



Stratum Project

Enabling era of next generation of SDN

Announcements

- Next-Generation SDN
 - A set of next generation interfaces
 - Leverages P4, P4Runtime, OpenConfig, gNMI, gNOI
 - Provides full lifecycle management & control
 - Successor for OpenFlow
- Stratum Project
 - New Open Source Project
 - Complete white box switch software solution
 - Supports next-generation SDN interfaces
- Business Benefits
 - Interchangeability of forwarding devices
 - Programmability of forwarding behaviors
 - Enables a new white-box ecosystem

STRATUM FOUNDING MEMBERS

Cloud Providers:

Google, Tencent

Telecom Operators:

China Unicom, NTT, Turk Telekom/Netsia

Networking Vendors:

Big Switch, Ruijie, VMware

White Box Vendors:

Delta, Edgecore, QCT

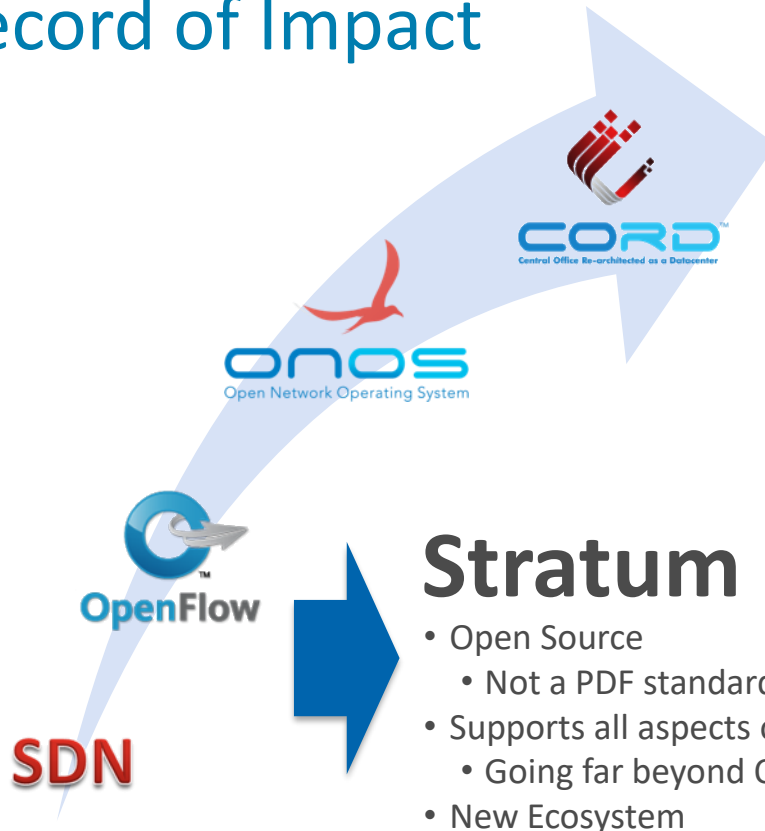
Silicon Vendors:

Barefoot, Broadcom,
Cavium, Mellanox, Xilinx

Open Source Projects:

CORD, ONL, ONOS,
OpenSwitch, OVS, SDKLT

ONF – An Operator Led Consortium with A Track Record of Impact



- Open Source
 - Not a PDF standard
- Supports all aspects of full lifecycle control and management
 - Going far beyond OpenFlow
- New Ecosystem
 - Enabling a vibrant market of white box solutions

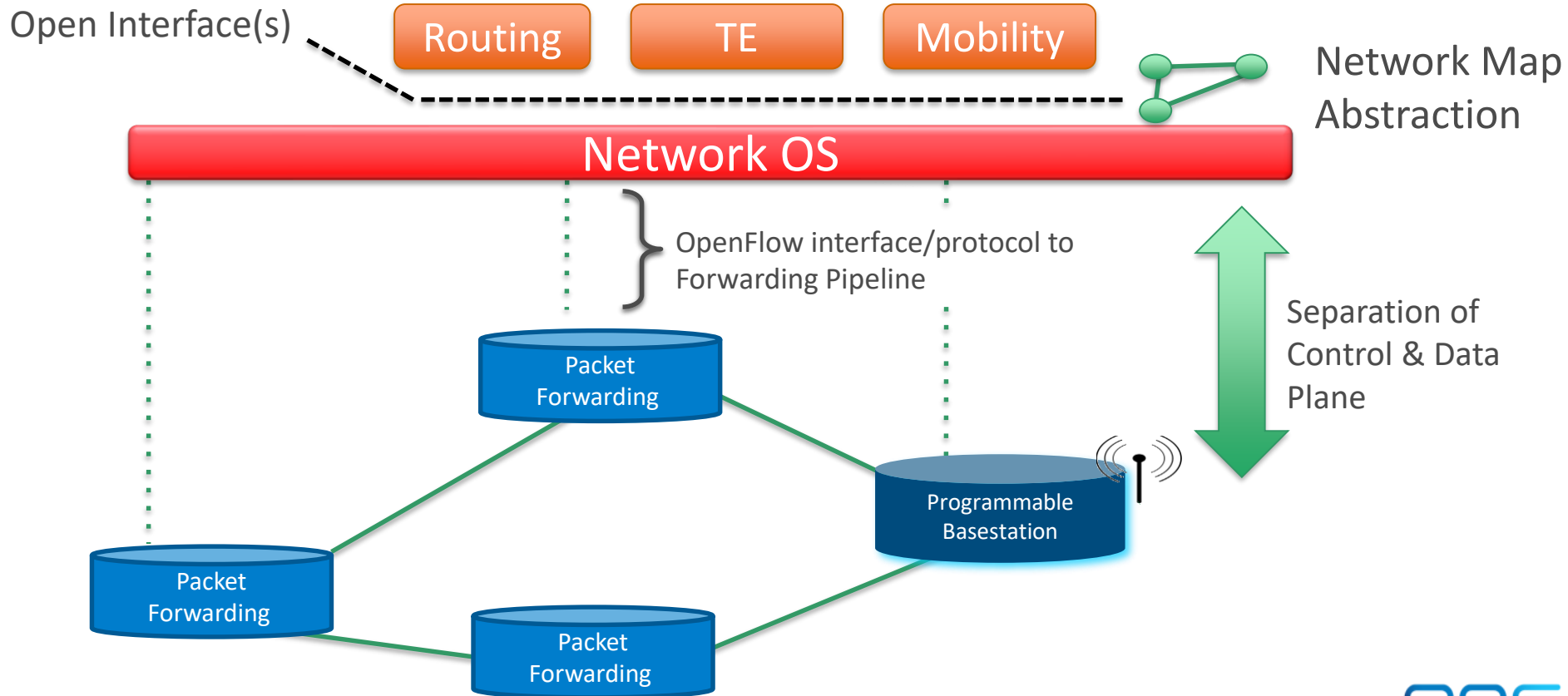
“Nearly 40% of all end-customers will have service provided by ... CORD by mid-2021”

Roz Roseboro
Heavy Reading

“70% of operators worldwide are planning to deploy CORD”

Michael Howard
IHS Markit

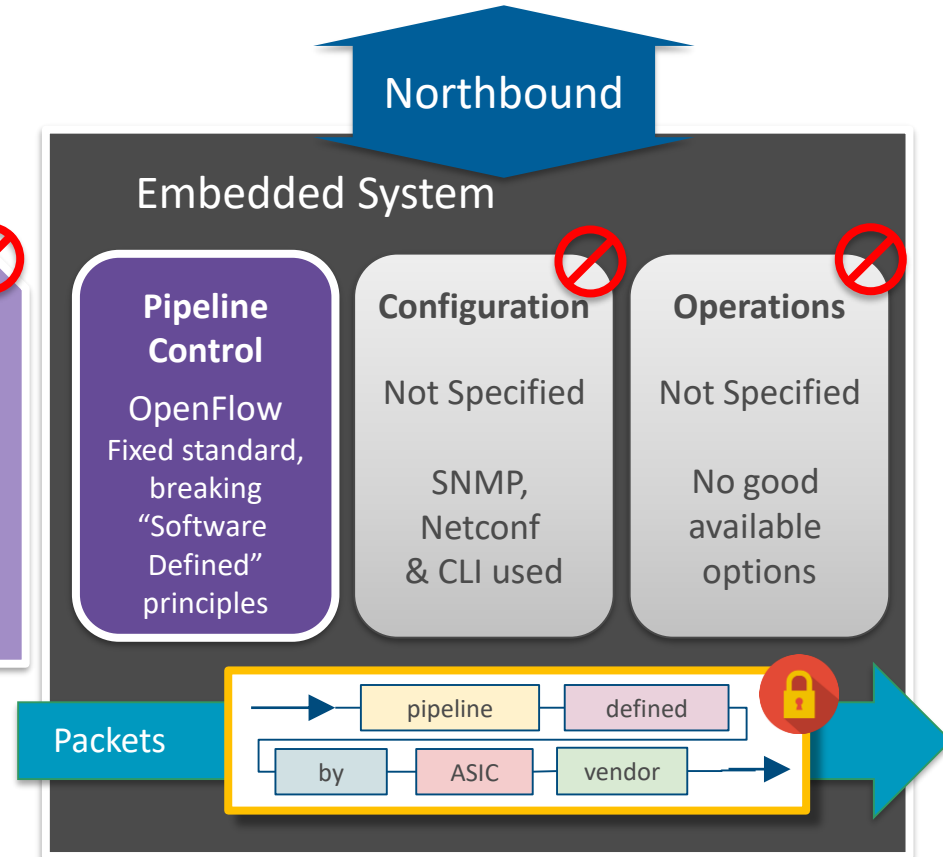
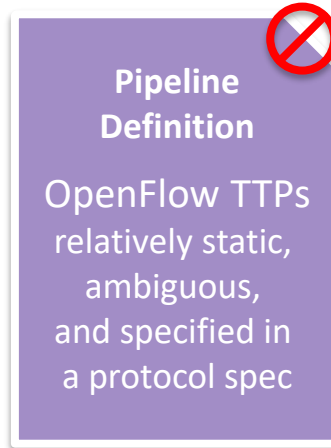
SDN Architecture: As Proposed Ten Years Ago



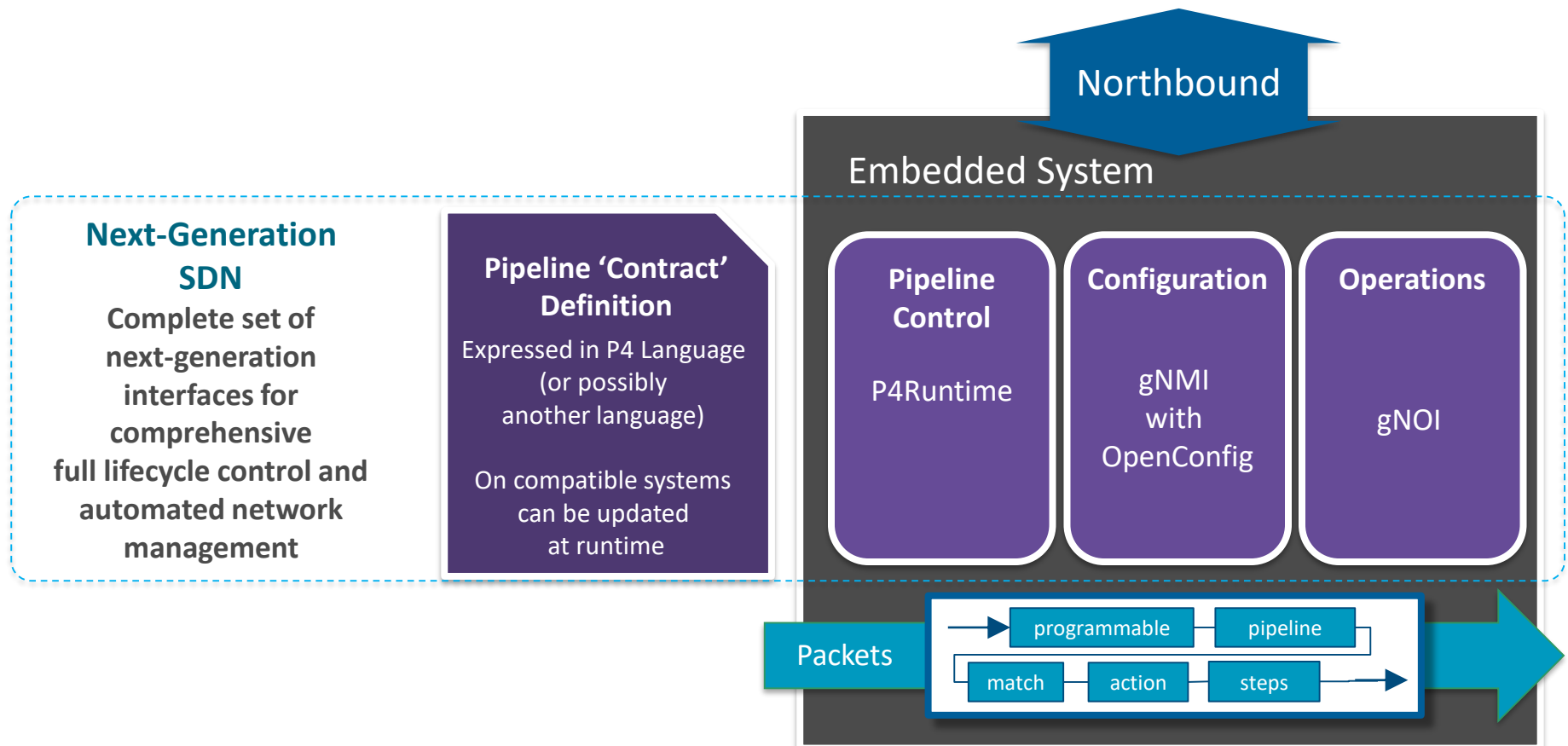
What have we learned? How can we improve on OpenFlow?

OpenFlow

- Addressed 1 of the 4 major areas needed for complete 'software defined' management & control
 - OpenFlow only provides pipeline control
 - Pipeline definition is typically in silicon vendor specs
 - Config & operations not addressed
- Used traditional standards process
 - Not 'software defined'
 - Very long innovation cycle
- Operators found challenges:
 - Proved to be non-deterministic
 - Specifies Match, not Actions
 - Each data plane has differences
 - Hard to deploy latest switching silicon innovations



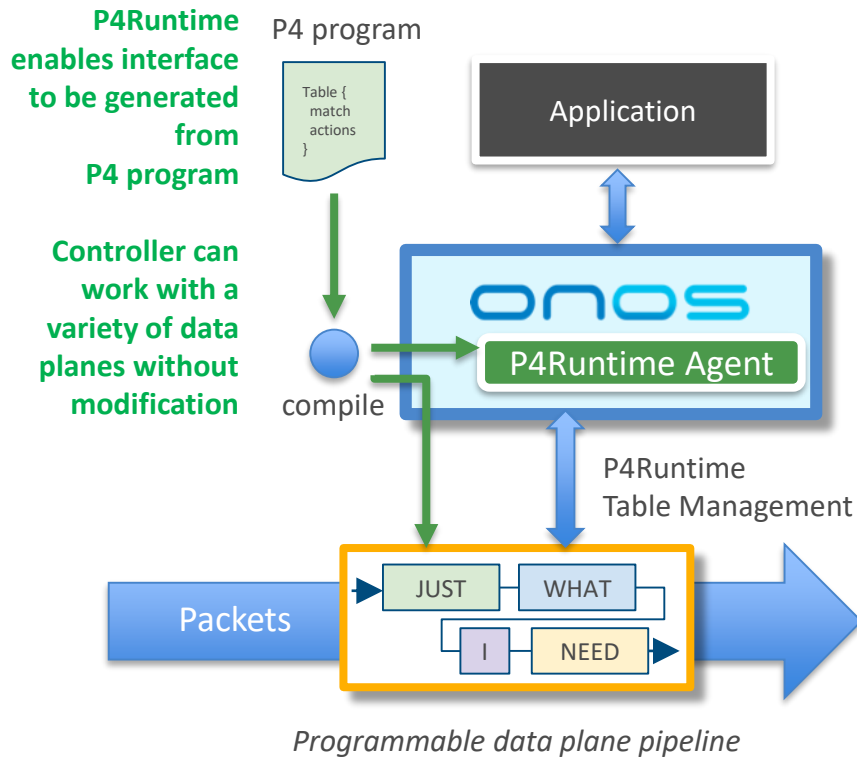
Next-Generation SDN Interfaces



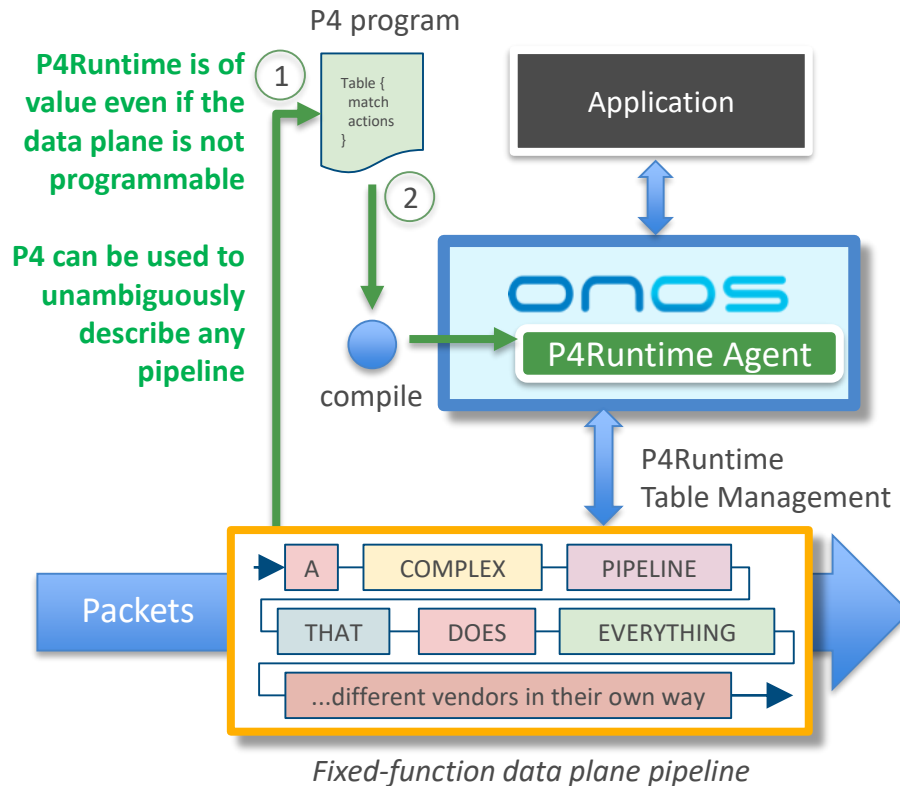
P4Runtime – works with programmable and fixed pipelines



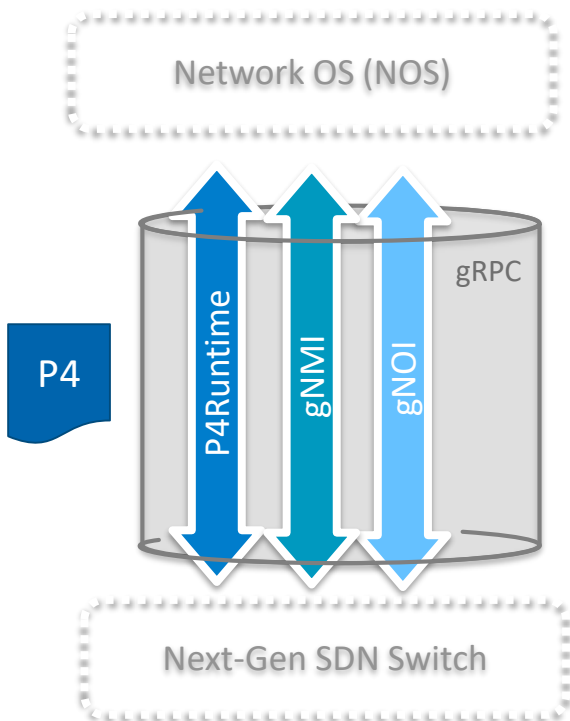
Programmable Pipeline



Fixed Pipeline



Next-Generation SDN Interfaces

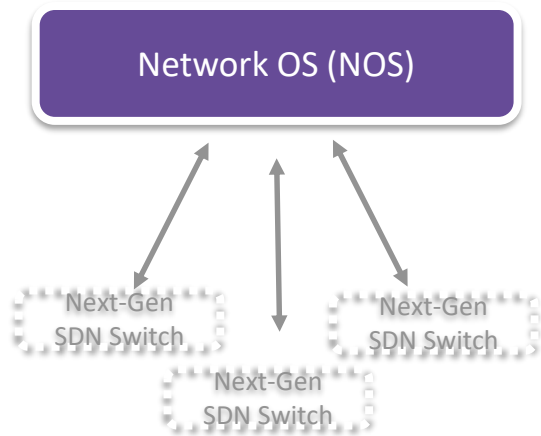


- P4 (for pipeline definition)
 - Defines the logical pipeline behavior that is silicon-, pipeline-, and pkt header-agnostic
 - Defines 'contract' between NOS and data plane
- P4Runtime (for pipeline control)
 - Message payloads derived from P4 program defining the pipeline
 - Allows for run time changes to the contract on systems with programmable silicon
- gNMI using OpenConfig models (for configuration)
 - Manage configuration (with persistence across reboots)
 - Stream telemetry
- gNOI (for operations)
 - Autonomous actions for debugging and operating a production network
 - Device reboots, key management, BERT & ping testing

All running over gRPC, which has many advantages:

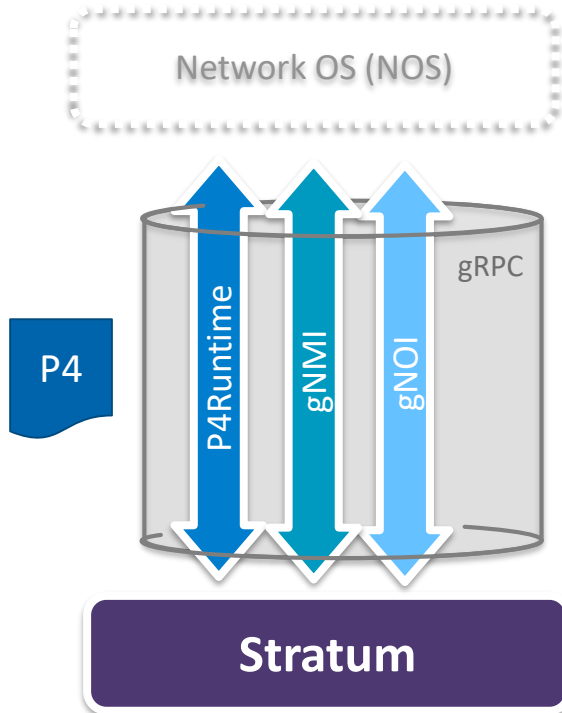
- Built on HTTP/2 for a high speed, bi-directional streaming, multiplexing, security
- Uses ProtoBuf, supporting many more languages and optimized for low latency

Benefits of a Centralized NOS



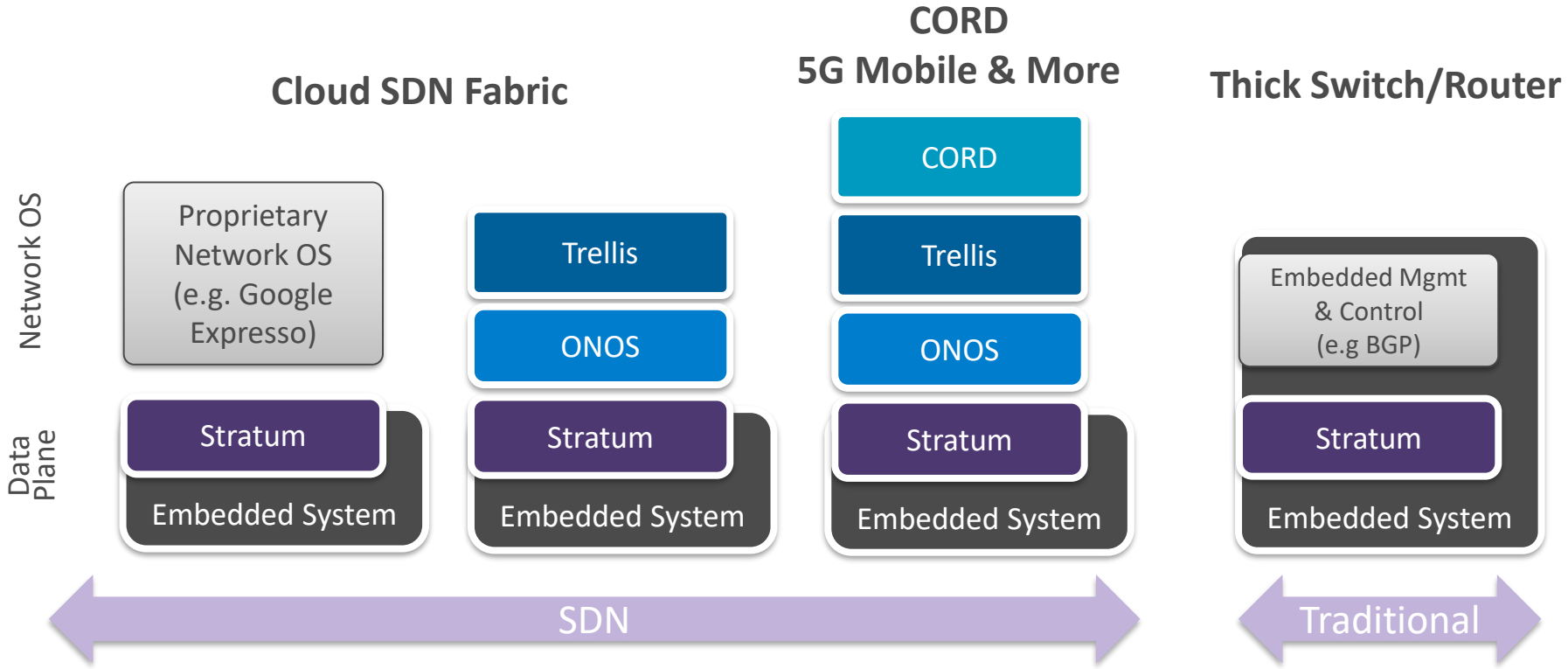
- Centralized NOS gets a complete and up to date view of all:
 - Forward state
 - Configuration state
 - Connectivity and end-to-end flow state
 - Performance status
- With a global view, one can build a tool chain to do:
 - Network Verification
 - Network Debugging
 - Change Management – verifying a change won't break anything
 - Lifecycle Management – bring-up, apply config, upgrades, rollbacks, etc.
- Intent-based networking then becomes possible:
 - Operators define policy
 - Proposed changes are calculated
 - Automatically generate flow table and configuration change
 - Before applying, verify how changes would affect the network
 - Apply changes, with ability to perform automated rollback
 - Verify changes are having desired affect

Stratum: Open Source Thin Switch Implementation



- Open Source streamlined implementation for a thin switch
- Implements next-gen SDN interfaces northbound to NOS
- Supports full lifecycle necessary for control and management
 - Configuration
 - Control
 - Operations
 - Optional pipeline programmability
- NOS could be external or embedded in the same switch

Stratum Use Cases



Stratum Goals

- Primary Goal - Interoperability
 - ‘Contract’ between the Network OS and data plane so behavior is deterministic
 - ‘Contract’ in code (unlike a PDF standard), eliminating ambiguity
 - Automated verification of the ‘contract’, to make it easy to deploy latest technologies
 - Complete set of interfaces for full lifecycle control and management
- Secondary Goal - Full pipeline programmability
 - Make it possible to create highly optimized custom ‘Contracts’
 - Each operator can specify in detail what they require

Stratum Benefit for Vendors

Next-Generation SDN Enables

Silicon and Box Vendors

to Bring More Value to Network Operators

with Reduced Time-to-Market and Reduced R&D

Stratum Timeline

- Incubation – 2018
 - Project Members have full access to code
 - Others can join with FTE resource commitment
- Open Phase – Expected Early 2019
 - Open Sourced
 - Apache 2.0 license
 - Expecting a Complete Ecosystem when Released:
 - Multiple interoperable solutions (including support on some legacy systems)
 - Variety of silicon options
 - Selection of white box suppliers ready with shippable product

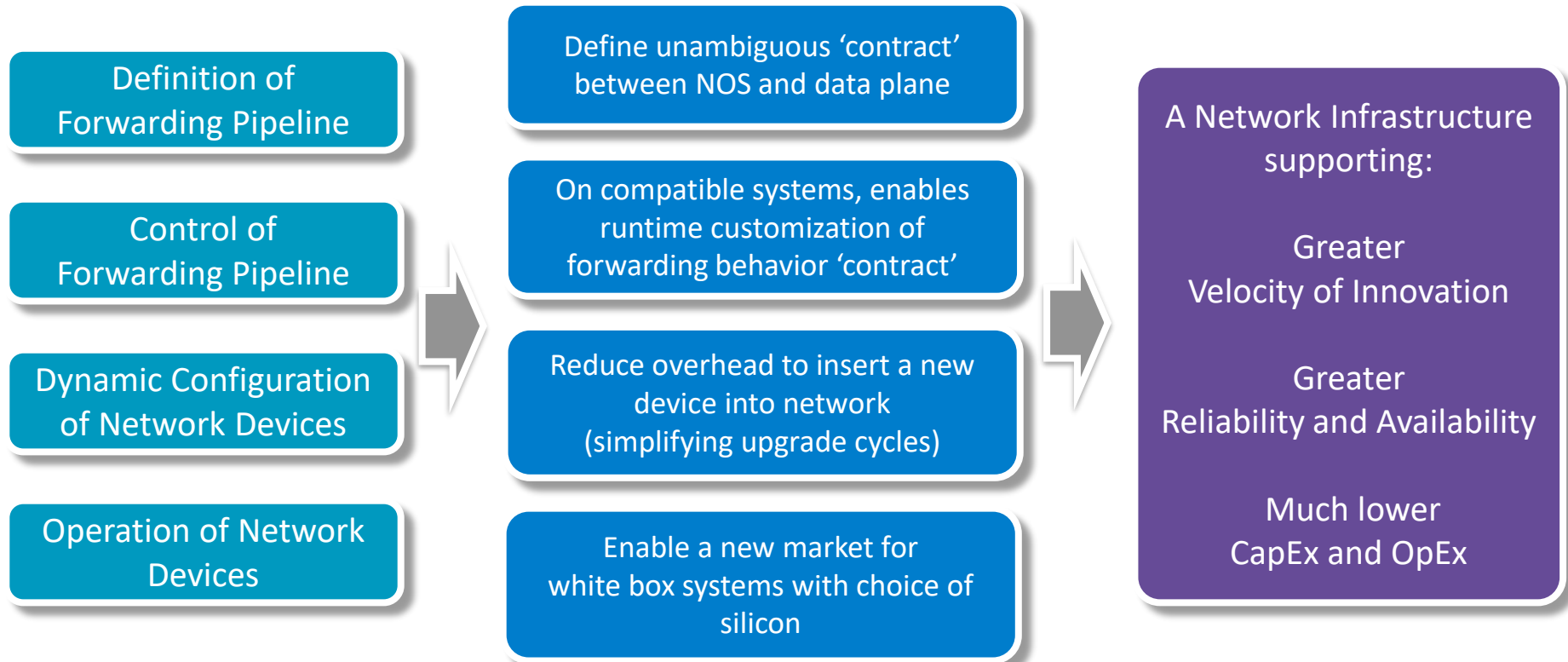
**Google has stated
they plan to take
Stratum into
production at scale
in 2018**

Realizing Full Potential of Software Defined

Software Defined

Enable Network Operators To

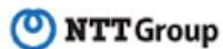
Net Result



Cloud Providers



Telecom Operators



Networking Vendors



White Box ODM Vendors



Silicon Vendors



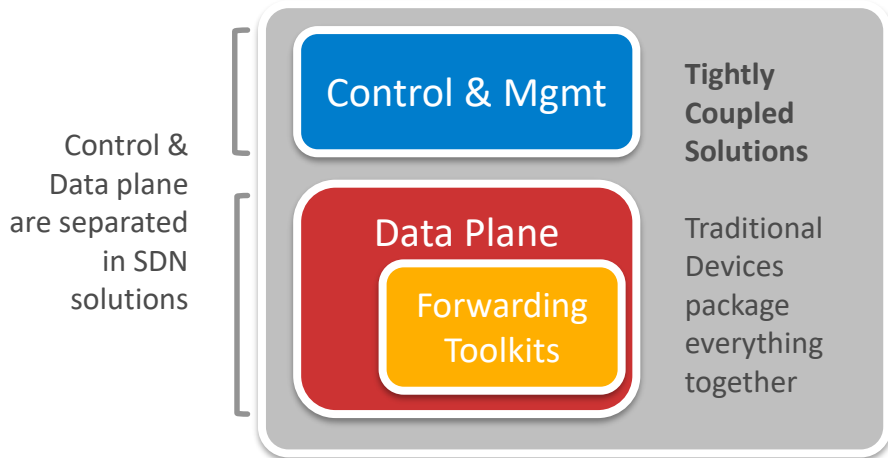
Other Open Source Projects



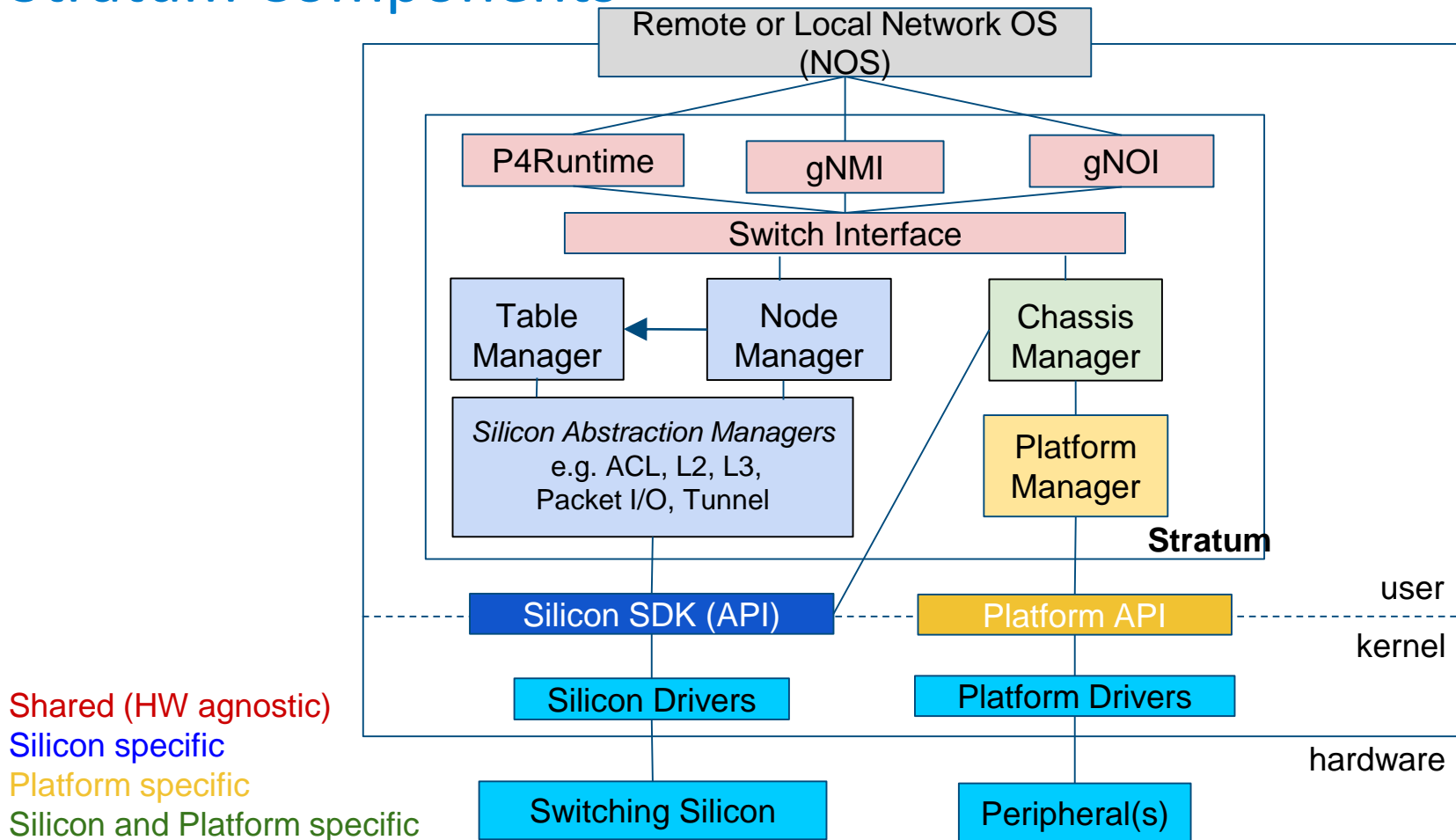
Backup

Understanding Landscape of Open Switching & Routing Projects

- Control & Management
 - FRR (replacing Quagga) – Routing protocols
 - ONOS – External Network OS (SDN Controller)
 - ODL – Centralized configurator for traditional networking devices
- Data Plane
 - ONL
 - **Stratum**
- Forwarding Toolkits (Silicon APIs)
 - SAI
 - SDKLT – New Broadcom project
- Traditional - Tightly Coupled Solutions
 - dNOS – Management and routing protocols
 - SONiC – Management & Routing, using SAI



Stratum Components





Thank You