



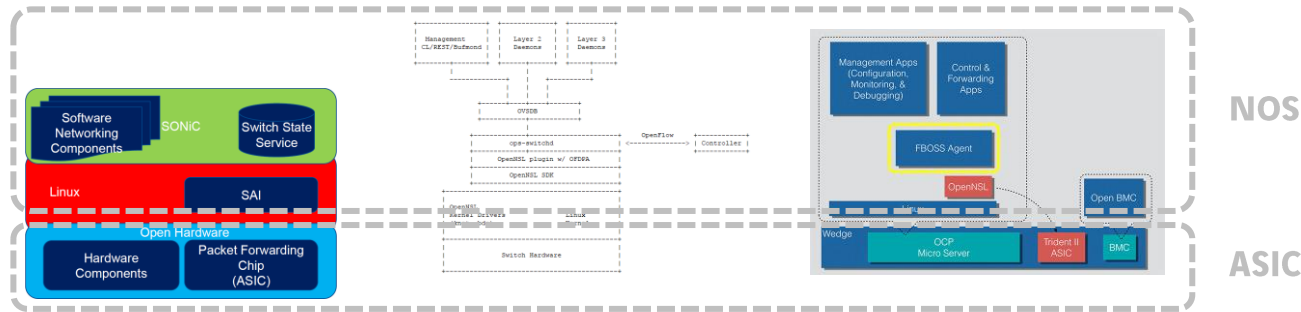
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Open Networking and whitebox switching

Introduction

- ▶ What is a white box switch anyway?
 - Let's start by defining a switch
 - Networking hardware that switches packets, ideally at line rate



- At the lowest level, lies the ASIC (Application Specific Integrated Circuit)
 - If there is an ASIC, there is an SDK for it. And a driver based on that SDK
 - There's no "silicon-independent"

Whitebox? Open?

▶ Whitebox switching

- Commodity hardware (based on merchant silicon)
- Not tied to any particular OS
- Open Compute Project (OCP) guarantees efficiency, openness, impact & scale
- Certified products from official solution providers are listed in OCP Marketplace (<https://www.opencompute.org/products>)
- Telecom Infra Project (TIP) also collaborating with OCP

▶ Open networking

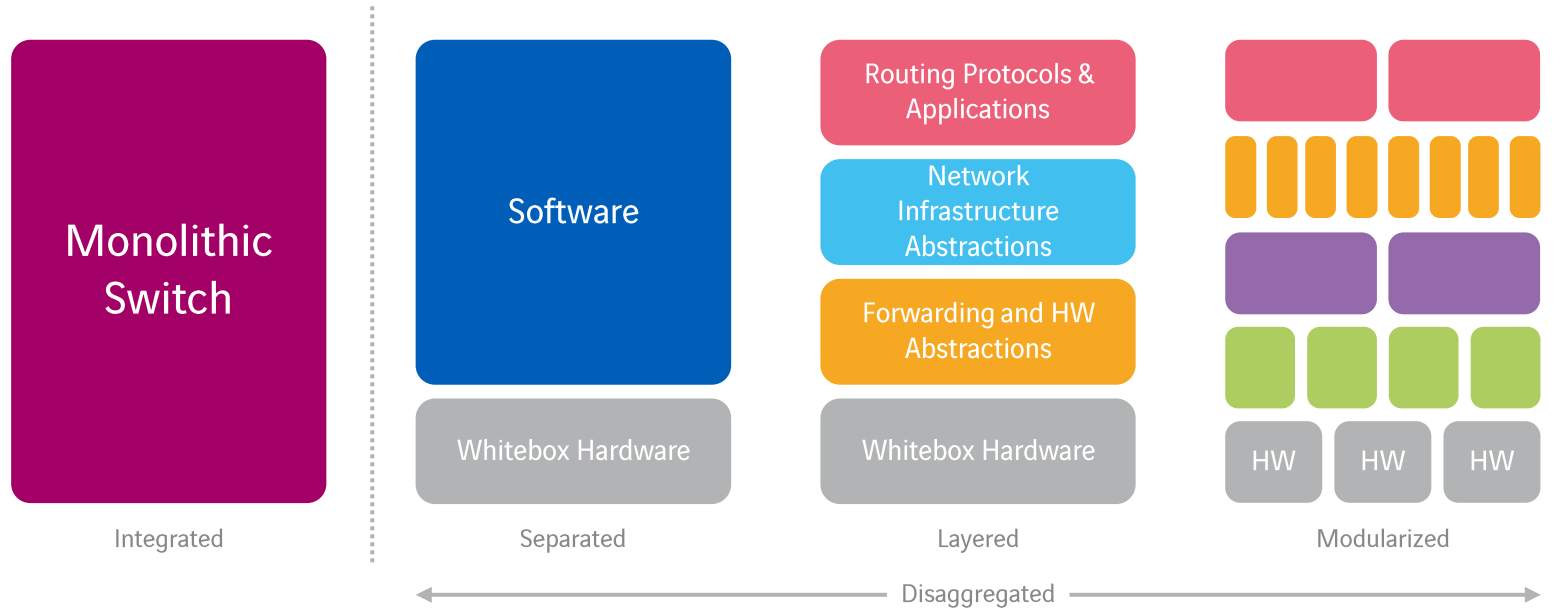
- Whitebox hardware + Open Network Operating System (NOS)
- What does “open” mean?
 - Open standards and APIs (and ideally, open hardware design and open source software)
 - Compatibility and interoperability
 - Disaggregation (modular components vs monolithic hardware appliances)
 - Flexibility and agility (broad range of hardware and software choices, and even custom code)
 - Other aspects usually related: SDN, NFV, cloud native technologies

▶ What’s the point?

- Economics, choice & scalability, all at once



The key is disaggregation



- Pre-integrated & pre-tested
- Vertical vendor support

- Economics
- Choice & granularity (vendor diversification)
- Custom software feature development

Compatibility

▶ Can I load X into Y?

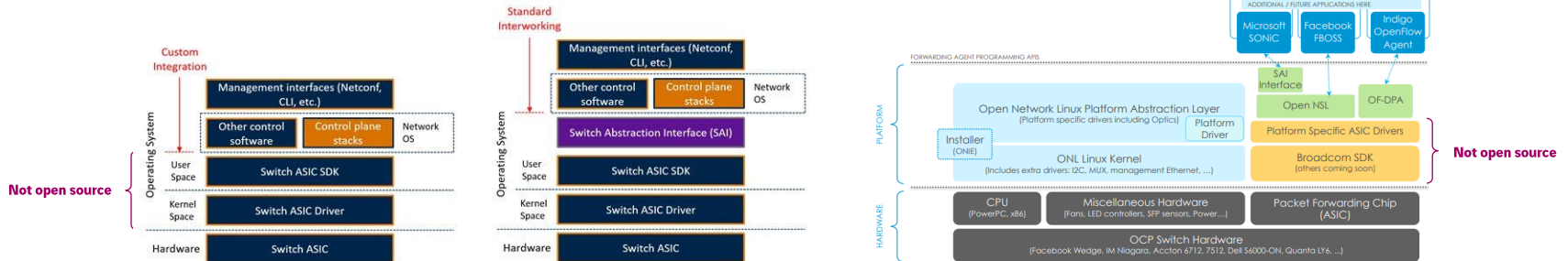


▶ Well, it's not that simple

- NOS must include drivers for the white box's ASICs
- Check Hardware Compatibility List (HCL) of the NOS

Software and hardware compatibility

- ▶ ASIC drivers are not open (it's the core business of merchant silicon vendors)
 - You can't just load a random open source NOS or routing suite
 - Many different APIs: Broadcom's OpenNSL & OF-DPA, OCP's SAI...
- ▶ Besides ASIC support, to get a switch hardware up and running in a NOS, you need:
 - Platform drivers for transceivers, sensors, LED management, system EEPROM driver...
 - Device specific ASIC configuration and port-mapping
 - Fan and power supply control
 - Installer configuration



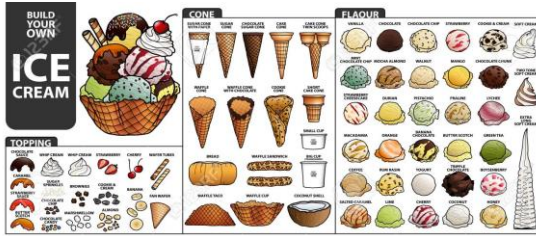
https://bm-switch.com/index.php/blog/whitebox_basics_p1/

<https://www.design-reuse.com/articles/44519/switch-abstraction-interface-sai.html>

Open Network Linux: A programmer's View (Rob Sherwood, et. Al. @ Big Switch Networks)

Build your own switch

- ▶ Many combinations to choose from



- ▶ Not all necessarily good



SILICON	PLATFORM	NOS	
BROADCOM [®]	metaswitch	Mellanox TECHNOLOGIES	SONIC
intel	Silicom Connectivity Solutions	Accton	Open Switch
BAREFOOT NETWORKS	FULCRUM microsystems	DELTA	STRATUM
NVIDIA	Mellanox TECHNOLOGIES	kontron	CUMULUS
MARVELL	CAVIUM	QCT	DANOS
Innovium [™]	Nephos	ADVANTECH	CUMULUS
centec	Inventec	big switch networks	ALPHA Alpha Networks Inc.
		ALPHA Alpha Networks Inc.	PICOS

Choosing the right whitebox switch

- ▶ Determine your **logical requirements**
 - Network architecture and protocols -> NOS
- ▶ Check available **NOS** options for compliance
- ▶ Read the hardware compatibility list (**HCL**) of the chosen NOS
- ▶ Determine your physical **hardware requirements**
 - Performance (bandwidth & pps throughput, latency...)
 - Environment (power, cooling, space...)
- ▶ **Shortlist** compliant vendors and models
- ▶ Ensure the features you need are supported in the specific **switch + NOS combination**
- ▶ Build a PoC and test drive in **lab**



NOS (Network Operating System)

- ▶ **SONiC** (Software for Open Networking in the Cloud) by Microsoft
- ▶ **DANOS** (Disaggregated Network Operating System) donated by AT&T to LNF
- ▶ **Cumulus Linux** by Cumulus Networks (acq. by NVIDIA)
- ▶ **OpenSwitch OPX** by LNF
- ▶ **Stratum** by ONF
- ▶ **PicOS** by Pica8
- ▶ **Switch Light** by Big switch (acq. by Arista)
- ▶ **SnapRoute** (acq. by Infoblox)
- ▶ **Rtbrick**
- ▶ **Netvisor ONE OS** by Pluribus Networks
- ▶ **ArcOS** by Arccus



Whitebox switch vendors

- ▶ Metaswitch
- ▶ Mellanox
- ▶ Silicom
- ▶ Accton
 - Edgework Networks
- ▶ Delta Agema product line
- ▶ Kontron
- ▶ Cumulus Networks (acq. by NVIDIA)
 - Cumulus Express
 - Minipack (by Edgework & Facebook)
- ▶ Quanta Cloud Technology
- ▶ Dell
- ▶ Advantech
- ▶ Big Switch (acq. by Arista)
- ▶ Datacom
- ▶ Inventec
- ▶ Alpha Networks
- ▶ Celestica
- ▶ UfiSpace
- ▶ InsidePacket
- ▶ Many more...

metaswitch

Silicom Ltd.
Connectivity Solutions

edgework
NETWORKS

kontron

QCT

ADVANTECH

Inventec

 **Mellanox**
TECHNOLOGIES

Accton

 **DELTA**

CUMULUS 



 **big switch**
networks

ALPHA
Alpha Networks Inc.

Merchant silicon vendors

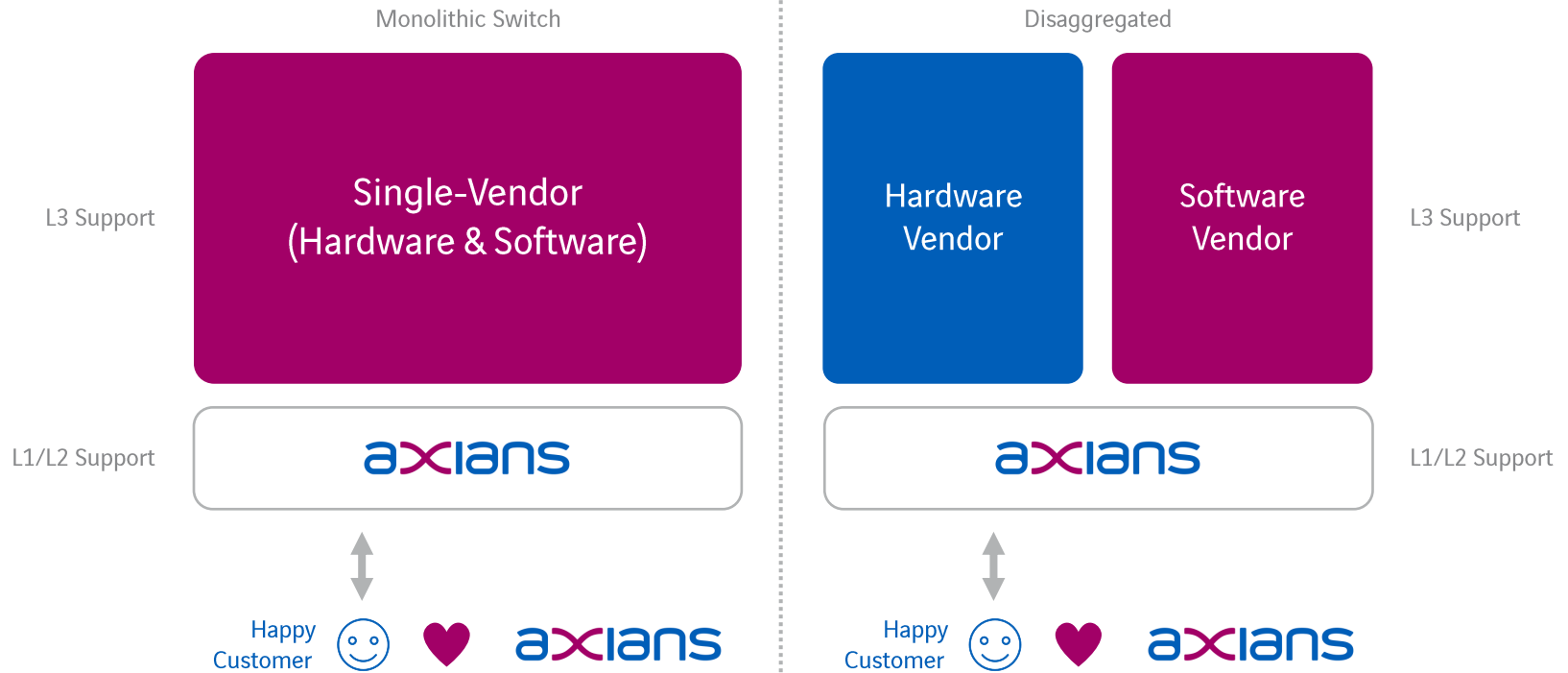
- ▶ **Broadcom:**
 - StrataXGS family, aimed at ToR: Trident, Tomahawk
 - StrataDNX (Dune) family, aimed at core: Qumran, Jericho, FE 3600
- ▶ Barefoot networks: Tofino... (acquired by Intel)
- ▶ Mellanox (acquired by NVIDIA)
- ▶ Cavium: XPliant (acquired by Marvell)
- ▶ Marvell Presteria
- ▶ Nephos (MediaTek): Aries, Taurus, Leo
- ▶ Centec networks
- ▶ Fulcrum (acquired by Intel)
- ▶ Innovium
- ▶ Probably more...



“Britebox” vendors

- ▶ Britebox: **branded whitebox**
- ▶ Traditional vendor’s attempt at not losing the wave
- ▶ Similar to whitebox, but with a nice logo on them
- ▶ Come preloaded with the vendor OS
- ▶ A few examples
 - Juniper Networks
 - Juniper announced OCX series (built by Alpha) in 2014 (EoL 2017)
 - Now some Juniper platforms, such as QFX support SONiC
 - Disaggregated JunOS now supports Accton EdgeCore’s AS7816-64X
 - Cisco Systems
 - IOS-XR on top of whitebox OCP accepted hardware (Edgecore AS5916-XKS & AS7816-64X)
 - SONiC on Nexus platforms & Cisco 8000 Series routers
 - Arista Networks
 - Now supports SONiC OS on certain switches
 - Acquired Big Switch in 2020

The whitebox support model



axians

Any questions? You can reach me at:



Diego Nuevo

Data Center & Network Architect

 @diegonuevo_v6

 diego.nuevo@axians.es