

OFCONFIG 1.1 – Implementation

Objective of this document

- Setup the development environment(Netconf and SIL) for the Ofconfig1.1
- Demonstrate a sample controller configuration through the OF config point

Development Environment

OfConfig 1.1 standard is a NETCONF based implementation. Here we would like to show the process of YUMA (an open source netconf implementation).

- YUMA Installation
- Server Instrumentation Library (SIL) setup and configuration
- Sample Configuration to OVS through OF Config Point

YUMA Installation

1.Prerequisites

```
Sudo apt-get update
Sudo apt-get install aptitude apt-show-versions vim cpp python
libxml2-dev libxml2 libssh2-1 libssh2-1-dev libncurses5
libncurses5-dev
```

2.Verify the installed external libraries

```
Sudo dpkg --list libxml2 libssh2-1
```

```
||/ Name          Version          Description
++-+-----+-----+-----+
ii  libssh2-1       1.2.8-2          SSH2 client-side library
ii  libxml2         2.7.8.dfsg-5.1   GNOME XML library
pc:~$
```

3.Install Yuma package

Here is an example showing all 3 packages being installed. The actual hardware platform identifier may be different: source <http://www.netconfcentral.org/download>.

For **Ubuntu 12.04** yuma-2.2-3.u1204.amd64.deb (yuma 64-bit)

```
mydir> sudo dpkg -i yuma-2.1-1.u1004.i386.deb
mydir> sudo dpkg -i yuma-doc-2.1-1.u1004.i386.deb
mydir> sudo dpkg -i yuma-dev-12.1-1.u1004.i386.deb
```

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4.You must modify the /etc/ssh/sshd_config file, and add the 'netconf' subsystem.

If the YUMA package was installed in a non-default location, then the path to the **netconf-subsystem** will be different than the example below. Also, you must add **port 830** in the list of ports.

```
# Package generated configuration file
# See the sshd_config(5) manpage for details

# What ports, IPs and protocols we listen for
Port 22
Port 830
```

```
#MaxStartups 10:30:60
#Banner /etc/issue.net

# Allow client to pass locale environment variables
AcceptEnv LANG LC_*

Subsystem sftp /usr/lib/openssh/sftp-server
Subsystem netconf /usr/sbin/netconf-subsystem
```

SIL INSTALLATION

1. Use existing YANG module(from ofconfig1.1 standard) or Create the YANG module data model definition

OpenFlow Management and Configuration Protocol (OF-Config 1.1) have all the requirement YANG specifications that can be used for model definition YANG file.

2. Validate the YANG module by compiling with the *yangdump*

All errors (alignment/indentation etc.) and warnings should also be examined to determine if they indicate data modeling bugs or not. In order to avoid any error please use attached fixed onfconfig1.1.yang file

```
Sudo yangdump onf-config1.1.yang
```

```
pc:/usr/share/yuma/modules% sudo yangdump onf-config1.1.yang

*** Generated by yangdump 2.2-4
*** Copyright (c) 2008-2012, Andy Bierman, All Rights Reserved.

*** /usr/share/yuma/modules/onf-config1.1.yang
*** 0 Errors, 0 Warnings
```

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3. Create a SIL development subtree

Generate the directory structure and the *Makefile* with the *make_sil_dir* script, installed in the */usr/bin* directory. This step will also call **yangdump** to generate the initial H and C files file the **SIL**.

```
Usr/share/Yuma/modules/> sudo make_sil_dir onf-config1.1
```

4. Use your text editor to fill in the device-specific instrumentation for each object, RPC method, and notification

In this example, edit *onf-config1.1/src/onf-config1.1.c*. Almost all possible **NETCONF**-specific code is either handled in the central stack, or generated automatically. So, this code is responsible for implementing the semantics of the **YANG** data model. Use example of **OFConfig** implementation: <https://github.com/UH-SDN/softconf.d>

```
...    ... @@ -11665,12 +11665,14 @@ static status_t onf_config1_1_capable_switch_logical_switches_switch_controllers
11665 11665     val_value_t *newval,
11666 11666     val_value_t *curval)
11667 11667     {
11668 11668     +   char newcom[100];
11669 11669     status_t res = NO_ERR;
11670 11670     val_value_t *errorval = (curval) ? curval : newval;
11671 11671
11672 11672     printf("\nhebele\n");
11673 11673     -   val_dump_value(curval,0);
11674 11674     -   val_dump_value(newval,0);
11675 11675     +   printf("\nIP => %s\n",VAL_STRING(newval));
11676 11676     +   sprintf(&newcom,"ovs-vsctl set-controller xenbr0 tcp:%s:6633",VAL_STRING(newval));
11677 11677     +   system(newcom);
11678 11678
11679 11679     if (LOGDEBUG) {
11680 11680     log_debug("\nEnter onf_config1_1_capable_switch_logical_switches_switch_controllers_controller_ip_address_e
11681 11681     }
```

5. Change .H file see <https://github.com/UH-SDN/softconf.d> again

```
...    ... @@ -853,7 +853,7 @@
853 853
854 854     /* container /capable-switch/logical-switches */
855 855     typedef struct y_onf_config1_1_T_capable_switch_logical_switches_ {
856 856     -   dlq_hdr_t switch;
857 857     +   dlq_hdr_t switch1;
858 858     } y_onf_config1_1_T_capable_switch_logical_switches;
859 859
860 860     /* container /capable-switch */
861 861     @@ -901,4 +901,4 @@ extern status_t y_onf_config1_1_init (
901 901     } /* end extern 'C' */
902 902     #endif
903 903
904 904     -#endif
905 905     \ No newline at end of file
906 906     +#endif
```

6. Compile your code

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Use the `make` command in the **SIL src** directory. This should generate a library file in the **SIL lib** directory.

```
Usr/share/Yuma/modules/onf-config1.1/src> sudo make
```

7. Install the SIL library so it is available to the netconfd server.

Use the `make install` command in the **SIL src** directory.

```
Usr/share/Yuma/modules/onf-config1.1/src> sudo make install
```

Sample Configuration to OVS through OF Config Point

1. Run the netconfd server

Create a new user and password for it

```
sudo useradd netconf
sudo passwd netconf
```

The user will be first prompted for his/her old password, if one is present. This password is then encrypted and compared against the stored password. The user has only one chance to enter the correct password. The **superuser** is permitted to bypass this step so that forgotten passwords may be changed.

Now **netconfd server** can be run with **superuser** permission. Server must be run from the directory where model definition **YANG** file is located.

```
Usr/share/Yuma/modules> sudo netconfd --superuser=netconf
```

Properly running **netconfd server** should look like:

```
pc:/usr/share/yuma/modules% sudo netconfd --superuser=netconf
Starting netconfd...
Copyright (c) 2008-2012, Andy Bierman, All Rights Reserved.

Default startup config file (startup-cfg.xml) not found.
  Booting with default running configuration!

Running netconfd server (2.2-4)
```

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In this step you **may** receive the following error:

```
Starting netconfd...
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Default startup config file (startup-cfg.xml) not found.
  Booting with default running configuration!

Running netconfd server (2.2-4)
bind: Address already in use

*** Cannot connect to ncxserver socket
*** If no other instances of netconfd are running,
*** try deleting /tmp/ncxserver.sock

ncxserver failed (operation failed)
Shutting down the netconfd server
```

In order to solve this error the following command must be run:

```
sudo rm /tmp/ncxserver.sock
```

2. Load the onfconfig yang module or the one you have created

Be sure to add a `load` command to the configuration file if the module should be loaded upon each reboot.

Type command `yangcli`, then connect to the **netconfd** server

```
Mydir> yangcli
Yangcli> Connect server=10.10.12.3 username=netconf password=123456
Yangcli netconf@10.10.12.3> load onf-config1.1
```

```
Checking Server Modules...

yangcli netconf@10.10.12.3> load onf-config1.1

RPC Data Reply 1 for session 1:

rpc-reply {
  mod-revision 2011-12-07
}

yangcli netconf@10.10.12.3> █
```

The **netconfd** server will load the specified **YANG** module and the **SIL** and make it available to all sessions.

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3. Now, any configurations can be created and pushed using netconfd client in XML format.

XML file can be created using Seguesoft NETCONF GUI, that can be downloaded from seguesoft.com. Tutorial also available in seguesoft.com/wordpress/category/netconf-client-browser/

Or, XML configuration file can be created by the user.

Simple sample of XML configuration file:

```
<?xml version='1.0' encoding='UTF-8'?>
<config>
  <capable-switch xmlns="urn:onf:of11:config:yang">
    <logical-switches>
      <switch>
        <id>1</id>
        <datapath-id>00:00:00:04:23:b7:19:03 </datapath-id>
        <enabled>true</enabled>
        <controllers>
          <controller>
            <id>1</id>
            <ip-address>100.1.2.3</ip-address>
            <port>6633</port>
            <protocol>tcp</protocol>
          </controller>
        </controllers>
      </switch>
    </logical-switches>
  </capable-switch>
</config>
```

Response of **netconfd** server:

```
Running netconfd server (2.2-4)

New session 1 created OK
Session 1 for netconf@10.10.12.2 now active (base:1.1)
New session 2 created OK
Session 2 for netconf@127.0.0.1 now active (base:1.1)
hebele

IP => 100.1.2.3
```

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References:

- 1) OpenFlow Management and Configuration Protocol (OF-Config 1.1) [Online]
<https://www.opennetworking.org/images/stories/downloads/of-config/of-config-1.1.pdf>
retrieved Jan. 14, 2013.
- 2) B. Pfaff and B. Davie, The Open vSwitch Database Management Protocol, draft-pfaff-ovsdb-proto-01, Feb. 20, 2013 (exp. Aug. 24, 2013)
- 3) OVSDb schema: <http://openvswitch.org/ovs-vswitchd.conf.db.5.pdf>
- 4) NETCONF: Enns, et al., RFC 6241. IETF. [Online] Jun. 2011. <http://tools.ietf.org/rfc/rfc6241.txt>
- 5) YANG: Bjorklund et al., RFC 6020. IETF. [Online] Oct. 2010. <http://tools.ietf.org/html/rfc6020>
- 6) SIL: SIL, YumaWorks, <http://doc.yumaworks.com/manuals/v2/html/dev/yuma-dev-manual3.xhtml#toc33>
- 7) <http://doc.yumaworks.com/manuals/v2/html/dev/yuma-dev-manual.xhtml>
- 8) OpenFlow 1.2: <https://www.opennetworking.org/standards/openflow-switch>
- 9) Droms, R, RFC 3679. IETF. [Online] Jan. 2004. <https://tools.ietf.org/html/rfc3679>
- 10) Netconf Browser/Client
<http://seguesoft.com/>
- 11) Netconf Browser/Client Tutorial
seguesoft.com/wordpress/category/netconf-client-browser/
- 12) OpenVswitch configuration daemon, basic implementation
<https://github.com/UH-SDN/softconf.d>