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# D4.4

## ADDONAS testing environment



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INTUNE Networks



## ADDONAS

ACTIVE DISTRIBUTED & DYNAMIC OPTICAL NETWORK ACCESS SYSTEMS

Project is co-funded by ERA-NET Plus action in coherence with the objectives of the 7th Framework Programme.		
Dissemination Level		
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This deliverable contains the description of the ADDONAS testing environment including hardware, control planes and potential software which needs tool be deployed in this environment.

# 1 Architecture

The objective of the ADDONAS project is to create a three-stage switch or (Clos Network) using next generation sub-wavelength networking architecture. There are various mechanisms in which this architecture can be achieved and validated using a combination of traditional switches and Intune’s OPST technology. Figure 1 below illustrates various Network Topologies available to the ADDONAS project.

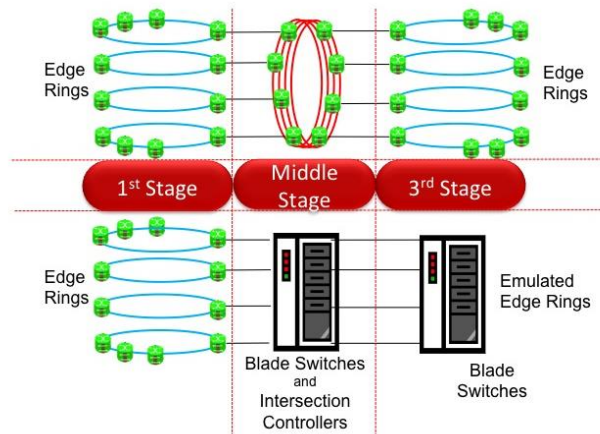


Figure 1. 3 Stage Switch - Architecture Options

# 2 Warm Staging

Figure 2 below illustrates the chosen topology to demonstrate the ADDONAS architecture. In this topology, the middle stage is replaced with an off-the shelf blade-switch to emulate an OPST Ring. In this prototype scenario, a second stage blade-switch will provide all the necessary capability but at a lower cost to the project. This topology will be “Warm Staged” in Intune Dublin prior to being shipped to PSNC for full ADDONAS integration and testing.

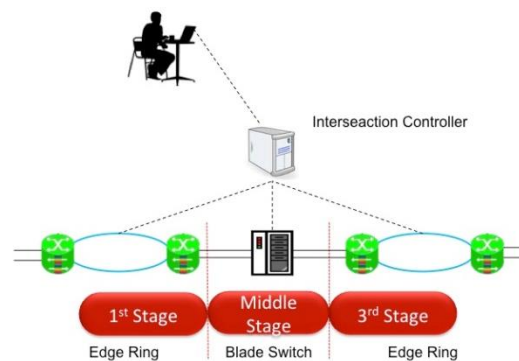


Figure 2. ADDONAS 3SS Architecture

Intune will also develop a prototype “3SS Intersection Controller”. This controller will scale a single stage OAM interface into a prototype three stage controller hosted on a standard server. The intersection controller will synchronize addressing tables with all individual rings and provide full 3SS network path identifier information to incoming packets for forwarding through the 3SS network. This

prototype network will emulate a scaled down 3SS Intersection Controller with a defined number of endpoints.

The Intune ADDONAS Networking templates will contain the following

- 4 chassis
- 4 client NPC Cards, with 2 \* 10GE ports each
- Optical Fabric System Cards,
- Distributed Sub-System Cards,
- CME Control Cards
- Blade Switch
- Common Power, Racking and Cabling Equipment

Intune will also facilitate the interfacing with PSNC’s Open Stack software either via abstraction layer or via a set of customised scripts in the Intune intersection controller for a pre-defined number of endpoints.

### 3 OpenFlow testing environment

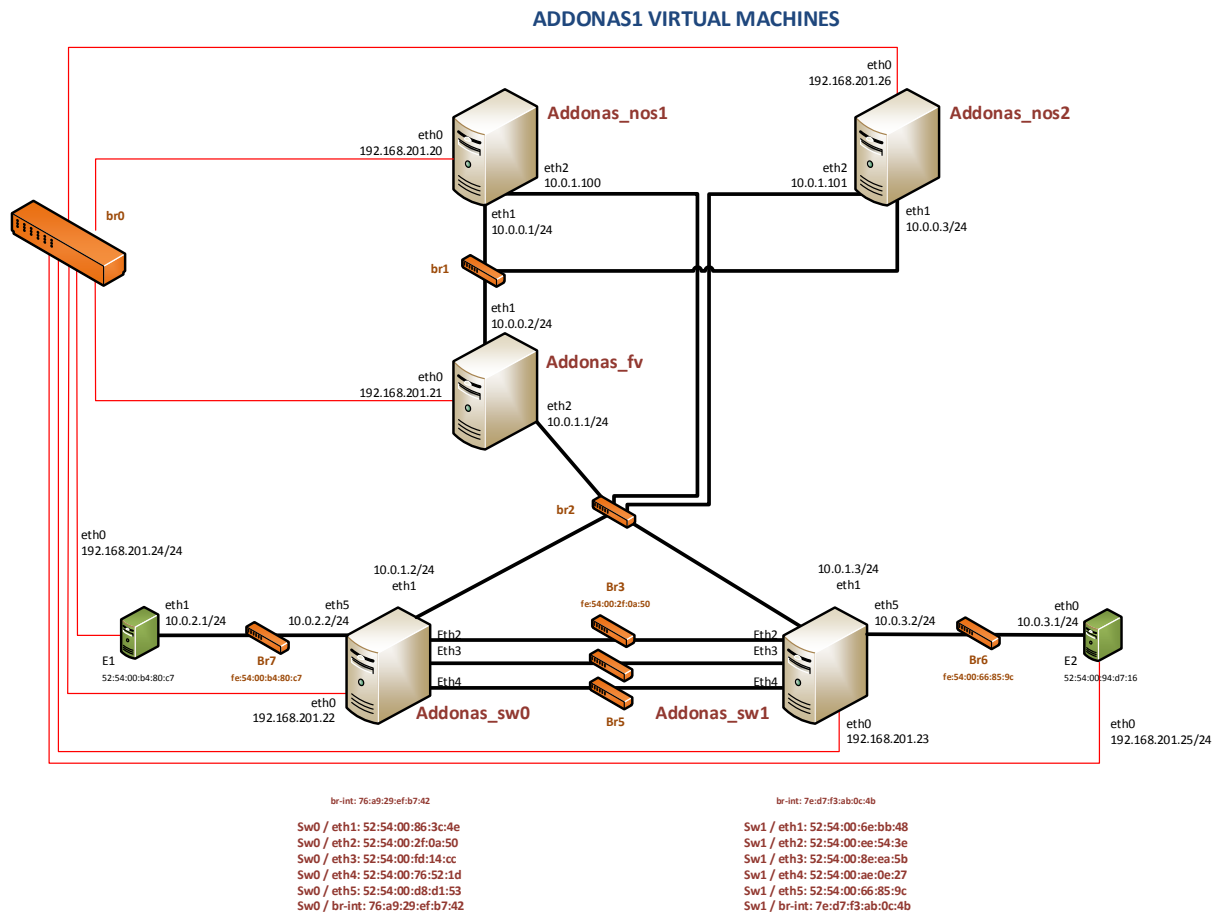


Figure 3. OpenFlow virtual environment

Poznan Supercomputing and Networking Center (PSNC) has prepared a virtual environment to test OpenFlow protocol (Figure 3). All devices in the testbed was created as virtual machines. This solution helped to create a test environment suitable for the planned tests.

First environment called “ADDONAS1 VIRTUAL MACHINES” enabled to test creation of dynamic connection between two end points (E1 and E2 in Figure 3). In order to establish connection OpenFlow switches (Addonas\_sw0 and Addonas\_sw1) were configured in two different ways: first one used controller (Addonas\_nos1) which sent configuration to FlowVisior (Addonas\_fv) and next FlowVisior configured OpenFlow switches (Addonas\_sw0 and Addonas\_sw1), the second one used controller (Addonas\_nos2) which sent configuration directly to OpenFlow Switches (Addonas\_sw0 and Addonas\_sw1).

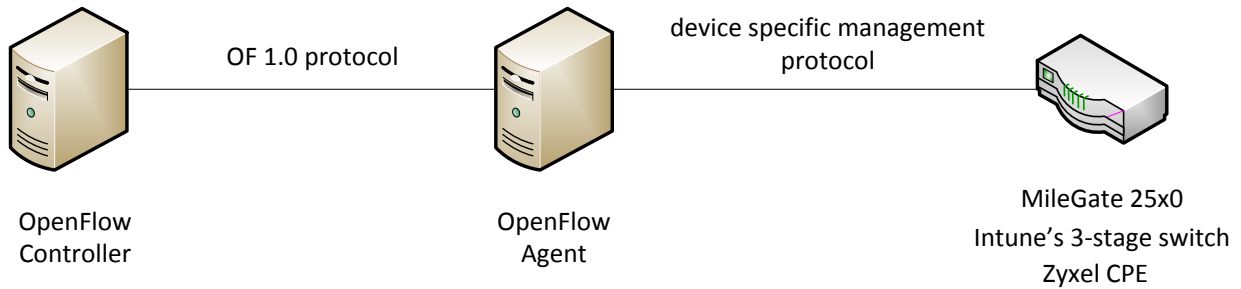


Figure 4. Network for Agent Development

Second environment, called “NETWORK FOR AGENT DEVELOPMENT”, was used to test the OpenFlow proxy agent implementation. Since the network elements used in the ADDONAS architecture are not OpenFlow enabled devices, an agent must be implemented to translate OpenFlow messages into device specific management protocol. The Figure 4 shows test-bed for agent testing. The similar mechanism is used to configure 3-Stage Switch, but instead of CLI the RESTful webservice are used.

## 4 Mininet ADDONAS Test-Bed

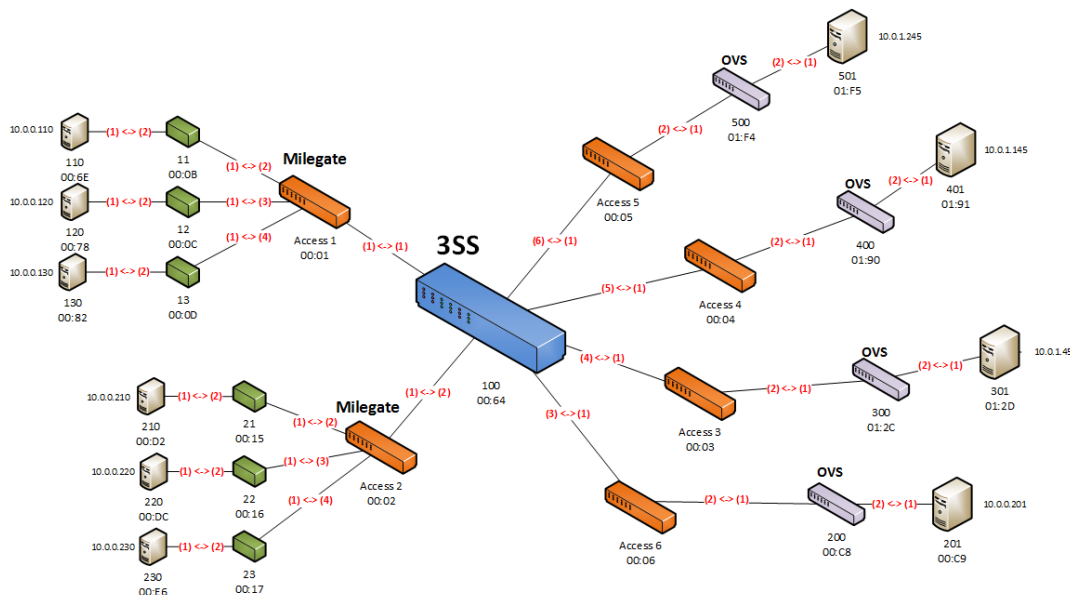


Figure 5. Mininet ADDONAS test-bed

Development of the Control Layer required setup of an OpenFlow test-bed in order to allow reliable tests of constraint-based path computation algorithm (taking into account allocated bandwidth on the links), resources allocation (performed by Service Composition module basing on the slice resources)

and overall working of the system (e.g. processing of the V2N setup and teardown requests). Test-bed has been created using the Mininet simulation software. Nodes and links are defined using python script.

In the Figure 5 ADDONAS Mininet test-bed has been shown. Architecture of the test-bed reproduced ADDONAS physical infrastructure. In the central place the Intune’s 3-stage switch is located (blue device in the figure). 3SS is perceived by the Control Layer as a one device with the number of ports to which Keymile’s Milegate nodes are connected (orange devices located on the left side in the figure). Customer Premises Equipment (CPE – marked as green devices in the figure) are interconnecting users end-devices with the access switch (Milegate node). Datacentres are located on the right side of the figure. Each access switch is symbolizing separate datacentre to which the number of physical or virtual servers are connected. In the figure only virtual servers have been shown. Each server is connected to the ADDONAS architecture via OpenVSwitch, which will be installed on physical servers. OpenVSwitch is also under the control of OpenFlow protocol, which implies that they are a part of ADDONAS physical infrastructure controlled by Control Layer.

Picture of the ADDONAS Mininet test-bed apart from devices and links among them contains also information regarding used ports (red text on the links), MAC or DPID (in the case of OF switches) addresses (under each device its decimal serial number is located which corresponds to its hexadecimal MAC/DPID address written below) and IP addresses of the endpoints (user end-devices as well as servers belonging to service providers).

## 5 ADDONAS demo test-bed

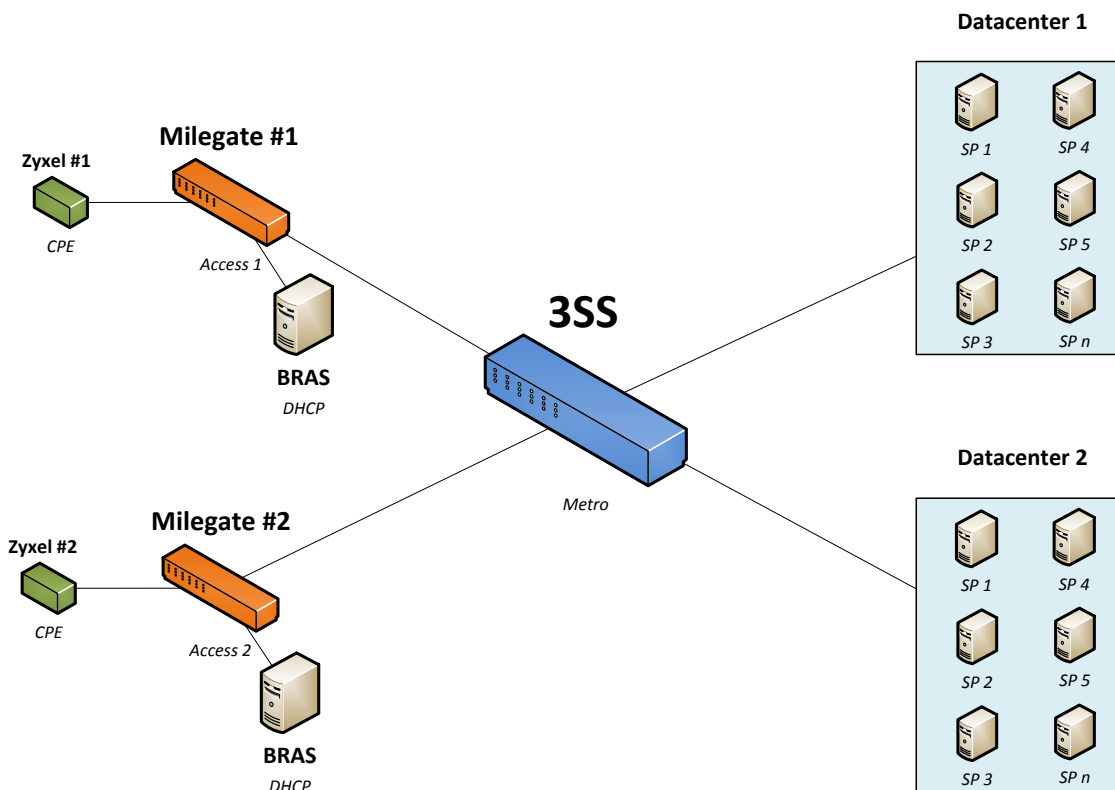


Figure 6. Demo test-bed



Figure 6 shows a test environment for the entire system ADDONAS. On the right side there are some service providers grouped in data centers simulated by virtual machines. In the center of the figure there is the 3-Stage Switch, on the left there are Milegate devices and customer premises equipment for end-user. In case of the ADDONAS architecture, CPE is a Zyxel Residential Gateway. This test-bed will allow for requesting the service by end-user from the SP, creation of the path from SP to end-user, and disconnecting the path.

## 6 Full ADDONAS Testing

Once Warm-staging in Intune is complete, the entire demo will be shipped to PSNC and re-assembled on-site. It will be then integrated with Servers and Keymile equipment. A number of test-cases and use-cases will then be executed onsite across the combined demo.

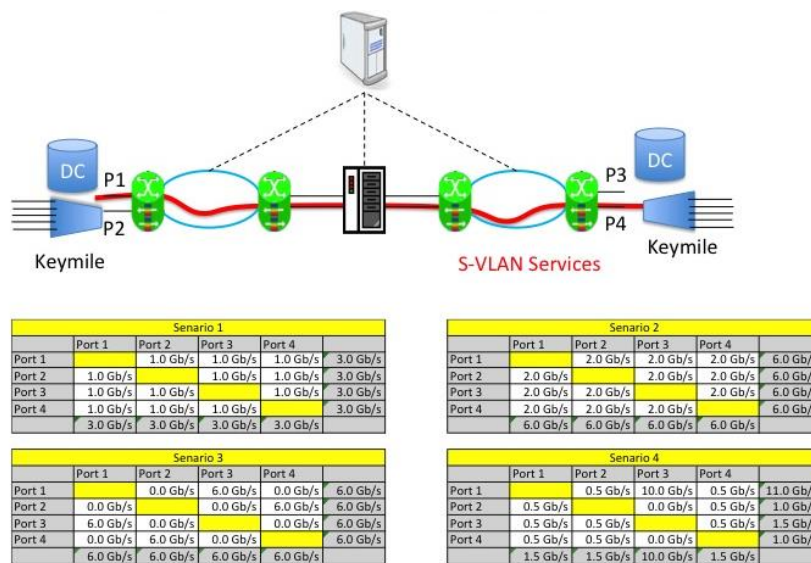


Figure 7. Testing environment