Custom-Made Enhanced Packet Cores as Network Services for 4G/5G Testbeds managed with Open Source MANO

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Mosaic5G Workshop

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Setting Up a 4G/5G Testbed

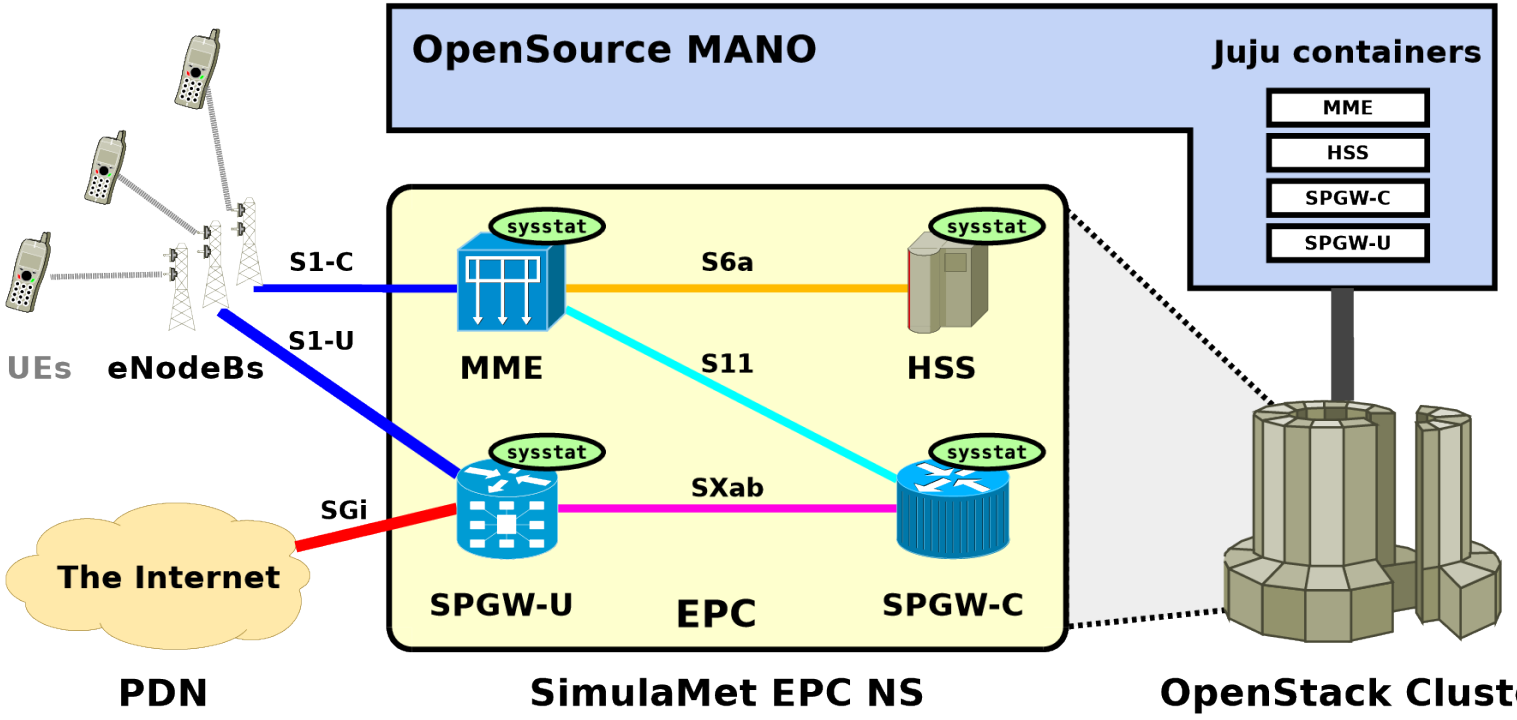
- Hardware:
  - User Equipment (modems, smartphones, etc.)
  - Programmable sim cards
  - Software-Defined Radio boards

- For the rest (eNodeBs, EPC):
  - OpenAirInterface Open Source software
  - Running on regular Linux PCs
  - **But: difficult to install and maintain!**

Our Goal: An OpenAirInterface VNF

- Main purpose: testbed setups for research and development
- OAI EPC as VNF
  - Easy to use, EPC should (hopefully) work “out of the box”
  - Build of OAI software inside VMs, according to specified Git repositories and commits
    ⇨ get exactly the desired installation (e.g. using Mosaic5G branches)
- NSs using the VNF and possibly other VNFs
  - Example 1: add Mobile Edge Computing services to EPC
  - Example 2: use FlexRAN for network slicing
  - ...

Basic Testbed Setup



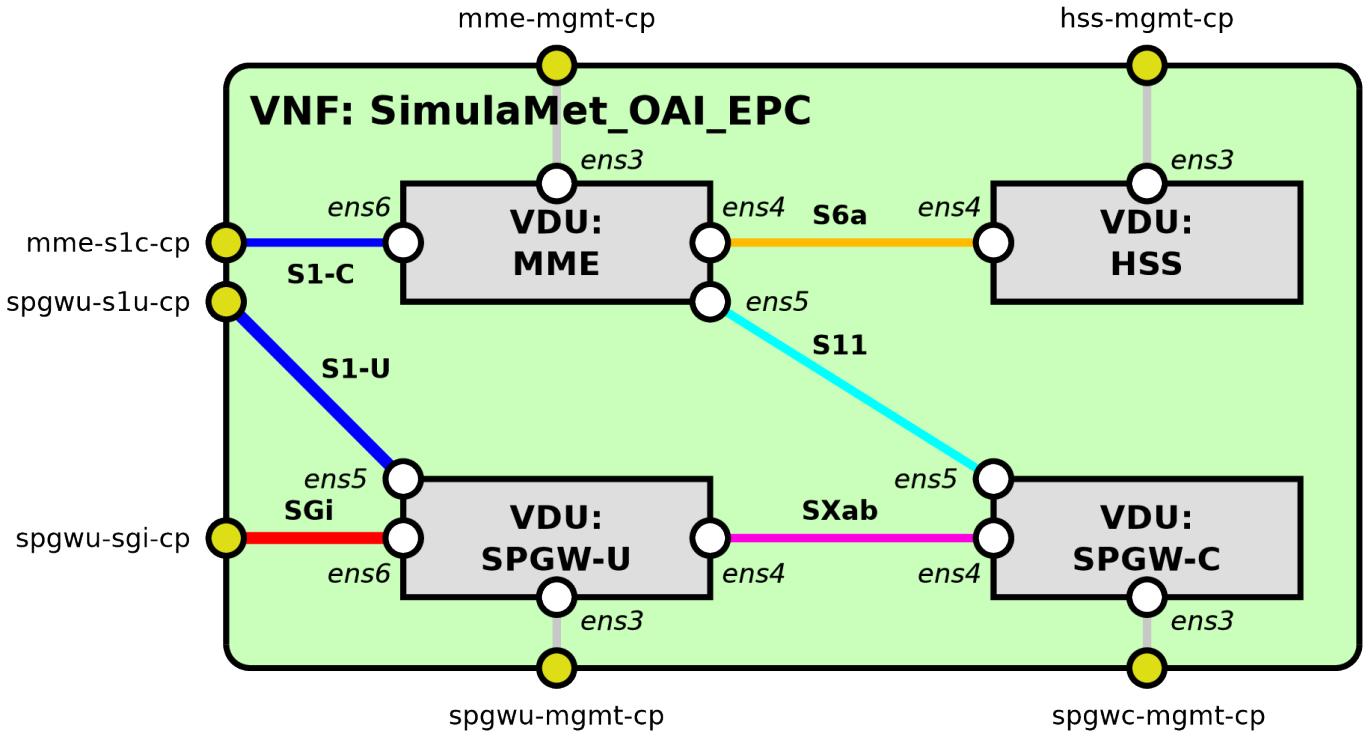
What is needed for the VNF?

- Base VDU image
- The VNF itself
- Juju Charms to configure the components
- Management of the build process

Base VDU Image

- VDU image goals:
  - Full-featured base VDU image, including development and debug tools
  - Different versions of Ubuntu LTS (Xenial, Bionic, Focal)
  - Up-to-date (i.e. all updates installed)
- Packer scripting:
  - Fully automatic installation using Packer
  - Preseeding (Ubuntu < 20.04); Subiquity (Ubuntu ≥ 20.04)
    - Additional PPA, keyboard layout setup, EFI boot, etc.
    - All updates installed
    - => Fresh, state-of-the art installation (avoids issues with “old” installations)
  - Details: https://github.com/simula/nornet-vmimage-builder-scripts

The SimulaMet EPC VNF



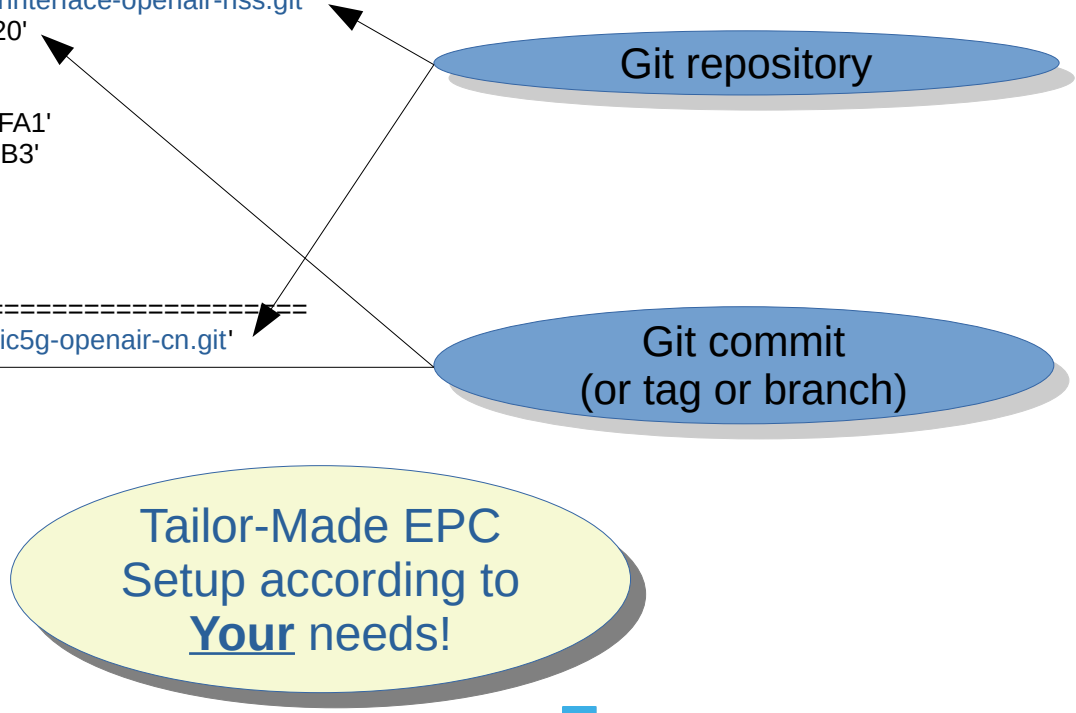
HSS: Home Subscriber Server
MME: Mobile Management Entity
SPGW-C:
Control Plane of the
Packet Data Network Gateway
SPGW-U:
User Plane of the
Packet Data Network Gateway

VNF Parameters Example

- # ====== HSS ==========
  hss_git_repository: 'https://github.com/simula/openairinterface-openair-hss.git'
  hss_git_commit: 'dreibh/cassandra-build-fix-22oct2020'
  hss_S6a_address: '172.16.6.129'
  network_realm: 'simula.nornet'
  network_k: '449C4B91AEACD0ACE182CF3A5A72BFA1'
  network_op: '1006020F0A478BF6B699F15C062E42B3'
  network_imsi_first: '242881234500000'
  network_msisdn_first: '24288880000000'
  network_users: '1024'

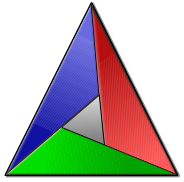
- # ====== MME ==========
  mme_git_repository: 'https://github.com/simula/mosaic5g-openair-cn.git'
  mme_git_commit: 'dreibh/mosaic5g
  mme_S1C_ipv4_interface: '192.168.247.102/24'
  mme_S1C_ipv4_gateway: '0.0.0.0'
  mme_S1C_ipv6_interface: ''
  mme_S1C_ipv6_gateway: ''
  mme_S11_ipv4_interface: '172.16.1.102/24'
  mme_S6a_address: '172.16.6.2'
  network_mcc: '242'
  network_mnc: '88'

- ...

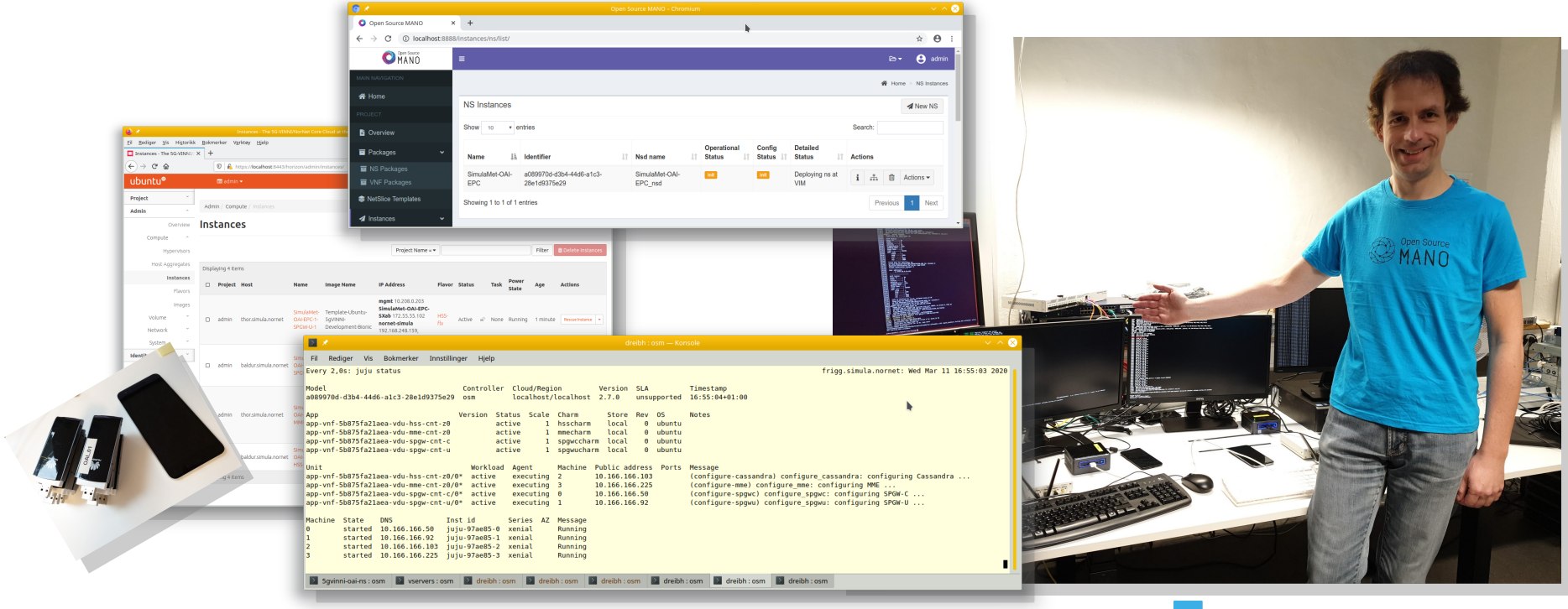


Managing VNFD/NSD Builds

- Multiple manual steps to generate and deploy VNFs and NSs
  - Strictly verify all YAML files with `yamllint` (very useful, to avoid problems and surprises!)
  - Copy Charm files to VNFDs and build Charms (charm build …)
    - Including our library “VDUHelper”
  - Verify descriptor(s) and generate VNFD package(s) (`validate_descriptor.py`, `generate_descriptor_pkg.sh`)
  - Verify descriptor(s) and generate NSD package(s)
- Initial approach: write a Makefile
- Better approach:
  - Git for source management ⇨ information about all relevant source files
  - Let CMake write Makefiles and take care of dependencies!



Live Demo


Open Source MANO - Chromium
Open Source MANO
localhost:8888/instances/ns/list/
NS Instances
New NS
Overview
Packages
NS Packages
VNF Packages
NetSlice Templates
Instances
ubuntu
Instances
dreibh : osm — Konsole
Fil Rediger Vis Bokmerker Innstillinger Hjelp
Every 2,0s: juju status
frigg.simula.nornet: Wed Mar 11 16:55:03 2020
Open Source MANO

Sources

- Get the sources here: https://github.com/simula/5gvinni-oai-ns
  - Open Source, GPL-licensed
  - README: how to set up a testbed
  - vmimage-builder-scripts/ (submodule):
    VDU preseeded image build script
  - juju/: The Juju Charms used by the VNF
  - SimulaMet-OAI-EPC_vnfd/: VNF descriptor
  - SimulaMet-OAI-EPC_nsd/: NS descriptor for simple example

simulamet

simula

5G-VINNI

Any Questions?

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