OF@TEIN+:

Open/Federated Playgrounds for Future Networks

Building and operating Open and Federated Future Internet
(SDN/NFV/Cloud-integrated) Testbed

This proposal is prepared in response to Asi@Connect WP4 (Future Internet)

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**SPONSORED BY ASI@CONNECT
WITH A TOTAL GRANT OF EUR281,000**

OF@TEIN (2012~2016)

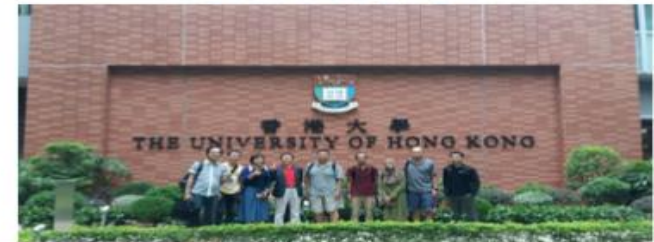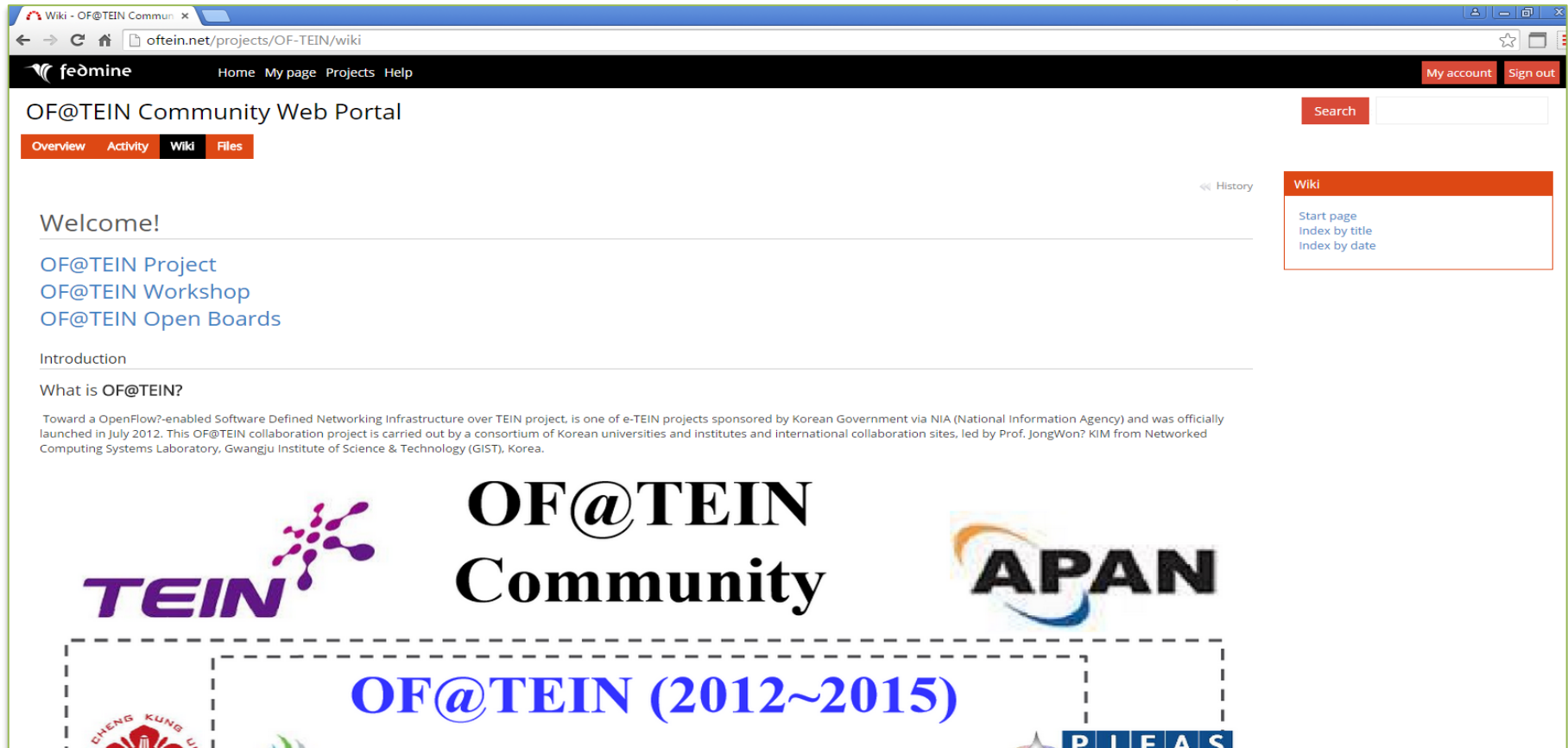# OF@TEIN Community

OF@TEIN (2012~2016)

Open Call

OF@TEIN Community Activities

- **Annual OF@TEIN Training WS: Sponsored by TEIN*CC**
  - 1st WS: 2013.02 @ Kuala Lumpur, MY
  - 2nd WS: 2014.03 @ Bangkok, TH
  - 3rd WS: 2015.05 @ Hanoi, VN
  - 4th WS: 2015.10 @ Islamabad, PKS

- **Annual OF@TEIN Collaboration Meetings : Co-located with APAN Meeting**
  - 2015.08 @ Kuala Lumpur, MY
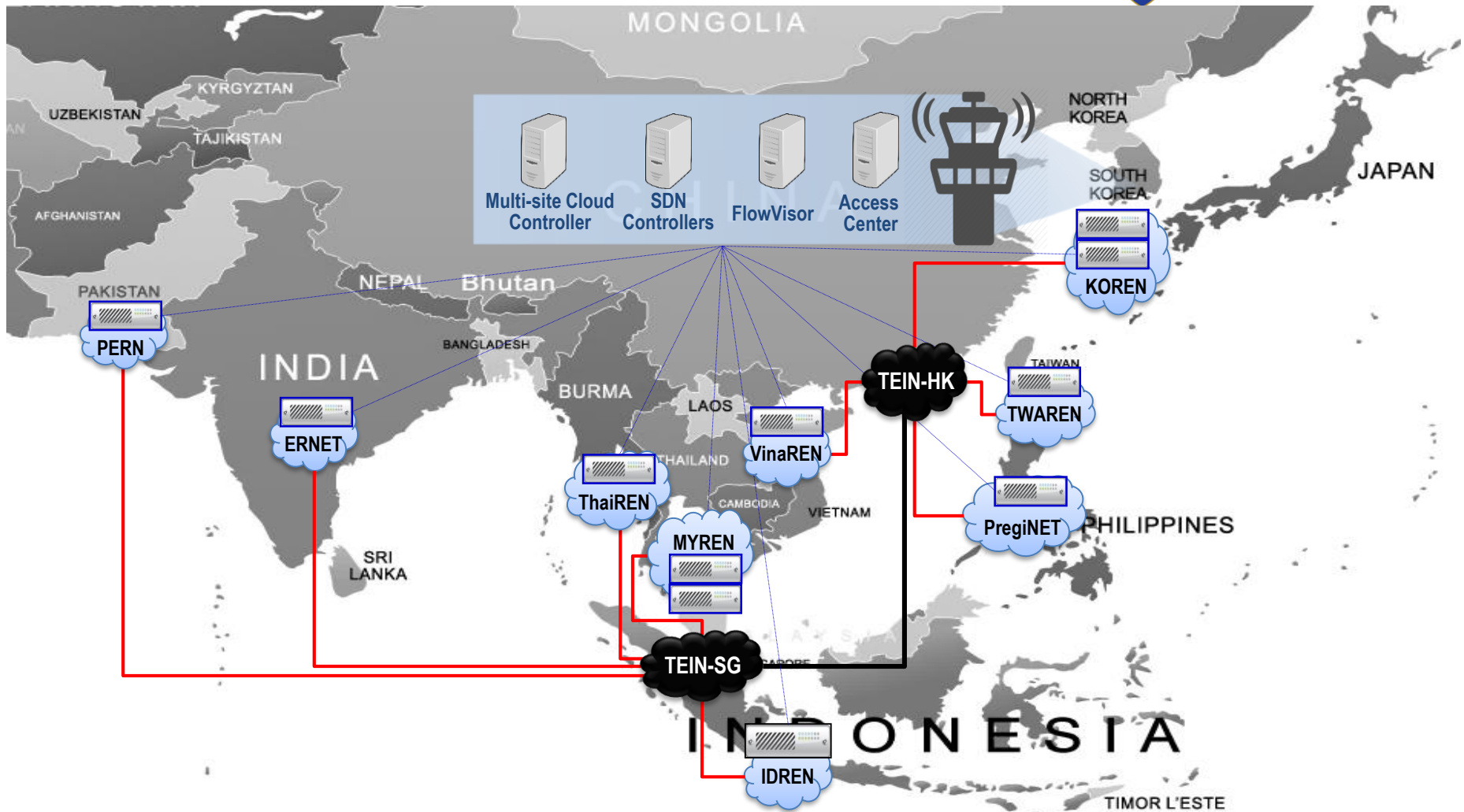 - 2016.08 @ Hong Kong

OF@TEIN Community Portal

http://oftein.net/projects/OF-TEIN/wiki

OF@TEIN Playground

OF@TEIN Physical (Multi-domain) Infrastructure
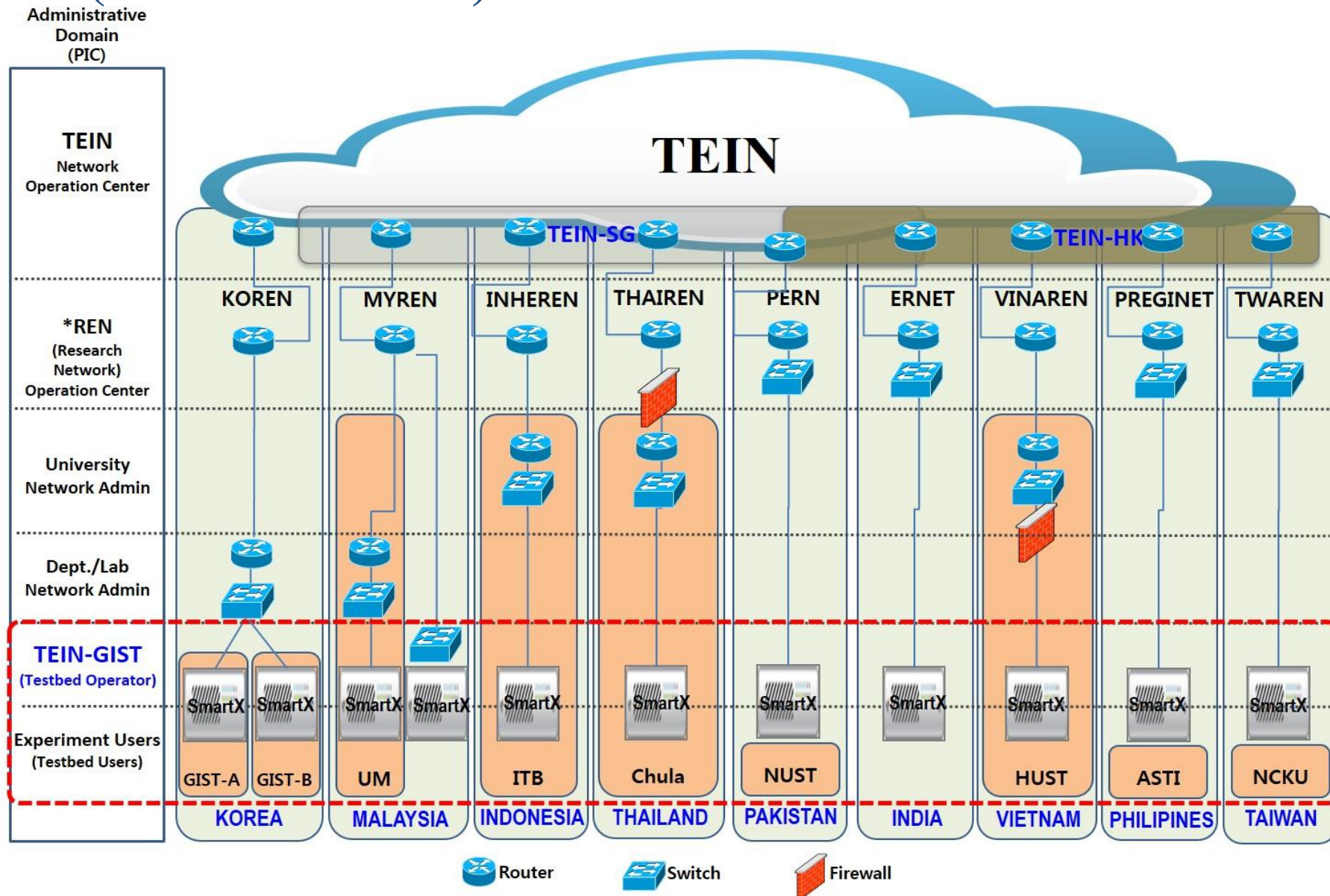
OF@TEIN Playground: Evolutions
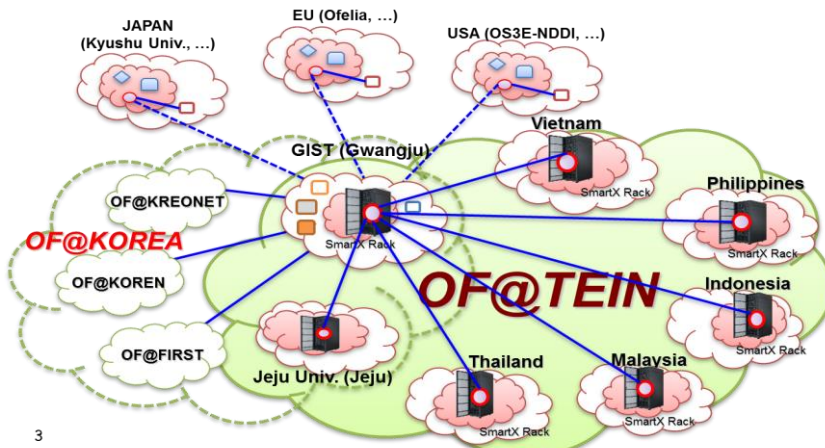
(2012)
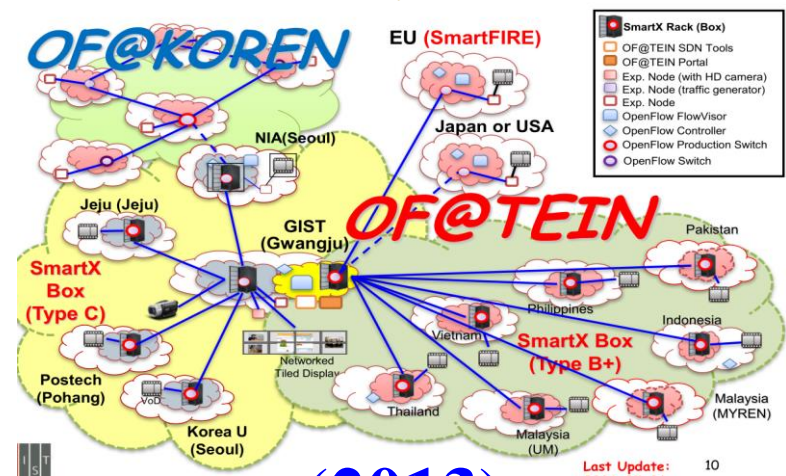
(2013)
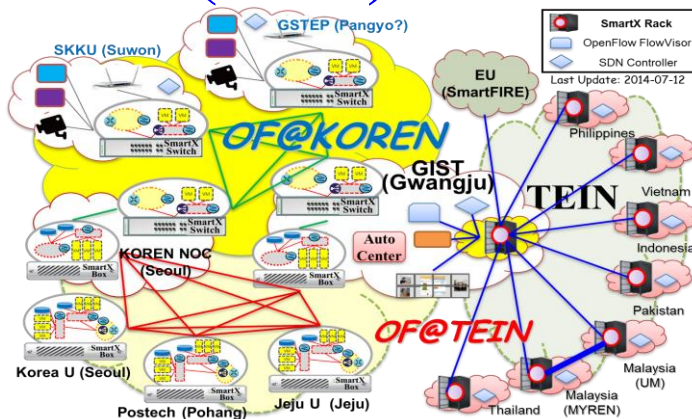
(2014)
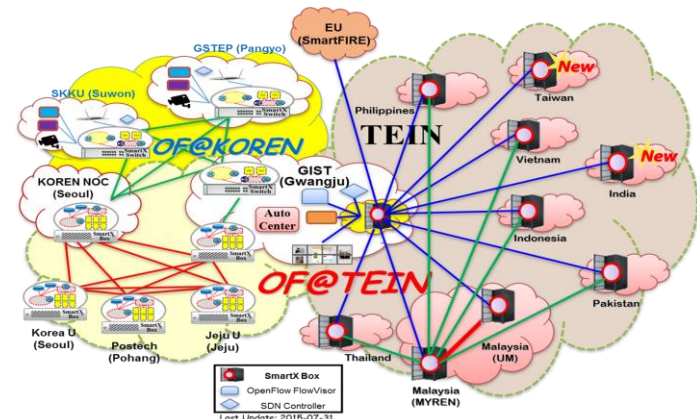
(2015 - 2016)

OF@TEIN Playground Resources: SmartX Box Type B (IBM System x3650 M4)

UNIVERSITY OF MALAYA

Model	IBM System x3650 M4
Size	17.5 in X 29.4in X 3.4in (2U)
Processor	**Intel® Xeon® processor E5-2630**, 12 Cores, 12 Threads, 2.30GHz
Memory	24 x DDR3 DIMM sockets (32GB)
Graphics	Matrox G200eR2
I/O	8 x USB 3.0 ports 2 x VGA port IBM Server RAID, IBM SATA Device
Network Interfaces	4 x 1GbE LAN ports 2 x 10GbE Embedded Adapter (Optional) 1 x Integrated Management Module II (IMM2)
Storage	600GB (HDD)

MYREN MALAYSIAN RESEARCH & EDUCATION NETWORK

APAN

Asi@Connect

TEIN CC COOPERATION CENTER

OF@TEIN Playground Resources:
SmartX Box Type B Series Configuration

UNIVERSITY OF MALAYA

(Type B)   (Type B+)   (Type B*)   (Type B**)   (Type B-)
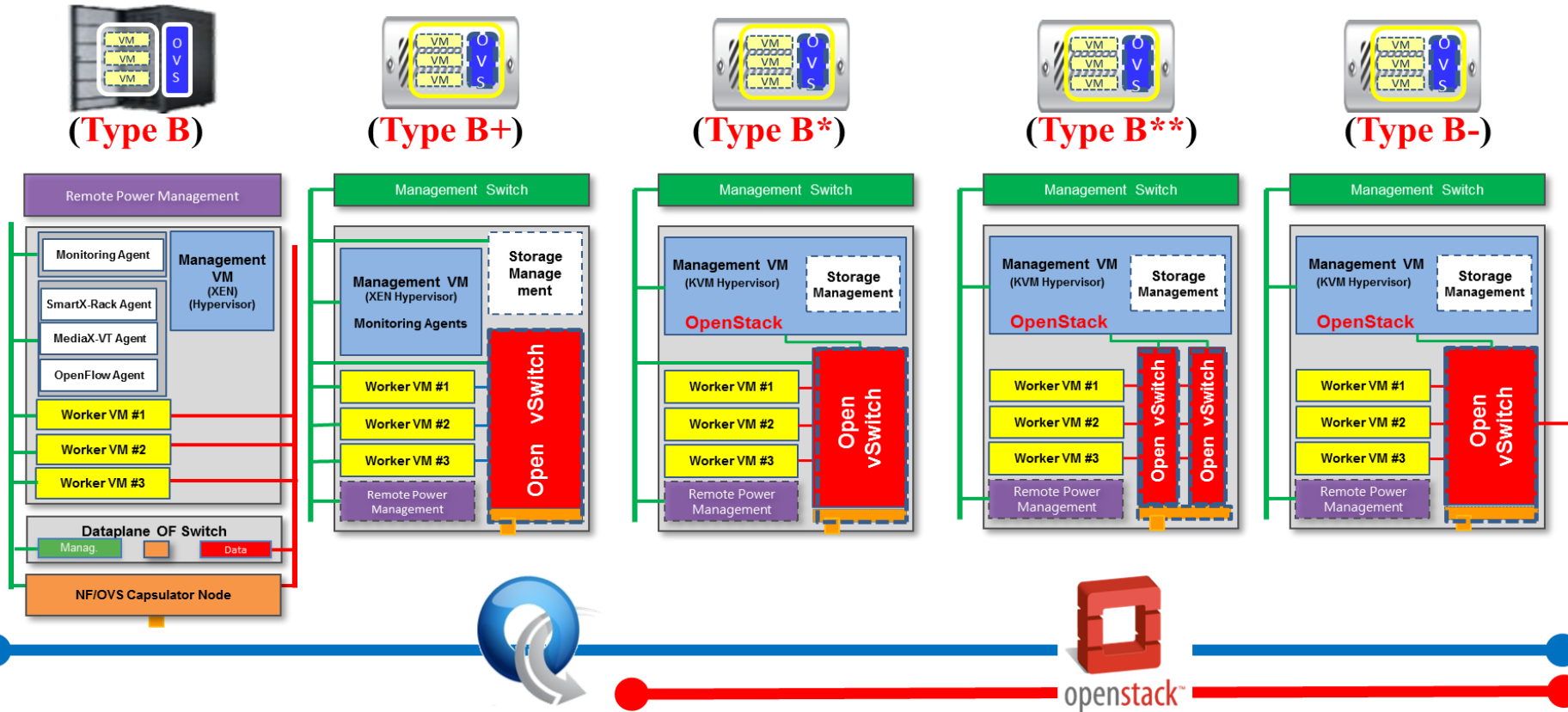
SmartX Box with 3-tier functions (Capsulator + OpenFlow SDN Switches + Cloud VM Workers), managed via 3 network connections (Power + Management / Control / Data (OF & Tunnel))

OF@TEIN Playground Operation Room

UNIVERSITY OF MALAYA

Running Visualizations at NetTD's

Visualization Infrastructure for OF@TEIN and OF@KOREN

KOREN For OF@TEIN
(103.22.221.0/24)
(61.252.60.0/24)(61.252.52.0/24)

TEIN

Juniper MX80
(103.22.221.1)

KOREN for OF@KOREN
(210.114.90.X/24)

Dell 6248 R
210.114.90.x/24   103.22.221.0/24

Cisco SG200-26

Visibility Center   SAGE Controller

| NetTD 1 | NetTD 2 | NetTD 3 | NetTD 4 |
| NetTD 5 | NetTD 6 | NetTD 7 | NetTD 8 |

NetWall

MYREN MALAYSIAN RESEARCH & EDUCATION NETWORK

APAN

Asi@Connect

TEIN CC COOPERATION CENTER

Success Stories

- An overlay virtualized OpenFlow-enabled SDN testbed over 12 international sites;

- Open and wide availability of state-of-the-art distributed SDN-Cloud testbed facility;

- Co-authored publications in high impact journals and conference proceedings;

- Dedicated knowledge-sharing workshops conducted annually in Malaysia, Thailand and Vietnam;

Success Stories

- Students and professors' mobility between collaborators;

- Incubated joint researches among project partners to work closely and improve research quality and impact;

FROM OF@TEIN TO OF@TEIN+

O~pen~F~low~@TEIN

➜➜ 2015 ➜➜

O~pen~F~ederation~@TEIN+

Primary goals of OF@TEIN+:

1. Gather and Learn Together: Expanding the OF@TEIN Community and Sharing the Knowledge about Open and Federated (i.e., shared) SDN/NFV/Cloud-integrated Playground amongst the Members.

2. Build and Upgrade Together: Deployment and Upgrade of Open/Federated Playground with Distributed SmartX Box Playground Resources and Centralized Data Lake/Analytics Hardware.

3. Operate and Automate Together: Collaborate among Leading Members to enable Automated DevOps-style Operation of Playground Resources and Platforms.

4. Play and Visualize Together: Collaborate with All Members in Experimenting (i.e., Playing) and Visualizing "Plays over Playground".

5. Investigate and Enrich Together: Investigate selected building-block topics on Future Network technology and attempt to enhance the playground capability/agility by applying the investigation outcomes.

Main Collaborators

- Chulalongkorn University, Thailand

- Gwangju Institute of Science and Technology (GIST), Korea

- National Cheng Kung University (NCKU), Taiwan

- University of Malaya, Malaysia

Team members

- Aung Htein Maw, PhD (UCSY, Myanmar)

- Bayani Benjamin Lara (ASTI, Philippines)

- Bo Shik Shin (KOREN-NOC, Korea)

- Chaodit Aswakul, PhD (Chulalongkorn University, Thailand)

- Chu-Sing Yang, PhD (National Cheng Kung University, Taiwan)

- Chun-Yong Chong (Monash Malaysia, Malaysia)

- Đinh Văn Dũng, PhD (VNU, Vietnam)

- Eueung Mulyana, PhD (ITB, Indonesia)

- Jiann-Liang Chen, PhD (NTUST, Taiwan)

- Khamxay Leevangtou (NUOL, Laos)

- Li-Der Chou, PhD (NCU, Taiwan)

- Muhammad Tayyab Chaudhry, PhD (CIIT, Lahore, Pakistan)

- Nguyen Huu Thanh, PhD (HUST, Vietnam)

- Panjai Tantatsanawong, PhD (UNINET, Thailand)

- Paventhan Arumugam, PhD (ERNET, India)

- Philip Ho (HKU, HK)

- Su Thawda Win, PhD (UCSM, Myanmar)

- Sunyoung Han, PhD (Konkuk U, Korea)

- Te-Lung Liu, PhD (NCHC, Taiwan)

- Wangcheol Song, PhD (Jeju University, Korea)

Goals

At the end of the project (22 months), the below goals will be achieved:

1. **Gather and Learn Together:**
    i. Workshop #1: Deliver training for accessing the playground through access center and access boxes for all members (**up to 20 participants**)
    ii. Workshop #2: Deliver training for utilizing initial shared DataLake for all members (**up to 20 participants**)
    iii. Workshop #3: Deliver training for SmartX Box Installation & Maintenance for ambassador (**up to 12 participants**)
    iv. Workshop #4: Deliver training for Playing with SmartX Box (**up to 36 participants**)
    v. Ambassador Programs: ambassador (**up to 12**) for installing/maintaining the boxes
2. **Build and Upgrade Together:**
    i. Access Center Deployment: Providing (*up to 20*) virtual desktops for high-speed developers
    ii. Access Box Deployment: Providing dedicated lightweight desktops (**up to 12**) for low-speed/isolated developers
    iii. SmartX Box Upgrade: boxes upgrade (**up to 8 sites**) and new installation (**up to 2 sites**)

3. **Operate and Automate Together:**
  i. Establishment of operational mailing-list and operational ticketing systems
  ii. Establishment of Initial DataLake for site-to-site Inter-Connection troubleshooting
  iii. Establishment of High-availability DataLake (**up to 2 sites**) for joint operation troubleshooting (underlay and overlay playground)

4. **Play and Visualize Together:**
  i. Developers (**up to 22 groups**) from all the community members to propose their experiments or to develop visualizations
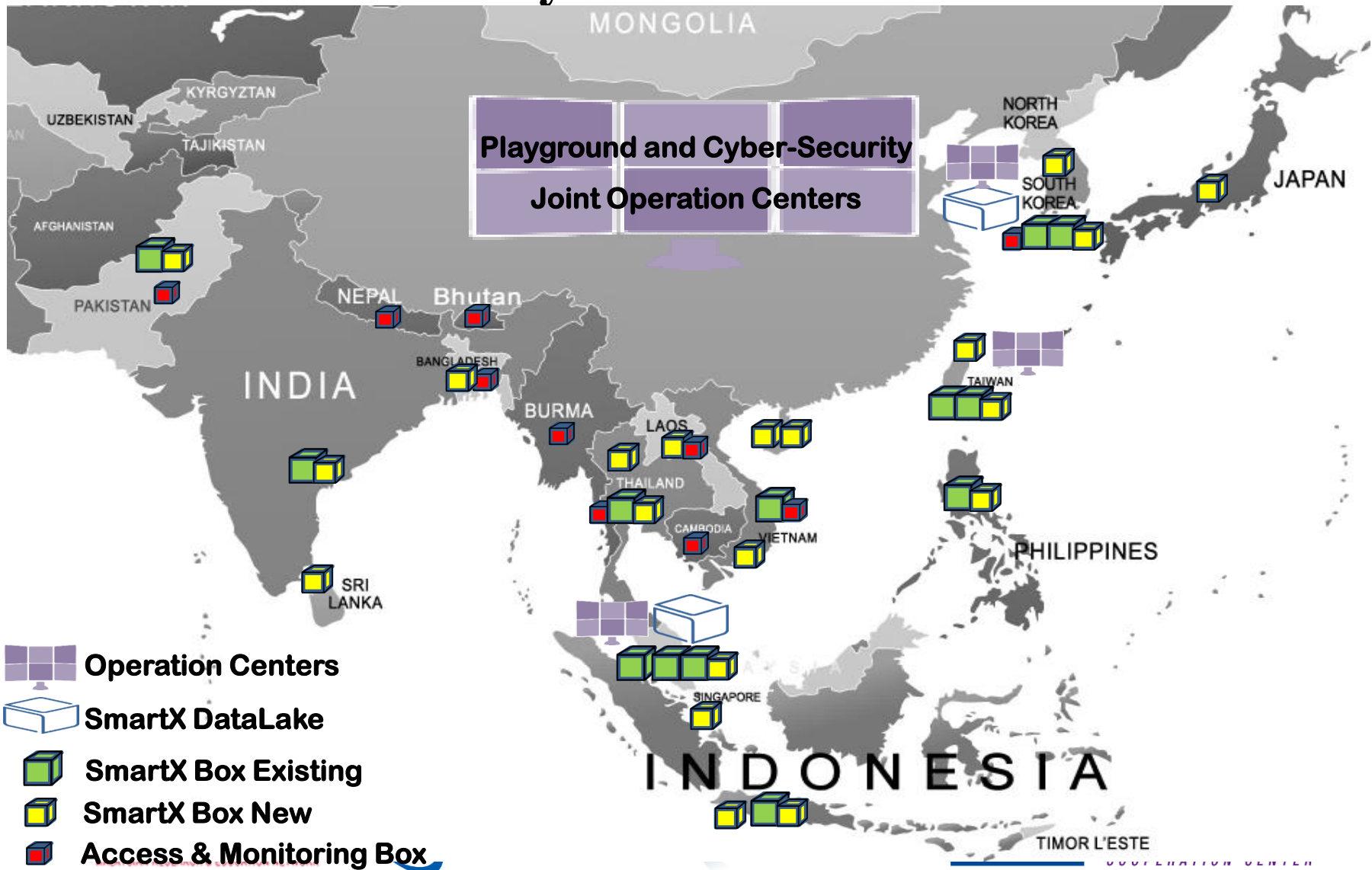 ii. Students (**up to 6**) for actively proposing new solutions to be deployed in the playground

5. **Investigate and Enrich Together:**
  i. Enhancing SDX-based deployment: Solutions/designs/plans (**up to 2**) to be deployed
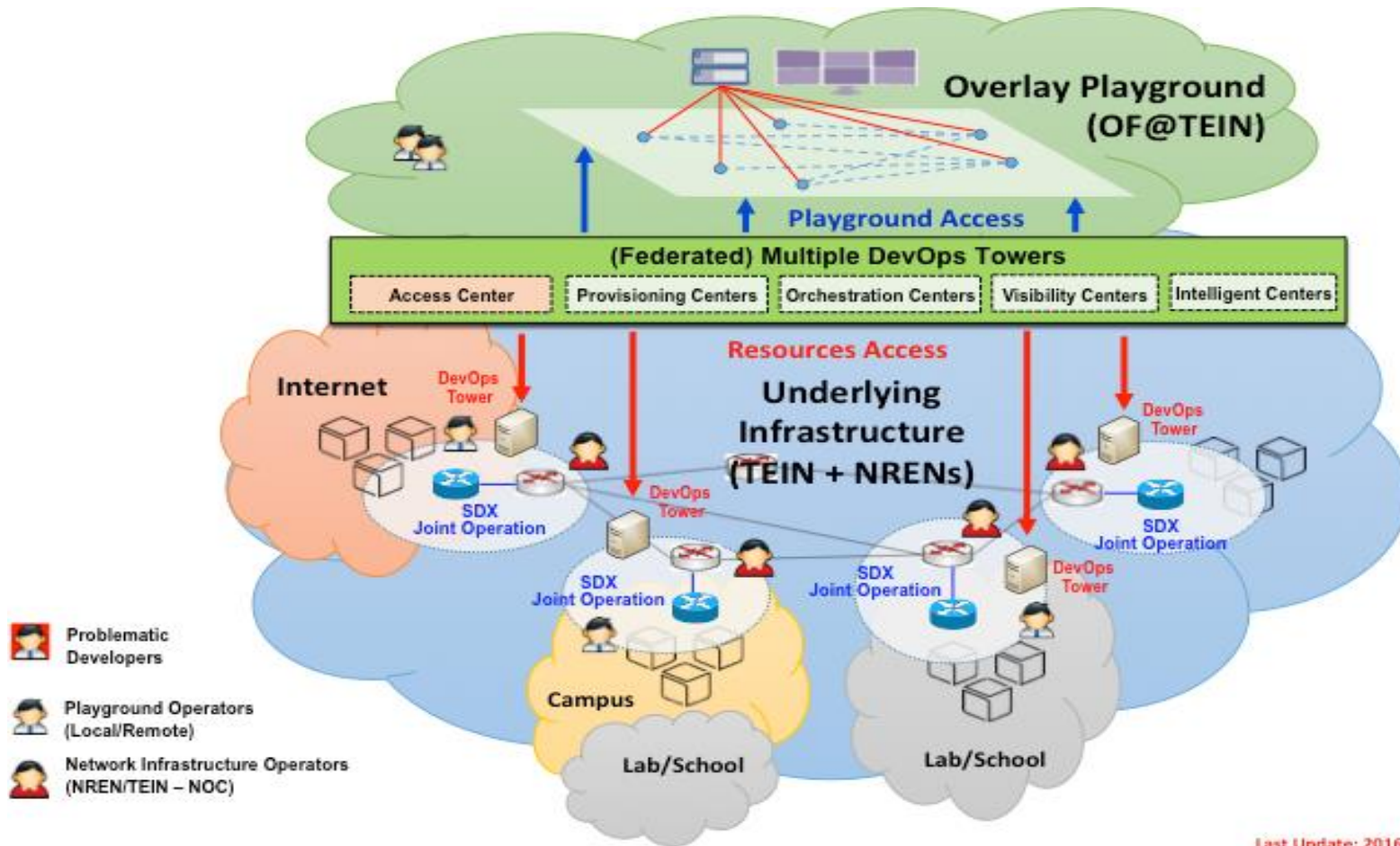 ii. Initial deployment of SOC: Deployment sites (**up to 3 sites**) for initial security collection

DETAILS TASKS

[Task# 2] Deployment/Upgrade OF @TEIN Playground with Distributed SmartX Box and DataLake/Analytics Hardware

Playground and Cyber-Security Joint Operation Centers

Legend:
- Operation Centers
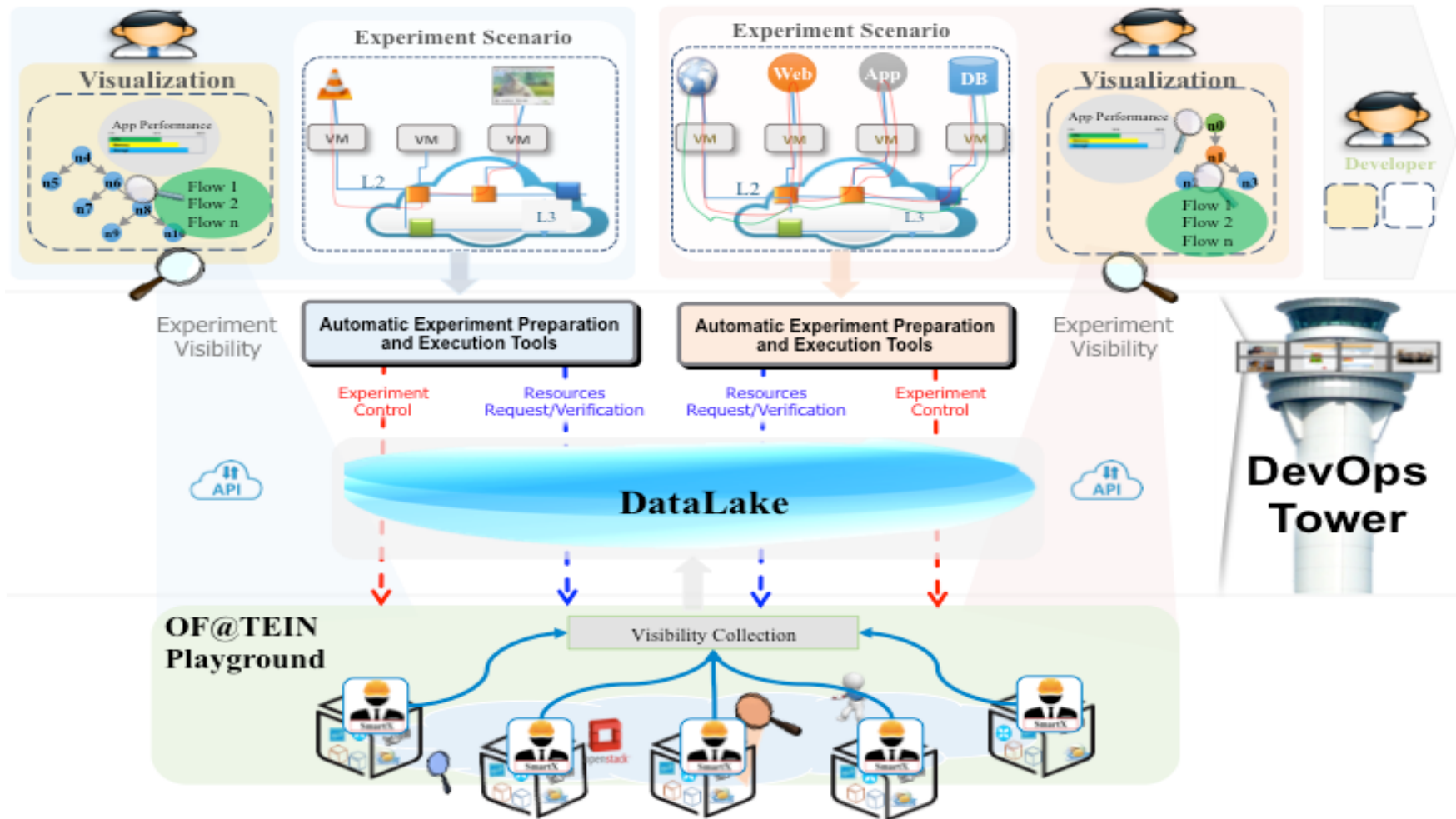- SmartX DataLake
- SmartX Box Existing
- SmartX Box New
- Access & Monitoring Box
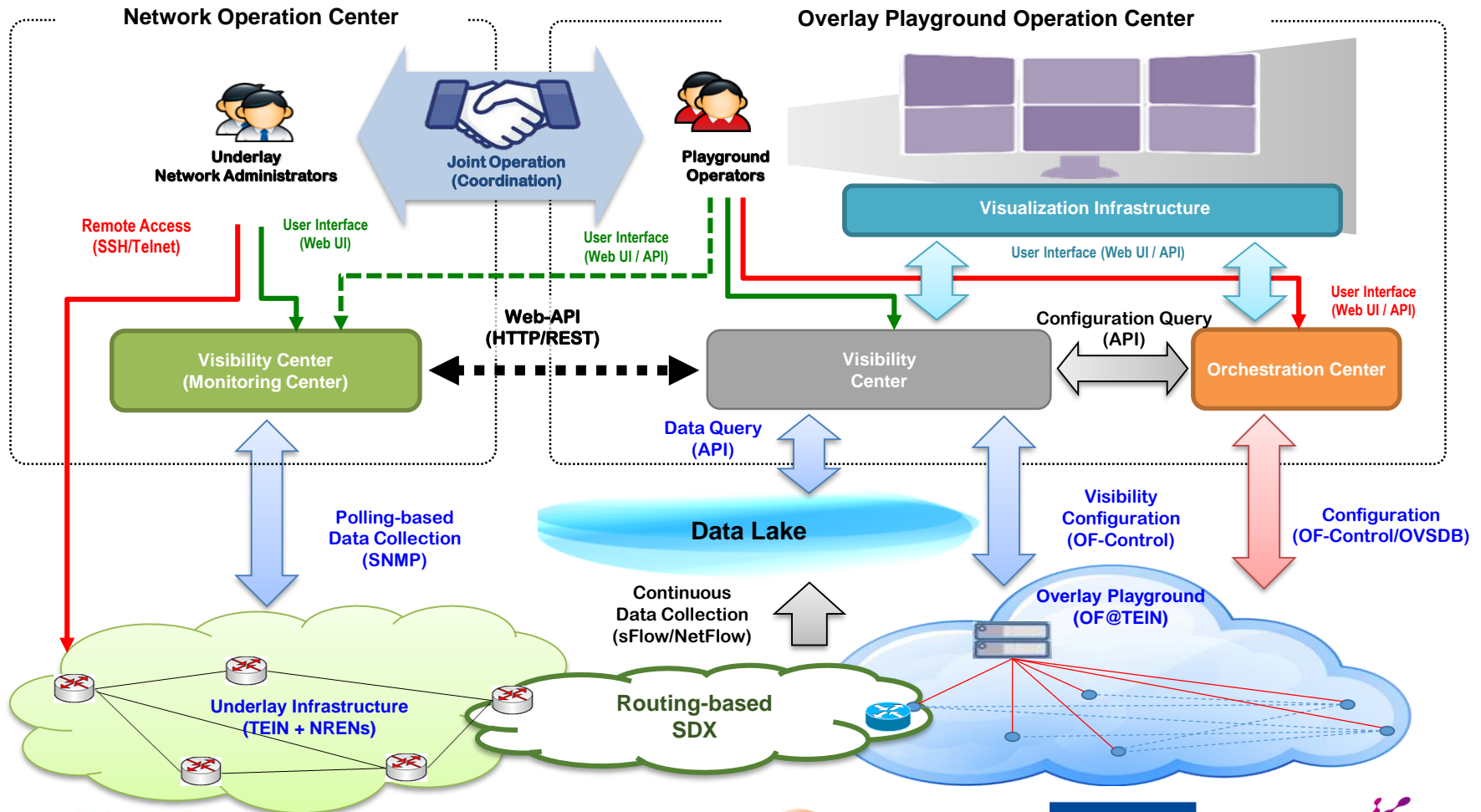
[Task# 3] DevOps-style Playground Operation with Federated DevOps Towers
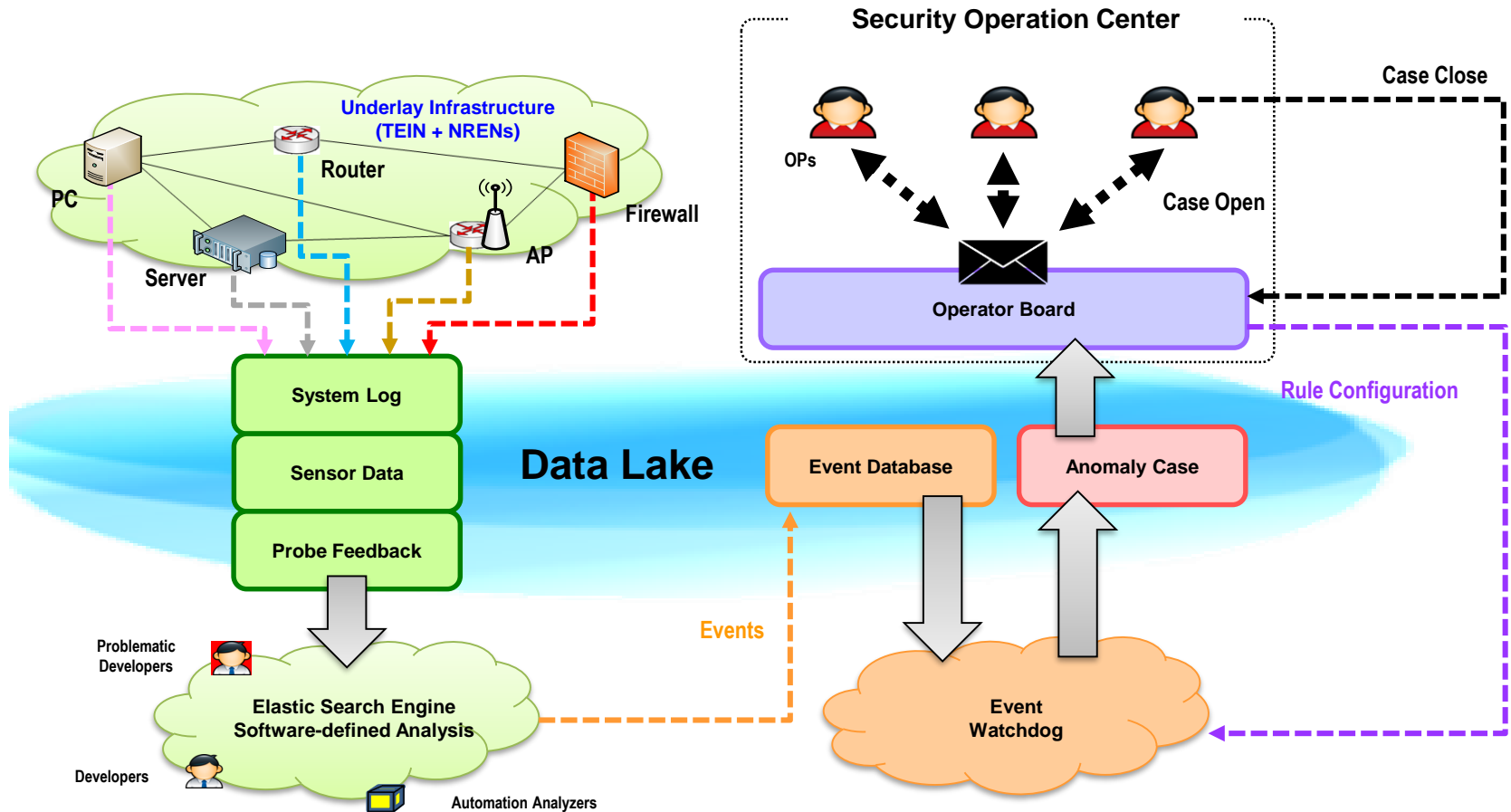
[Task# 4] Experimenting and Visualizing "Plays over Playground"

[Task# 5] SDX-based Joint Playground Operation With Underlay Network Infrastructure Coordination

[Task# 5] Investigate Technology for Playground Enhancement: SD-Security with Security Operations Center

Other Players' Proposed Focus

- Software-Defined Routing Exchange (NCKU, Taiwan)

- Construction of Advanced Intelligent Cyber Defense Centre (NCKU, Taiwan)

- Server Load Balancing Strategy for SDN Controller (UCSM, Myanmar)

- Distributed Denial of Service Attack Detection in SDN (UCSM, Myanmar)

OF@TEIN+ RESOURCES

"Proposed" SmartX Box Type O (SuperMicro SuperServer E300)

Model	SuperMicro SuperServer E300-8D
Size	10in X 8.9in X 8.9in
Processor	**Intel® Xeon® processor D-1518**, 4 Cores, 8 Threads, 2.2GHz
Memory	4x DDR4 DIMM sockets (32GB)
Graphics	Aspeed® AST2400
I/O	2 USB 3.0 ports 1 VGA port 4 x SATA3 ports
Network Interfaces	2 10G SFP+ LAN ports 6 1GbE LAN ports 1 Dedicated IPMI LAN port
Storage	256GB (SSD)

HUMAN RESOURCES SUPPORT

HR Support

Ambassador	Operators or investigators who maintain and monitor the continuous operation and development of OF@TEIN+ playgrounds. They will actively share the experiences and ideas through training/presentation in many different sites (Online/On site).
Developers	Group of researchers who conduct experiments over OF@TEIN+ Playgrounds or making improvement to the playgrounds.
Student Fellows	Local students who help ambassadors and developers activities at each site.

If you would like to join us!

Please Contact:

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Questions ?