SDN Controllers - 1

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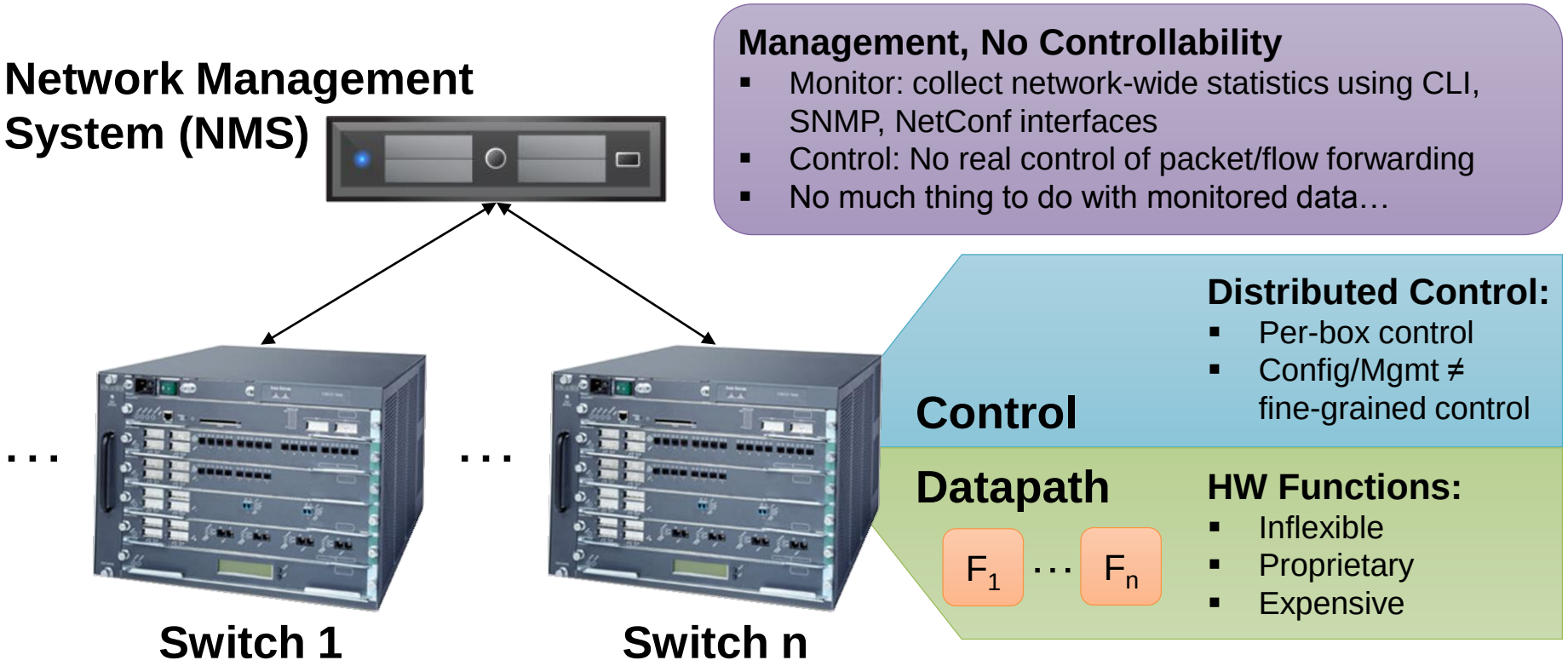
Introduction to OpenFlow Controller (1/2)

❖ Problem Statement

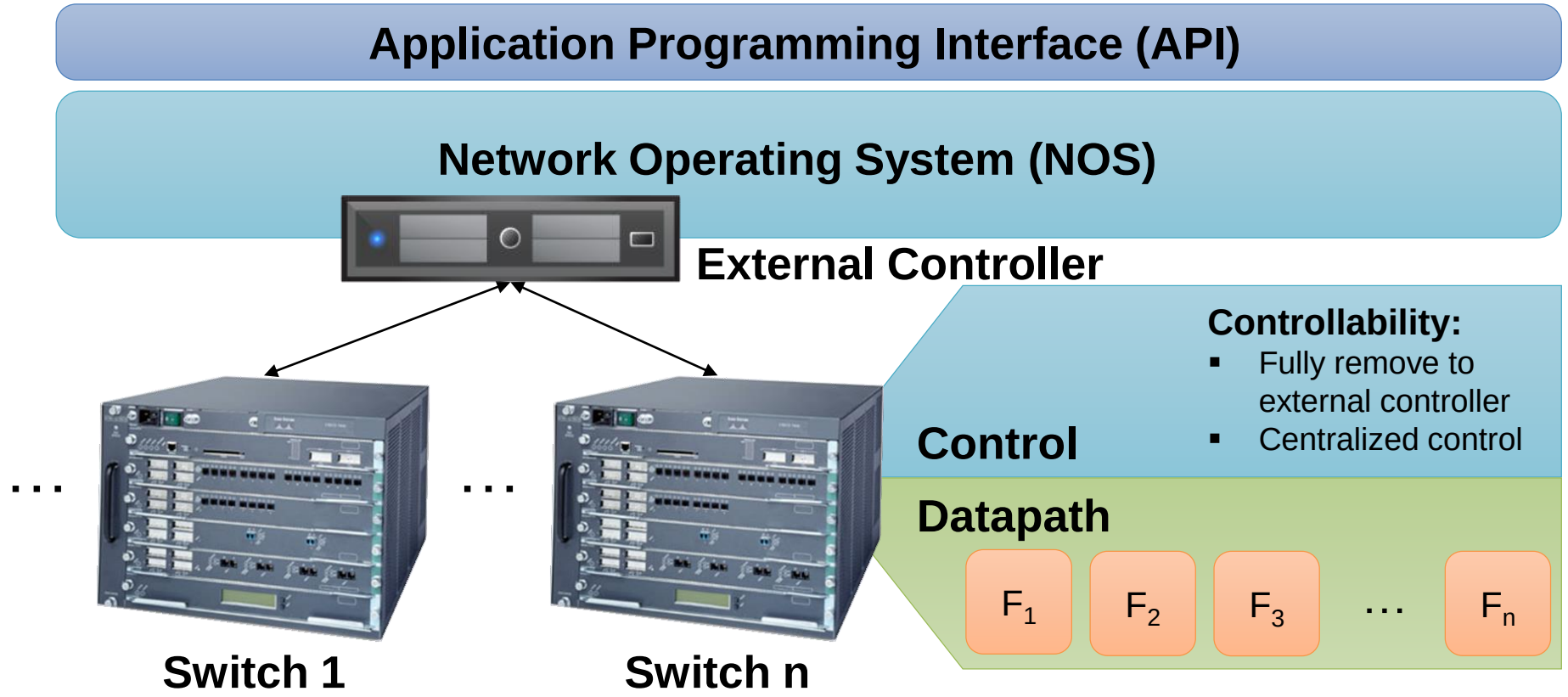
- New functions require new hardware
  - E.g., VNTag, TrustSec
- No support for network-wide control or high-level abstractions
- Distributed control reduces the controllability



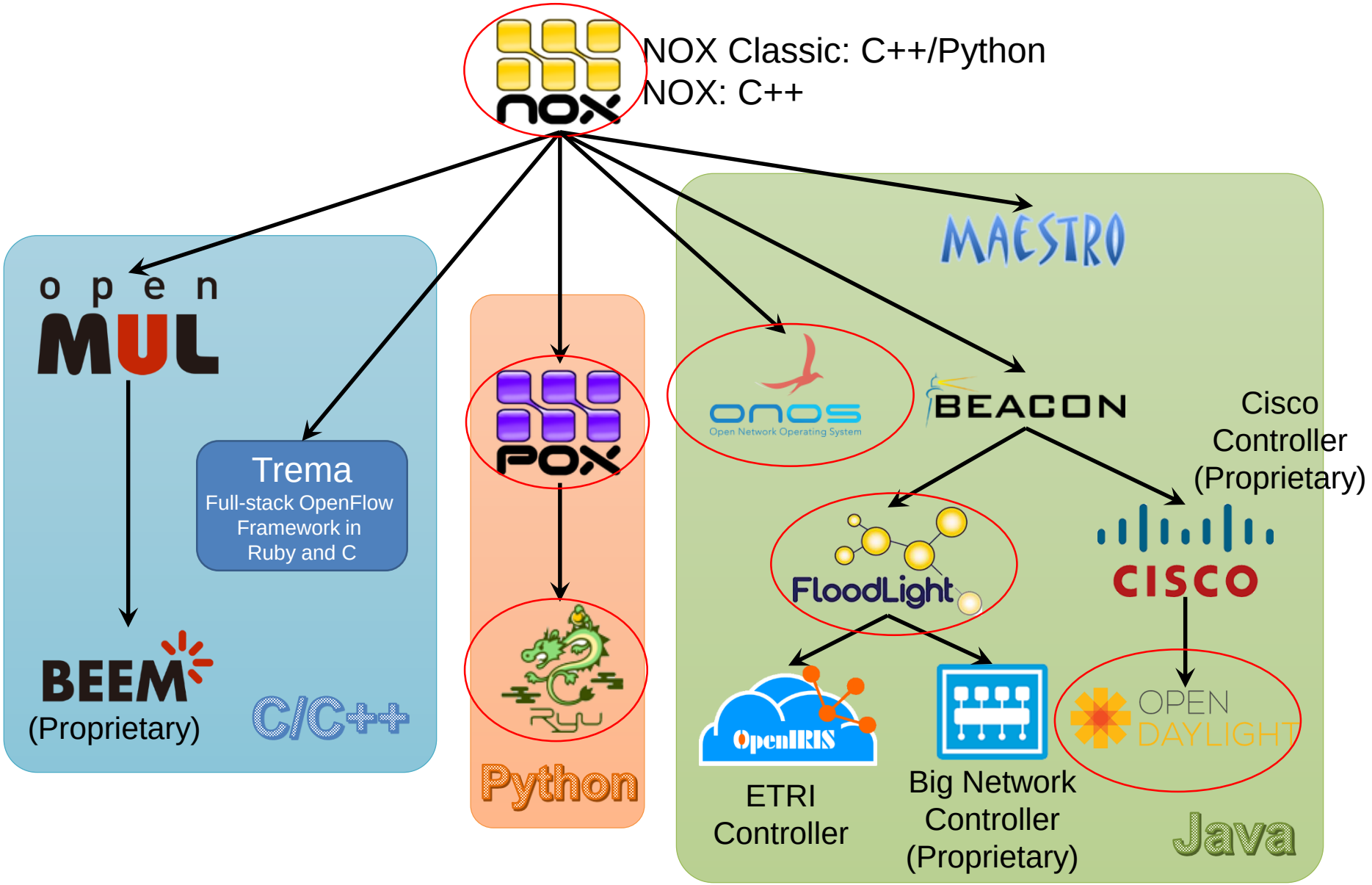
Introduction to OpenFlow Controller (2/2)

❖ Solution

- Need a Network Operating System (NOS), provide a uniform and centralized programmatic interface to the entire network
- NOS does not manage the network itself, instead it provides a programmatic interface



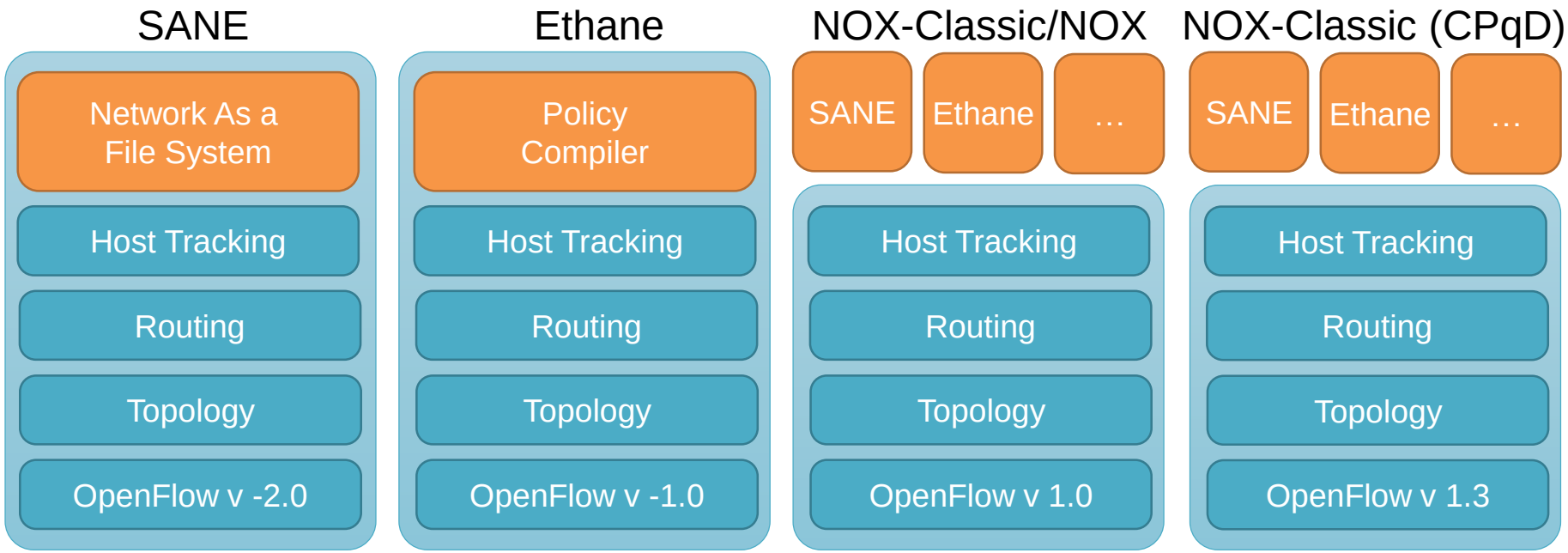
Pedigree Chart of OpenFlow Controllers



History of NOX

❖ History

- Started from SANE project and applied to Ethane in 2006
- Ethane project was announced via SIGCOMM in 2007
- Announced the OpenFlow spec 0.1.0 in Nov. 2007, spec 0.8.0 in May, 2008
- NOX was initially developed by Nicira side-by-side with OpenFlow, and open sourced as the first OpenFlow controller in 2008
- NOX was further developed by CPqD to support OpenFlow 1.3 in Nov. 2012



NOX Classic vs NOX

❖ NOX Versions

Version Name	Branch Name	Version No.	Release Date	OF Spec	GUI
NOX Classic	Zaku	0.9.0	2010-09-15	v1.0	Support
	Destiny	0.9.1	2012-07-20	v1.0	Support
	CPqD ver.	N/A	2012-11-10	v1.3	Not support
(new) NOX	Verity	0.9.2	2012-05-11	v1.0	Not support

❖ NOX-Classic

- Original NOX (now, officially deprecated)
- C++ based SDN controller, applications can be developed using Python

❖ NOX

- New NOX, separated from NOX-classic branch
- Only support C++ for application development
- Fewer default applications than NOX-classic
- Enhanced performance and better source readability
- No graphic user interface

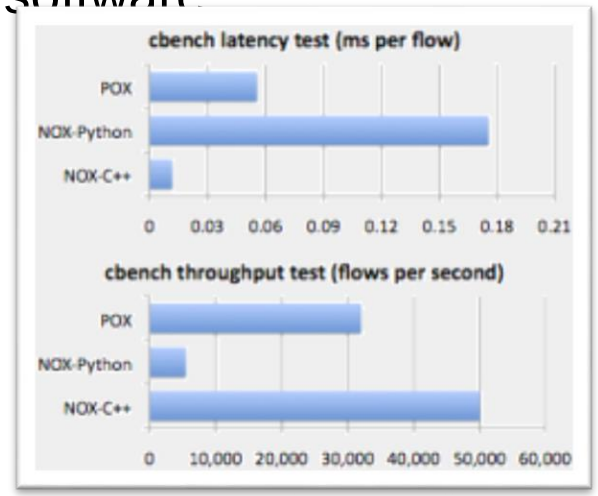
POX Overview

❖ POX Versions

Controller Name	Branch Name	Version No.	Release Date	OF Spec	GUI
POX	Angler	0.0.0	2012 Fall	v1.0	Support
	Betta	0.1.0	2013 Spring	v1.0	Support
	Carp	0.2.0	2013 Fall	v1.0	Support
	Dart	0.3.0	2014 Summer	v1.0	Support

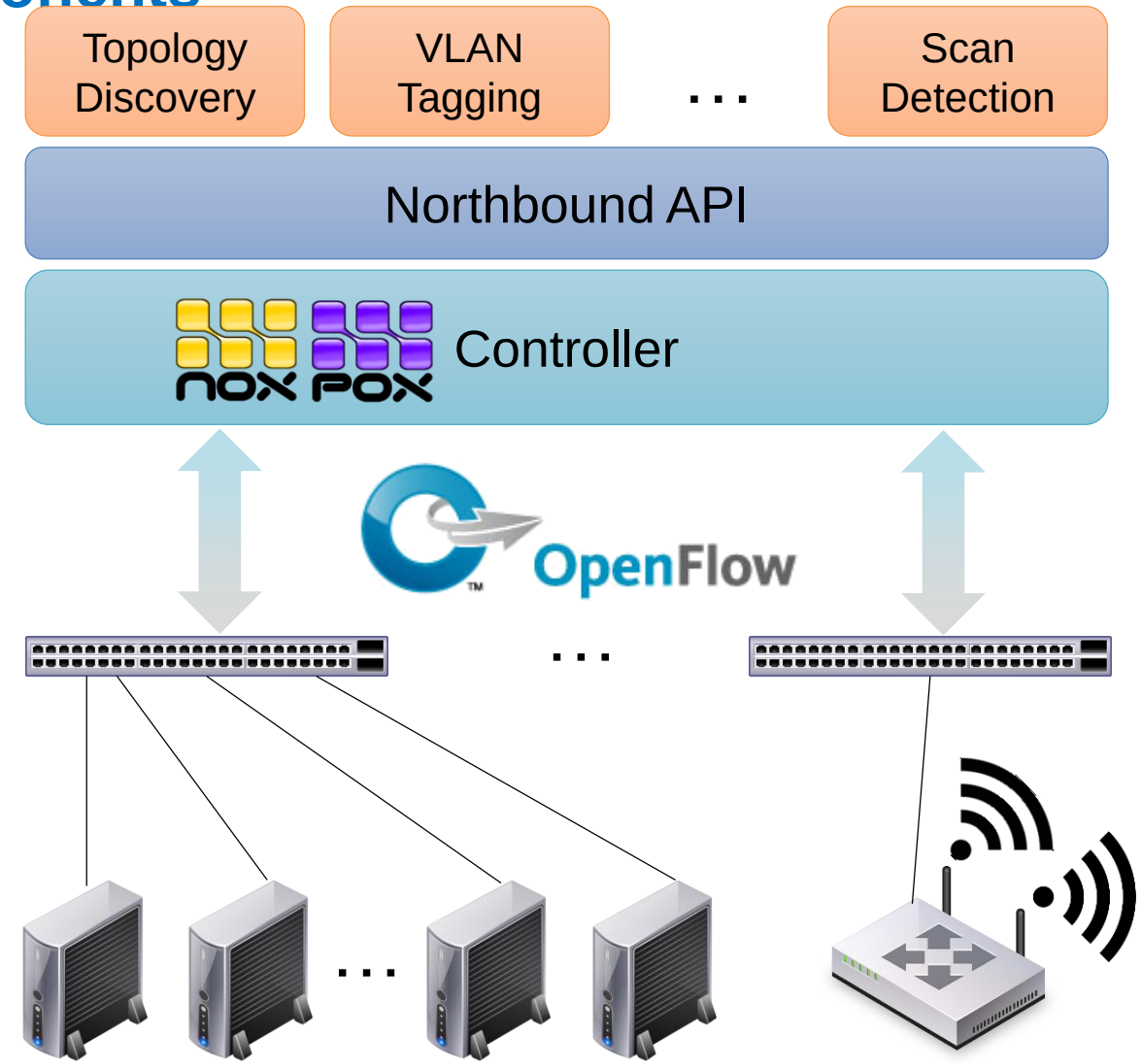
❖ POX

- NOX's younger sibling implemented using Python
- For the rapid development and prototyping of network control software
- Support all OS (e.g., Linux, Mac, Windows)
- Can bundle with install-free PyPy runtime
- Performs well compared to NOX-classic Python
  - Note that NOX-classic does not support PyPy runtime
- Used for research and education purpose



NOX/POX Overview

❖ Components



Network Application Services
- New functions as software services

Northbound API
- Provide interface to network applications
- Not yet standardized

NOX Controller – Network OS
- Provide system-wide abstractions
- Turn networking into a software problem

Southbound API
- Standardized OpenFlow protocol
- Controller, switch interoperability

OpenFlow Enabled Switches
- New functions as software services

NOX/POX Architecture