SmartMesh IP VManager CLI Guide
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1 About This Guide

1.1 Related Documents

The following documents are available for the SmartMesh IP network:

1.1.1 Getting Started with a Starter Kit

- **SmartMesh VManager Easy Start Guide** - walks you through basic VManager installation and a few tests to make sure your network is working.
- **SmartMesh IP Embedded Manager Easy Start Guide** - walks you through basic embedded manager installation and a few tests to make sure your network is working.
- **SmartMesh IP Embedded Manager Tools Guide** - the installation section contains instructions for installing the serial drivers and example programs used in the Easy Start Guide and other tutorials.

1.1.2 User's Guide

- **SmartMesh IP User's Guide** - describes network concepts, and discusses how to drive mote and manager APIs to perform specific tasks, e.g. to send data or collect statistics. This document provides context for the API guides. It also contains a glossary of SmartMesh terms.

1.1.3 Interfaces for Interaction with a Device

There are two interfaces for interaction with a Manager - an Application Programming Interface (API) for programmatic interaction, and a Command Line Interface (CLI) for human interaction.

- **SmartMesh IP Embedded Manager CLI Guide** - used for human interaction with an embedded manager (e.g. during development of a client, or for troubleshooting). This document covers connecting to the CLI and its command set.
- **SmartMesh IP Embedded Manager API Guide** - used for programmatic interaction with an embedded manager. This document covers connecting to the API and its command set.
- **SmartMesh IP VManager CLI Guide** - used for human interaction with a VManager (e.g. during development of a client, or for troubleshooting). This document covers connecting to the CLI and its command set.
- **SmartMesh IP VManager API Guide** - used for programmatic interaction with a VManager. This document covers connecting to the API and its command set.
- **SmartMesh IP Mote CLI Guide** - used for human interaction with a mote (e.g. during development of a sensor application, or for troubleshooting). This document covers connecting to the CLI and its command set.
1.1.4 Access Point Motes

- SmartMesh IP User's Guide - describes reprogramming DC2274 for use as an Access Point Mote.
- VManager AP Bridge User’s Guide - user’s guide for the Access Point Bridge reference software

1.1.5 Software Development Tools

- Dustcloud.org - contains documentation and links to various open source software tools for exercising mote and manager APIs and visualizing the network.

1.1.6 Application Notes

- SmartMesh IP Application Notes - Cover a wide range of topics specific to SmartMesh IP networks and topics that apply to SmartMesh networks in general.

1.1.7 Documents Useful When Starting a New Design

- The Datasheet for the mote being used, e.g. the LTC5800-IPM SoC, or one of the modules based on it.
- The Datasheet for the embedded manager being used, e.g. the LTC5800-IPR SoC, or one of the embedded managers based on it.
- A Hardware Integration Guide for the mote/manager SoC or module - this discusses best practices for integrating the SoC or module into your design.
- A Hardware Integration Guide for the embedded manager - this discusses best practices for integrating the embedded manager into your design.
- A Board Specific Integration Guide - For SoC motes and Managers. Discusses how to set default IO configuration and crystal calibration information via a "fuse table".
- Hardware Integration Application Notes - contains an SoC design checklist, antenna selection guide, etc.
- The ESP Programmer Guide - a guide to the DC9010 Programmer Board and ESP software used to load firmware on a device.
1.1.8 Software

- ESP software - used to program firmware images onto a mote or module. Described in the ESP Programmer Guide.
- Fuse Table software - used to construct the fuse table as discussed in the Board Specific Configuration Guide.

1.1.9 Other Useful Documents

- A list of Frequently Asked Questions.
1.2 Conventions Used

The following conventions are used in this document:

**Computer type** indicates information that you enter, such as specifying a URL.

**Bold type** indicates buttons, fields, menu commands, and device states and modes.

**Italic type** is used to introduce a new term, and to refer to APIs and their parameters.

- **Tips** provide useful information about the product.
- **Informational text** provides additional information for background and context.
- **Notes** provide more detailed information about concepts.
- **Warning!** Warnings advise you about actions that may cause loss of data, physical harm to the hardware or your person.

**Code blocks** display examples of code.

The CLI commands are described using the following notations and terminology:

```
| Indicates alternatives for a field. For example, 
<macAddr> | <moteId> indicates that you can specify a mote by its mote ID or MAC address.
< > Indicates a required field.
{} Indicates a group of fields.
[] Indicates an optional field.
```
When specifying a MAC address, do not use spaces. You may omit hyphens (though this document uses them to enhance readability).

The following examples are all valid:

```
$> show mote 00000000000022CA
$> show mote 00-00-00-00-00-00-22-CA
```
### 1.3 Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12/15/2015</td>
<td>Initial Release</td>
</tr>
<tr>
<td>2</td>
<td>08/19/2016</td>
<td>Phase I Production</td>
</tr>
<tr>
<td>3</td>
<td>11/08/2016</td>
<td>Added show apcs command; Updated show mote/ap command; Numerous minor improvements</td>
</tr>
<tr>
<td>4</td>
<td>11/18/2016</td>
<td>Updated config set network command</td>
</tr>
<tr>
<td>5</td>
<td>03/15/2017</td>
<td>Clarified show unjoined command; Updated some sample output examples</td>
</tr>
</tbody>
</table>
2 Introduction

This guide describes the commands that you can send to a SmartMesh IP VManager by logging on to its Command Line Interface (CLI). The CLI is available via ssh connection to the Manager server. The CLI is intended for human interaction with a manager, e.g. during development, or for interactive troubleshooting. Most commands are atomic - a command and its arguments are typed into the CLI, and a response is returned. For example, the `help` command returns a list of possible commands. Commands that perform network operations are not atomic - they generate output asynchronously after receiving a response. Traces are not atomic - once started, they generate output asynchronously until cancelled.

For a machine-to-machine communications (e.g. a host program talking to the manager), the Application Programming Interface (API) is used. See the SmartMesh IP VManager API Guide for details.

2.1 Manager Connection

To access the CLI, you must first connect to the Manager Linux shell. This can be done using any terminal program that supports ssh, such as PuTTY or TeraTerm on Windows, or from any console/terminal window in Linux/OS X. You must know the IP address of the Manager server to ssh - e.g. if the server is at 192.168.1.100, then you would use:

```
$ ssh dust@192.168.1.100
```

You will be prompted for a password. For the user `dust`, the default password is also `dust`. For the SSH connection, users are managed through the system’s user management commands.

Issue the `console` command from the Linux shell to start the CLI. The default username is `dust` and password is `dust`. For the Console and API connections, users are managed internally within the VManager configuration.

```
dust@voyager-vm:~$ console
Welcome to the Voyager CLI Console on Linux
Version 0.1.0.10

Enter your username: dust
dust's password:
$>
```

Note that although the default username and password (used to log into the console) are the same as the Linux login, these are separate logins and can be re-configured separately.
2.1.1 Managing User Accounts

Once logged into CLI, the user can change the password (or any other user field) for the default user account using the config set user CLI command:

```bash
$> show user dust
User information:  
   Id:       dust  
   Privilege: USER  
   Description: duster

$> config set user dust description="a dust user"
Done

$> config reload users
Done

$> show user dust
User information:  
   Id:       dust  
   Privilege: USER  
   Description: a dust user
```
Note that once the persistent user database has been modified, it must be reloaded to take effect. Similarly, new users can be created, and unneeded users can be deleted:

```
$> show users
User configuration:
Id:     dust

$> config set user bobo description="bobo" password="free4willy" privilege=user
Done

$> config reload users
Done

$> show users
User configuration:
Id:     dust
Id:     bobo

$> config delete user bobo
Done

$> config reload users
Done

$> show users
User configuration:
Id:     dust
```

### 2.1.2 Helpful tips

This manual describes the console commands available in the SmartMesh IP VManager. The console is case sensitive.

Several console shortcuts are available for command entry:

- The **up-arrow** key cycles through a history of previous commands
- The **tab** key autocompletes partially entered command names
- The `#` prefix can be used to simplify MAC addresses, e.g. `show mote #38-01-02` expands to `show mote 00-17-0D-00-00-38-01-02`

Commands that generate multi-page output can be invoked with a `-p` (or `--page`) switch to produce paginated output - pressing the **return** key advances to the next page.
2.1.3 Stored Versus Active Configuration

VManager distinguishes between active configuration parameters from those stored for use the next time the manager is started.

- The `show` commands display the active configuration
- The `config set/get` commands store or display stored parameters
- The `config reload` command overwrites the active configuration for a particular module with the stored version
- The `config restore` command overwrites the stored configuration with default values, aka "factory restore"

2.1.4 API Equivalents

API equivalents to CLI commands are given in Swagger format, e.g.:

```
POST /path/to/a/resource
```

See the Swagger documentation for JSON format of requests and responses for the equivalent API call.
3 Commands

3.1 clear

Description
This command clears the console screen

Syntax

```
clear
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> clear
```
3.2 config

The config commands interact with the stored inactive configuration settings. To see the currently used active settings, use the `show` command.

3.2.1 config delete

Description

Delete an item from a list in stored configuration.

Syntax

```
config delete acl <macAddr> | dcl <macAddr> | user <userId>
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(one of the following)</td>
<td></td>
</tr>
<tr>
<td>acl</td>
<td>Delete a mote from the access control list, <code>macAddr, joinkey</code></td>
</tr>
<tr>
<td>dcl</td>
<td>Delete a mote from the deny control list, <code>macAddr</code></td>
</tr>
<tr>
<td>user</td>
<td>Delete a user from the system</td>
</tr>
</tbody>
</table>

Example

```
$> config delete dcl 00-17-0D-00-00-12-34-56
Done

$> config delete user mrdusty
Done
```
3.2.2 config deletei

Description

Deletes the contents of an INI value that was changed by a user, and resets it to the default value. This does not delete the actual parameter, its value is reset to the system defaults. If a non-existent parameter is entered, no error message is returned.

⚠️ This command requires superuser privileges - see the su command. INI parameters should only be changed under Linear guidance to achieve specific performance goals.

Syntax

```bash
config deletei <param>
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>param</td>
<td>Parameter to be reset</td>
</tr>
</tbody>
</table>

Example

```
#> config deletei BWMULT
Done
```
3.2.3 config get

Description

Display stored configuration for the requested item(s). When the -p or --page option is used, output is paused after each page.

Syntax

```
config get [-p|--page] acl <macAddr> |
          dcl <macAddr> |
          network |
          system |
          user <userId> |
          users
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>Get the stored access control list (acl) configuration - entire acl or entry for mote macAddr</td>
</tr>
<tr>
<td>dcl</td>
<td>Get the stored deny control list (dcl) configuration - entire dcl or entry for mote macAddr</td>
</tr>
<tr>
<td>network</td>
<td>Get the stored network configuration</td>
</tr>
<tr>
<td>system</td>
<td>Get the stored system configuration</td>
</tr>
<tr>
<td>user</td>
<td>Get the stored user configuration for user userId</td>
</tr>
<tr>
<td>users</td>
<td>Get the stored users configuration</td>
</tr>
</tbody>
</table>

Example
$> config get -p acl
00-17-0D-00-00-12-34-AA
00-17-0D-00-00-12-34-AB

$> config get dcl
00-17-0D-00-00-12-34-56

$> config get network
Network configuration:
  networkId:              294
  topologyType:           MESH
  dsFrameMultiplierDelay: 3600000
  ccaMode:                0
  ipAddrPrefix:           FE80::
  basePkPeriod:           15000
  dsFrameMultiplier:      1
  joinSecurityType:       COMMON_SKEY
  minServicePkPeriod:     100
  dsFrameSize:            512
  numParents:             2
  gpsMode:                False
  channelList:            32767
  usFrameSize:            1024

$> config get system
System configuration:
  Name:
  Location:
  CLI timeout: 0 minutes

$> config get users
User configuration:
  Id:     dust

$> config get user dust
User information:
  Id:     dust
  Password: ****
  Privilege: USER
  Description: duster
3.2.4 config geti

Description

Displays internal INI settings. If a parameter `param` isn’t specified, all parameters are listed. An asterisk (*) can be used as a wildcard in the `param` field.

⚠️ This command requires superuser privileges - see the `su` command. There are a large number of tuning parameters (not documented here) that have been optimized for general use - most use cases will use the default parameters. INI parameters should only be changed under Linear guidance to achieve specific performance goals.

Syntax

```
config geti [param]
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>param</td>
<td>Name of the INI parameter</td>
</tr>
</tbody>
</table>

Example

```
#> config geti *
MNGRINI Module configuration :
ADV_SEND_TO:180000
ADV_TIME_DELAY:3600000
ADV_TIME_OFF:1000
ADV_TIME_ON:1000
.....
#> config geti NUMBCAST
MNGRINI Module configuration :
NUMBCAST:2
```
### 3.2.5 `config set`

**Description**

Change the stored inactive configuration settings. If an item does not exist, it will be created if appropriate. Fields arguments whose names contain spaces, need to be wrapped in quotes. For example `sysName = "Foo Bar"`.

All settings changed in inactive memory have no effect on the system until they are loaded into active memory. To do so, use the `config reload <module> | all` command. Also note that all settings marked with an asterisk (*) require a system reset before they can take effect, using the `reset --reload` command.

**Syntax**

```
config set acl <macAddr> joinKey=<joinKey> |
   dcl <macAddr> |
   network {<field=val> [field2=val2] ...} |
   system {<field=val> [field2=val2] ...} |
   user <userId> {<field=val> [field2=val2] ...}
```

**Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(one of the following)</strong></td>
<td></td>
</tr>
<tr>
<td>acl</td>
<td>Store the access control list entry tuple <code>macAddr, joinkey</code>, where <code>joinkey</code> is a 16-byte key</td>
</tr>
<tr>
<td>dcl</td>
<td>Store the deny control list entry for mote <code>macAddr</code></td>
</tr>
<tr>
<td>network</td>
<td>Store a network configuration field</td>
</tr>
<tr>
<td>system</td>
<td>Store a system configuration field</td>
</tr>
<tr>
<td>user</td>
<td>Store a user’s configuration (Note: UserID can ONLY small letters and numbers are valid)</td>
</tr>
</tbody>
</table>

**Example**
$>  config set acl 00-17-0D-00-00-60-04-B0 joinkey=445553544E4554574F524B53524F434B
Done

$>  config set dcl 00-17-0D-00-00-12-34-56
Done

$>  config set system sysName="Foo" location="Bar Baz"
Done

$>  config set user mrdusty privilege=user
Done

$>  config reload all
Done
### config set network parameters

The following network parameters are settable. Note that all items marked with an asterisk (*) require a `reset network --reload` command to take effect. This will cause a full network reset.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>networkId *</td>
<td>Network ID</td>
<td>1229</td>
</tr>
<tr>
<td>topologyType *</td>
<td>Routing and cascading (MESH), routing and non-cascading (EVENT), or non-routing (STAR)</td>
<td>MESH</td>
</tr>
<tr>
<td>downFrameMultiplierDelay *</td>
<td>Time from first mote join until switching to use the downstream frame multiplier (ms)</td>
<td>3600000</td>
</tr>
<tr>
<td>ccaMode *</td>
<td>Mode used for clear channel assessment. 0=False=off, 1=True=on</td>
<td>False</td>
</tr>
<tr>
<td>ipAddrPrefix *</td>
<td>IP Address Prefix for WSN</td>
<td>FE80::</td>
</tr>
<tr>
<td>basePkPeriod</td>
<td>Minimum bandwidth to allocate to each device (ms)</td>
<td>15000</td>
</tr>
<tr>
<td>downFrameMultiplier</td>
<td>Downstream frame multiplier for steady state. The downstream frame is extended from <code>downFrameSize</code> to <code>downFrameSize * downFrameMultiplier</code> after the network has formed</td>
<td>1</td>
</tr>
<tr>
<td>joinSecurityType *</td>
<td>Security mode for joining devices - one of COMMON_SKEY, COMMON_SKEY_QUARANTINE, UNIQUE_SKEY)</td>
<td>COMMON_SKEY</td>
</tr>
<tr>
<td>commonJoinKey</td>
<td>Common join key (only valid if <code>joinSecurityMode</code> is set to COMMON_SKEY or COMMON_SKEY_QUARANTINE. Must be in base64 format and be 128 bits long. For security reasons, the key is not returned in GET response</td>
<td>44 55 53 54 4E 45 54 57 4F 52 4B 53 52 4F 43 4B</td>
</tr>
<tr>
<td>minServicePkPeriod</td>
<td>Minimum (fastest) service request allowed (ms)</td>
<td>100</td>
</tr>
<tr>
<td>downFrameSize *</td>
<td>Downstream frame size (slots). Must be within a factor of 4 smaller or larger than <code>upFrameSize</code>.</td>
<td>512</td>
</tr>
<tr>
<td>numParents</td>
<td>Desired number of parents for each mote</td>
<td>2</td>
</tr>
<tr>
<td>channelList *</td>
<td>Bitmap of used channels (b0 = IEEE channel 11)</td>
<td>32767</td>
</tr>
<tr>
<td>upFrameSize *</td>
<td>Upstream frame size (slots). Must be within a factor of 4 smaller or larger than <code>downFrameSize</code>.</td>
<td>512</td>
</tr>
<tr>
<td>gpsMode *</td>
<td>Clock source for the network, GPS or free-running. 0=False=off, 1=True=on</td>
<td>False</td>
</tr>
</tbody>
</table>

### Example
$> config set network networkId=1229
Done
$> reset network --reload
config set system parameters

The following system parameters are settable:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sysName</td>
<td>Name string assigned by the user</td>
</tr>
<tr>
<td>location</td>
<td>Location string assigned by the user</td>
</tr>
<tr>
<td>cliTimeout</td>
<td>CLI timeout for inactive session (s)</td>
</tr>
</tbody>
</table>

Note that strings containing spaces must be entered in quotes, e.g. “Mr Dusty”.

config set user parameters

Create a new user. The following user parameters are settable:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>userId</td>
<td>User id (string), see userId limitations below</td>
</tr>
<tr>
<td>description</td>
<td>Description of the user</td>
</tr>
<tr>
<td>password</td>
<td>User password</td>
</tr>
<tr>
<td>privilege</td>
<td>User privilege level, user or viewer</td>
</tr>
</tbody>
</table>

There are two possible privilege settings. The user privilege has access to all (non-su) commands and can change system settings, while the viewer privilege can only view settings.

The userId must consist of only lowercase letters, numbers, and the _ and - characters, and must begin with a letter. No uppercase letters, spaces, or other characters may be part of the userId.

Example

$> config set user mrdusty privilege=user password=mypw
Done
3.2.6 config seti

Description

Change internal INI parameters.

⚠️ This command requires superuser privileges - see the `su` command. There are a large number of tuning parameters (not documented here) that have been optimized for general use - most use cases will use the default parameters. INI parameters should only be changed under Linear guidance to achieve specific performance goals.

Syntax

```
config seti <param>=<value>
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>param</td>
<td>Name of the INI parameter</td>
</tr>
<tr>
<td>value</td>
<td>New value for the INI parameter</td>
</tr>
</tbody>
</table>

Example

```
$> config seti numbcast=3
OK
```
### 3.2.7 config reload

#### Description
Configuration information saved in "stored" memory is loaded into active memory. The system starts using the new loaded parameters immediately.

The keyword 'all' can be used in place of a module to reload all modules.

#### Syntax
```
config reload <module>|all
```

#### Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>module</td>
<td>reload the specified module</td>
</tr>
</tbody>
</table>

#### Example

```
$> config reload all
Done

Creating a new user and making it active would be done as follows...

$> config set user mrdusty privilege=user password=mypw
Done

$> show user mrdusty
Error: Entry not found
$> config reload users
Done
$> show user mrdusty
User information:
   userId:   fred
   privilege: USER
   description:
```
3.2.8 config restore

Description

Restore all configurations to their factory default settings.

⚠️ This command will restore all settings to their factory default settings. All user settings will be lost and cannot be recovered.

⚠️ The VManager must be explicitly restarted after issuing this command.

Syntax

```
config restore
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> config restore
OK
```
3.3 exec

The exec commands interact with the network or topology database.

3.3.1 exec clearStats

Description

Clear accumulated statistics

Syntax

```
exec clearStats
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> exec clearStats
Done
```
3.3.2 exec decommission

Description

This command prepares a mote for graceful removal from the network by moving its children to other parents. Returns a callback ID - this callback ID will be contained in a subsequent console notification when the mote is ready for deletion. Note that in some cases a child may have no other possible parents (this will never occur if following recommended deployment guidelines) so the child will be stranded when the mote is reset.

Syntax

```
exec decommission <macAddr|moteId>
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>macAddr or moteId</td>
<td>Decommission the mote specified by macAddr or moteId</td>
</tr>
</tbody>
</table>

Example

```
$> exec decommission 00-17-0D-00-00-12-34-56

Done. Callback id: 1
```
### 3.3.3 exec deleteMote

**Description**

Delete a mote from the network. If the mote is not currently lost, it should be decommissioned first to avoid potential data loss.

This command should be used to clear a mote’s join counter in the event that it is completely reflashed. Failure to do so will prevent a mote from joining the network until the join counter matches. The same applies to *blink* packets when using that mode, none will be delivered until the join counter matches.

**Syntax**

```
exec deleteMote <macAddr|moteId>
```

**Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>macAddr or moteId</td>
<td>Delete the mote specified by <em>macAddr</em> or <em>moteId</em></td>
</tr>
</tbody>
</table>

**Example**

```
$>  exec deleteMote 00-17-0D-00-00-12-34-56

Done
```
3.3.4 exec deleteUnjoined

Description

Removes configdb entries for motes not currently in the topology. This command is useful for removing an unjoined mote that has been reprogrammed such that its join counter may not match that in the configdb.

Syntax

```bash
exec deleteUnjoined
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> exec deleteUnjoined
Done
```
3.3.5 exec exchJoinKey

Description

This command changes the join key on the specified mote. This command also updates the corresponding ACL entry once the mote has responded affirmatively to the command.

Syntax

exec exchJoinKey <macAddr|moteId> <key>

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>macAddr or moteId</td>
<td>Change the joinKey on the mote specified by macAddr or moteId</td>
</tr>
<tr>
<td>key</td>
<td>The new 16-byte join key</td>
</tr>
</tbody>
</table>

Example

$> exec exchJoinKey 00-17-0D-00-00-12-34-56 0001020304050607080A0B0C0D0E0F

Done. Callback id: 1
3.3.6 exec exchNetId

Description

This command distributes a new network ID to all the motes in the network. Returns a callback ID - this callback ID will be contained in a subsequent console notification when the netId has been changed.

Syntax

exec exchNetId <newNetId>

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>newNetId</td>
<td>Change the network's ID to newNetId</td>
</tr>
</tbody>
</table>

Example

$> exec exchNetId 294

Done. Callback id: 2
3.3.7 exec motelog

Description

This command retrieves a mote’s reset log.

Syntax

exec motelog <macAddr|moteId>

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>macAddr or moteId</td>
<td>Retrieve the log file from the mote specified by macAddr or moteId</td>
</tr>
</tbody>
</table>

Example

```sh
$> exec motelog 00-17-0D-00-00-12-34-56
$> TRACE MOTELOG
   2015-12-09 15:10:27.890 from mote 00-17-0D-00-00-12-34-56 : (x100)
```

In this example the mote returns reset code 0x100 indicating a normal (watchdog) reset.
3.3.8 exec setAdv

Description

This command controls advertising in the network. Setting to off turns off all advertisements to prevent motes from joining the network. Setting to on turns on mote advertisements to allow motes to join the network. The VManager does not automatically turn advertising on and off.

⚠️ It is dangerous to turn off advertising in the network. When advertising is off, new motes can not join and existing motes can not rejoin the network after a reset. Turning off advertising may be useful in unusual situations, such as to prevent motes from joining the network or to save power. In most cases, it is best to allow advertising to remain under the control of the VManager.

Syntax

exec setAdv <on|off>

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>on or off</td>
<td>on = enable advertisements, off = disable advertisements</td>
</tr>
</tbody>
</table>

Example

```bash
$> exec setAdv on
Done
```
3.3.9 exec sendData

Description

Send a packet to a mote. This command is equivalent to invoking the API command POST /motes/m/{mac}/dataPacket.

Syntax

exec sendData <macAddr|moteId> <srcPort> <dstPort> <priority> <payload>

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>macAddr or moteId</td>
<td>Send packet to the mote specified by macAddr or moteId</td>
</tr>
<tr>
<td>srcPort</td>
<td>UDP source port of the packet</td>
</tr>
<tr>
<td>dstPort</td>
<td>UDP destination port of the packet</td>
</tr>
<tr>
<td>priority</td>
<td>Priority of the packet. One of LOW, MEDIUM, or HIGH</td>
</tr>
<tr>
<td>payload</td>
<td>Payload bytes of the packet, in hexadecimal. Maximum size of payload is 80 bytes</td>
</tr>
</tbody>
</table>

Example

Send packet to mote, source port=0xF0B8, destination port= 0xF0B8, priority=MEDIUM, payload bytes=0x11 0x22 0x33 0x44 0x55:

```bash
$> exec sendData 00-17-0D-00-00-12-34-56 61624 61624 MEDIUM 1122334455
Done. Callback id: 2
```
3.3.10 exec sendIP

Description

This command sends a packet with specified payload to a mote. It requires that the user construct a valid 6LoWPAN header that is prepended to their data. This command is equivalent to invoking the API command POST /motes/m/{mac}/ipPacket.

Syntax

exec sendIP <macAddr> <priority> <encryptionOffset> <payload>

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>macAddr</td>
<td>MAC address of the mote that is the destination of the packet</td>
</tr>
<tr>
<td>priority</td>
<td>Priority of the packet. One of LOW, MEDIUM, or HIGH</td>
</tr>
<tr>
<td>encryptionOffset</td>
<td>The offset in bytes to the the start of the encrypted portion of the packet (normally the start of user data)</td>
</tr>
<tr>
<td>payload</td>
<td>Payload bytes of the packet, in hexadecimal. This consists of the prepended 6LoWPAN header followed by the user data. Maximum size of payload is 80 bytes</td>
</tr>
</tbody>
</table>

Example

To send packet from the manager to mote 00-17-0D-00-00-12-34-56, with source port=0xF0B8, destination port= 0xF0B8, priority=MEDIUM, and payload bytes=0x11 0x 22 0x 33 0x44 0x55:

- The encryption offset is 0.
- The IP header fields are as follows:
<table>
<thead>
<tr>
<th>Field</th>
<th>Bytes</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOWPAN_IPHC</td>
<td>2</td>
<td>011.11.1.10:C.S.ss.M.D.dd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 011 - IPHC dispatch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 11 - Traffic Class and Flow Label are elided</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 1 - Next Header field is compressed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 10 - Hop Limit is compressed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- C (context identifier) = 0 (elided)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- S (source compressed) = 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ss (source mode = 11 (elided))</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- M (multicast) = 0 (none)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- D (destination compressed) = 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- dd (destination mode) = 11 (elided)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0111.1110.0111.01111 = 0x7E77</td>
</tr>
<tr>
<td>Context ID Extension</td>
<td>0</td>
<td>Not used</td>
</tr>
<tr>
<td>Source Address</td>
<td>0</td>
<td>Elided</td>
</tr>
<tr>
<td>Destination Address</td>
<td>0</td>
<td>Elided</td>
</tr>
<tr>
<td>UDP Header</td>
<td>0/1</td>
<td>111101.S.D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- S/D (source/dest. port is compressed) = 11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1111.0111 = 0xF7</td>
</tr>
<tr>
<td>UDP Ports</td>
<td>1</td>
<td>s.d</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- s (source port = F0Bs) = b1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- d (dest port = F0Bd) = b1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1000.1000 = 0x88</td>
</tr>
</tbody>
</table>

So the 6LoWPAN header is 0x7D77F788.

```bash
$> exec sendIP 00-17-0D-00-00-12-34-56 MEDIUM 0 7E77F77D77F7881122334455

Done. Callback id: 20
```
3.4 exit/logout/quit

Description

This command exits the console application, returning the user to the Linux shell. Can be invoked either as "exit", "logout" or 'quit'.

Syntax

exit | logout | quit

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

$> exit
3.5 help

Description
Show list of commands available, or details of a command.

Syntax
help [command] [subCommand]

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>command</td>
<td>Any of the CLI commands</td>
</tr>
</tbody>
</table>

Example

```
$> help
For more information on a specific command, type HELP command-name
clear        Clear screen
...

$> help clear
Usage: clear

Clear screen.
```
3.6 ping

Description

This command requests that the mote or AP indicated send a response containing reply time, temperature and voltage. This is an application layer command and does not use ICMP echo.

Syntax

```
ping <macAddr|moteId>
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>macAddr or moteId</td>
<td>Ping the mote specified by <code>macAddr</code> or <code>moteId</code></td>
</tr>
</tbody>
</table>

Example

```
$> ping 1
Done. Callback id: 2
$> PING 2015-10-12 14:12:40.598 Reply from Mote #1, mac: 00-17-0d-00-00-12-34-56
   CallbackId: 2, Latency: 8ms (0 hops), Data: 3276mV, 34C
```
### 3.7 reset

The reset commands reset specific devices or the network.

#### 3.7.1 reset mote

**Description**

Issue reset to a mote or AP.

**Syntax**

```
reset <mote|ap> <macAddr|moteId>
```

**Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(one of the following)</td>
<td></td>
</tr>
<tr>
<td>mote or ap</td>
<td>Reset device type specified by macAddr or moteId</td>
</tr>
<tr>
<td>macAddr or moteId</td>
<td>The device to be reset</td>
</tr>
</tbody>
</table>

**Example**

```bash
$>  reset mote 25
OK

$>  reset ap 00-01-02-03-04-05-06-07
OK
```
3.7.2 reset network

Description

Reset the network. An optional ‘reload’ argument indicates whether configuration should be reloaded prior to starting the network again.

Syntax

reset network [--reload]

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

$> reset network --reload
Done
## 3.8 show

The show commands display current (active) configuration, statistics, and volatile information. To see persistent parameters, use `config`.

Commands that generate multi-page output can be invoked with a `-p` | `--page` switch to produce paginated output - pressing the `return` key advances the page.

### 3.8.1 show acl

**Description**

Displays a list of the motes currently whitelisted on the manager Access Control List. When the `-p` or `--page` option is used, output is paused after each page. When a MAC address is provided, only the entry for that device is printed.

**Syntax**

```
show acl [-p|--page] [macAddr]
```

**Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>macAddr</td>
<td>Print only the device with MAC address <code>macAddr</code> if on the ACL</td>
</tr>
</tbody>
</table>

**Example**

```bash
$> > show acl
ACL:

    MAC: 00-17-0D-00-00-38-FF-FF

    MAC: 00-17-0D-00-00-37-6E-A1
```
3.8.2 show alarms

Description

Returns a list of all open alarms.

Syntax

```
show alarms
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> show alarms

Alarm info list:
   2015-03-17 16:34:38 Maximum number of motes reached
```
### 3.8.3 show time

**Description**

This command displays information on the AP Bridge Connector associated with the specified AP Bridge.

**Syntax**

```
show apc <macAddr|moteId>
```

**Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;macAddr</td>
<td>moteId&gt;</td>
</tr>
</tbody>
</table>

**Example**

```
$> show apc 1
APC apc-603528, Interface ID: 1
   AP #1, MAC: 00-17-0D-00-00-60-35-28 (Oper)
   Version: 1.0.1.16 (built 2016/08/04 11:43:34)
   State: Working
   Connection: 127.0.0.1:41444

   APC statistics:
   RX pkts: 119998
   TX pkts: 37149
   TX delays: <5ms: 37149, <7ms: 0, <10ms: 0, <50ms: 0, >50ms: 0; Max delay: 4.743ms
   Pauses: 0
   Disconnects: 0
```
3.8.4 show apcs

Description

Displays the list of all Access Point Controllers (APCs) in the network. Each APC represents the connection of an AP Bridge to the VManager. When the -p or --page option is used, output is paused after each page.

Syntax

```
show apcs [-p|--page]
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> show apcs
Name        ID   APC St  AP MAC                   AP ID  AP St
----------- ---- ------- ------------------------ ------ ----
apc-603528     1 Working 00-17-0D-00-00-60-35-28       1 Oper
apc-603772     3 Working 00-17-0D-00-00-60-37-72       3 Oper
```

This command lists all the apcs currently or previously in the network.

- Name: APC identifier
- ID: index of AP
- APC St: Current state of the APC connection (Working, Busy, Offline)
- AP MAC: EUI-64 of the AP Mote
- AP ID: Short address assigned to the AP Mote by the manager
- AP St: Current state of the AP Mote (Nego, Conn, Oper, Lost)
3.8.5 show aps

Description

Displays the list of all Access Points (APs) in the network. This is similar to the `show motes` command to display the list of motes. When the `-p` or `--page` option is used, output is paused after each page.

Syntax

```
show aps [-p|--page]
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> show aps
AP MAC                  Id  Clk State  State time  Jn  Nbrs Links
----------------------- --- --- ----- ------------ --- ---- -----  
00-17-0D-00-00-60-35-28   1 Int  Oper   0-20:06:36   1    4    60
00-17-0D-00-00-60-37-72   3 Net  Oper   0-07:26:08   2    4    28

APs: 2. Live: 2, joining: 0, lost: 0
```

This command lists all the aps currently or previously in the network.

- AP MAC: EUI-64 of the device
- ID: short address assigned to this device by the manager
- Clk: Clock source for the AP (Int, Ext, Net)
- State: Current state of each device (Negot, Conn, Oper, Lost)
- State time: Time (d-hh:mm:ss) since the device was advanced to its current state. When a device is Operational, State time shows how long it has been in the network
- Age: Seconds since the most recent packet was received by the manager from this device
- Jn: Shows how many times the device has joined and advanced to the Operational state
- Nbrs: Number of neighbors with which this device has active links
- Links: Total number of active links on this device
### 3.8.6 show dcl

**Description**

Displays a list of the motes currently blacklisted (not allowed to join) on the manager Deny Control List. When the `-p` or `--page` option is used, output is paused after each page. When a MAC address is provided, only the entry for that device is printed.

**Syntax**

```
show dcl [-p|--page] [macAddr]
```

**Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>macAddr</td>
<td>Print only the device with MAC address <code>macAddr</code> if on the DCL</td>
</tr>
</tbody>
</table>

**Example**

```
$>  > show dcl
DCL:

   MAC: 00-17-0D-00-0B-AD-0B-AD
```
3.8.7 show ini

Description

Displays currently used and "Active" ini settings. If a parameter \textit{param} isn't specified or a n asterisk (*) is used, displays all parameters.

⚠️ This command requires superuser privileges - see the \texttt{su} command.

Syntax

\texttt{show ini \{param | *\}}

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>param</td>
<td>The ini \textit{param} to be displayed. The &quot;*&quot; parameter will display all ini parameters</td>
</tr>
</tbody>
</table>

Example

\#> show ini NUMBCAST  
MNGRINI Module configuration :  
NUMBCAST:2
3.8.8 show mote/ap

Description

This command returns network and neighbor information about the specified mote or Access Point (AP). When the -p or --page option is used, output is paused after each page. When the -a or --all-neighbors option is used, all neighbors (linked and discovered) are shown - normally only linked neighbors are shown. When the -l or --links option is used, information on each link is shown - normally on the total number of links per path are shown.

Syntax

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>macAddr or moteId</td>
<td>Return information for the mote specified by macAddr or moteId</td>
</tr>
</tbody>
</table>

Example
$> show mote 00-17-0D-00-00-DD-EE-FF
MOTE #2, MAC: 00-17-0D-00-00-DD-EE-FF
Version: 1.3.2.4 (stack 1.2.3.6)
State: Oper, Hops: 1.0, State time: 0-00:02:55, Age: 30
Power: 65534 (Routing)
Power Cost: Max 65534, FullTx 65, FullRx 65, Used 401
Capacity: 200 links, 31 neighbors
Number of neighbors (parents, children) : 1 (1, 0)
Bandwidth total / descendants (requested) : 14849 / 0 (27840)
Number of links total, TX / RX / requested: 12, 3 / 0 / 1

Statistics:
Reliability: 100.000% (0 lost, 15 total)
Avg Latency: 1052 ms, 3712 ms est. to mote
Voltage: 3306 mV
Charge consumed: 29335 mC

Neighbors:
# 1 parent Q:75 links: 3 rssi:-41/-41 Ready

$> show ap 1
AP #1, MAC: 00-17-0D-00-00-60-39-7F
Version: 1.4.0.76 (stack 1.4.0.5)
Identity: apc-60397f
State: Oper, Hops: 0.0, State time: 1-21:13:27
Clock Source: Int
Capacity: 1000 links, 499 neighbors
Number of neighbors (parents, children) : 7 (0, 7)
Descendant bandwidth : 758
Number of links total, TX / RX : 50, NA / 30

Neighbors:
# 2 child Q: 94 links: 3 rssi:-47/-53
# 3 child Q: 95 links: 3 rssi:-58/-59
# 4 child Q: 96 links: 2 rssi:-42/-53
# 5 child Q: 92 links: 10 rssi:-54/-55
# 6 child Q: 96 links: 3 rssi:-45/-56
# 7 child Q: 91 links: 5 rssi:-50/-62
# 8 child Q: 93 links: 4 rssi: 0/-53
Description of the fields in the reply:

General:

- Mote #: moteId of the mote
- MAC: EUI-64 of the mote
- State: Current state - one of Idle, Negot1-2, Conn1-5, Oper, Lost
- Hops: Average ("empirical") hops for upstream data
- State time: Time since last state change
- Age: Time, in seconds, since the manager last received a packet from this device
- Power: Power, i.e. maxStCurrent in powerSrcInfo param reported by mote - one of Routing, or Low Power (maxStCurrent less than needed for routing). Note that “routing type” can be set either on the mote or on the manager. If either the mote or the manager declares a mote to be non-routing, then the mote will not be assigned children or advertisement links
- Power Cost: powerSrcInfo param reported by mote
- Capacity: Maximum number of links and neighbors that are supported by mote
- Number of neighbors: first entry is # parents + # children = # nbrs, first entry in parentheses is # parents, second entry in parentheses is # children
- Bandwidth (ms/packet): total (mote + descendants) / descendants, and requested for this mote alone in parentheses. A lower value here is more bandwidth. In this example the mote has more bandwidth than it requested
- Number of links: Total links across all slotframes, number of upstream TX links, number of upstream RX links, link equivalent of bandwidth requested by this mote

Statistics:

- Reliability: Percentage, lost and total generated in parentheses
- Avg Latency: Average upstream latency, estimated average downstream latency
- Voltage: Supply voltage in mV
- Charge consumed: Charge since last mote reset in mC

Neighbors:

- Neighbor moteld, relationship (parent or child or ‘-‘ for discovered), path quality in percent (30% or 75% until path stability is measured), number of upstream links to neighbor, RSSI to, RSSI from, and whether the path is in use (Ready), or merely discovered (Not Ready).
3.8.9 show motes

Description

Displays the list of all motes in the network. When the -p or --page option is used, output is paused after each page.

Syntax

```
show motes [-p|--page]
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> show motes
Mote MAC                Id  State  State time  Age  Jn  Nbrs  Links
----------------------- --- ----- ------------ --- --- ---- -----  
00-17-0D-00-00-30-4B-1D   2  Oper   0-20:10:32  12   1    4    20
00-17-0D-00-00-30-44-A4   4  Oper   0-20:09:56  14   1    4    20
00-17-0D-00-00-30-5A-BD   5  Oper   0-20:09:53   0   1    4    45
Motes: 3. Live: 3, joining: 0, lost: 0

$> show aps
AP MAC                  Id  Clk  State  State time  Jn  Nbrs  Links
----------------------- --- --- ----- ------------ --- ---- -----  
00-17-0D-00-00-60-35-28   1  Int  Oper   0-20:11:28   1    4    60
00-17-0D-00-00-60-37-72   3  Net  Oper   0-07:31:00   2    4    28
APs: 2. Live: 2, joining: 0, lost: 0
```

This command lists all the motes currently or previously in the network.

- MAC: EUI-64 of the device
- MoteID: short address assigned to this device by the manager
- State: Current state of each device (Negot, Conn, Oper, Lost)
- State time: Time (d-hh:mm:ss) since the device was advanced to its current state. When a device is Operational, State time shows how long the mote has been in the network
- Age: Seconds since the most recent packet was received by the manager from this mote
- Jn: Shows how many times the device has joined and advanced to the Operational state
- **Nbrs**: Number of neighbors with which this device has active links
- **Links**: Total number of active links on this device
3.8.10 show network

Description

Displays information about the network configuration and statistics.

Syntax

```
show network
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>This command has no parameters</td>
<td></td>
</tr>
</tbody>
</table>

Example

```
$> show network
Network configuration:
    networkId:                1229
    topologyType:             MESH
    downFrameMultiplierDelay: 3600000
    ccaMode:                  False
    ipAddrPrefix:             FE80::
    basePkPeriod:             15000
    downFrameMultiplier:      1
    joinSecurityType:         COMMON_SKEY
    minServicePkPeriod:       100
    downFrameSize:            512
    numParents:               2
    channelList:              32767
    upFrameSize:              1024
Network statistics:
    Network start time:  2015-12-04 15:13:42.408, uptime   4-01:32:49
    Live motes:          12
    Reliability:         100.000% (0 lost, 477682 total)
    Avg Latency:         1168 ms
    Path stability:      81.164%
    Advertising:         On
    Queue (net/user):    0/0
    Current frame size:  512
```
Network configuration

See `config set network parameters` for details

Network statistics

- Network start time: start time and uptime
- Live motes: Number of motes (not APs) in the *Operational* state
- Reliability: The network reliability is calculated as the percentage of packets generated by any mote that are successfully received by the manager. This number should be 99.99% or higher in a healthy network. This statistic is counted directly on the manager by monitoring the security counter on the packets as they come in
- Avg Latency: The average upstream latency of packets received by the manager. The manager checks the packet header for the generation timestamp (ASN) and compares this to the current ASN to calculate each individual packet latency
- Path stability: The network path stability represents the percentage of total MAC transmissions that have succeeded. This number will vary depending on individual mote placement. The network is designed to achieve 100% reliability even at 50% stability. At lower stability values, motes will use more energy and bandwidth as more packets need to be retried. This statistic is computed based on health reports received from motes. The manager increments the total number of transmits and fails with each new health report arrival
- Advertising: Current state of advertising
- Queue: Number of packets in the manager queue, both for manager generated (net) and user generated packets
- Current frame size: Downstream frame size (slots) at this time, the downstream frame can lengthen in steady-state if `downFrameMultiplier > 1`
3.8.11 show paths

Description

This command displays information all paths for a specified mote. When the -p or --page option is used, output is paused after each page. The -a or --all option additionally lists unused potential paths.

Syntax

```
show paths [-p|--page] [-a|--all] <macAddr|moteId>
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>macAddr or moteId</td>
<td>The macAddr or moteId of device</td>
</tr>
</tbody>
</table>

Example

```
$> show paths 00-17-0D-00-00-AA-BB-CC
Neighbors:
  # 2 child Q:82 links: 3 rssi:-41/-41 Ready
  # 3 child Q:75 links: 4 rssi: 0/ 0 Not Ready
```

This command displays all the paths between the specified device and its active neighbors. Each row of the display lists the mote ID of a neighbor, its relationship (Parent or Child), the number of links assigned to that path, the path quality statistics, and the RSSI.

In this example, mote 2 is a child of this mote and the has a Quality which has been measured based on success/fail statistics to be 82% (path stability), has 3 links assigned, and has a RSSI of -41dB.
3.8.12 show route

Description

Displays the source route from the manager to the mote specified.

Syntax

```
show route <macAddr|moteId>
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>macAddr or moteId</td>
<td>Display the source route to the mote specified by macAddr or moteId.</td>
</tr>
</tbody>
</table>

Example

```
S> show route 20
Route for Mote #20, 00-17-0D-00-00-38-00-D9
   -> AP  # 1, 00-17-0D-00-00-60-36-D7
   -> MOTE # 7, 00-17-0D-00-00-38-00-55
   -> MOTE # 11, 00-17-0D-00-00-38-00-B6
   -> MOTE # 14, 00-17-0D-00-00-38-00-C0
   -> MOTE # 17, 00-17-0D-00-00-38-00-C9
```

Each hop gets one row of output. In this example, the route to mot eid=20 is 1-7-11-14-17-20.
3.8.13 show services

Description
Displays service information for the specified mote.

Syntax

```
show services <macAddr|moteId>
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>macAddr or moteId</td>
<td>Display service information for the mote specified by <code>macAddr</code> or <code>moteId</code></td>
</tr>
</tbody>
</table>

Example

```
$> show services 00-17-0D-00-00-DD-EE-FF
Services:
  # 0 MAC: 00-17-0D-00-00-00-FF-FE
      Allocated BW:  27840
      Latency:     1737 (1 hops)
```
3.8.14 show sessions

Description

Displays the list of current user sessions. A session is created when a user logs into Console or authenticates in the External API.

1. The External API will generate a new user session whenever an API request contains the Authentication header. This can cause a large number of sessions to be listed in the show sessions output.

   Internally, the number of user sessions is limited to a maximum number based on activity, older sessions will be removed if the number of sessions grows too large.

Syntax

```
show sessions
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> show sessions
User           Last activity            Login                    Client Info
-------------  -----------------------  -----------------------  ---------------
dust           2016-05-24 11:10:44.542  2016-05-24 11:10:44.542
```
3.8.15 show system

Description

Display system information such as the system start and uptime, the user designated system name string, the user designated location string, and the CLI timeout. These fields can be set using the `config set system` command.

Syntax

```
show system
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> show system
System information:
    System start: 2015-12-04 15:13:42.433, Uptime:  3-23:15:12
    sysName:    Thermal1
    location:   Unit5
    cliTimeout: 0 minutes
```
3.8.16 show time

Description

Displays two different measures of time: Server system time, and network (AP) time.

Syntax

```
show time
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> show time
Network start: 2015-12-01 16:50:40.717, Network uptime: 0-18:02:49
```
3.8.17 show unjoined

Description

Display motes that have a join counter stored in the configdb, but are not part of current topology. This is not a state that motes will typically be in; this command is intended for development when motes' software is being upgraded and the network is being reset.

Syntax

```
show unjoined
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> show unjoined
No entries found
```
3.8.18 show user

Description

Display information about a specified user.

Syntax

```
show user <userId>
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>userID</td>
<td>Display information for the user specified by <em>userId</em>.</td>
</tr>
</tbody>
</table>

Example

```
$> show user dust
User information:
  Id: dust
  Password: ****
  Privilege: USER
  Description: duster
```
3.8.19 show users

Description

Display information about all users. When the -p or --page option is used, output is paused after each page.

Syntax

show users [-p|--page]

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

$> show users
User configuration:
Id: dust
### 3.8.20 show ver

**Description**

Displays the versions of the individual software components of the VManager, as well as the VManager package.

**Syntax**

```
show ver [component]
```

**Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>component</td>
<td>Leave blank for all or specify the component name. In most cases, the component name matches the name used in the output. Use <code>apiserver</code> to refer to the External API component.</td>
</tr>
</tbody>
</table>

**Example**

```
$> show ver
Package version:  1.1.0.8
External API version:  1.1.0.8 (built 2017/03/02 11:16:10)
AuthManager version:  1.1.0.8 (built 2017/03/02 11:16:13)
ConfigDB version:  1.1.0.8 (built 2017/03/02 11:16:17)
Console version:  1.1.0.8 (built 2017/03/02 11:16:21)
Manager version:  1.1.0.8 (built 2017/03/02 11:15:44)
Watchdog version:  1.1.0.8 (built 2017/03/02 11:16:23)

$> show ver console
Console version:  1.1.0.8 (built 2017/03/02 11:16:21)
```
3.9 sm

Description

This command shows a list of all motes and Access Points (APs) in the network. It is similar to the show motes or show aps commands.

Syntax

```
sm [-p|--page]
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command has no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> sm

AP MAC                  Id  Clk State  State time  Age Jn  Nbrs Links
----------------------- --- --- ----- ------------ --- --- ---- ----- 
00-17-0D-00-00-60-37-9C   1 Int  Oper   0-00:01:29 112   1    3    15

Mote MAC                Id  State  State time  Age Jn  Nbrs Links
----------------------- --- ----- ------------ --- --- ---- ----- 
00-17-0D-00-00-30-08-2D   2  Oper   0-00:01:29 112   1    3    15
00-17-0D-00-00-30-08-05   3  Nego   0-00:03:02 112   1    3    15

APs: 1, Motes: 2, 1 live, 1 joining
```

This command lists all the devices currently or previously in the network.

- MAC: EUI-64 of the device
- MoteID: short address assigned to this device by the manager
- Clk: Clock source (APs only)
- State: Current state of each device (Nego, Conn, Oper, Lost)
- State time: Time (d-hh:mm:ss) since the device was advanced to its current state. When a device is Operational, State time shows how long the mote has been in the network
- Age: Seconds since the most recent packet was received by the manager from this mote. Age may grow large for APs.
- Jn: Shows how many times the device has joined and advanced to the Operational state
- Nbrs: Number of neighbors with which this device has active links
- Links: Total number of active links on this device
3.10 su

Description

Enter superuser mode, which enables some commands primarily used for debugging and testing. The console prompt changes from $> to #> to indicate that the user is in superuser mode.

Syntax

```
su becareful
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This command takes no parameters</td>
</tr>
</tbody>
</table>

Example

```
$> su becareful
#>
```
3.11 trace

Description

Enable/disable trace output to console. Before this setting will take effect, the set loglevel command must be used to activate the trace. The full set of traces is available by typing the subscribe command, but most of these are intended only for internal debugging purposes. The following traces are of general interest:

<table>
<thead>
<tr>
<th>TraceId</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>mngr.net.io.data</td>
<td>User data packets</td>
</tr>
<tr>
<td>mngr.tplgdb.mote</td>
<td>Mote state changes (e.g. motes progressing through the join process)</td>
</tr>
<tr>
<td>mngr.tplgstat</td>
<td>Upstream latency and hops information</td>
</tr>
</tbody>
</table>

Syntax

```
set loglevel <traceId> TRACE
trace [<traceId> <on|off>]  
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>traceId</td>
<td>Enable the <em>traceId</em> trace</td>
</tr>
<tr>
<td>on or off</td>
<td>on = enable trace, off = disable trace</td>
</tr>
</tbody>
</table>

Example

```
$> set loglevel mngr.tplgstat TRACE
Done
$> trace mngr.tplgstat on
Trace enabled for mngr.tplgstat

```
In this example, the manager has received a packet from moteId 12. The manager compares the current ASN to the ASN contained in the packet header to calculate the upstream latency in \( \mu s \). The manager uses the TTL field in the header to calculate the number of hops taken to get to the AP, and this value is printed in units of 0.1 hops. Above, the packet hops are specified as 50 indicating that the packet took 5 hops to reach the AP. This trace also prints an IIR-filtered average of the upstream latency and hops for this mote.
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