Agenda

- **About Linaro and me**
- **What is TuxSuite ?**
- **TuxSuite Usecases last year**
- **TuxSuite YP/OE support**
- **Build definition Template**
- **TuxBake**
- **Building a single YP/OE distro image with TuxSuite**
- **Building multiple YP/OE distro images with TuxSuite Plans**

Linaro

- Driving open source software development on Arm since 2010, providing the tools, Linux kernel quality and security needed for a solid foundation to innovate on.
- Working with member companies and the open source community to maintain the Arm software ecosystem and enabling new markets on Arm architecture.
- Linaro Developer Services: Helping build, deploy and maintain your products on Arm
- Software Services that accelerate development and testing of open source Operating System software.
- Linaro projects:
  - Linux kernel
  - toolchains
  - security
  - continuous integration testing
  - Automotive
  - IoT & Edge Devices, Client Devices
  - Cloud Computing & Servers.

About Me

- Senior Engineer in Linaro as part of Tuxsuite Team, developing cloud solutions to build various open source software products.
- 14 years of experience designing and building CI/CD solutions for a variety of embedded software stacks.
- Have worked on various components of the stack
  - u-boot
  - edk2
  - AOSP
  - Yocto

What is TuxSuite?

- On-demand APIs and tools that executes in parallel at scale in the cloud.
  - Building Linux kernels
  - Testing Linux kernels on Qemu
  - Building Yocto Project / OpenEmbedded and derivatives
- TuxSuite can scale to more than 1000 builds or tests in parallel within minutes
- [tuxsuite cli](#) is a python cli application to talk to the API endpoint
- Easily Reproducible in the cloud and locally thanks to OSS tools:
  - Linux Kernel - [TuxMake](#)
  - Boot Testing with Qemu - [TuxRun](#)
  - Build YP/OE - [TuxBake](#)

TuxSuite Usecases Last Year

- LKFT
  - Linux Kernel build, boot and LTP tests
  - OE builds for building userspace for kernel testing
  - Peak usage in a day
    1. 2000+ hrs ~= 40+ 8 core machines doing the builds for 24 hrs.
    2. 9500+ builds
  - 136,995 builds in April 2022
  - 1,203,113 kernel built in 2021
- Individual Linux Kernel maintainers use it to build test
- ClangbuiltLinux - Linux kernel build tests with different Clang versions
  - Peak Usage in a day: 1000+ hrs for 2000+ builds
  - 54,043 builds in the month of April 2022
  - More details are available here: Deepdive Into ClangBuiltLinux
- Morello - Running Linux and Android tests on FVP in the cloud

TuxSuite Applications

- Easily integrated with any modern CI systems and Code Review tools:
    - Gerrit
    - Gitlab CI
    - Github Actions
    - Jenkins
    - Travis CI
- Developers can use it for wider build/boot test locally

TuxSuite YP/OE Support

- TuxSuite supports building YP/OE
  - Supported backends:
    - [TuxBake](#)
    - [kas](#)
- Per project caching:
  - shared SSTATE Mirror.
  - shared DL_DIR.

TuxSuite YP/OE Support

- Publish build artifacts at a non-guessable URL

Filename	Last Modified	Size
↑ Parent Directory		
📁 images/		
📁 licenses/		
📁 rpm/		
📄 bitbake-environment	2 hours ago	1M
📄 build-debug.log	2 hours ago	498K
📄 build-definition.json	2 hours ago	806B
📄 build.log	2 hours ago	454K

tuxpub 0.1.10, by Linaro.
Tip: If ?export=json is appended to the URL, a json representation of the page will be provided.

TuxSuite + TuxBake

- TuxBake is an Open Source Python3 Application to build YP/OE.
- Containerized build environment.
  - Ubuntu-<16.04/18.04/20.04/22.04>
  - Debian-<buster/bullseye/stretch>
  - Centos-8
  - Fedora-<33/34>
  - opensuse-leap-<15.1/15.2>
- Uses Docker/Podman for providing the containerized environment.
- Uses build-definition Template.
- Git / Android Repo tool to manage sources.
- Allows users to define local.conf, bblayers.conf, environment variables, sstate_mirror, dl_dir, distro, machine, container.

Build definition fields

- **sources** (dictionary with a single item): could be one git_trees, repo or kas
  a. **git_trees** (list of dictionaries): url, branch and optionally commit ids/refs
  b. **repo** (a dictionary): branch, manifest file name and manifest repo url
  c. **kas** (a dictionary): url, branch, kas yaml and optionally ref.
- **envsetup**: path to the script, relative to the source directory, sourced to setup bitbake environment
- **distro**, **machine**, **target**: variables passed to the bitbake command
- **container**: the container used by Docker to do the build.
- **local_conf, bblayers_conf** (list of strings): each entry corresponds to a line in local.conf file.
- **environment** (dictionary of environment variables)

build-definition examples - Yocto Project / Poky

```
$ # Install tuxsuite
$ pip3 install tuxsuite
$ cat yocto.json
{
  "container": "ubuntu-20.04",
  "envsetup": "poky/oe-init-build-env",
  "distro": "poky",
  "machine": "qemux86-64",
  "target": "core-image-minimal",
  "sources": {
    "git_trees": [
      {
        "url": "git://git.yoctoproject.org/poky",
        "branch": "kirkstone",
        "sha": "780eeec8851950ee6ac07a2a398ba937206bd2e4"
      }
    ]
  }
}
```

build-definition examples - Yocto Project / Poky

```
$ tuxsuite bake submit yocto.json

*** WARNING: BITBAKE SUPPORT IS EXPERIMENTAL ***
Building target: core-image-minimal with bitbake from {'git_trees': [{'url':
'git://git.yoctoproject.org/poky', 'branch': 'honister'}]} source with distro:
poky machine: qemux86-64 arguments
uid: 291KafvkrqBvDt8iFO3nf2jQWjS

⚙️  Provisioning: {'git_trees': [{'url': 'git://git.yoctoproject.org/poky',
'branch': 'honister'}]} with poky qemux86-64 for core-image-minimal:
https://oebuilds.tuxbuild.com/291KafvkrqBvDt8iFO3nf2jQWjS/

🚀  Running: {'git_trees': [{'url': 'git://git.yoctoproject.org/poky', 'branch':
'honister'}]} with poky qemux86-64 for core-image-minimal:
https://oebuilds.tuxbuild.com/291KafvkrqBvDt8iFO3nf2jQWjS/

🎉  Pass: {'git_trees': [{'url': 'git://git.yoctoproject.org/poky', 'branch':
'honister'}]} with poky qemux86-64 for core-image-minimal:
https://oebuilds.tuxbuild.com/291KafvkrqBvDt8iFO3nf2jQWjS/
```

build-definition examples - Oniro

```
$ cat oniro.json
{
  "container": "ubuntu-20.04",
  "distro": "oniro-linux",
  "environment": {
    "TEMPLATECONF": "../oniro/flavours/linux"
  },
  "envsetup": "oe-core/oe-init-build-env",
  "machine": "qemux86-64",
  "sources": {
    "repo": {
      "branch": "kirkstone",
      "manifest": "default.xml",
      "url": "https://gitlab.eclipse.org/eclipse/oniro-core/oniro"
    }
  },
  "target": "oniro-image-base-tests"
}
```

build-definition examples - Oniro

```
$ tuxsuite bake submit oniro.json

*** WARNING: BITBAKE SUPPORT IS EXPERIMENTAL ***
Building target: oniro-image-base with bitbake from {'repo': {'branch': 'kirkstone',
'manifest': 'default.xml', 'url': 'https://booting.oniroproject.org/distro/oniro'}}
source with distro: oniro-linux machine: qemux86-64 arguments
uid: 291SyRebaz5UNPVoaWWDbwWtecI

⚙️  Provisioning: {'repo': {'branch': 'kirkstone', 'manifest': 'default.xml', 'url':
'https://booting.oniroproject.org/distro/oniro'}} with oniro-linux qemux86-64 for
oniro-image-base: https://oebuilds.tuxbuild.com/291SyRebaz5UNPVoaWWDbwWtecI/

🚀  Running: {'repo': {'branch': 'kirkstone', 'manifest': 'default.xml', 'url':
'https://booting.oniroproject.org/distro/oniro'}} with oniro-linux qemux86-64 for
oniro-image-base: https://oebuilds.tuxbuild.com/291SyRebaz5UNPVoaWWDbwWtecI/

🎉  Pass: {'repo': {'branch': 'kirkstone', 'manifest': 'default.xml', 'url':
'https://booting.oniroproject.org/distro/oniro'}} with oniro-linux qemux86-64 for
oniro-image-base: https://oebuilds.tuxbuild.com/291SyRebaz5UNPVoaWWDbwWtecI/
```

build-definition examples - Kas

```
$ cat kas.json
{
  "sources": {
    "kas": {
      "url": "https://git.codelinaro.org/linaro/dependable-boot/meta-ts",
      "yaml": "ci/zynqmp-starter.yml"
    }
  }
}
```

build-definition examples - Kas

```
$ tuxsuite bake submit kas.json

*** WARNING: BITBAKE SUPPORT IS EXPERIMENTAL ***
Building target: None with bitbake from {'kas': {'url':
'https://git.codelinaro.org/linaro/dependable-boot/meta-ts', 'yaml':
'ci/zynqmp-starter.yml'}} source with distro: None machine: None arguments
uid: 291T4fWMaux9zNIZdAVQAFwlm8s

⚙  Provisioning: {'kas': {'url':
'https://git.codelinaro.org/linaro/dependable-boot/meta-ts', 'yaml':
'ci/zynqmp-starter.yml'}} with None None for None:
https://oebuilds.tuxbuild.com/291T4fWMaux9zNIZdAVQAFwlm8s/

🚀 Running: {'kas': {'url': 'https://git.codelinaro.org/linaro/dependable-boot/meta-ts',
'yaml': 'ci/zynqmp-starter.yml'}} with None None for None:
https://oebuilds.tuxbuild.com/291T4fWMaux9zNIZdAVQAFwlm8s/

🎉 Pass: {'kas': {'url': 'https://git.codelinaro.org/linaro/dependable-boot/meta-ts',
'yaml': 'ci/zynqmp-starter.yml'}} with None None for None:
https://oebuilds.tuxbuild.com/291T4fWMaux9zNIZdAVQAFwlm8s/
```

TuxSuite Plans for Yocto - Poky master-next

```
$ cat poky-next.yaml
common: &commondata
  "container": "ubuntu-20.04"
  "distro": "rpb"
  "envsetup": "setup-environment"
  "sources": {
    "git_trees": [
      {
        "url":
"git://git.yoctoproject.org/poky",
        "branch": "master-next"
      }
    ]
  }
  "target": "core-image-minimal"
version: 1
name: Poky next validation
```

```
description: Build Poky for various qemu
jobs:
- name: next-tracking
  bakes:
    - { <<: *commondata, "machine": "qemuarm64"}
    - { <<: *commondata, "machine": "qemuarm"}
    - { <<: *commondata, "machine": "qemuarmv5"}
    - { <<: *commondata, "machine": "qemumips64"}
    - { <<: *commondata, "machine": "qemumips"}
    - { <<: *commondata, "machine": "qemuppc64"}
    - { <<: *commondata, "machine": "qemuppc"}
    - { <<: *commondata, "machine": "qemuriscv32"}
    - { <<: *commondata, "machine": "qemuriscv64"}
    - { <<: *commondata, "machine": "qemux86-64"}
    - { <<: *commondata, "machine": "qemux86"}
```

TuxSuite Plans for Yocto

```
$ tuxsuite plan poky-next.yaml
*** WARNING: BITBAKE SUPPORT IS EXPERIMENTAL ***
Running Bake plan 'Poky next validation': 'Build Poky for various qemu'
Plan https://tuxapi.tuxsuite.com/v1/groups/tuxsuite/projects/vishal/plans/2974WYyncHQsrfgwhdDvIElLOut

uid: 2974WYyncHQsrfgwhdDvIElLOut
⚙  Provisioning: {'git_trees': [{'url': 'git://git.yoctoproject.org/poky', 'branch': 'master-next'}]} with
poky qemuarm64 for core-image-minimal: https://oebuilds.tuxbuild.com/2974WfMW5ffFuWdMvPepMHdr0BQ/
⚙  Provisioning: {'git_trees': [{'url': 'git://git.yoctoproject.org/poky', 'branch': 'master-next'}]} with
poky qemuarm for core-image-minimal: https://oebuilds.tuxbuild.com/2974WhiciLNQzgqRy355y0FoeeY/
.
.
🚀  Running: {'git_trees': [{'url': 'git://git.yoctoproject.org/poky', 'branch': 'master-next'}]} with poky
qemuarm64 for core-image-minimal: https://oebuilds.tuxbuild.com/2974WfMW5ffFuWdMvPepMHdr0BQ/
🚀  Running: {'git_trees': [{'url': 'git://git.yoctoproject.org/poky', 'branch': 'master-next'}]} with poky
qemuarm for core-image-minimal: https://oebuilds.tuxbuild.com/2974WhiciLNQzgqRy355y0FoeeY/
.
.
```

TuxSuite Plans for Yocto

```
🚀 Running: {'git_trees': [{'url': 'git://git.yoctoproject.org/poky', 'branch': 'master-next'}]} with poky qemuarm for
core-image-minimal: https://oebuilds.tuxbuild.com/2974WhiciLNQzgqRy355y0FoeeY/
.
🎉 Pass: {'git_trees': [{'url': 'git://git.yoctoproject.org/poky', 'branch': 'master-next'}]} with poky qemuarmv5 for
core-image-minimal: https://oebuilds.tuxbuild.com/2974Wbe9Gen3HeXg4Px4Br7mHyy/
🎉 Pass: {'git_trees': [{'url': 'git://git.yoctoproject.org/poky', 'branch': 'master-next'}]} with poky qemumips for
core-image-minimal: https://oebuilds.tuxbuild.com/2974WchEEacRybPXsXAju9D9Z4W/
.
.
Summary: https://tuxapi.tuxsuite.com/v1/groups/tuxsuite/projects/vishal/plans/2974WYyncHQsrfgwhdDvIElLOut
2974WfMW5ffFuWdMvPepMHdr0BQ 🎉 Pass
2974WhiciLNQzgqRy355y0FoeeY 🎉 Pass
2974Wbe9Gen3HeXg4Px4Br7mHyy 🎉 Pass
2974WbxRWEWpDQ2ZVoKAhGG45xR 🎉 Pass
2974WchEEacRybPXsXAju9D9Z4W 🎉 Pass
2974WhDS5hlao2m1FbRHERVEcIC 🎉 Pass
2974WeGXcIU2FkXdkM0CHDZ0Ri7 🎉 Pass
2974Wekt2wuoUB4iakkdJOQfHhd 🎉 Pass
2974Wb8xdKq25w5kh4eehwJiGWM 🎉 Pass
2974WhhEG72AT3msg9tzJsDWLIG 🎉 Pass
2974WgTngYzmHY2B1ap7hffnW57 🎉 Pass
```

TuxSuite Applications - Yocto

- Layers premerge testing and tracking changes with Yocto upstream.
    - meta-rpb premerge testing: https://github.com/96boards/oe-rpb-manifest/blob/qcom/master/.github/workflows/build-template.yml
    - upstream Poky master-next tracking: https://ci.linaro.org/job/lt-qcom-poky-master/
    - meta-qcom layer CI: https://github.com/ndechesne/meta-qcom/tree/master/.github/workflows

Reproducing the build with TuxBake locally

```
$ tuxbake --build-definition yocto.json --src-dir $PWD/yocto
Cloning into 'poky'...
remote: Enumerating objects: 561369, done.
remote: Counting objects: 100% (1355/1355), done.
remote: Compressing objects: 100% (911/911), done.
remote: Total 561369 (delta 742), reused 685 (delta 425), pack-reused 560014
Receiving objects: 100% (561369/561369), 182.99 MiB | 524.00 KiB/s, done.
Resolving deltas: 100% (407297/407297), done.
Using default tag: latest
latest: Pulling from tuxbake/ubuntu-20.04
Digest: sha256:a4e2a7f852b53c5ba741ef0e4d459913df9a2135d0444d6ec8e211792c2ede00
Status: Image is up to date for tuxbake/ubuntu-20.04:latest
docker.io/tuxbake/ubuntu-20.04:latest
usermod: no changes
bash -c 'rm build/conf/bblayers.conf; rm build/conf/local.conf; source poky/oe-init-build-env build; cat
../extra_local.conf >> conf/local.conf; cat ../bblayers.conf >> conf/bblayers.conf || true; echo
'"'"'Dumping local.conf..'"'"'; cat conf/local.conf; bitbake -e > bitbake-environment; bitbake
core-image-minimal'
rm: cannot remove 'build/conf/bblayers.conf': No such file or directory
rm: cannot remove 'build/conf/local.conf': No such file or directory
You had no conf/local.conf file. This configuration file has therefore been
created for you with some default values. You may wish to edit it to, for
example, select a different MACHINE (target hardware). See conf/local.conf
for more information as common configuration options are commented.
.
.
```

TuxSuite Yocto Roadmap

- Boot Test Yocto images on Qemu with TuxTest
- no-cache option to skip sstate_cache usage
- Support to download sstate_cache objects
- Serve sstate_cache and dl_dir from TuxSuite Cloud to tuxbake
- artifacts download by CLI
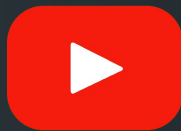- Publish Statistics for the build

TuxSuite Token

We have trial vouchers available for those interested in experimentation with the build service.

Please request a tuxsuite token via the: TuxSuite Token Request

Getting Started with TuxSuite: https://learn.tuxsuite.com

TuxSuite References

- https://tuxsuite.com
- https://tuxrun.org
- https://tuxmake.org
- https://learn.tuxsuite.com
- https://gitlab.com/Linaro/tuxsuite
- https://gitlab.com/Linaro/tuxbake
- https://gitlab.com/Linaro/tuxmake
- https://gitlab.com/Linaro/tuxrun
- https://gitlab.com/Linaro/tuxsuite/-/tree/master/examples/bitbake