Next-Generation Access Networks

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Agenda

- **Next-Generation Networks**
  - ▶ Open Source Evolution
  - ▶ Operators' and Suppliers' Motivations and Challenges
  - ▶ SDN and NFV Motivations and Challenges

- **Introducing Next-Generation OLT → OpenOLT™**

- **Company Introduction**

Next-Generation Networks

Open Source Evolution
Operators' and Suppliers' Motivations and Challenges
SDN and NFV Motivations and Challenges

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Open Source Evolution

- Open Source concept was introduced several years ago with the primary focus on SW

- Today, Open Source concept has extended beyond SW to HW, Mechanical, FPGA, etc.

- At least one tier-1 operator in the US is actively promoting "Open Source Catalog" that includes SW, HW and Mechanical modules. Their goal is to enable their network operation groups to mix and match modules from the "Open Source Catalog" to optimize network performance, OPEX and CAPEX

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Operators' and Suppliers' Motivations and Challenges

▶ Operators' Motivations

- Cost Reduction (especially OPEX)
- Programmability (inventing and offering new services as market opportunities emerge)
- Flexibility (vendor agnostic and interoperability, competition among suppliers resulting in CAPEX reduction)

▶ Operators' Challenges

- Ecosystem Readiness (Open Source Catalog)

▶ Suppliers' Motivations

- Access to much larger market and revenue (different types of customers)
- Partnerships and close collaborations with Operators (new product and solution emergence)

▶ Suppliers' Challenges

- Commodity market, lower margins, profits to be made on high volume

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SDN and NFV Motivation and Challenges

Operator's Expected Values

Network OPEX
Resource Utilization
Policy
Operation
Complexity
Management

PMO
Fixed
Pre-Defined / Static
Manual
Fat & Monolithic
Domain - Specific

FMO
Scalable
Cognitive
Automated
Lean
End-to-End

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Next-Generation OLT: OpenOLT™

Virtualized Access Network

PMO

FMO

PON Ports   Ethernet Ports   PON Ports

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Next-Generation OLT: OpenOLT™
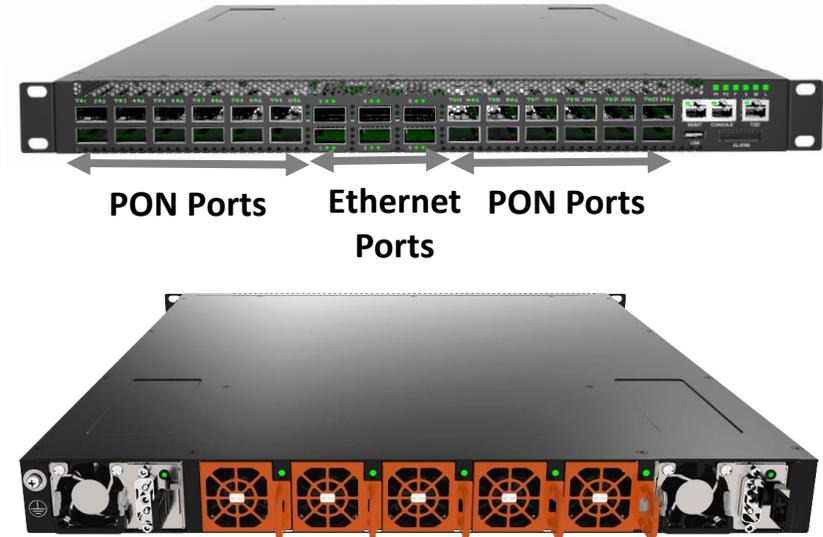
PON Ports   Ethernet Ports   PON Ports
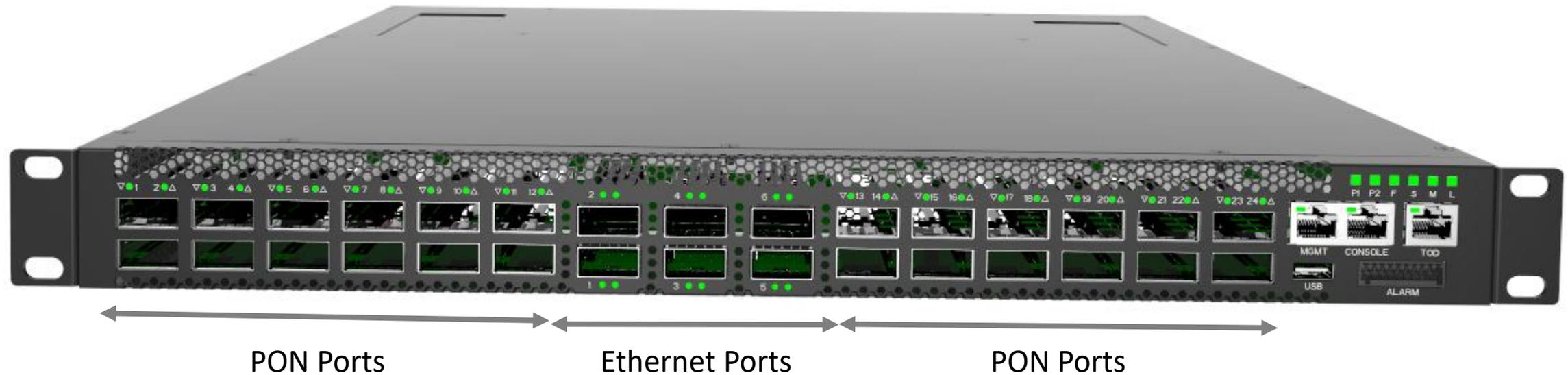
MODEL	CONFIGURATION
24P XGS-PON	24x10G PON ports 6x100GE QSFP28 Ethernet Ports

Major Features

o   HW-only or bundled with SW to support different customer applications

o   Open APIs (e.g., OpenFlow and NetConf) to enable SDN / NFV integrations

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## OpenOLT™ - Mechanical Design

Fans

- Redundant hot swappable fan modules (4+1)
- Color coding to indicate airflow direction

Label	Color of fan module
AIR OUT	Orange

PSUs

- Two models: i) AC and ii) DC
- Redundant hot swappable power supply modules (1+1)
- LED per power supply to indicate status
- Chassis Grounding for both models
- Color coding to indicate airflow direction

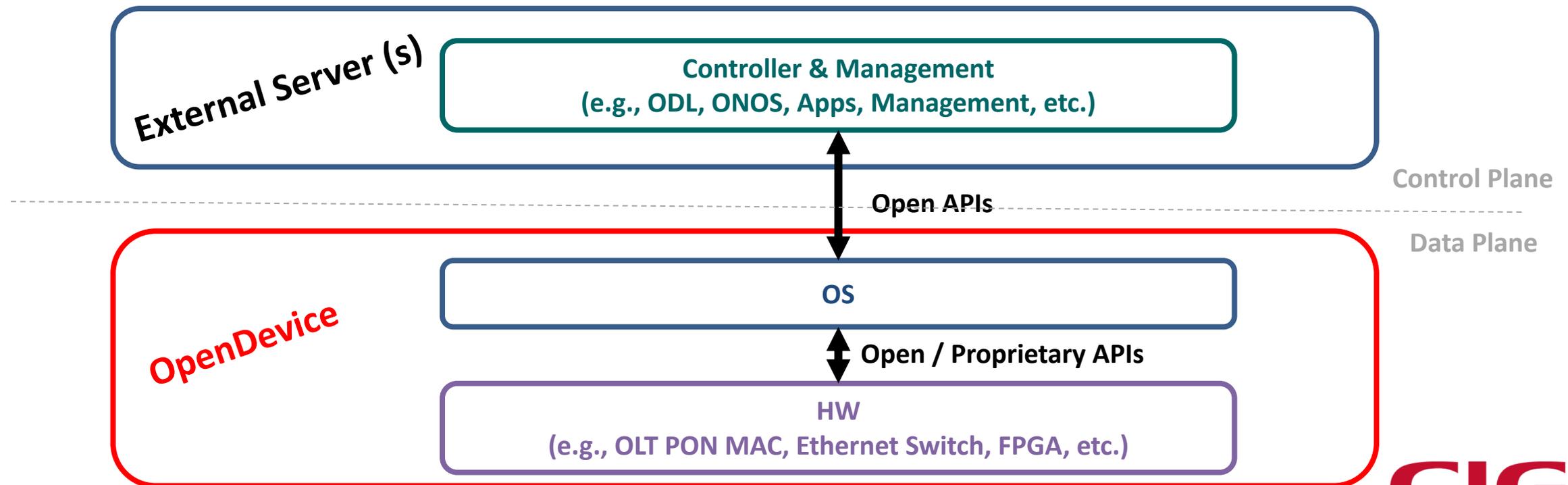| Label	Color of fan module
AIR OUT	Orange

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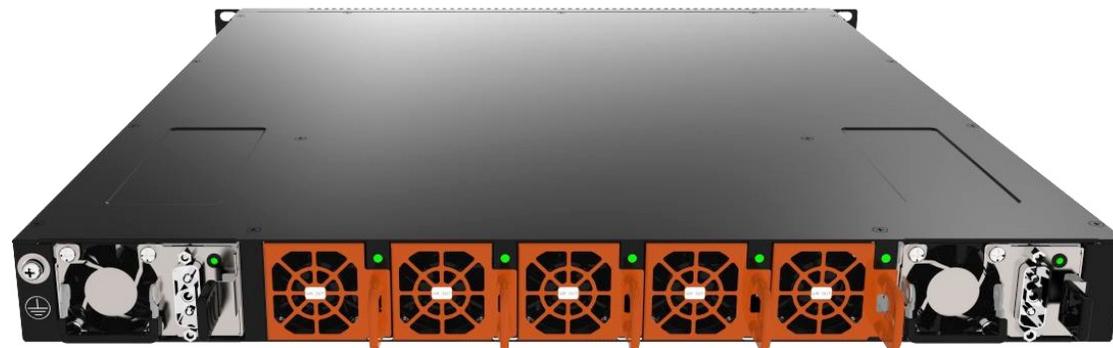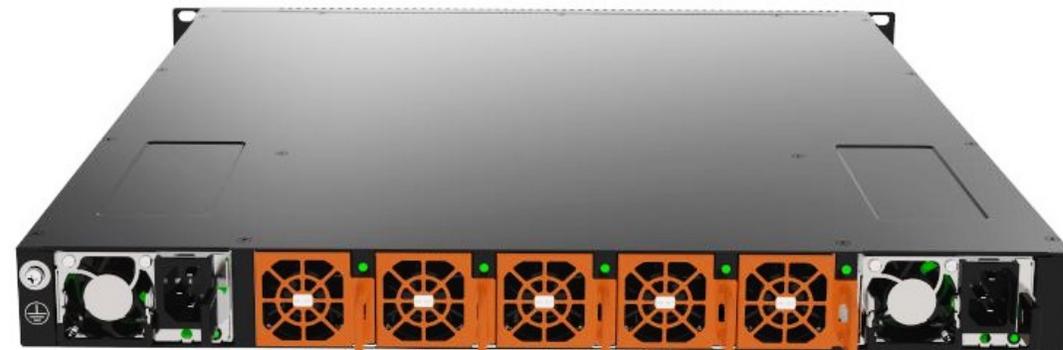
Next-Generation OLT: OpenOLT™
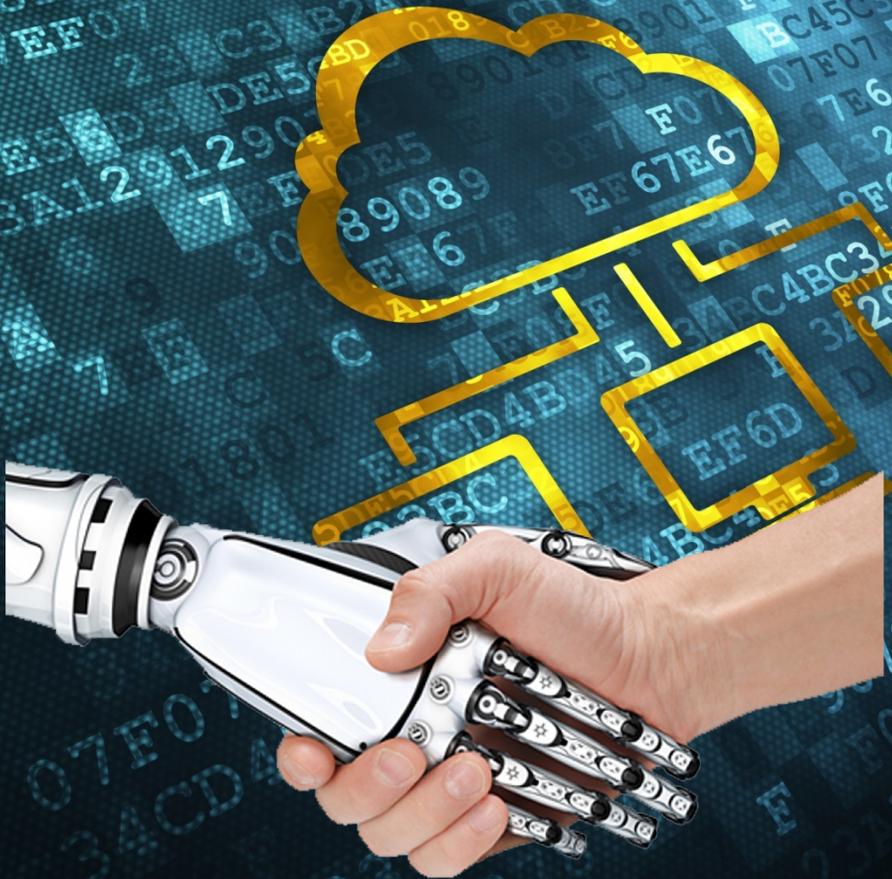
OpenOLT™ - Major Features

- 24 x XFP XGS-PON + 6 x 100GE port
  - ▶ G.9807.1 10G PON MAC
  - ▶ Up to 256 ONTs / 2048 service flows per PON port
- **Non-blocking line-rate architecture** to forward packet flows at wire speed on all ports
- **Deep packet buffers** for high-speed packet processing
- **Flexibility** to define a wide range of match-action table processing (OpenFlow 1.3+ multi-table pipelines)
- **Interop with various SDN controllers** (OpenDaylight and ONOS) to program match-action tables in real-time via the out-of-band OpenFlow 1.3+ channel
- **Guaranteed fast failover** (link or device) by supporting large number of flow mod / sec
- **High-performance processor** to ensure device's stability and OpenFlow control plane performance

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Next-Generation OLT: OpenOLT™

▶ SW agnostic solution

▶ Support 3ʳᵈ Party OS

▶ Implement standardized bootloaders, e.g., Open Network Install Environment (ONIE)

External Server (s)

Controller & Management
(e.g., ODL, ONOS, Apps, Management, etc.)

Control Plane

Open APIs

Data Plane

OpenDevice

OS

Open / Proprietary APIs

HW
(e.g., OLT PON MAC, Ethernet Switch, FPGA, etc.)

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Company Introduction

Company Introduction

- **Founded in 2006 (Shanghai, China)**
  - ✓ R&D (600+ engineers) in China and USA (Silicon Valley – growing!)
  - ✓ Manufacturing personnel (1500+) in China + Sister partner in Germany
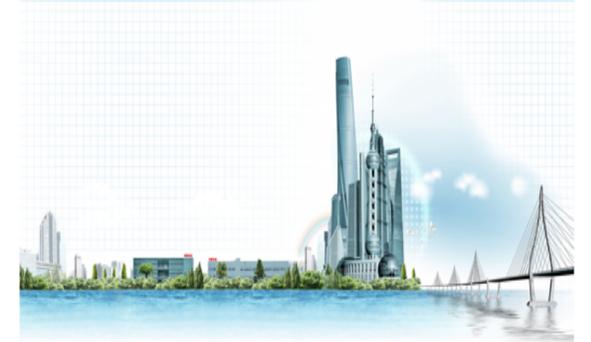- **Company Focus:**
  - ✓ R&D Innovation
  - ✓ High Product Quality
  - ✓ Superior Customer Support
  - ✓ 2016 Broadband Access Terminal Shipment (global): 30M+ units
- **Networking Technologies**
  - ✓ Optical and Copper (ONT, OpenOLT™, ROADM)
  - ✓ SFP / Transceivers, Carrier Ethernet Switch
  - ✓ xDSL, G.fast, G.hn, MoCA…etc.
  - ✓ Wireless (Home-networking Wi-Fi, LTE femtocells…)
- **Dark Factory (Lights-Out) Manufacturing Methodology**
  - ✓ Strong commitment to manufacturing, process development and quality

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- **Leading ODM / JDM / OEM networking vendor**
  - ✓ $500M+ Annual Revenue (IPO Shanghai Exchange November 2017)
- **Domain expertise Carrier and Enterprise-grade communications systems**
  - ✓ Broadband Access (copper and fiber)
  - ✓ Carrier and DC Ethernet Switches
  - ✓ Optical Technology (ONTs, OLTs, Transceivers, etc.)
  - ✓ Gateways (home and enterprise)
  - ✓ Wi-Fi and LTE Wireless Access (carrier and enterprise)
  - ✓ IoT (residential and industrial applications)
- **Software/Firmware Team**
  - ✓ System SW, Device FW, Software Quality and production test SW development
- **Mechanical Design Team (3D Modeling, Thermal Analysis, DFM)**
- **Expertise in DFx (DFM, Production Test, SFC, ERP, SPC)**
- **US Headquarters** (75,000 sq. ft. in Santa Clara, CA)
  - ✓ R&D, Sales, Marketing and Customer Support teams based in Silicon Valley

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Company Introduction – continue

- **Deep investment in production automation**
  - ✓ Complete end-to-end manufacturing automation
  - ✓ Design for automation is required for high volume products
- **RFID-based end-to-end information system**
  - ✓ 100% incoming inspection on all components
  - ✓ Traceability for all components lot codes through work orders to individual product unit serial numbers.
- **Economy of volume manufacturing for small quantities, MOQ: 3K**
- **High quality manufacturing process achievements**
  - ✓ Quality awards from major customers in the US and China
  - ✓ High quality scores from US tier-1 carrier
- **Highly skilled manufacturing workforce + Sister partner in Germany**

> High Quality Product Design and Superior Manufacturing lead to lower costs and higher Quality products for our customers

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A few of our Customers

▶ ODM / JDM Customers

▶ End Customers (via ODM / JDM)

Thank you

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