

YumaWorks YANG-Based Unified Modular Automation Tools User Guide

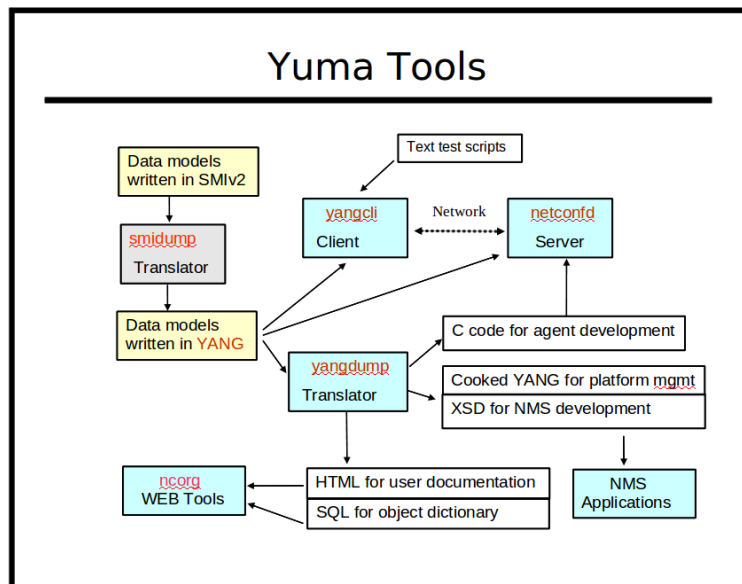
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YumaWorks YANG-Based Unified Modular Automation Tools



Preface

Legal Statements

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Additional Resources

Other documentation includes:

- YumaPro Installation Guide
- YumaPro Quickstart Guide
- YumaPro API Quickstart Guide
- YumaPro User Manual
- YumaPro netconfd-pro Manual
- YumaPro yangcli-pro Manual
- YumaPro yangdiff-pro Manual
- YumaPro yangdump-pro Manual
- YumaPro Developer Manual
- YumaPro ypclient-pro Manual
- YumaPro yp-system API Guide
- YumaPro yp-show API Guide
- YumaPro yp-snmp Manual

To obtain additional support you may contact YumaWorks technical support department:

support@yumaworks.com

WEB Sites

- **YumaWorks**
 - <https://www.yumaworks.com>
 - Offers support, training, and consulting for YumaPro.
- **Netconf Central**

- <http://www.netconfcentral.org/>
- Free information on NETCONF and YANG, tutorials, on-line YANG module validation and documentation database
- Yang Central
 - <http://www.yang-central.org>
 - Free information and tutorials on YANG, free YANG tools for download
- NETCONF Working Group Wiki Page
 - <http://trac.tools.ietf.org/wg/netconf/trac/wiki>
 - Free information on NETCONF standardization activities and NETCONF implementations
- **NETCONF WG Status Page**
 - <http://tools.ietf.org/wg/netconf/>
 - IETF Internet draft status for NETCONF documents
- **libsmi Home Page**
 - <http://www.ibr.cs.tu-bs.de/projects/libsmi/>
 - Free tools such as smidump, to convert SMIv2 to YANG

Mailing Lists

- **NETCONF Working Group**
 - <https://mailarchive.ietf.org/arch/browse/netconf/>
 - Technical issues related to the NETCONF protocol are discussed on the NETCONF WG mailing list. Refer to the instructions on <https://www.ietf.org/mailman/listinfo/netconf> for joining the mailing list.
- **NETMOD Working Group**
 - <https://datatracker.ietf.org/wg/netmod/documents/>
 - Technical issues related to the YANG language and YANG data types are discussed on the NETMOD WG mailing list. Refer to the instructions on the WEB page for joining the mailing list.

Conventions Used in this Document

The following formatting conventions are used throughout this document:

Documentation Conventions

Convention	Description
<code>–foo</code>	CLI parameter foo
<code><foo></code>	XML parameter foo
some text	Example command or PDU
some text	Plain text

Intended Audience

This document is intended for software developers using the YumaPro SDK and multi-protocol server in custom embedded Linux platforms by using the Yocto Project and its BitBake recipes. It covers the setup and basic steps required to build the software. The reader should be familiar with the Yocto Project.

Introduction

- The Yocto Linux development system allows custom Linux variants to be created in an automated, controlled manner. Yocto Home Page: <https://www.yoctoproject.org/>
- The build-time and run-time information needed to build an entire Linux platform for an embedded system is managed as metadata within Yocto.
- OpenEmbedded Home Page: https://www.openembedded.org/wiki/Main_Page
- Yocto Features Supported by the YumaPro Server:
 - Makefiles have been updated to fully support bitbake environment variables for cross-compiler use
 - dropbear SSH server integration
 - openSSH SSH server integration
 - system deamon integration
 - lighttpd WEB server integration
 - net-snmp integration for SNMP protocol support
 - base-files integration for yp-shell integration and user management

This preliminary version of the YumaPro for Yocto Linux package supports version 2.3 (Pyro) of the Yocto Linux development system. The recipe “core-image-minimal” is used as the base for YumaPro server integration. The complete YumaPro server can be built for Yocto Linux to provide YANG-based NETCONF, RESTCONF, SNMP, and CLI management interfaces.

The YumaPro functionality is specified in a layer named “meta-yumapro”. There are two variants (called recipes) of the server supported at this time:

- netconfd-pro-iot: Server for IoT platforms, based on yumapro-core source tarball
- netconfd-pro-sdn: Server for SDN platforms, based on yumapro-server source tarball

These recipes can be customized as needed. It is expected that specific board support packages (BSPs) will be selected by a vendor according to project requirements. The meta-yumapro package contains the recipes and other data files to allow a Yocto cross-compile image to be created. All makefiles have been updated so that the variables used by bitbake are supported for correct cross-compile development.

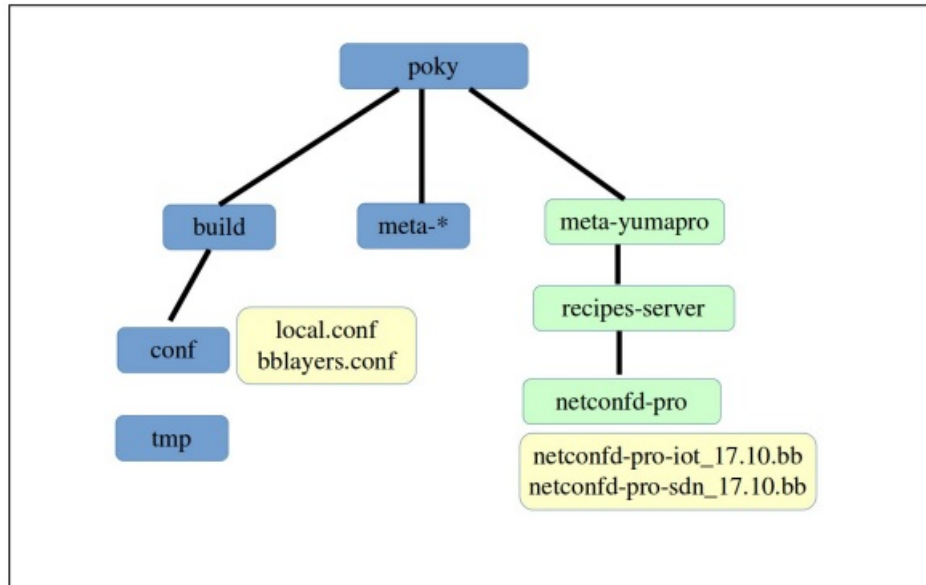
IoT vs. SDN Recipe Differences

There are two example server recipes provided. These can be used directly or adapted for use in a yocto build environment. The following table summarizes the differences between these recipes.

Feature	netconfd-pro-iot	netconfd-pro-sdn
SSH Server for NETCONF and yp-shell	dropbear	openssh
WEB Server for RESTCONF	lighttpd	lighttpd
YControl Protocol	Not Supported	Supported
DB-API Protocol	Not Supported	Supported
SIL-SA Protocol	Not Supported	Supported
YP-HA Protocol	Not Supported	Supported
Static Build	Supported	Not Supported

Yocto Build Host Software

- The build host tools need to be setup before the server can be built.
- The yumapro layer is designed to work with the Yocto 2.3 release (Pyro) or later.
- The “pyro” and “master” branches of the Poky project have been tested with the meta-yumapro layer.
- The following diagram shows the directories that the user is expected to setup (in blue) and the directories that the supplied software will add.



Directory	Description
poky	Yocto installation of poky build system
build	Root of all build directories
conf	Build configuration directory. Edit local.conf and bblayers.conf
tmp	Root of all bitbake generated build files
meta-*	Several opensource layer directories
meta-yumapro	Root of the yumapro layer bitbake files
recipes-server	Root directory for all yumapro server recipes
netconfd-pro	Root directory of all netconfd-pro recipes (IoT and SDN)

The netconfd-pro-iot and netconfd-pro-sdn recipes are designed to integrate with certain open source recipes, in order to automatically produce a system image with a running system, upon first boot. The following recipes are used by the yumapro server recipes:

- base-files: Used to add yp-shell to /etc/shells
- dropbear: Used to integrate netconfd-pro-iot support into dropbear and configure boot-time parameters
- openssh: Used to configure netconfd-pro-sdn boot-time parameters into OpenSSH

- `lighttpd`: Used to configure RESTCONF server boot-time parameters for lighttpd WEB server
- `net-snmp`: Used to integrate SNMP protocol support and configure boot-time SNMP parameters

Setup Yocto Linux

These instructions do not override the Yocto documentation.

This document is not a yocto tutorial. Refer to the Yocto documentation for details on using the Yocto and bitbake software.

- Yocto Project Quick Start Guide:
<https://docs.yoctoproject.org/brief-yoctoprojectqs/index.html>
- Yocto Project Mega Manual:
<https://docs.yoctoproject.org/singleindex.html>
- Yocto Project Developer Manual:
<https://docs.yoctoproject.org/dev-manual/index.html>
- Building your own recipe:
https://wiki.yoctoproject.org/wiki/Building_your_own_recipes_from_first_principles
- Bitbake User Manual:
<https://docs.yoctoproject.org/bitbake/bitbake-user-manual/bitbake-user-manual-intro.html#the-bitbake-command>

Install Yocto

Follow the instructions in the Yocto Quick Start guide. Example Ubuntu Install.

```
1a) install dependencies
> sudo apt-get install gawk wget git-core diffstat unzip texinfo gcc-multilib \
    build-essential chrpath socat cpio python python3 python3-pip python3-pexpect \
    xz-utils debianutils iputils-ping libssl1.2-dev xterm

1b) Install poky
> git clone git://git.yoctoproject.org/poky
> cd poky
    [Should be on branch 'master']

1c) add meta-webserver
> git clone git://git.openembedded.org/meta-openembedded
```

Setup Build Configuration

Starting in the 'poky' directory, source the environment file to enable bitbake. Then cd to the "conf" directory and edit the configuration files.

```
> source oe-init-build-env
build> cd conf
build/conf>
```

Edit local.conf:

1. Enable a target platform. The default is the i586 architecture on the qemu86 virtual target. Refer to the Yocto Quick start guide to enable different targets and board support packages (BSPs).
2. Add the netconfd-pro server recipe to the image. Choose either netconfd-pro-iot or netconfd-pro-sdn, but not

both. Example for netconfd-pro-sdn:

```
IMAGE_INSTALL_append = " netconfd-pro-sdn"
```

NOTE: Starting with the Hardknott release(3.3) of OpenEmbedded, bitbake is using a new variable override syntax. For Hardknott and later releases, the netconfd-pro server recipe should be added like this:

```
IMAGE_INSTALL:append = " netconfd-pro-sdn"
```

Edit bblayers.conf:

Enable layers needed to build the desired Yocto Linux system variants. The following example shows the layers needed for all variants of the netconfd-pro server. The file locations will be different depending on your Yocto installation location.

```
BBLAYERS ?= " \
/home/andy/swdev/poky/meta \
/home/andy/swdev/poky/meta-poky \
/home/andy/swdev/poky/meta-yocto-bsp \
/home/andy/swdev/poky/meta-openembedded/meta-oe \
/home/andy/swdev/poky/meta-openembedded/meta-python \
/home/andy/swdev/poky/meta-openembedded/meta-networking \
/home/andy/swdev/poky/meta-openembedded/meta-webserver \
/home/andy/swdev/poky/meta-yumapro \
"
```

meta-yumapro Layer

The meta-yumapro tarball contains “yumapro” layer files required to build, install, and integrate a multi-protocol server for Yocto Linux.

Installation

Tarball Naming Conventions

The filename structure of the tarball file is as follows:

```
meta-yumapro-version.gz
```

Example Filename:

```
meta-yumapro-20.10-11.tar.gz
```

Extract to the poky Directory

The files need to be extracted to the poky directory so subtrees can be integrated into the build environment for the server.

Extraction Example:

```
> cd poky
> tar xvf meta-yumapro-20.10-11.tar.gz

Creates a directory named meta-yumapro in the current directory.
```


Configuration

The only recipes supported at this time are “netconfd-pro-iot” and “netconfd-pro-sdn”. The configuration files for these recipes are located in the directory poky/meta-yumapro/recipes-server/netconfd-pro. There are several


















features that can be enabled or disabled by uncommenting or commenting a set of directives. The set of recipe files:

- netconfd-pro.inc: common recipe file
- netconfd-pro-iot.inc: IoT configuration recipe file
- netconfd-pro-sdn.inc: SDN configuration recipe file
- netconfd-pro-iot_17.10.bb: IoT configuration main recipe file for 17.10 release train
- netconfd-pro-sdn_17.10.bb: SDN configuration main recipe file for 17.10 release train

Documents / Resources

 YumaWorks YumaPro Yocto Linux Quickstart Guide Yocto Based Embedded Automation Tools Yocto Quickstart Guide Version 1.0.0	YumaWorks YANG-Based Unified Modular Automation Tools [pdf] User Guide YANG-Based, Unified Modular Automation Tools, Unified Modular, Automation Tools
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References

-  [meta-openembedded - Collection of OpenEmbedded layers](#)
-  [poky - Poky Build Tool and Metadata](#)
-  [Network Configuration \(netconf\)](#)
-  [Network Configuration Wiki](#)
-  [libsmi - A Library to Access SMI MIB Information](#)
-  [NetconfCentral:](#)
-  [Network Modeling \(netmod\)](#)
-  [1 Overview — Bitbake dev documentation](#)
-  [Yocto Project Quick Build — The Yocto Project ® 4.2.999 documentation](#)
-  [Yocto Project Development Tasks Manual — The Yocto Project ® 4.0.999 documentation](#)
-  [netconf](#)
-  [Building your own recipes from first principles - Yocto Project](#)
-  [netconf Info Page](#)
-  [Openembedded.org](#)
-  [Yocto Project – It's not an embedded Linux distribution – it creates a custom one for you](#)
-  [YANG-driven Automated Network Management Tools | YumaWorks](#)
-  [YANG-driven Automated Network Management Tools | YumaWorks](#)