

# ONFのAether-in-a-Boxと sdran-in-a-boxを起動してみた

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# 自己紹介： 桑田 斉（くわた ひとし）

## • 所属

- APRESIA Systems 株式会社

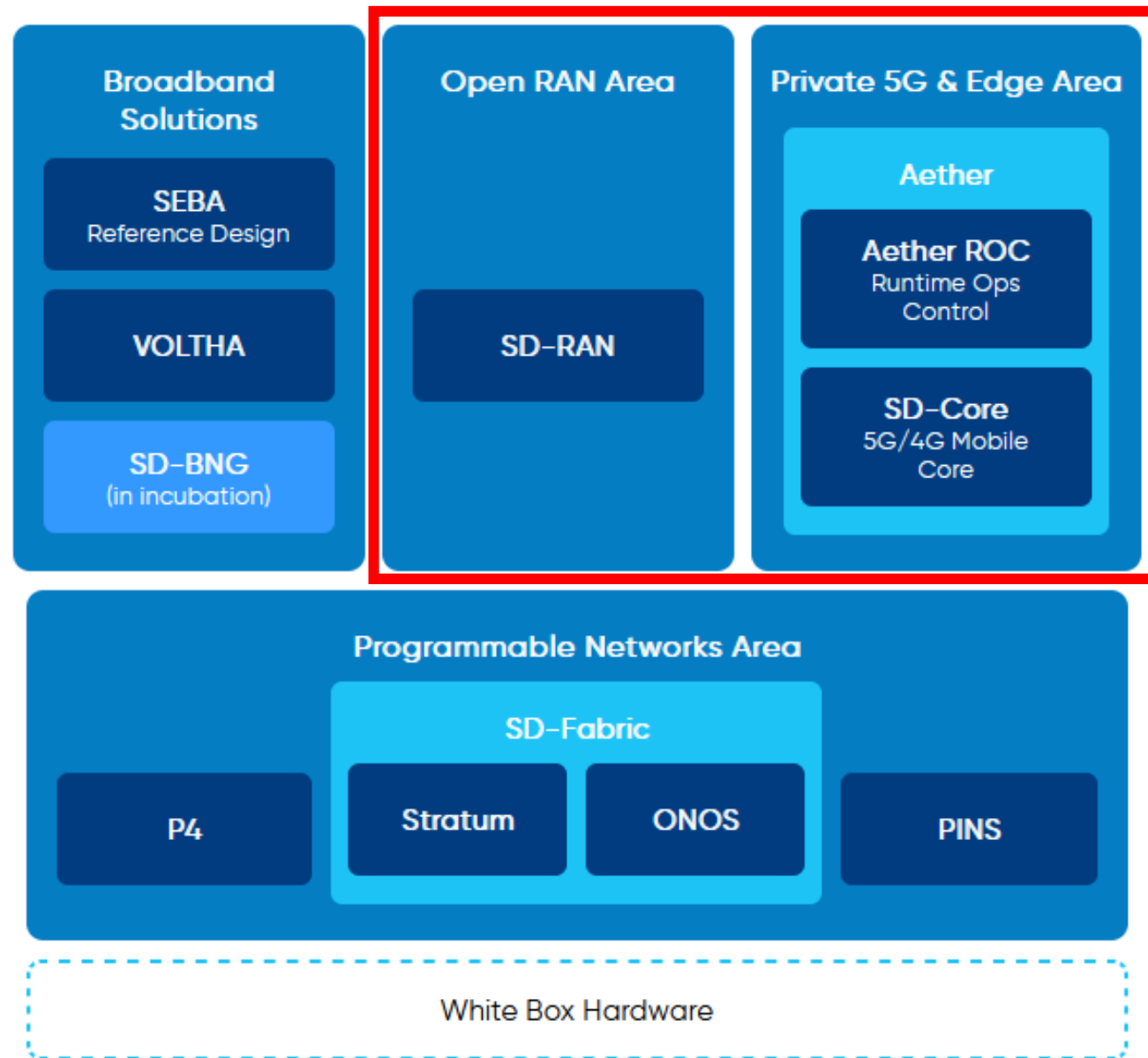
## • 経歴

- 組み込みソフトウェア開発（社会人最初の10年くらいは、こちらに専念）
  - 通信事業者向け、エンブラ向けの自社製イーサネットスイッチ
- 最近では、イーサネットスイッチに関するソフトウェア技術全般
  - 過去にOpenFlowやONOSを経験（その経緯もあって、ONFに参加したこともあり）
  - 最近では、ホワイトボックススイッチやSONiC、P4を中心に活動
    - <https://www.janog.gr.jp/meeting/janog49/sonic/>
    - <https://www.youtube.com/watch?v=Db7k-ZguB64>
- Local 5Gは素人
  - 勉強も兼ねて、ONFの5Gソフトウェアを動かしてみた話を本日は共有

# 今回お話する対象

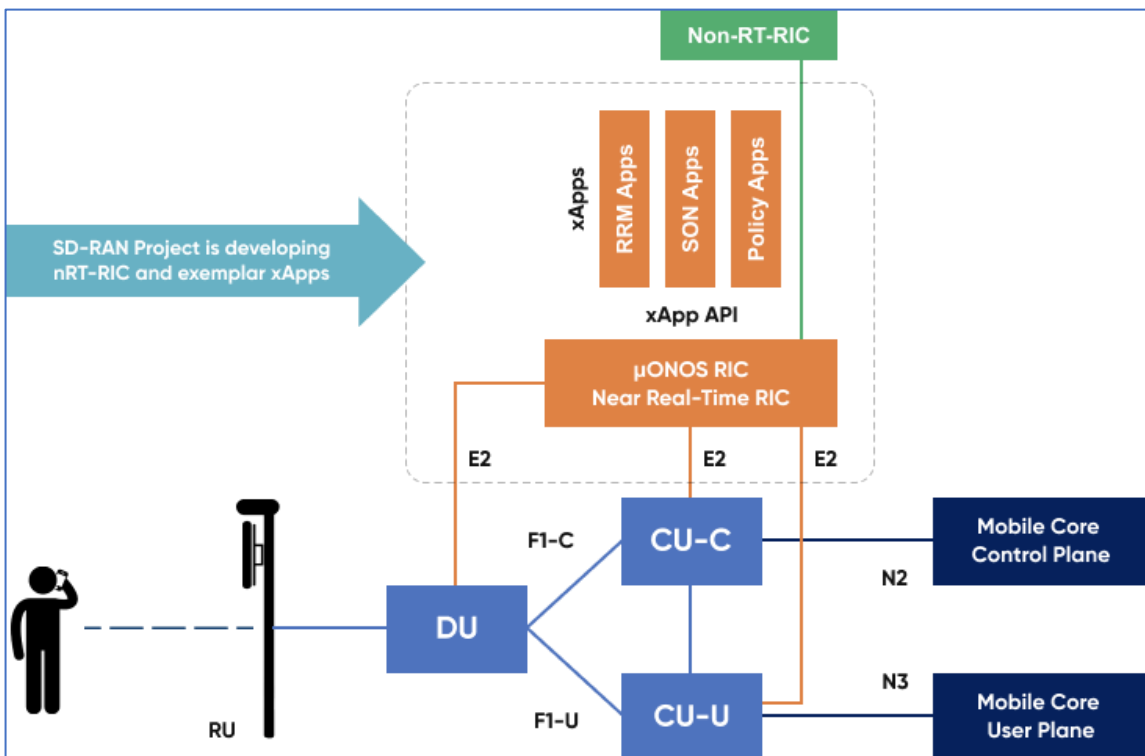
- ONFが開発している5Gのソフトウェアのテスト環境を作ること
    - Aether
    - SD-RAN
- ※ ONF: Open Networking Foundation

## ONF Areas & Projects

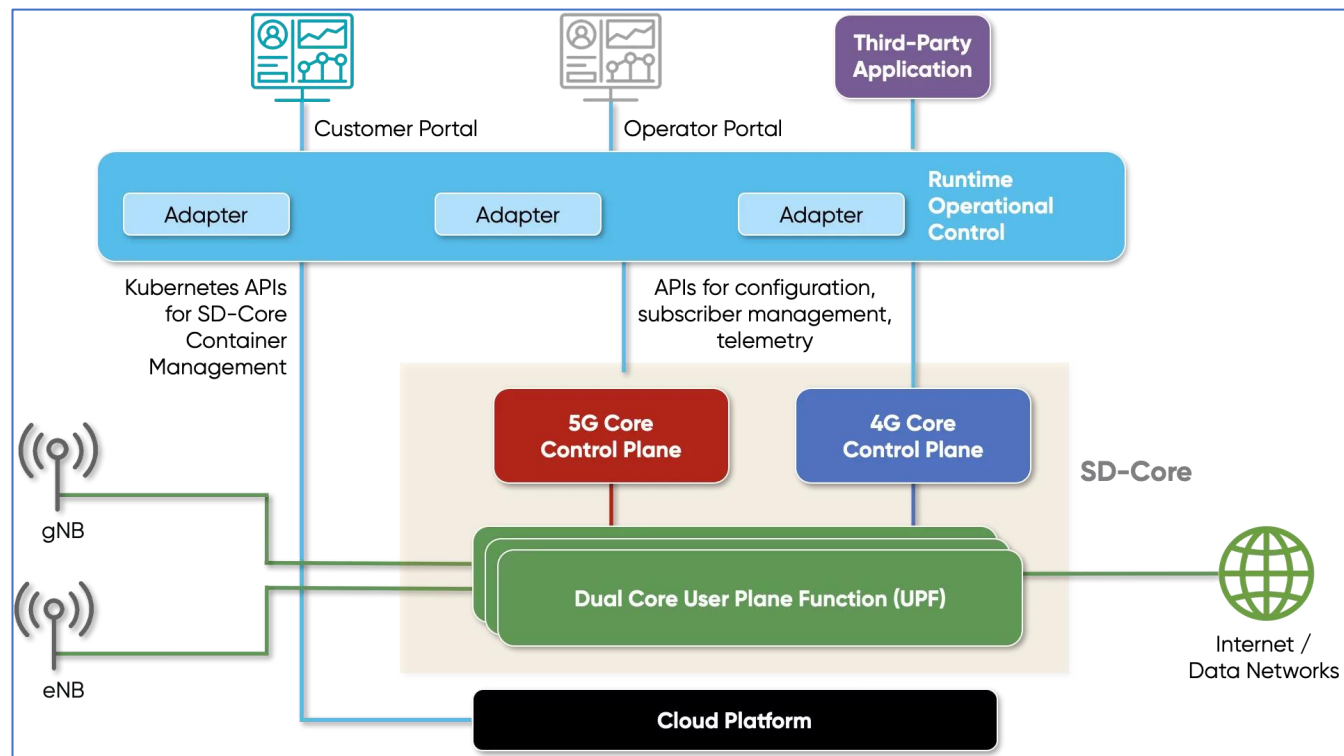


# AetherとSD-RANのソフトウェア開発対象

- Aether: 4G/5GコントロールプレーンとUPF、上位のコントローラが対象
- SD-RAN: Open RANの特にRIC (RAN Intelligent Controller)が対象
  - 商用環境ではデータプレーンはハードウェアにて実現することを想定



<https://opennetworking.org/open-ran/>



<https://opennetworking.org/sd-core/>

# AetherとSD-RANのOSS化

- 2022/2/22

- ONF's Leading Private 5G Connected Edge Platform Aether™ Now Released to Open Source

- <https://opennetworking.org/news-and-events/press-releases/onfs-leading-private-5g-connected-edge-platform-aether-now-released-to-open-source/>

- ONF's SD-RAN™ Now Fully Released to Open Source

- <https://opennetworking.org/news-and-events/press-releases/onfs-sd-ran-now-fully-released-to-open-source/>

# ドキュメント類の参照場所

- Aether

- <https://docs.aetherproject.org/master/index.html>

- SD-RAN

- <https://docs.sd-ran.org/master/index.html>

**AETHER**  
2.1.0-dev

Search docs

**AETHER QUICK START**

- Aether-in-a-Box for Developers
- Aether-in-a-Box with External 4G Radio
- Aether-in-a-Box with External 5G Radio
- Aether-in-a-Box FAQs and Troubleshooting
- Contributing to Aether

**OPERATIONS**

- Aether ROC GUI Basics
- Subscriber and Device Management
- Application Management
- Slice Management
- QoS Metering
- Monitoring using the GUI
- Other Procedures

**PRODUCTION EDGE DEPLOYMENT**

- Overview
- Site Planning
- Management Network Bootstrap
- Server Bootstrap
- Fabric Switch Bootstrap
- VPN Bootstrap

» Aether Documentation [View page source](#)

## Aether Documentation

Aether is an ONF's 5G/LTE Connected Edge Platform-as-a-Service. More information about Aether can be found at the [ONF website](#).

### Getting Started with Aether

Here are some useful places to start with Aether:

- Setup an Aether software development environment with [Aether-in-a-Box](#).
- For a PoC deployment, bring up an [Aether-in-a-Box on 4G Real Radios](#).
- For a PoC deployment, bring up an [Aether-in-a-Box on 5G Real Radios](#).
- Learn about how to [configure Aether using the ROC](#).
- Learn the requirements of hosting an [Aether Connected Edge](#).
- Read the most recent [Release Notes](#).

### Aether Architecture and Components

Aether uses components from several ONF projects. More information can be found at these sites:

- **SD-Core**
  - [SD-Core Website](#)
  - [SD-Core Documentation](#)
- **SD-Fabric**
  - [SD-Fabric Website](#)
  - [SD-Fabric Documentation](#)
- **SD-RAN**
  - [SD-RAN Website](#)
  - [SD-RAN Documentation](#)

**SD-RAN**  
1.4.3

Search docs

**OVERVIEW**

- Introduction
- Architecture

**INSTALLATION**

- sdRan-in-a-Box
- Hardware Installation
- Other Installations

**COMPONENTS**

- onos-api
- onos-ric-sdk-go
- Kubernetes Operator for μONOS
- onos-e2t
- onos-a1t
- onos-e2-sm
- onos-kpimon
- onos-pci
- onos-config
- onos-topo

» SD-RAN Documentation [View page source](#)

## SD-RAN Documentation

### Community

Information about participating in the SD-RAN community and development process can be found on the [ONF Wiki](#).

### Overview

- [Introduction](#)
- [Architecture](#)

### Releases

- [SD-RAN 1.0 Release Notes](#)
- [SD-RAN 1.1 Release Notes](#)
- [SD-RAN 1.2 Release Notes](#)
- [SD-RAN 1.3 Release Notes](#)
- [SD-RAN 1.4 Release Notes](#)

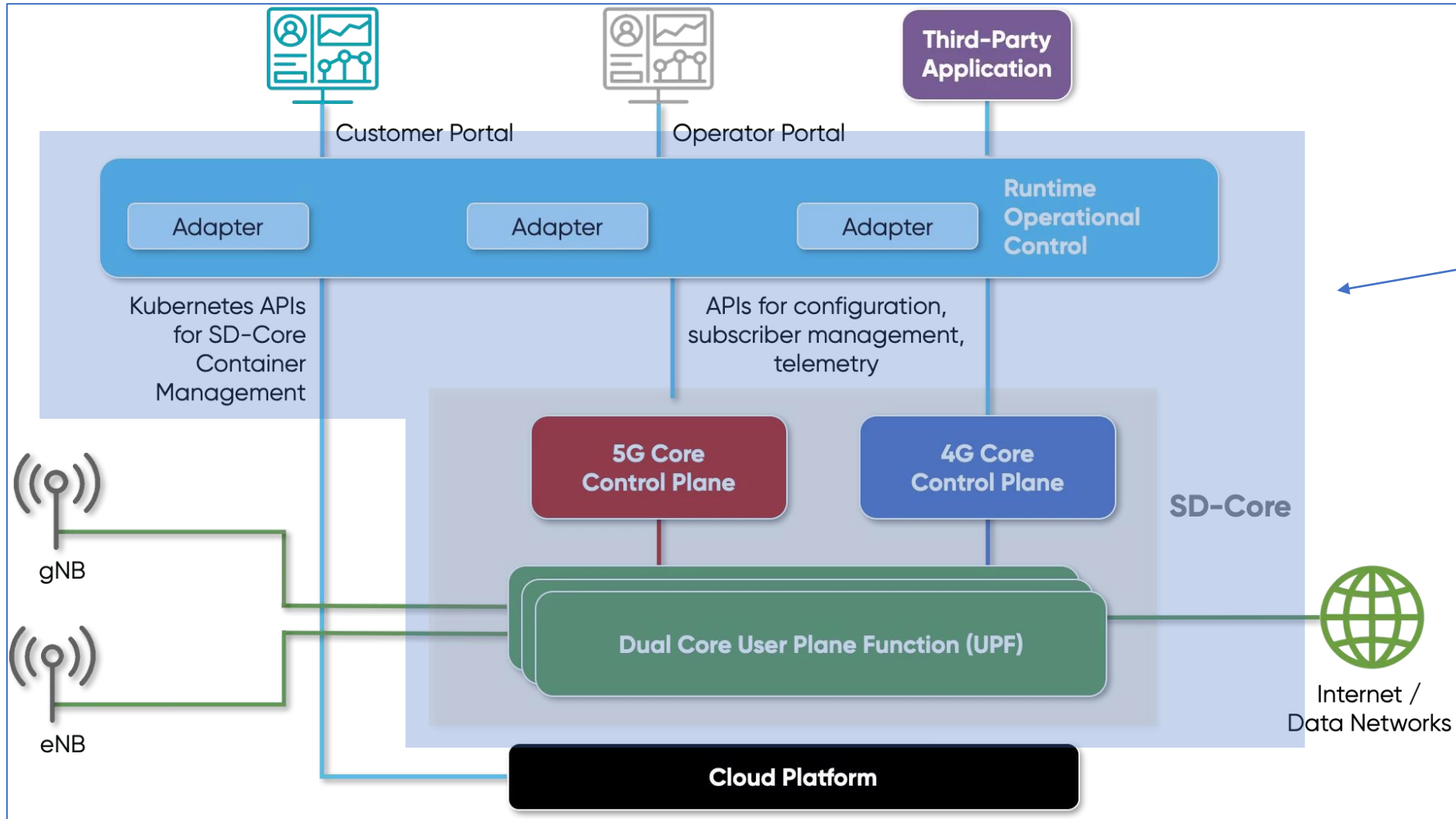
[Next](#)

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Built with [Sphinx](#) using a [theme](#) provided by [Read the Docs](#).

# XXXX-in-a-Box

- 一つの仮想マシンの中で閉じて、ツールをお試しできる環境
- 今回試した環境
  - Aether-in-a-Box for Developers
    - <https://docs.aetherproject.org/master/developer/aiab.html>
  - Installation with RAN-Simulator and Facebook-AirHop xAPP
    - [https://docs.sd-ran.org/master/sdran-in-a-box/docs/Installation\\_RANSim\\_FBAH.html](https://docs.sd-ran.org/master/sdran-in-a-box/docs/Installation_RANSim_FBAH.html)

# Aether-in-a-Box



仮想化環境で動かす範囲



# Aether-in-a-Box for Developersのインストール

## • 要求されている条件

- Ubuntu 18.04
- Kernel 4.15 or later
- Haswell CPU or newer
- At least 4 CPUs and 12GB RAM

## • 準備した仮想マシン

- Ubuntu 18.04 server
- Kernel 4.15.0-192-generic
- CPU 16コア
- メモリ 32GB
- ストレージ 80GB

## • 事前準備

- パスワード無しのsudo実行
- sudo apt install make

## • Clone 5G AIAB (aether-in-a-box)

- git clone "https://gerrit.opencord.org/aether-in-a-box"
- cd ~/aether-in-a-box

## • 5G ROCを有効にして環境構築(20-30分)

- CHARTS=release-2.0 make roc-5g-models

## • テスト環境を起動

- CHARTS=release-2.0 make 5g-test

## • あと片づけ

- make reset-test
- make roc-clean

# 起動確認

```
aether@aether:~/aether-in-a-box$ kubectl get pods --all-namespaces
```

NAMESPACE	NAME	READY	STATUS	RESTARTS	AGE
aether-roc	aether-roc-api-57c6688dd4-zzttw	1/1	Running	1 (7m25s ago)	17d
aether-roc	aether-roc-gui-v2-7bb747cfbd-rz2qg	1/1	Running	3 (6m22s ago)	17d
aether-roc	aether-roc-umbrella-grafana-6487d556cd-mm8r	2/2	Running	2 (7m25s ago)	17d
aether-roc	aether-roc-websocket-568db578d4-g9hqj	1/1	Running	1 (7m24s ago)	17d
aether-roc	onos-cli-964c988cb-xfbcd	1/1	Running	1 (7m24s ago)	17d
aether-roc	onos-config-76db864d5b-5mgtq	6/6	Running	6 (7m24s ago)	17d
aether-roc	onos-consensus-store-0	1/1	Running	1 (7m24s ago)	17d
aether-roc	onos-topo-f56c6785b-wqsws	3/3	Running	3 (7m24s ago)	17d
aether-roc	sdcore-adapter-v2-5957f4f444-kfxh8	1/1	Running	1 (7m24s ago)	17d
calico-apiserver	calico-apiserver-bb47c55db-2zxdp	1/1	Running	1 (7m25s ago)	17d
calico-system	calico-kube-controllers-6dc5cd4855-kvj1q	1/1	Running	1 (7m25s ago)	17d
calico-system	calico-node-2llkl	1/1	Running	1 (7m25s ago)	17d
calico-system	calico-typha-5c6b55fd66-gvcs1	1/1	Running	1 (7m25s ago)	17d
default	router	1/1	Running	1 (7m25s ago)	17d
kube-system	atomix-controller-5fd6d58b57-slvk5	1/1	Running	1 (7m24s ago)	17d
kube-system	atomix-raft-storage-controller-778f8dbfcf-nzp2z	1/1	Running	1 (7m25s ago)	17d
kube-system	cloud-controller-manager-aether	1/1	Running	2 (7m15s ago)	17d
kube-system	etcd-aether	1/1	Running	1 (7m24s ago)	17d
kube-system	helm-install-rke2-calico-crd-c5vth	0/1	Completed	0	17d
kube-system	helm-install-rke2-calico-mtw7n	0/1	Completed	2	17d
kube-system	helm-install-rke2-coredns-dvwst	0/1	Completed	0	17d
kube-system	helm-install-rke2-ingress-nginx-vb7dm	0/1	Completed	0	17d
kube-system	helm-install-rke2-metrics-server-6hpq2	0/1	Completed	0	17d
kube-system	helm-install-rke2-multus-79zrk	0/1	Completed	0	17d

# 起動確認

kube-system	onos-operator-topo-947b58ffd-x6xmj	1/1	Running	1 (7m24s ago)	17d
kube-system	rke2-coredns-rke2-coredns-869b5d56d4-6d5sz	1/1	Running	1 (7m25s ago)	17d
kube-system	rke2-coredns-rke2-coredns-autoscaler-5b947fbb77-b6ngh	1/1	Running	1 (7m24s ago)	17d
kube-system	rke2-ingress-nginx-controller-vkxjm	1/1	Running	1 (7m24s ago)	17d
kube-system	rke2-metrics-server-6564db4569-r5fcb	1/1	Running	1 (7m24s ago)	17d
omec	amf-84c8fd57-s44cm	1/1	Running	1 (7m24s ago)	17d
omec	ausf-6ff868744d-x8v25	1/1	Running	1 (7m24s ago)	17d
omec	gnbsim-0	1/1	Running	1 (7m24s ago)	17d
omec	mongodb-55bbb8c4c4-csqmh	1/1	Running	1 (7m26s ago)	17d
omec	nrf-668cb788f4-9l7lv	1/1	Running	1 (7m24s ago)	17d
omec	nssf-67bfbff46-csm97	1/1	Running	1 (7m24s ago)	17d
omec	pcf-698fd99555-sds7n	1/1	Running	1 (7m24s ago)	17d
omec	simapp-6c49b87c96-s928k	1/1	Running	1 (7m25s ago)	17d
omec	smf-f7d9788b5-rlkrz	1/1	Running	1 (7m24s ago)	17d
omec	udm-7f9fd74c59-qzzb4	1/1	Running	1 (7m25s ago)	17d
omec	udr-5dd8f96c8-wl9wl	1/1	Running	1 (7m24s ago)	17d
omec	upf-0	5/5	Running	6 (6m2s ago)	17d
omec	webui-6b9c957565-phvlg	1/1	Running	1 (7m24s ago)	17d
tigera-operator	tigera-operator-6df8b7694c-c47gp	1/1	Running	1 (7m24s ago)	17d

# GUI確認


- `http://<仮想マシンのIPアドレス>:31194`

The screenshot displays the AETHER dashboard interface. At the top left is the AETHER logo. The main content is divided into two sections: 'Slice (1)' and 'Site (2)'. The 'Slice (1)' section shows a table with columns for 'Active', 'Inactive', and 'Idle'. One entry, 'AiaB Slice (aiab-vcs)', is shown with a red error icon. The 'Site (2)' section shows a table with columns for 'Monitoring Agents (up/total)' and 'Cluster Nodes (up/total)'. Two entries are listed: 'AiaB site (aiab-site)' and 'Global Default Site (defaulttent-defaultsite)', both with red error icons. Navigation elements like 'Items per page' and '1 - 1 of 1' are visible at the bottom of each table.

**AETHER**

DASHBOARD



### Slice (1)

Active	Inactive	Idle
		

AiaB Slice (aiab-vcs)


Items per page: 4 1 - 1 of 1 < >



### Site (2)

Monitoring Agents (up/total)	Cluster Nodes (up/total)
AiaB site (aiab-site)	AiaB test site 
Global Default Site (defaulttent-defaultsite)	Global Default Site 




Items per page: 4 1 - 2 of 2 < >


# GUI確認





0 





## Slice Add

Name (ID)	Description	Enterprise	Site	Filter	Default Behavior	MBR	Device Group	SD	SST	UPF	Edit	Delete	Monitor
AiaB Slice (aiab-vcs)		<a href="#">aiab-enterprise</a>	<a href="#">aiab-site</a>		ALLOW-ALL	↑ 10000000 ↓ 5000000	<a href="#">aiab-device-group</a>	10203	1	<a href="#">aiab-upf</a>			












0 


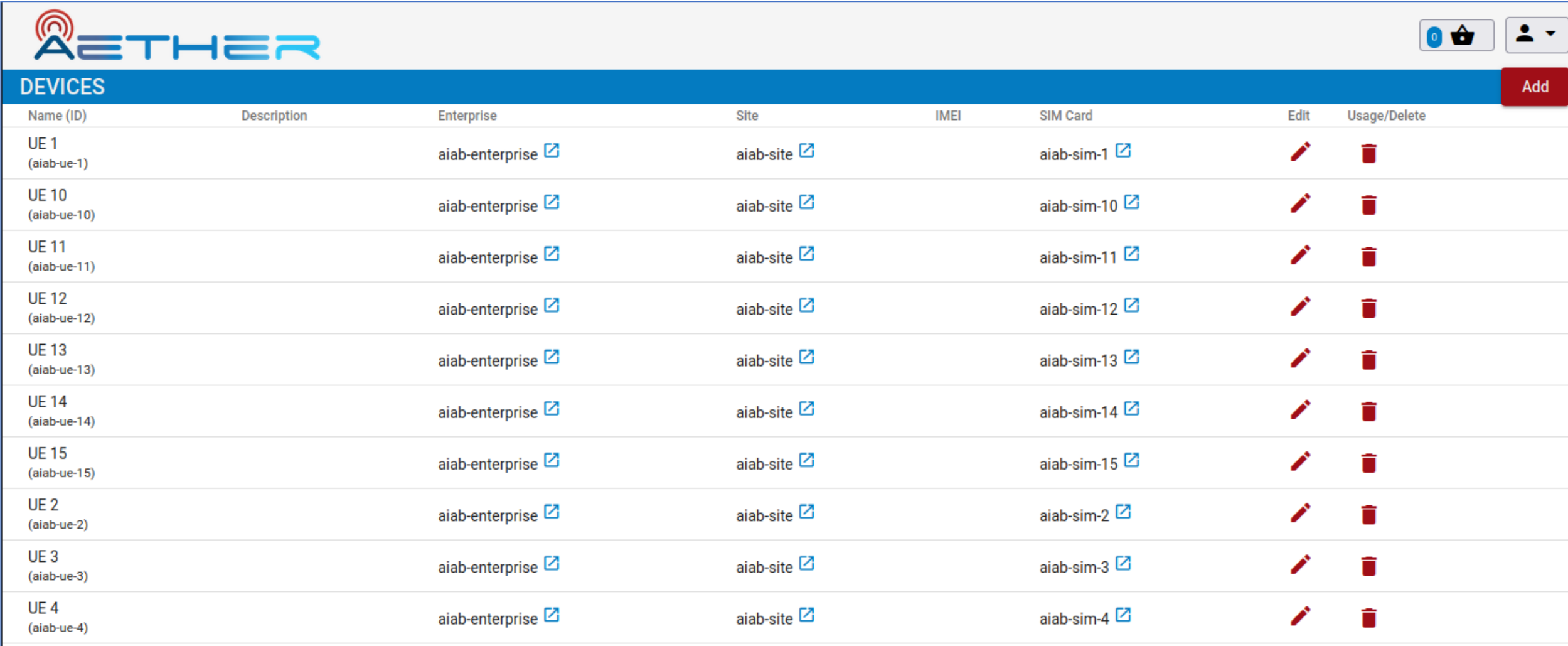
## User Plane Function Add

Name (ID)	Description	Enterprise	Site	Address	Config-Endpoint	Port	Edit	Usage/Delete	Monitor
AiaB UPF (aiab-upf)		<a href="#">aiab-enterprise</a>	<a href="#">aiab-site</a>	upf	http://upf-http.omec.svc:8080	8805			





















# GUI確認

 <span style="float: right;">0  </span>									
DEVICE-GROUPS <span style="float: right; background-color: #c00; color: white; padding: 2px 5px; border-radius: 3px;">Add</span>									
Name (ID)	Description	Enterprise	Site	IP-Domain	Device	Edit	Usage/delete	Monitor	
AiaB Users (aiab-device-group)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>	aiab-ip-pool <a href="#">↗</a>	Device ID: aiab-ue-14 Device ID: aiab-ue-15 Device ID: aiab-ue-4 Device ID: aiab-ue-6 Device ID: aiab-ue-11 Device ID: aiab-ue-12 Device ID: aiab-ue-1 Device ID: aiab-ue-2 Device ID: aiab-ue-5 Device ID: aiab-ue-10 Device ID: aiab-ue-9 Device ID: aiab-ue-13 Device ID: aiab-ue-7 Device ID: aiab-ue-8 Device ID: aiab-ue-3				
Unknown Inventory (defaultent-defaultsite-default)		defaultent <a href="#">↗</a>	defaultent-defaultsite <a href="#">↗</a>	defaultent-defaultip <a href="#">↗</a>					

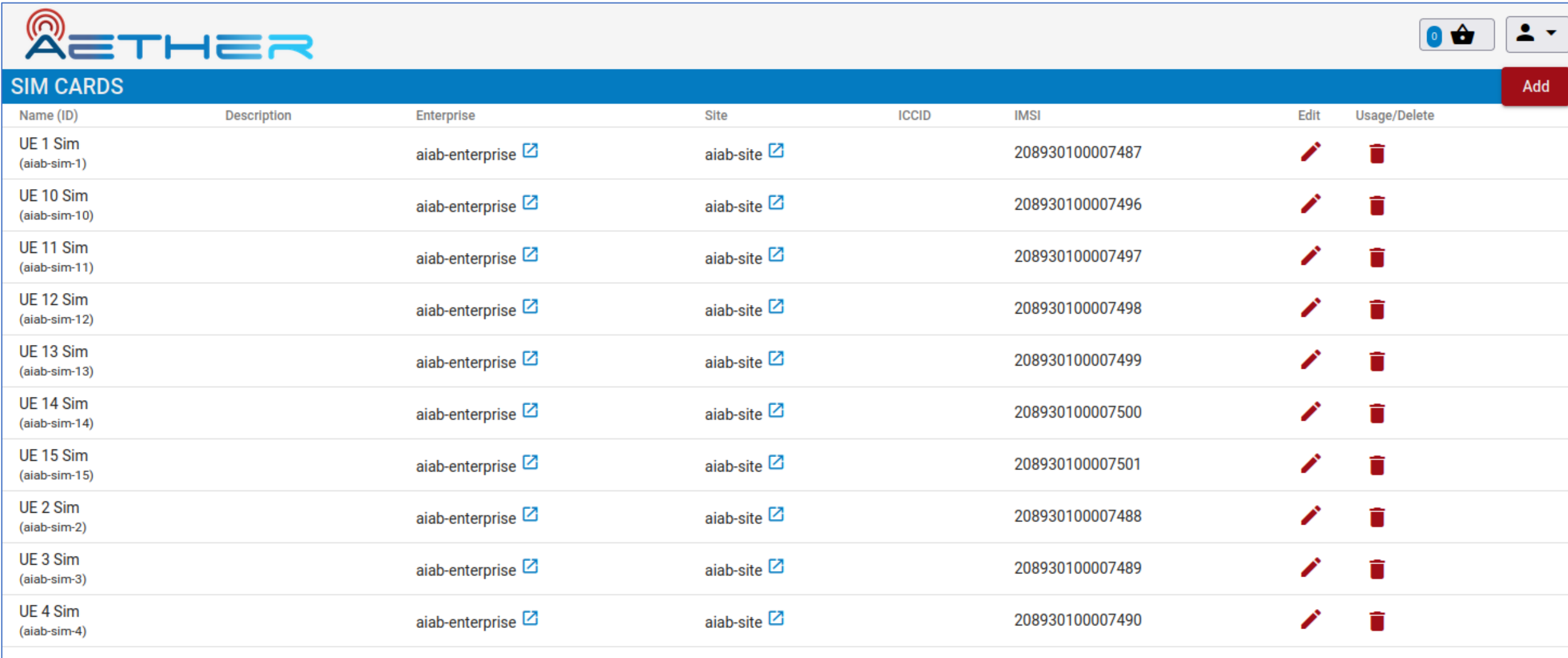
# GUI確認





The screenshot displays the AETHER web interface. At the top left is the AETHER logo. In the top right corner, there are icons for a notification (0), a shopping cart, and a user profile. Below the header is a blue bar with the word "DEVICES" and an "Add" button. The main content is a table with columns for Name (ID), Description, Enterprise, Site, IMEI, SIM Card, Edit, and Usage/Delete. The table lists 15 devices, each with a unique ID and associated enterprise, site, and SIM card information. Each row includes edit and delete icons.





















Name (ID)	Description	Enterprise	Site	IMEI	SIM Card	Edit	Usage/Delete
UE 1 (aiab-ue-1)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		aiab-sim-1 <a href="#">↗</a>		
UE 10 (aiab-ue-10)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		aiab-sim-10 <a href="#">↗</a>		
UE 11 (aiab-ue-11)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		aiab-sim-11 <a href="#">↗</a>		
UE 12 (aiab-ue-12)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		aiab-sim-12 <a href="#">↗</a>		
UE 13 (aiab-ue-13)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		aiab-sim-13 <a href="#">↗</a>		
UE 14 (aiab-ue-14)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		aiab-sim-14 <a href="#">↗</a>		
UE 15 (aiab-ue-15)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		aiab-sim-15 <a href="#">↗</a>		
UE 2 (aiab-ue-2)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		aiab-sim-2 <a href="#">↗</a>		
UE 3 (aiab-ue-3)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		aiab-sim-3 <a href="#">↗</a>		
UE 4 (aiab-ue-4)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		aiab-sim-4 <a href="#">↗</a>		

# GUI確認



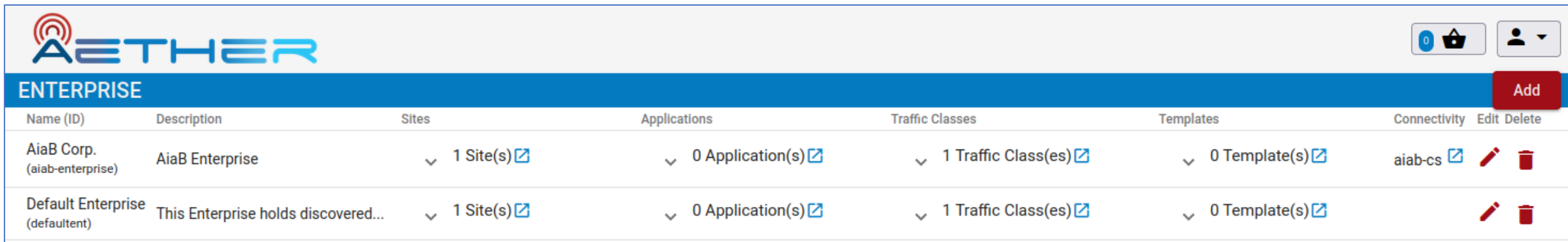
**AETHER**

**SIM CARDS** 0   Add

Name (ID)	Description	Enterprise	Site	ICCID	IMSI	Edit	Usage/Delete
UE 1 Sim (aiab-sim-1)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		208930100007487		
UE 10 Sim (aiab-sim-10)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		208930100007496		
UE 11 Sim (aiab-sim-11)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		208930100007497		
UE 12 Sim (aiab-sim-12)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		208930100007498		
UE 13 Sim (aiab-sim-13)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		208930100007499		
UE 14 Sim (aiab-sim-14)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		208930100007500		
UE 15 Sim (aiab-sim-15)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		208930100007501		
UE 2 Sim (aiab-sim-2)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		208930100007488		
UE 3 Sim (aiab-sim-3)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		208930100007489		
UE 4 Sim (aiab-sim-4)		aiab-enterprise <a href="#">↗</a>	aiab-site <a href="#">↗</a>		208930100007490		



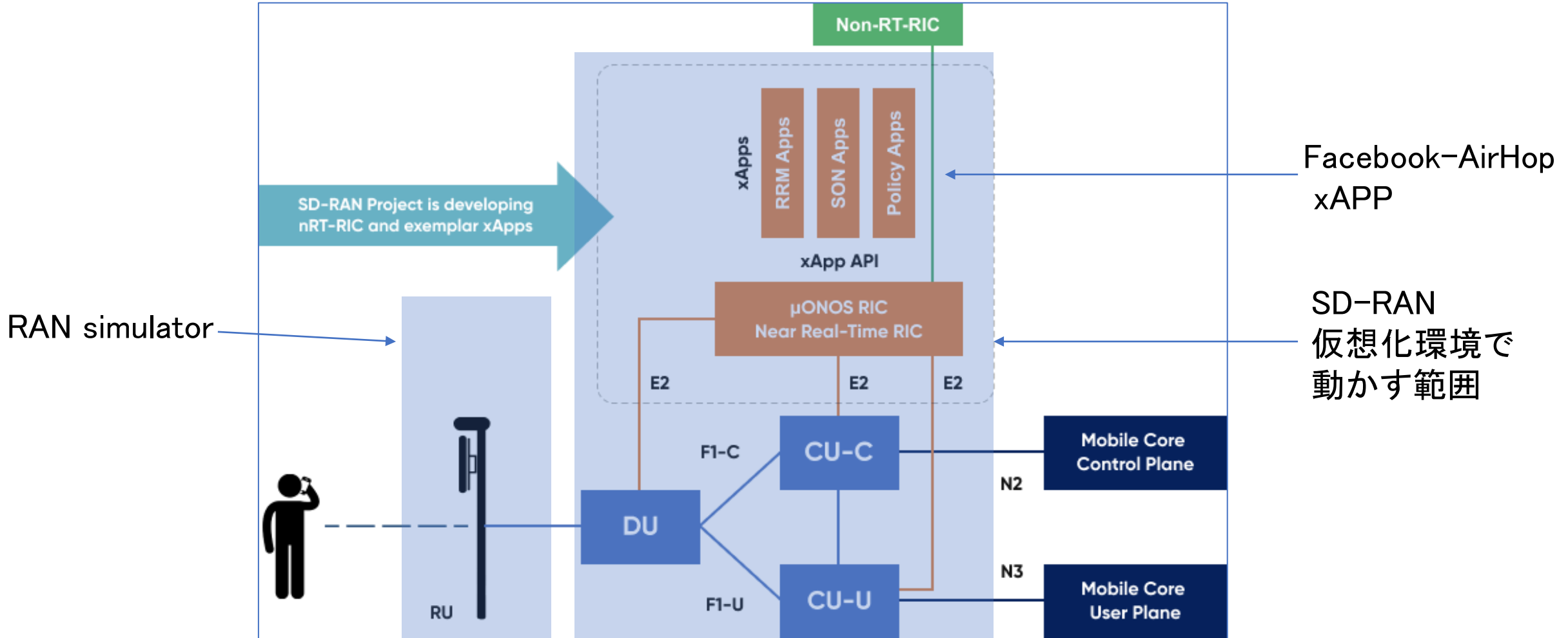
# GUI確認



The screenshot displays the AETHER ENTERPRISE management interface. At the top left is the AETHER logo. On the right, there are icons for notifications (0), a shopping cart, and a user profile. Below the logo is a blue header bar with the word "ENTERPRISE" and an "Add" button. The main content is a table with columns for Name (ID), Description, Sites, Applications, Traffic Classes, Templates, and Connectivity. Each row represents an enterprise, with expandable links for Sites, Applications, Traffic Classes, and Templates. The first row is for "AiaB Corp. (aiab-enterprise)" and the second is for "Default Enterprise (defaultent)".

Name (ID)	Description	Sites	Applications	Traffic Classes	Templates	Connectivity	Edit	Delete
AiaB Corp. (aiab-enterprise)	AiaB Enterprise	▼ 1 Site(s) <a href="#">↗</a>	▼ 0 Application(s) <a href="#">↗</a>	▼ 1 Traffic Class(es) <a href="#">↗</a>	▼ 0 Template(s) <a href="#">↗</a>	aiab-cs <a href="#">↗</a>	<a href="#">✎</a>	<a href="#">🗑️</a>
Default Enterprise (defaultent)	This Enterprise holds discovered...	▼ 1 Site(s) <a href="#">↗</a>	▼ 0 Application(s) <a href="#">↗</a>	▼ 1 Traffic Class(es) <a href="#">↗</a>	▼ 0 Template(s) <a href="#">↗</a>		<a href="#">✎</a>	<a href="#">🗑️</a>

# SD-RAN in a Box with RAN-Simulator and Facebook-AirHop xAPP



# SDRAN-in-a-Box with RAN-Simulator and Facebook-AirHopのインストール

## • 推奨スペック

- CPU: at least 4 cores
- OS: Ubuntu 18.04
- RAM: At least 16GB
- Storage: At least 50GB (推奨100GB)

## • 今回のスペック

- Ubuntu18.04 server
- Kernel 4.15.0-192-generic
- CPU 16コア
- メモリ 32GB
- ストレージ128GB

## • 事前準備

- パスワード無しのsudo実行
- sudo apt install make

## • ソースコードを準備

- git clone <https://github.com/onosproject/sdran-in-a-box>
- cd sdran-in-a-box
- git checkout v1.4.0

## • SD-RAN 環境構築(初回20-30分程度)

- make riab OPT=fbah VER=v1.4.0

## • テスト実行

- make test-kpimon

## • あと片づけ

- make reset-test

# 起動確認

```
sdran@sdran:~/sdran-in-a-box$ kubectl get pods --all-namespaces
```

NAMESPACE	NAME	READY	STATUS	RESTARTS	AGE
kube-system	atomix-controller-99f978c7d-t2b5x	1/1	Running	1	14d
kube-system	atomix-raft-storage-controller-75979cfff8-2nj2h	1/1	Running	1	14d
kube-system	calico-kube-controllers-7d99d6cbbd-8s7bw	1/1	Running	1	14d
kube-system	calico-node-9wb8p	1/1	Running	1	14d
kube-system	coredns-dff8fc7d-x2xt5	1/1	Running	1	14d
kube-system	dns-autoscaler-5d74bb9b8f-2pf6k	1/1	Running	1	14d
kube-system	kube-apiserver-node1	1/1	Running	1	14d
kube-system	kube-controller-manager-node1	1/1	Running	1	14d
kube-system	kube-multus-ds-amd64-z4t6f	1/1	Running	1	14d
kube-system	kube-proxy-6flgk	1/1	Running	1	14d
kube-system	kube-scheduler-node1	1/1	Running	1	14d
kube-system	kubernetes-dashboard-667c4c65f8-42xj2	1/1	Running	1	14d
kube-system	kubernetes-metrics-scraper-54fbb4d595-gjqsd	1/1	Running	1	14d
kube-system	node-local-dns-tmmbb	1/1	Running	1	14d
kube-system	onos-operator-app-588d479876-dpqkt	1/1	Running	1	14d
kube-system	onos-operator-topo-5f8cd6ff7c-w8lvm	1/1	Running	1	14d
riab	ah-son-test-server-ccf5ccf5d-gk58r	1/1	Running	1	14d
riab	fb-ah-gui-6b4868d8f-vl6c6	1/1	Running	0	92s
riab	fb-ah-xapp-66b994575c-k9cbl	2/2	Running	0	74s
riab	fb-kpimon-xapp-5c78fd7486-lvxnf	2/2	Running	8	14d
riab	onos-a1t-84db77df99-vvgr5	1/2	Running	2	14d
riab	onos-cli-6b746874c8-qm9kn	1/1	Running	1	14d
riab	onos-config-7bd4b6f7f6-npz5p	4/4	Running	4	14d
riab	onos-consensus-store-0	1/1	Running	1	14d
riab	onos-e2t-58b4cd867-rpbg4	3/3	Running	4	14d
riab	onos-kpimon-966bdf77f-jfshn	2/2	Running	2	14d
riab	onos-topo-7cc9d754d7-bsh2l	3/3	Running	3	14d
riab	onos-uenib-779cb5dbd6-bdpvd	3/3	Running	3	14d
riab	ran-simulator-85b945db79-5xh28	1/1	Running	1	14d

# 起動確認

```

sdran@sdran:~/sdran-in-a-box$ make test-kpimon
Helm values.yaml file: /home/sdran/sdran-in-a-box//sdran-in-a-box-values-master-stable.yaml
HEAD is now at 9f79ab8 Fix the default SRIOV resource name for UPF user plane interfaces
HEAD is now at 29ffaaaf update MHO chart to run with RC service model (#1134)
*** Get KPIMON result through CLI ***

```

Node ID	Cell Object ID	Cell Global ID	Time	RRC. Conn. Avg	RRC. Conn. Max	RRC. ConnEstabAtt. Sum	RRC. ConnEstabSucc. Sum	RRC. ConnReEstabAtt. HOFail	RRC. ConnReEstabAtt. Other	RRC. ConnReEstabAtt. Sum	RRC. ConnReEstabAtt. reconfigFail
e2:1/5153	13842601454c001	1454c001	05:12:27.0	1	2	0	0	0	0	0	0
e2:1/5153	13842601454c002	1454c002	05:12:27.0	6	6	0	0	0	0	0	0
e2:1/5153	13842601454c003	1454c003	05:12:27.0	0	2	0	0	0	0	0	0
e2:1/5154	138426014550001	14550001	05:12:27.0	2	3	0	0	0	0	0	0
e2:1/5154	138426014550002	14550002	05:12:27.0	1	3	0	0	0	0	0	0
e2:1/5154	138426014550003	14550003	05:12:27.0	0	1	0	0	0	0	0	0

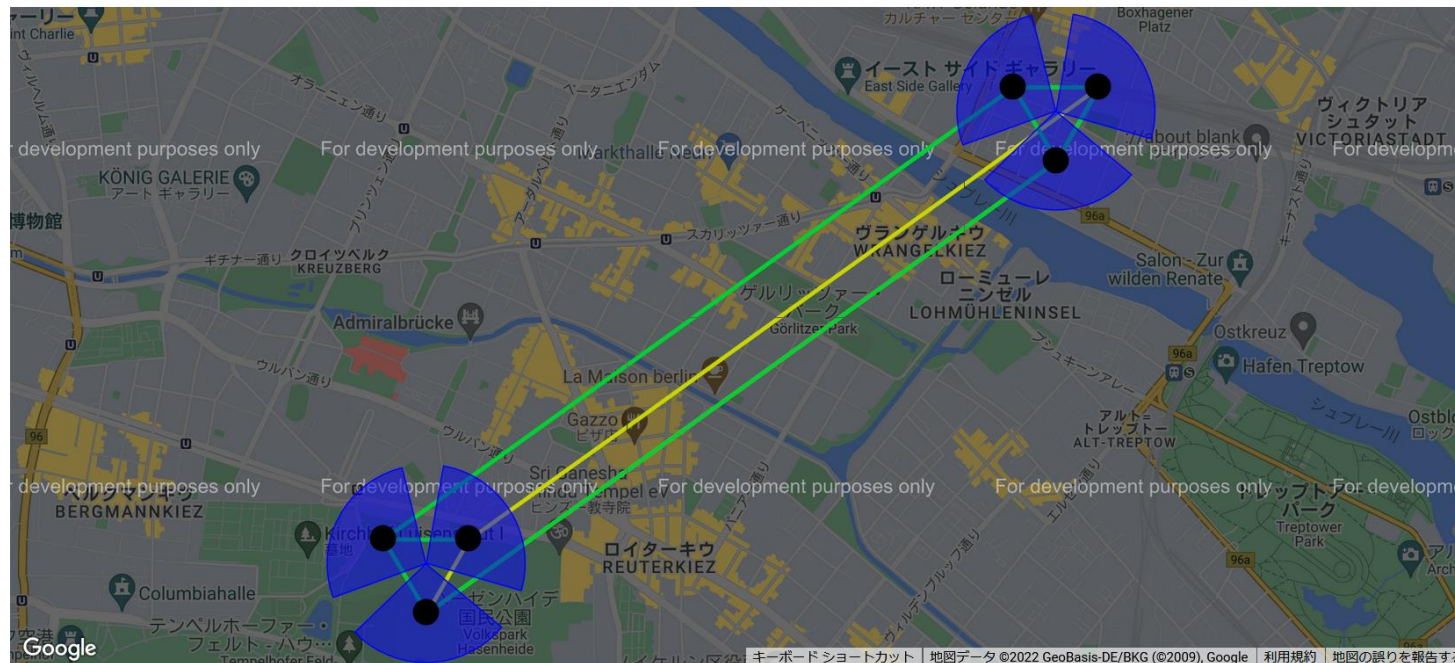
Conn. Max	RRC. ConnEstabAtt. Sum	RRC. ConnEstabSucc. Sum	RRC. ConnReEstabAtt. HOFail	RRC. ConnReEstabAtt. Other	RRC. ConnReEstabAtt. Sum	RRC. ConnReEstabAtt. reconfigFail
2	0	0	0	0	0	0
6	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
3	0	0	0	0	0	0
1	0	0	0	0	0	0

# GUI確認

http://<仮想マシンのIPアドレス>:30095

3つの基地局の干渉を避けている??  
GUIで見れるものは、あまり無い。。。

## PCI Conflict Dashboard



- Show Collisions
- Show Confusions
- Show No Conflict

### Cells

NCGI	PCI	Neighbors
0x13842601454c001	218	0x13842601454c002,0x13842601454c003,0x138426014550001
0x13842601454c002	148	0x13842601454c001,0x13842601454c003,0x138426014550002
0x13842601454c003	480	0x13842601454c001,0x13842601454c002,0x138426014550003
0x138426014550001	136	0x13842601454c001,0x138426014550002,0x138426014550003
0x138426014550002	35	0x13842601454c002,0x138426014550001,0x138426014550003
0x138426014550003	148	0x13842601454c003,0x138426014550001,0x138426014550002

# onos-cliで中の動きを確認

```
$ sudo docker ps | grep onos-cli
e87d63de24cb (省略) k8s_onos-cli_onos-cli-6b746874c8-bv7gs_riab_ee4cd779-8768-4653-a4e7-f9f868924326_0
dfbe46e0ab4f (省略) k8s_POD_onos-cli-6b746874c8-bv7gs_riab_ee4cd779-8768-4653-a4e7-f9f868924326_0

$ sudo docker exec -ti k8s_onos-cli_onos-cli-6b746874c8-bv7gs_riab_ee4cd779-8768-4653-a4e7-f9f868924326_0 bash
onos-cli-6b746874c8-bv7gs:~$
onos-cli-6b746874c8-bv7gs:~$ onos
ONOS command line client

Usage:
  onos [command]

Available Commands:
  alt          ONOS alt subsystem commands
  completion  Generated bash or zsh auto-completion script
  config      ONOS configuration subsystem commands
  e2t         ONOS e2t subsystem commands
  help        Help about any command
  kpimon      ONOS KPIMON subsystem commands
  mho         ONOS MHO subsystem commands
  mlb         ONOS MLB subsystem commands
  pci         ONOS PCI subsystem commands
  perf        simple gRPC performance measurement client
  ransim      ONOS RAN simulator commands
  rsm         ONOS RSM subsystem commands
  topo        ONOS topology resource commands
(省略)
```

# onos-cliで中の動きを確認

```
$ onos ransim get
Commands for retrieving RAN simulator model and other information
```

Usage:

```
onos ransim get [command]
```

Available Commands:

```
cell      Get a cell
cells     Get all cells
layout    Get Layout
metric    Get metric value
metrics   Get all metrics of an entity
node      Get an E2 node
nodes     Get all E2 nodes
plmnid    Get the PLMNID
route     Get a UE route
routes    Get all UE routes
ue        Get UE
ueCount   Get UE count
ues       Get UEs
```

Flags:

```
-h, --help  help for geta command.
```

(省略)

```
$ onos ransim get ues
```

IMSI	Serving Cell	CRNTI	Admitted	RRC
4307020	138426014550003	90127	false	RRCSTATUS_IDLE
4278974	138426014550001	90129	false	RRCSTATUS_IDLE
5349350	13842601454c002	90131	false	RRCSTATUS_IDLE
8969181	138426014550003	90133	false	RRCSTATUS_IDLE
8774850	138426014550003	90134	false	RRCSTATUS_IDLE
9839301	138426014550001	90125	false	RRCSTATUS_CONNECTED
2524940	138426014550003	90126	false	RRCSTATUS_IDLE
5898365	13842601454c001	90128	false	RRCSTATUS_CONNECTED
1316387	13842601454c002	90130	false	RRCSTATUS_CONNECTED
6350072	13842601454c001	90132	false	RRCSTATUS_IDLE



# onos-cliで中の動きを確認

```
$ onos ransim get nodes
GnbID           Status   Service Models  E2T Controllers  Cell NCGIs
5154            Running mho, rcpre2, kpm2 e2t-1           138426014550001, 138426014550002, 138426014550003
5153            Running mho, rcpre2, kpm2 e2t-1           13842601454c001, 13842601454c002, 13842601454c003

$ onos ransim get node 5154
GnbID: 20820
Status: Running
Service Models: mho, rcpre2, kpm2
Controllers: e2t-1
Cell EGGIs: 138426014550001, 138426014550002, 138426014550003

$ onos ransim get node 5153
GnbID: 20819
Status: Running
Service Models: mho, rcpre2, kpm2
Controllers: e2t-1
Cell EGGIs: 13842601454c001, 13842601454c002, 13842601454c003
```

## onos-cliで中の動きを確認

```
$ onos ransim get cells
NCGI          #UEs Max UEs   TxDB      Lat      Lng Azimuth   Arc   A3Offset  TTT  A3Hyst PCeIIOffset FreqOffset  PCI   Color Idle Conn Neighbors(NCelleIOffset)
138426014550003  0  99999  11.00  52.504  13.453  240  120  0  0  0  0  0  56  green  2,  0, 13842601454c003 (3), 138426014550001 (0), 138426014550002
13842601454c001  0  99999  11.00  52.486  13.412  0  120  0  0  0  0  0  173 green  2,  1, 13842601454c002 (0), 13842601454c003 (0), 138426014550001
13842601454c002  0  99999  11.00  52.486  13.412  120  120  0  0  0  0  0  195 green  1,  1, 13842601454c001 (0), 13842601454c003 (0), 138426014550002
138426014550001  0  99999  11.00  52.504  13.453  0  120  0  0  0  0  0  114 green  1,  2, 138426014550003 (0), 13842601454c001 (-8), 138426014550002
138426014550002  0  99999  11.00  52.504  13.453  120  120  0  0  0  0  0  160 green  0,  0, 13842601454c002 (0), 138426014550001 (0), 138426014550003
13842601454c003  0  99999  11.00  52.486  13.412  240  120  0  0  0  0  0  190 green  0,  0, 13842601454c001 (0), 13842601454c002 (0), 138426014550003
```

```
$ onos ransim get cell 138426014550003
NCGI:          138426014550003
UE Count:      0
Max UEs:       99999
TxPower dB:    11.00
Latitude:      52.504
Longitude:     13.453
Azimuth:       240
Arc:           120
PCI:           56
Color:         green
Neighbors:     13842601454c003, 138426014550001, 138426014550002
A3offset:      0
A3TimeToTrigger: 0
A3Hystereis:   0
A3CellIOffset: 0
A3FrequencyOffset: 0
RrcIdleCount:  0
RrcConnectedCount: 2
```

```
$ onos ransim get cell 13842601454c003
NCGI:          13842601454c003
UE Count:      0
Max UEs:       99999
TxPower dB:    11.00
Latitude:      52.486
Longitude:     13.412
Azimuth:       240
Arc:           120
PCI:           190
Color:         green
Neighbors:     13842601454c001, 13842601454c002, 138426014550003
A3offset:      0
A3TimeToTrigger: 0
A3Hystereis:   0
A3CellIOffset: 0
A3FrequencyOffset: 0
RrcIdleCount:  0
RrcConnectedCount: 0
```

# 【参考】SD-RANをHWにインプリする場合のイメージ

