

yocto-tools [Andrys Jiri, 2018.01.25]

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1. Overview and Motivation

The `yocto-tools` helps to maintain multiple yocto environments/BSPs and hold host's dependencies in shape. Package is designed for people who porting software to different boards and also have intention to do something else than handling yocto. Yocto environments are stored in virtual disks in raw format. Images are mapped with help of loopback devices. Loop devices are slow in comparison with native write. Separation of BSPs to images ease switching between them.

If you do something with yocto/poky/openembedded then you know that initial build take most of time and also take a lot of space on storage. Yocto-tools stores this data in virtual disks.

After first initialization of yocto, location and linux ACLs mappings have to remain the same. In case that we are working with more than one BSP it is difficult to handle multiple environment such as move BSP to different machine or reuse huge image without necessity to rebuild entire yocto.

Because of all data are stored in images it is easy to handle it or map it from NAS to any system ("ymount"). In result user can copy virtual disk to any machine(windows, linux) then just continue work without necessity to recreate entire yocto-environment.

Moreover, it is also possible to use yocto environment of someone else, just copy virtual disk to any machine and continue working.

Yocto-tools fully support build machine concept(one common machine for builds). Developers usually do not want to create magical releases, where nobody knows what is necessary for build and windows/“mail machines” usually differs from machines where devel is done. On user’s windows/“mail machine” there are usually no free resources.

We suppose that build is made on PC/Machine where multiple users are logged in and multiple users are using yocto in parallel. Tools allows access one user to multiple images, but one user per build is allowed. Multiple builds can run in one build machine.

- Users have following mount points of yocto image:
“/opt/\$USER/works” Here, bitbake should be called. Only in one yocto-image-environment user can build at time.
- Multiple images for given user are mounted in different paths:
“/mnt/\$USER/vdXXX”
Please read help for ymount, for more details.
- **Yocto Data Image** —mount—> “/mnt/USER/vdXXX” — — —
bind — — > ”/opt/USER/works”

Different BSPs/“yocto-recipes” may use quite diferent attitude in sense of what cross compile means, such as using direct headers from host instead of headers from yocto cross , or may need particular version of linux distro for cross We want to separate native linux system(build machine) from build environment. Here comes reason for docker and docker-per-user (“docker_user”).

In short, we run \$ yocto cimg and create image for yocto, then we just call yocto command and docker will make isolation for us. From now on we don’t need to care about linux distro in host (ubuntu 16.04, 12.04 etc..). If we dont want to use docker then we can call only ymount and tool will ask for path to yocto image as before. Another advantage of using docker is that we can simply run yocto in Windows system. In case of Windows we also need VirtualBox, hypervisors such as Hyper V are not supported. Windows related dependencies such as docker-machine and docker will be installed with great help of chocolatey repository. In Windows environment we can not use “ycimg”, “ymount”.

Yocto-tools has been tested on following systems:

- Ubuntu 14.04(64bit)
- Ubuntu 16.04(64bit with docker)
- Fedora 24(64bit)
- Windows 7(32bit)
- Windows 7(64bit)

2. Getting Started

2.1 Installation

Because of yocto-tools during installation copy files to system folders, given user have to be member of sudo group. Once tools are installed yocto-tools modify sudoerr file and limit user only to yocto-tools, then general privileged rights (being member of sudo group) are not necessary and we can remove given user from sudo group.

1. In case of normal PC (linux), please call following command as normal user:
`>$./yocto install --install-subsystem-files`
2. In case of multi-user environment (buildmachine, linux + systemd) and initial installation, please call following command as normal user:
`>$./yocto install --install-subsystem-files --install-services`
3. In case of multi-user environment (buildmachine, linux + systemd) and new user, please call following command as normal user:
`>$./yocto install --install-services`
4. In case of windows OS please install cygwin and git, curl and awk package, then in cygwin shell just call :
`>$./yocto install`
The rest of tools such as docker will be installed by from “chocolatey repository”

Note.: Characters “./” are important, please do not skip them during installation phase.

2.2 Create Image

```
$ yocto cimg
```

2.3 “Run” in Linux

- In case that we want to use docker:
`>$ yocto`
- In case that we do not want to use docker, then just run:
`>$ ymount`

2.4 “Run” in Windows

```
$ yocto
```

3. Architecture

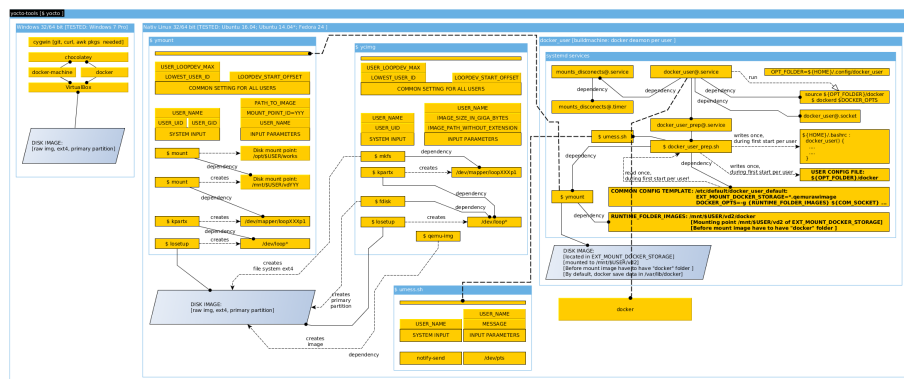


Figure 1:

4. Dependency List:

1. Standard tools, included in almost all kind of distros and installed by default:
>bash, mkdir, chmod, chown, mount, grep, egrep, awk, id, base64, bunzip2, lsof
2. Additional tools:
>losetup, kpartx, smbstatus, smbcontrol, docker, git, qemu-img, df
3. In case of Windows System:
>cygwin env. and also git, curl, awk packages. Docker, VirtualBox, docker-machine will be installed automatically.

5. Buildmachine Setup

When we select **–install_services** during installation step, systemd services related to docker per user(“docker_user”) will be installed. This means that every user have separated:

- dockerd daemon and its startup parameters
- private storage for docker images(virtual env. where yocto will run)

Private storage for docker images are stored separated as virtual disks and are always mounted to user's last mount point id.
Number of mount points depends on settings of ymount and can be changed per buildmachine.

- Default value of maximal number of mount points is 3.
This is also maximal number of mounted virtual disk at time per user by yocto-tools/ymount.
- First mount point is “/mnt/\$USER/vd0” and is used during build of yocto.
(working yocto-env where user build yocto)
- Second mount point is “/mnt/\$USER/vd1” and purpose is us up to user.
- Last mount point is “/mnt/\$USER/vd2” and is used by docker(docker_user), in case of buildmachine installation.
Location of virtual disk for docker images is :
EXT_MOUNT_DOCKER_STORAGE=“*/docker_imgs_storage.qemurawimg”
This virtual image can be created automatically during buildmachine installation.
- In order to protect data on mounted virtual disks, “mounts_disconnects@USER.service” is installed and provides unmounting of all virtual disks. Another unit mounts_disconnects@USER.timer serve as trigger. Default trigger time is set to: 23:45, everyday.

We suppose that somewhere in NAS in network we have common place to store all images for all “build-users”.

After “Buildmachine” ops install yocto-tools’s services for user, then dockerd settings is located in

“\${HOME}/.config/docker_user/docker”.

User settings is not hard-coded, settings is templated per buildmachine.

During first buildmachine installation location of virtual disk for docker images will be defined,

yocto-tools asks for location and store settings in:

“/etc/default/docker_user_default”

Following service-only installation for adding new user yocto-tools use template.

Please take a look to architecture(doc folder) and to sources in order to understand well.

6. Yocto-tools and Yocto Build Environment

As have been described before, docker provide isolation from host's env. Definition of running environment for yocto build is stored in dockerfiles located in following directory:

`${HOME}/.config/yocto_docker/build_*`

During start of `$ yocto` command user choose from docker-user files.

Definition of running environment is composed from two dockerfiles:

1. `"*yocto_base.v*.docker"` :
 - Should not be modified and contains most of data
 - In order to speed up process and also for offline mode
 - Prepared image can be stored as `"*yocto_base.v*.docker.tar.bz2"`
During installation, yocto-tools check docker-image-file in current directory and if exist copy it to user's folder for later use.
2. `"*yocto_user.v*.docker"` :
 - On base of yocto_base docker file
 - User can copy this file and modify it
 - In order to rebuild image with same name of dockerfile old image have to be removed from docker