Getting Started with Automotive Grade Linux

(builds , emulator, SDK)

Jan-Simon Möller

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Welcome, I am

Jan-Simon Möller

AGL Release Manager

reach me via:

jsmoeller@linuxfoundation.org

IRC: 'DL9PF' on **libera.chat** **join #automotive there !**

Overview

Goals and Topics

We will learn:

- where to get AGLs source code
- the prerequisites to build AGL
- what machines or boards are supported
- what images do exist
- how to start a build
- what prebuilt images exist
- how to run an image in the emulator

We'll not cover now:

- What 'is' AGL -> See 'AGL Architecture' presentation and docs.automotivelinux.org
- HTML5 and Flutter images are in their own presentations later
- Specifics of machines or target images → we'll present the generic concepts here first

Notes

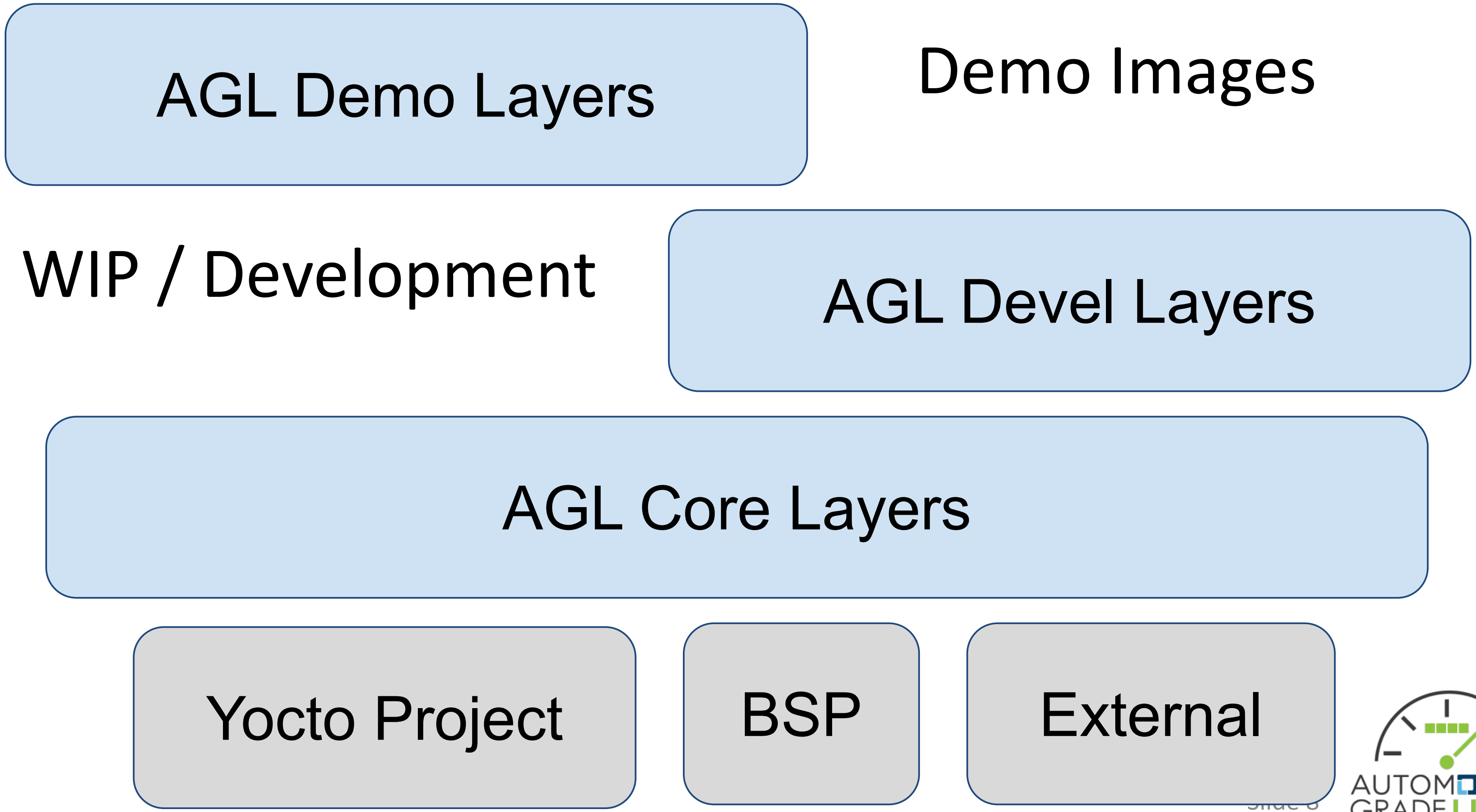
- We won't have time to do all steps on your PC in parallel during the presentation
- All steps that need to be executed on the commandline are marked below like so:

```
source aglsetup.sh
```

- Find this and more on https://docs.automotivelinux.org/

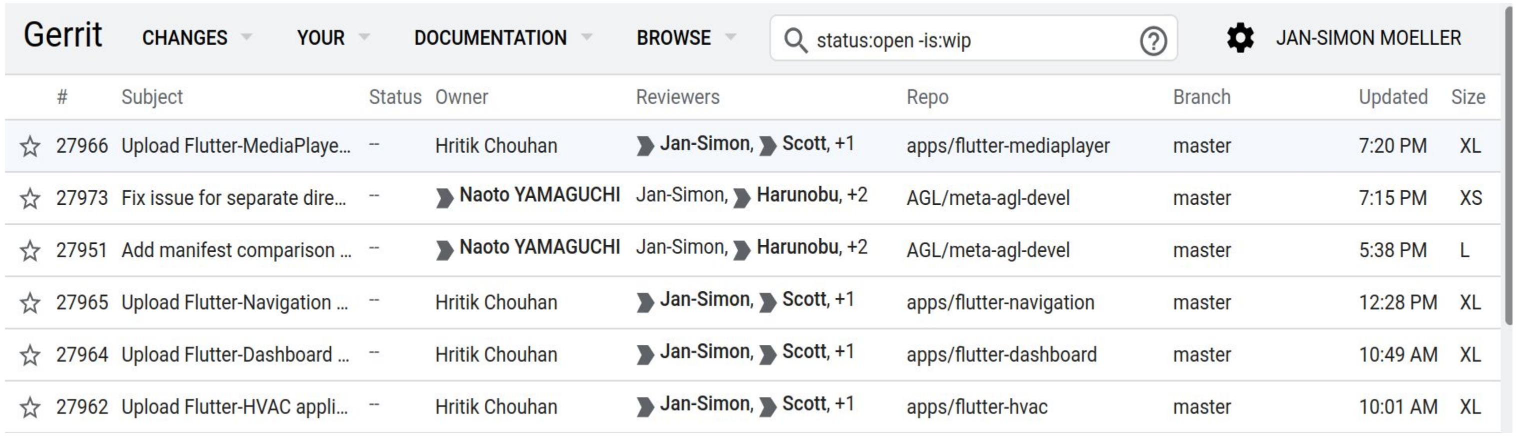
AGL source code

AGL Layers


AGL Demo Layers
Demo Images
WIP / Development
AGL Devel Layers
AGL Core Layers
Yocto Project
BSP
External

AGL source code repositories

- AGL hosts a gerrit instance for code review at https://gerrit.automotivelinux.org



	#	Subject	Status	Owner	Reviewers	Repo	Branch	Updated	Size
☆	27966	Upload Flutter-MediaPlaye...	--	Hritik Chouhan	Jan-Simon, Scott, +1	apps/flutter-mediaplayer	master	7:20 PM	XL
☆	27973	Fix issue for separate dire...	--	Naoto YAMAGUCHI	Jan-Simon, Harunobu, +2	AGL/meta-agl-devel	master	7:15 PM	XS
☆	27951	Add manifest comparison ...	--	Naoto YAMAGUCHI	Jan-Simon, Harunobu, +2	AGL/meta-agl-devel	master	5:38 PM	L
☆	27965	Upload Flutter-Navigation ...	--	Hritik Chouhan	Jan-Simon, Scott, +1	apps/flutter-navigation	master	12:28 PM	XL
☆	27964	Upload Flutter-Dashboard ...	--	Hritik Chouhan	Jan-Simon, Scott, +1	apps/flutter-dashboard	master	10:49 AM	XL
☆	27962	Upload Flutter-HVAC appli...	--	Hritik Chouhan	Jan-Simon, Scott, +1	apps/flutter-hvac	master	10:01 AM	XL

AGL source code repositories

- A mirror is available at https://git.automotivelinux.org

Directory structure:

/AGL/	- layers and infra
/apps/	- application code
/src/	- middleware and platform code
/staging/	- experimental code

Prepare environment

For simplicity, we define a shell variable for the top-level folder $HOME/AGL named $AGL_TOP:

```
export AGL_TOP=$HOME/AGL
echo 'export AGL_TOP=$HOME/AGL' >> $HOME/.bashrc
mkdir -p $AGL_TOP
```

Clone AGL repositories

We do use the 'repo' tool to construct the folder from multiple git repositories:

```
sudo apt-get install curl python-is-python3 git gnupg\
                     language-pack-en wget qemu-system-x86-64
mkdir -p $HOME/bin
export PATH=$HOME/bin:$PATH
echo 'export PATH=$HOME/bin:$PATH' >> $HOME/.bashrc
curl https://storage.googleapis.com/git-repo-downloads/repo \
     > $HOME/bin/repo
chmod a+x $HOME/bin/repo
```

Clone AGL repositories II

Next we will create a folder and download the code:

```
git config --global user.email "you@example.com"
git config --global user.name "Your Name"
cd $AGL_TOP
mkdir needlefish
cd needlefish
repo init -b needlefish \
   -u https://gerrit.automotivelinux.org/gerrit/AGL/AGL-repo
repo sync
```

Summary

```
export AGL_TOP=$HOME/AGL
echo 'export AGL_TOP=$HOME/AGL' >> $HOME/.bashrc
mkdir -p $AGL_TOP
sudo apt-get install curl python-is-python3 language-pack-en wget qemu-system-x86-64 git gnupg
mkdir -p $HOME/bin
export PATH=$HOME/bin:$PATH
echo 'export PATH=$HOME/bin:$PATH' >> $HOME/.bashrc
curl https://storage.googleapis.com/git-repo-downloads/repo > $HOME/bin/repo
chmod a+x $HOME/bin/repo
git config --global user.email "you@example.com"
git config --global user.name "Your Name"
cd $AGL_TOP
mkdir needlefish
cd needlefish
repo init -b needlefish -u https://gerrit.automotivelinux.org/gerrit/AGL/AGL-repo
repo sync
```

Prerequisites to build AGL

Build host

- Your build host needs:
  - >= 8GB of RAM
  - >= 8 CPU cores
  - >= 100GB free space
    - better more
    - better a SSD or NVMe
  - Native machine preferred
    → no VM if possible

Build dependencies - software

AGL does build upon the Yocto Project layers and Openembedded tooling (bitbake).

Thus refer to the:

- Supported distributions document
  - Recommendation: Ubuntu 20.04 or Debian 10.x

```
sudo apt install gawk wget git diffstat unzip texinfo gcc \
 build-essential chrpath socat cpio python3 python3-pip \
 python3-pexpect xz-utils debianutils iputils-ping python3-git \
 python3-jinja2 libegl1-mesa libsdl1.2-dev pylint3 xterm \
 python3-subunit mesa-common-dev zstd liblz4-tool
```

As much re-use of artifacts as possible …

- bitbake can re-use a folder for downloaded sources and a folder for a binary cache.
  We prepare to re-use these across builds below:

```
echo "# reuse download directories" >> $AGL_TOP/site.conf
echo "DL_DIR = \"$AGL_TOP/downloads/\"" >> $AGL_TOP/site.conf
echo "SSTATE_DIR = \"$AGL_TOP/sstate-cache/\"" >> $AGL_TOP/site.conf
```

- To use this configuration fragment, execute in a project folder lateron:

```
cd $AGL_TOP/my-qemux86-64-project-folder/
ln -sf $AGL_TOP/site.conf conf/
```

Option: copy content of USB-sticks

USB sticks are provided with a

downloads/

and

sstate-cache/

folder.

Copy these into $AGL_TOP/downloads and $AGL_TOP/sstate-cache

Summary

```
sudo apt install gawk wget git diffstat unzip texinfo gcc \
   build-essential chrpath socat cpio python3 python3-pip \
   python3-pexpect xz-utils debianutils iputils-ping python3-git \
   python3-jinja2 libegl1-mesa libsdl1.2-dev pylint3 xterm \
   python3-subunit mesa-common-dev zstd liblz4-tool


# prepare configuration fragment "site.conf"
echo "# reuse download directories" >> $AGL_TOP/site.conf
echo "DL_DIR = \"$AGL_TOP/downloads/\"" >> $AGL_TOP/site.conf
echo "SSTATE_DIR = \"$AGL_TOP/sstate-cache/\"" >> $AGL_TOP/site.conf
```

Supported machines or boards

Supported Boards

- AGL supports these as reference platforms:
  - Renesas R-Car 3
    - h3ulcb, m3ulcb, Kingfisher add-on board
    - AGL Reference Hardware board
  - x86_64 (via qemux86-64 as MACHINE)
  - ARM32 (via qemuarm)
  - AARCH64 (via qemuarm64)
  - Pi4

Supported Boards

- AGL supports these as community supported:
    - TI
        - beaglebone / beaglebone enhanced
        - j721e-evm
    - NXP
        - i.mx6 (via cubox-i)
        - imx8mq-evk
    - qemuriscv64
    -

aglsetup.sh

aglsetup.sh is the setup script to manage all the required settings for boards/layers/agl-features.

TLDR:

aglsetup.sh -h will list all options

aglsetup.sh -m <MACHINE> will select the board

aglsetup.sh -b <myproject>   will set the folder

AGL (demo) images

AGL demo images

- There are a number of demo images available:
  - IVI demo:
    - **agl-ivi-demo-platform** (Qt)
      - agl-ivi-demo-platform-crosssdk
    - agl-ivi-demo-platform-flutter
    - agl-ivi-demo-platform-html5

AGL demo images

There are a number of demo images available:

- Instrument Cluster demo:
  - **agl-cluster-demo-platform**
  - agl-cluster-demo-platform-flutter
  - (agl-cluster-demo-qtcompositor)
- Telematics demo:
  - **agl-telematics-demo-platform**

Expert Group images

Instrument Cluster EG:

- **agl-cluster-demo-lxc-host**

Production-IVI EG:

- agl-image-flutter-runtimedebug
- agl-image-flutter-runtimeprofile
- agl-image-flutter-runtimerelease
- agl-image-boot-basesystem

Generic Images for re-use

- agl-image-boot
  - minimal/smallest bootable image
- agl-image-minimal
  - minimal console tooling
- agl-image-weston
  - image with wayland+weston
- agl-image-agl-compositor
  - image with wayland+agl-compositor

How to build an AGL image

Choices

- With all preparations done, it is time to build an example image.
- The choices are:
  - MACHINE = qemux86-64
  - agl-demo-platform-crosssdk

Note:

Images might require certain options to be enabled

agl-demo-platform-crosssdk

This requires the following call to aglsetup.sh:

```
cd $AGL_TOP
cd needlefish
source meta-agl/scripts/aglsetup.sh agl-demo agl-devel
```

Note:

- this uses a default project folder of "./build"
- recommendation is to specify one with "-b"

agl-demo-platform-crosssdk II

Recommended option - cache setup:

```
ln -sf $AGL_TOP/site.conf conf/
```

agl-demo-platform-crosssdk III

Time to build the image:

```
bitbake agl-demo-platform-crosssdk
```

This takes a long time. The outcome is in:

```
ls tmp/deploy/images/qemux86-64
```

Re-entering an existing project

Whenever you want to enter an existing project folder, e.g. because you started a new terminal session or rebooted, you need to call this:

```
cd $AGL_TOP/needlefish
cd build
source agl-init-build-env
```

Summary

```
cd $AGL_TOP
cd needlefish
source meta-agl/scripts/aglsetup.sh agl-demo agl-devel
ln -sf $AGL_TOP/site.conf conf/
bitbake agl-demo-platform-crosssdk
ls tmp/deploy/images/qemux86-64

cd $AGL_TOP/needlefish
cd build
source agl-init-build-env
```

Prebuilt images and artifacts

Release images

- AGL does provide prebuilt artifacts for releases:

https://download.automotivelinux.org/AGL/release/

E.g.:

- https://download.automotivelinux.org/AGL/release/needlefish/14.0.0/qemux86-64/deploy/images/qemux86-64/agl-demo-platform-crosssdk-qemux86-64.wic.vmdk.xz
- https://download.automotivelinux.org/AGL/release/needlefish/14.0.0/qemux86-64/deploy/sdk/poky-agl-glibc-x86_64-agl-demo-platform-crosssdk-corei7-64-qemux86-64-toolchain-14.0.0.sh

Nightly Snapshots

A nightly build publishes its artifacts to:

https://download.automotivelinux.org/AGL/snapshots/

E.g.:

- https://download.automotivelinux.org/AGL/snapshots/needlefish/latest/qemux86-64/deploy/images/qemux86-64/agl-demo-platform-crosssdk-qemux86-64.wic.vmdk.xz
- https://download.automotivelinux.org/AGL/snapshots/needlefish/latest/qemux86-64/deploy/sdk/poky-agl-glibc-x86_64-agl-demo-platform-crosssdk-corei7-64-qemux86-64-toolchain-14.0.0.sh

Run an image in the emulator

'runqemu'

runqemu is a helper to run the resulting image and part of the bitbake environment:

```
cd $AGL_TOP/needlefish
cd build
source agl-init-build-env
runqemu kvm slirp serialstdio  [snapshot] [publicvnc]
```

How to use prebuilt artifacts

See:

https://docs.automotivelinux.org/en/needlefish/#0_Getting_Started/1_Quickstart/Using_Ready_Made_Images/

Running a prebuilt image:

```
### Don't do that at the training (-ETooSlowInternet) - try at home
cd $AGL_TOP
mkdir prebuilt
cd prebuilt
wget -nd -O AGLx86.ext4.xz -c "https://bit.ly/3qjTrel"
wget -nd -O bzImage -c "https://bit.ly/3qeG9j9"
xz -d AGLx86.ext4.xz
qemu-system-x86_64 -device virtio-net-pci,netdev=net0,mac=52:54:00:12:35:02 \
    -netdev user,id=net0,hostfwd=tcp::2222-:22 \
    -drive file=AGLx86.ext4,if=virtio,format=raw -show-cursor -usb -usbdevice tablet \
    -device virtio-rng-pci -vga virtio -machine q35 -cpu kvm64 -cpu host -enable-kvm \
    -m 2048 -serial mon:vc -serial mon:stdio -serial null -kernel bzImage \
    -append 'root=/dev/vda rw console=tty0 mem=2048M ip=dhcp oprofile.timer=1
             console=ttyS0,115200n8 verbose fstab=no'
```

Demo

agl-demo-platform image in qemu

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Questions ?

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Q/A

- Don't hesitate and ask now !
- Slides are available.
- Questions can be sent later-on as well to:
  - https://lists.automotivelinux.org/g/agl-dev-community/messages

- Email: jsmoeller@linuxfoundation.org
- IRC: DL9PF   #automotive on libera.chat

Thank you!

Thanks for joining.

Appendix

The 'traditional' SDK

The SDK installer

- bitbake can output a self-extracting SDK installer
- it is in the folder tmp/deploy/sdk/
- it contains a c/c++ toolchain and the libraries matching the image built

Execute the installer

```
cd $AGL_TOP/needlefish
cd build/tmp/deploy/sdk/
./poky-agl-glibc-x86_64-agl-demo-platform-crosssdk-*.sh

# Select target directory for SDK : ~/AGL/agl-sdk
```

Activate the SDK environment

Every time you want to use the SDK environment, you have to source the script:

```
source ~/AGL/agl-sdk/environment-setup-corei7-64-agl-linux
```

To check the compiler is set:

```
echo $CC
```