mime-rule) will only execute its action if it passes the following constraints:
  - msg-type: any, out-of-dialog, or response
  - methods: if it's the right SIP method
- *Every* rule of *any* level has certain constraints it must pass to execute its action
  - match-value: if its match-value results in TRUE, based on its comparison-type and applied to the relevant SIP message/field
- Specific rules have specific constraints as well
  - header-rule will only act on the defined SIP header
  - element-rule will only act on the defined "type"
  - mime-rule will only act on the defined MIME body type

Sub-rules

- Every top-level rule has zero or more sub-rules
  - header-rule can have element-rules
  - mime-rule can have mime-header-rules

- Sub-rules will be executed, based on certain conditions
  - Only if the top-level rule's msg-type/methods matched, AND:
    - If the top-level rule's action is add, store, find-replace-all, or sip-manip OR
    - If the top-level rule's action is manipulate and its match-value was TRUE
  - Sub-rules will not execute if the top-level rule's action was delete or none

- Every sub-rule executes in provisioned order, even if one sub-rule matches FALSE (does not execute)

CHEAT SHEET

Rule actions

- store – the item matched by match-value is saved for later reference (empty match-value means match everything)
- manipulate/replace – the item is replaced with new-value
- add – the item is added, with the contents of new-value
- delete – the item is deleted
- find-replace-all – the match-value is a regex applied against the item and replaced with the new-value, then again from the end of the previously matched spot in item
- sip-manip – run the sip-manipulation identified in new-value
- reject – if it's a SIP request, it's rejected with the response-code in the new-value
- log – certain portions of the SIP message are logged in matched.log
- none – rule not executed, nor are any sub-rules executed

What's the "item"?

- For a header-rule, it's the whole header value
  - The 'header-name' field defines the specific Header
- For an element-rule, its defined by the 'type' field
  - Valid 'types' are: header-value, header-param-name, header-param, uri-display, uri-user, uri-user-only, uri-phone-number-only, uri-user-param, uri-host, uri-port, uri-param-name, uri-param, uri-header-name, uri-header, status-code, reason-phrase, mime
- For a mime-rule, it's a MIME body part
  - The 'content-type' field defines the specific body
  - *We'll explain this more in Part 2 of this TechTalk*

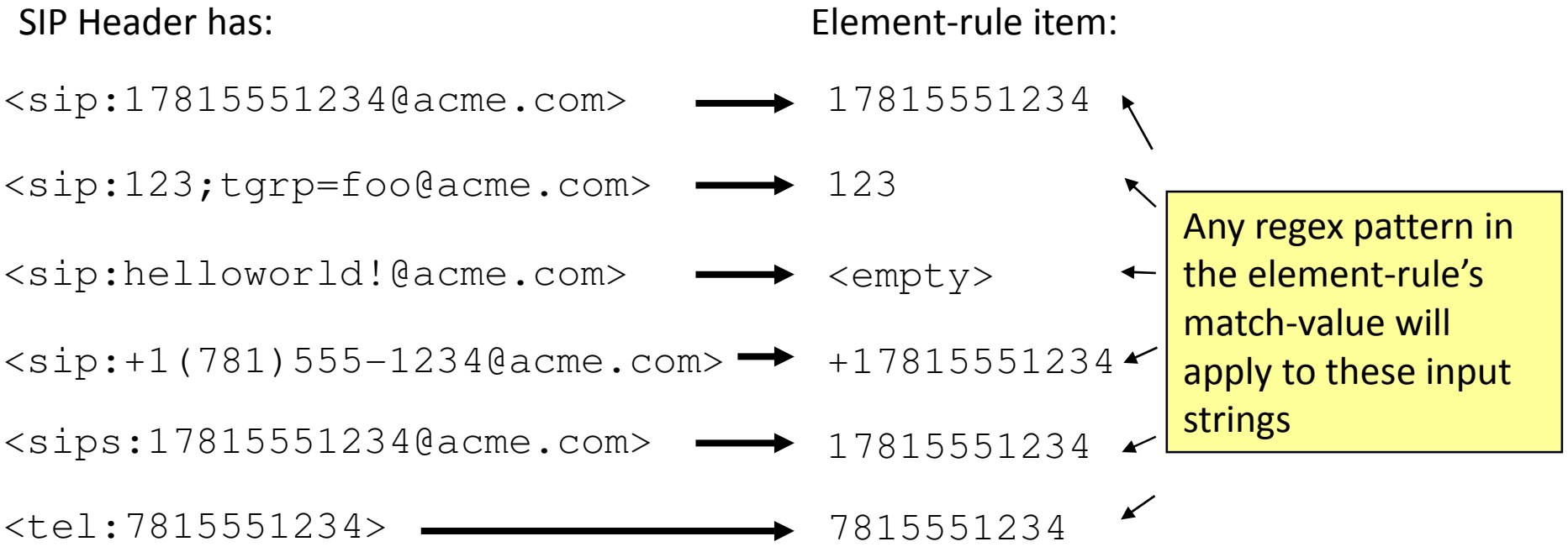
CHEAT SHEET

Example “items”

```
To: ”John Smith” <sip:+1(781)328-4400;rn=123@acmepacket.com;user=phone>;foo=bar
```

- The header-name is ‘To’
- The uri-display is ‘John Smith’
- The uri-user is ‘+1(781)328-4400;rn=123’
- The uri-user-only is ‘+1(781)328-4400’
- The uri-phone-number-only is ‘+17813284400’
- The ‘rn=123’ is a uri-user-param (‘rn’ is the param-type, ‘123’ is the value)
- The uri-host is ‘acmepacket.com’, the uri-port is ‘5060’
- The ‘user=phone’ is a uri-param (‘user’ is the param-type, and also a uri-param-name)
- The ‘foo=bar’ is a header-param (‘foo’ is the param-type, and also a header-param-name)

Uri-phone-number-only



- Using an element-rule, the *item* being worked on is constrained/filtered to be based on the 'type' configured
  - In this case of uri-phone-number-only, it's the digits, with/without the leading '+'
  - If it's not digits, it's as if the *item* didn't exist, so the action won't take place

The match-value field

- If the other constraints match (SIP message type, method name, parameter exists, etc.), the match-value is checked based on the configured 'comparison-type'
  - case-sensitive and case-insensitive compare the *string* in match-value against the *item*, using string comparison
  - refer-case-sensitive and refer-case-insensitive compare the *referenced* value in match-value against the *item*, using string compare
  - pattern-rule treats the match-value field as a regular expression, and performs regex comparison of it against the *item*
  - boolean treats the match-value as a boolean expression, and resolves it to TRUE or FALSE (i.e., not really related to the *item*)
- If the result of the match-value resolution is TRUE, then the action is performed
- If the match-value was a regex (and the comparison-type was pattern-rule), then it also stores the matches for later referencing

Dereferencing variables

- All references start with a '$' character
- References can refer to strings stored by previous Rules
  - The reference is defined by the *name* field of the Rule by which it was stored, e.g. $myHeaderRule.$0
  - If referencing sub-rules, the top-level Rule name must be noted first, e.g. $myHdrRule.$myElemRule.$0
- A reference ending with a $<number> resolves to the stored string or sub-string matched by the regex
  - $0 is the string matched by the whole regex pattern
  - $1 is the first parenthesis sub-group, $2 is the next, etc.
- A reference of just the $name resolves TRUE or FALSE for whether it matched or not (i.e., did it store anything)

Example references

- Assume the above is stored in an element-rule named "getPhone", of a header-rule named "getPAI"
  - $getPAI.$getPhone will resolve to TRUE
  - $getPAI.$getPhone.$0 will resolve to '17815551234'
  - $getPAI.$getPhone.$1 will resolve to '781'
  - $getPAI.$getPhone.$2 will resolve to '5551234'

CHEAT SHEET

Boolean operators

- New string-logic operators for use in match-value boolean logic
  - "==" case-sensitive string comparison
    - Resolves to TRUE if left and right strings are the same
    - Example: `match-value $getVal1.$0 == $getVal2.$0`
  - "~="case-insensitive string comparison
  - "!=" case-sensitive inequality (TRUE if left is not same as right)
- New integer-logic operators for match-value
  - "<=" less than or equal to, left-hand integer is less than right side
  - ">=" greater than or equal to operator
  - "<" less-than operator
  - ">" greater-than operator
  - Example: `match-value $getVal1.$0 >= $getVal2.$0`

The new-value field

- For most actions, the new-value field is used as an expression, which once resolved, results in a string to replace/add
  - The new-value is not a plain string – it's an expression
  - For sip-manip action, the new-value is used to hold the name of the sip-manipulation to be invoked
  - For reject action, the new-value field defines the response code, and optionally the reason-phrase, to use for the response

- Special command characters are used in new-value field
  - '+' is used to append/concatenate, '^+' is for prepend
  - '-' is used to truncate/cut, and '^-' is used to truncate from the front

```
new-value <sip:12345@acmepacket.com>
new-value <sip:+$FROM_PHONE.$0+@acmepacket.com>
new-value $ORIGINAL^+\+   (which is the same as "\++$ORIGINAL")
```

CHEAT SHEET

Nested HMRs

```
sip-manipulation
     name                          parent_HMR
     description
     header-rule
          name                     nested_Nat_IP
          header-name              From
          action                   sip-manip
          comparison-type          case-sensitive
          match-value
          msg-type                 any
          new-value                Nat_IP
          methods
last-modified-by                   admin@10.23.0.38
last-modified-date                 2008-08-06 10:18:08
```

You must put a valid header name here to trigger a match

Tells the SBC to call another HMR

Specify the name of your "child" HMR – in this case, our old pal Nat_IP

Using built in variables

CHEAT SHEET

Referencing built in variables

- HMR offers many system-defined "built in" variables

LOCAL_IP	TO_USER	PAI_USER
LOCAL_PORT	TO_PHONE	**PAI_PHONE**
REMOTE_IP	TO_HOST	PAI_HOST
REMOTE_PORT	TO_PORT	PAI_PORT
REMOTE_VIA_HOST	FROM_USER	PPI_USER
TRUNK_GROUP	FROM_PHONE	PPI_PHONE
TRUNK_GROUP_CONTEXT	FROM_HOST	PPI_HOST
MANIP_STRING	FROM_PORT	PPI_PORT
MANIP_PATTERN	CONTACT_USER	PCPID_USER
CRLF	CONTACT_PHONE	PCPID_PHONE
ORIGINAL	CONTACT_HOST	PCPID_HOST
REPLY_IP	CONTACT_PORT	PCPID_PORT
REPLY_PORT	RURI_USER	CALL_ID
TARGET_IP	RURI_PHONE	TIMESTAMP_UTC
TARGET_PORT	RURI_HOST	T_GROUP
M_STRING	RURI_PORT	T_CONTEXT

```
match-value $PAI_PHONE.$0==17813284428
match-value !$PAI_PHONE
new-value <sip:+$RURI_PHONE.$0+@+$REMOTE_IP.$0>
```

Note the $0 notation is to dereference that variable

Remember example 3?

```
sip-manipulation                                header-rule
     name              copyFrom                       name              modPAI
     description                                      header-name       P-Asserted-Identity
     header-rule                                      action            manipulate
          name              getFrom                   comparison-type   case-sensitive
          header-name       From                      match-value
          action            store                     msg-type          request
          comparison-type   pattern-rule              new-value
          match-value                                 methods           INVITE
          msg-type          request                   element-rule
          new-value                                      name              modName
          methods           INVITE                       parameter-name
          element-rule                                   type              uri-user
               name              getUser                 action            replace
               parameter-name                            match-val-type    any
               type              uri-user                comparison-type   boolean
               action            store                   match-value       $getFrom.$getUser
               match-val-type    any                     new-value         $getFrom.$getUser.$0
               comparison-type   pattern-rule
               match-value       ^\+?[0-9]+
               new-value
```

Example 3 reduced

```
header-rule
      name                  modPAI
      header-name           P-Asserted-Identity
      action                manipulate
      comparison-type       case-sensitive
      match-value
      msg-type              request
      new-value
      methods               INVITE
      element-rule
          name               modName
          parameter-name
          type               uri-user
          action             replace
          match-val-type     any
          comparison-type    boolean
          match-value        $FROM_PHONE
          new-value          $FROM_PHONE.$0
```

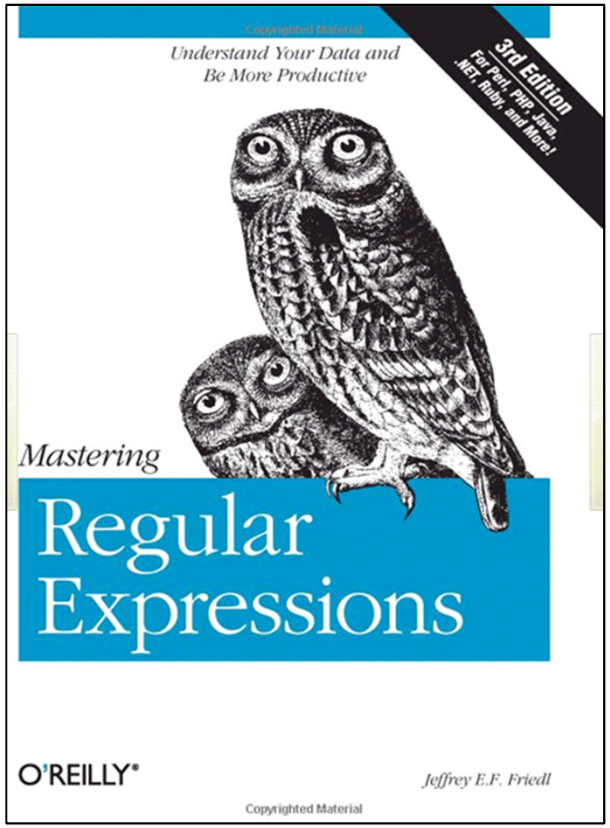
Now one header-rule can do what two rules did before!

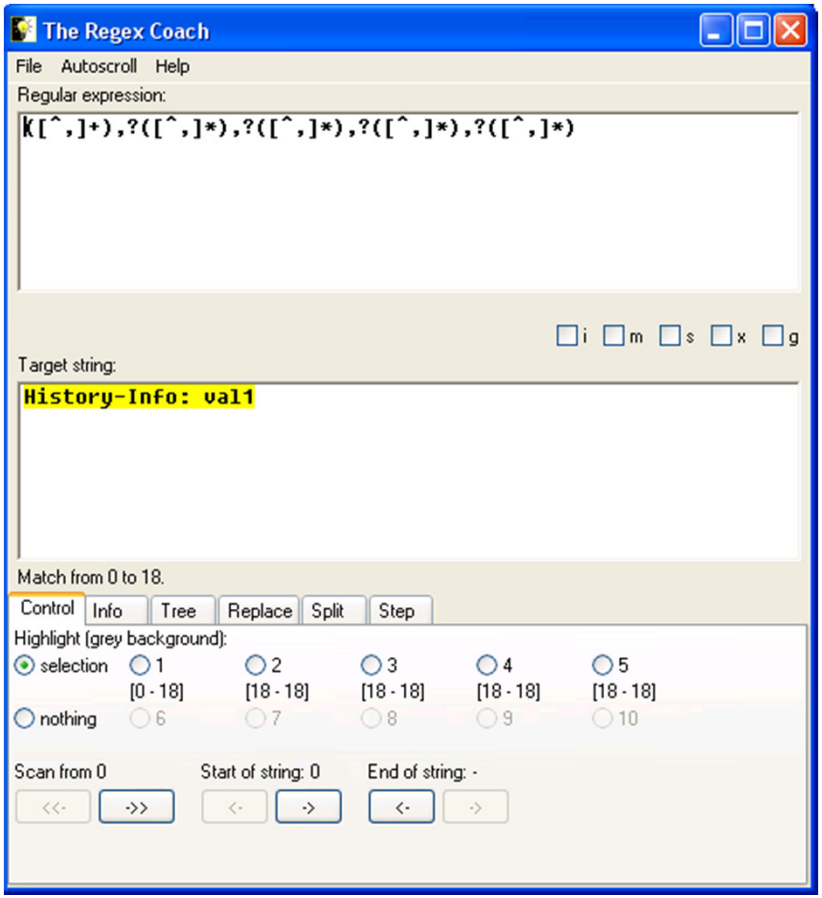
- Easier to provision
- Performs faster
- Easier to read

A mini primer on regular expressions

Regular Expressions

- Best book: *Mastering Regular Expressions* by Jeffrey Friedl
- Best tools: The Regex Coach and RegexBuddy (w/ tutorial)
- Best command: test-pattern-rule





Regex basics

- A regex engine starts at the first character of the regex pattern, and before the first character of the input string
- It walks across the string until the first command of the regex pattern is matched/true
- Then it moves to the next command in the pattern, and tries to match it to the current spot in the string – a spot can be between actual characters in the string
- This continues, until it can no longer match – if there is any (non-optional) pattern left, it failed (extra string doesn't matter)

CHEAT SHEET

Regex character commands

- Any character (letter, number, whatever) *except* "special characters" means match that literal character

- Special characters:

  . = match any character except carriage-return or linefeed

  ^ = match the *spot* of the beginning of a string

  $ = match the *spot* of the end of the string

  \ = escapes the next character, possibly making it a special/command, or making a special character no longer "special"

  + = match the previous command *one* or more times, as much as possible

  * = match the previous command *zero* or more times, as much as possible

  ? = match the previous command *zero* or *one* times, prefer *one*

  | = match the whole pattern on the left, or the one on the right of the bar

  [= starts a bracket "character class"

  (= starts a parenthesis group

  { = starts a brace min/max repetition count

Regex backslash commands

- When a "\" backslash is before a "special character", it makes it no longer special, but just literal (e.g., "\." matches a period)
- When a backslash is before a backslash, it makes it match a literal "\" backslash in the input string
- When a backslash is before a normal character, it means another command:

  \, = match any character, including carriage-return or linefeed

  \b = match the spot between a word character, and a non-word one

  \B = match the spot between two word characters, or between two non-word characters

  \d, \w, \s = match a digit, word character, whitespace respectively

  \D, \W, \S = match the opposite of the characters of \d, \w, \s

  \r, \n, \f, \t, \v = match carriage-return, newline, form-feed, h-tab, v-tab

  \R = match either \r or \n or both together \r\n

Regex character classes

- A bracket pair "[…]" encompass a character class
- This can take on of two forms: either a list of characters, possibly including ranges, to match *one* character in the string to, or the negation of it if "[^…]"

BRACKET PAIR:

`^555[12].*`

`5551234`

`5552234`

`5553234`

NEGATION:

`^555[^12].*`

`5551234`

`5552234`

`5553234`

Braced min/max repetitions

- A "{*n*,*m*}" is a command which means match the previous command a minimum of *n* times, to a maximum of *m* times, preferably more
  - *m* can be left blank, to mean the max is infinite
- A "?" is basically the common case of "{0,1}"
- A "*" would be the same as "{0,}" and a "+" would be "{1,}"

Breaking down a real-world example

```
element-rule
     name                    getDigits
     parameter-name
     type                    uri-user
     action                  store
     match-val-type          any
     comparison-type         pattern-rule
     match-value             ^\+1([0-9]{6}).*$
     new-value               $1
```

- ^ => start of string
- \+ => delimiter for the “plus” character
- [0-9] => any character in the specified range, meaning 0123456789
- {6}=> six characters from that range, so [0-9]{6} could be anything from 000000 to 999999
- .* => any sequence of characters
- $ => end of string
- Parentheses store the six digit string in the variable $1

CHEAT SHEET

…and accessing the values

```
element-rule
     name                    getDigits
     parameter-name
     type                    uri-user
     action                  store
     match-val-type          any
     comparison-type         pattern-rule
     match-value             ^\+1([0-9]{6}).*$
     new-value               $1
```

- To access the digits stored by this element-rule, I need to dereference what is in the parentheses
  - $HR.$ER.$0 => this is the ENTIRE string that you're matching against, and this is how you would dereference the value to use it ELSEWHERE in your HMR
  - $0 => when used as the new-value for a given match-value, this is the ENTIRE string that you're matching against in that corresponding match-value
  - $1 => when used as the new-value for a given match-value, this is the value stored in the FIRST set of parentheses; to access it ELSEWHERE within the HMR you would do a $HR.$ER.$1
  - $2 => when used as the new-value for a given match-value, this is the value stored in the SECOND set of parentheses

HMR strategies and best practices

When authoring HMRs…

- Often times, there are different ways to tackle HMR requirements – and some are better than others
- A good rule of thumb is to think "performance first"
  - Reuse as many "built in" variables as possible
  - Avoid lengthy string matches unless absolutely necessary
  - Wherever possible, constrain your HMR appropriately by specifying a SIP method and message type
- Practice and document!
  - Over time, an HMR library proves to be invaluable

Tips on using regex patterns

- ALWAYS use a ^ beginning of line anchor if you can
- ALWAYS use a $ end of line anchor if you can
- Do not use parentheses unless you need to
- Try to avoid .* or .+ if you expect to have text following it
- Sometimes, the NOT operator e.g. [^abc] can give you the easiest access to the string you're looking to retrieve
- Avoid vague search patterns like (.*)foo(.*) or (foo.*bar)*
- Think of other possible combinations for your match
  - If you are looking for a particular string it could be at the beginning, the middle, or the end of a line. You have to plan for all cases!
- Test your pattern against things that do NOT match, or that you don't want to match

Tips on HMR for performance and security

- Use element-rules to store/modify/add/delete the specific SIP header pieces you want instead of just using a header-rule

- Reduce the number of header-rules as much as possible

- Try to make your rules generic and future-proof
  - Avoid creating sip-manips for each realm/agent
  - Don’t forget sips and tel URIs
  - Not all URI usernames are numbers, and some have user-params
  - REGISTERs can have more than one Contact header
  - Phone numbers can have visual-separators: +1(212)555-1212 => uri-phone-number-only

Use caution with regular expressions

- Be very careful with MIME manipulation, e.g. SDP
  - They're big strings, so regex MUST be efficient
  - SDP is a *protocol*, and has rules – don't break them
  - SDP offers are NOT always in INVITEs – for example, delayed offers come back in 18x/200ok, and answers can be in PRACK or ACK
- Be mindful of RegEx performance
  - Example: (.*)foo(.*) is really not efficient, though it may be the only solution
  - Often the worse-case performance is when your regex does NOT match

Two sample HMRs of varying complexity

Two HMRs of varying complexity

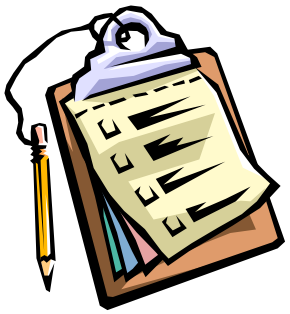
- Beginner: HMR to strip leading plus from Diversion
- Intermediate: HMR to add a cn RURI param containing charge number
- *Expert: two part HMR to turn Recvonly into Sendonly in transcoding scenarios*
  - *We'll save this one for the "HMR – Part 2" TechTalk*

Q&A

Summary – Part 1

Key takeaways

- Make sure you need to use HMR in the first place!
- Think “performance first”
  - Avoid string matches if at all possible
  - Use built in variables as much as possible
- Regular expressions are not as scary as you might think… You just need to practice!
- HMR is not as scary as you might think… You just need to practice!

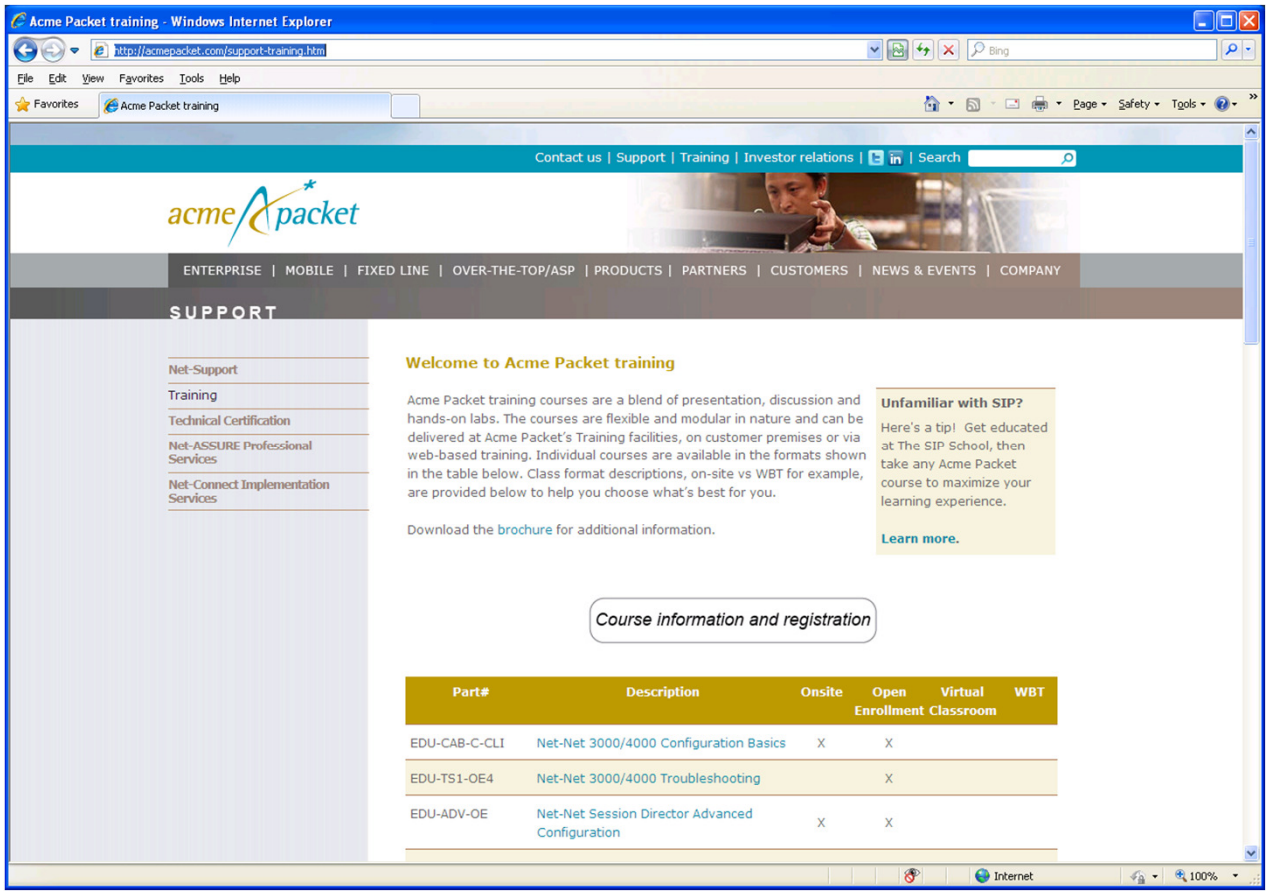


For more information

- Acme Packet documentation
  - Acme Packet HMR Developer's Guide
  - Net-Net Session Director Configuration Guide
  - Net-Net Session Director ACLI Reference Guide
- Acme Packet Best Current Practices (BCP) documents available on the Acme Packet Support Portal
- The Acme Packet Community
- Acme Packet training
- Direct Acme Packet support

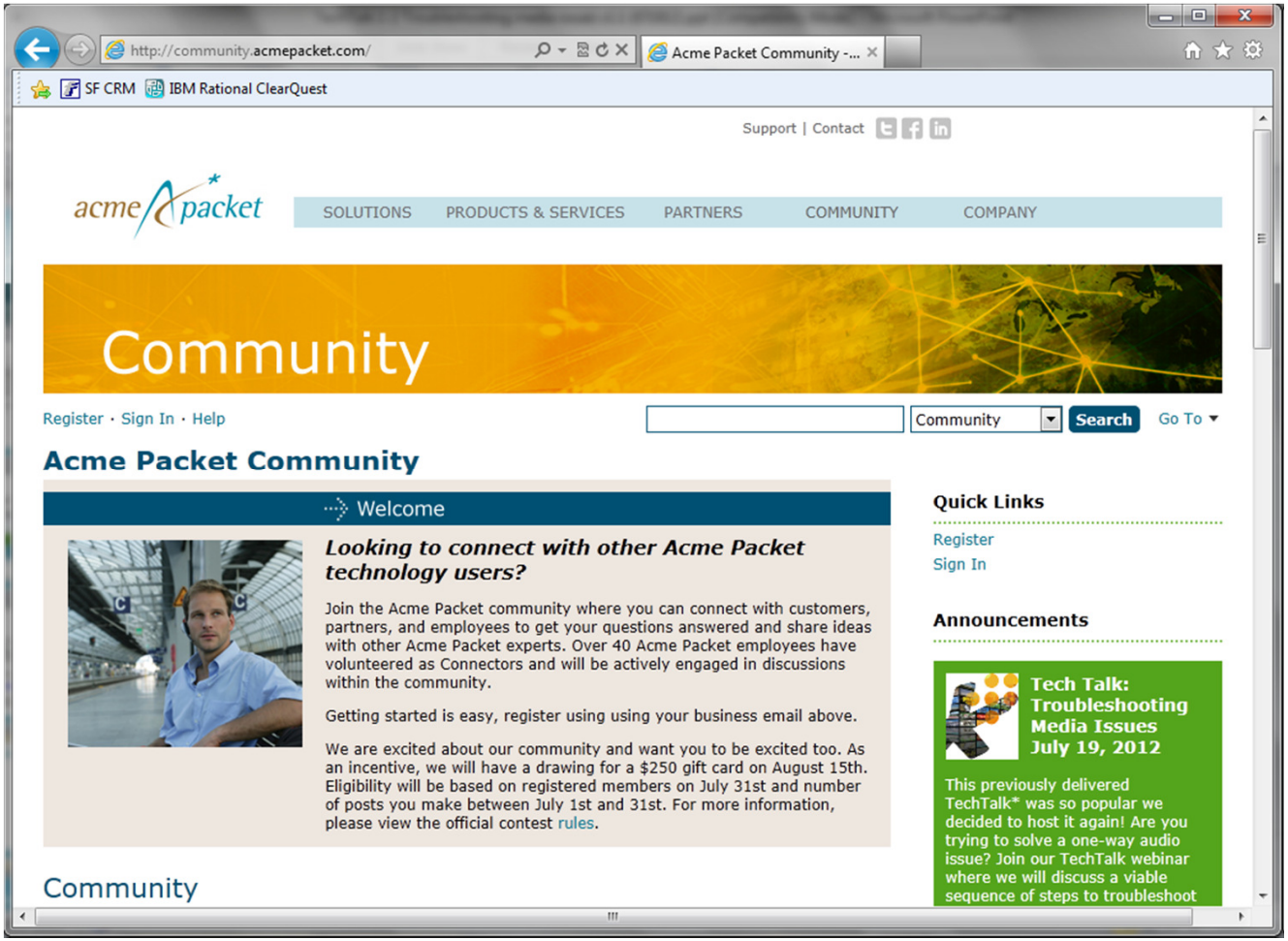
And remember…

- Formal Acme Packet training is available in the area of HMR and other topics



Join the Acme Packet Community

- Come get connected! Post questions – and answer some too!



Thank you for attending!

Our next TechTalk Webinar:

HMR Part 2 – Advanced Concepts

13 February 2013