ODTN, Open Disaggregated Transport Network

Status, Current work, Roadmap
Collaboration with TIP OOPT

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Clear ask from operators

Open Source Data Center Interconnect (DCI) Solution

1. Open and Standard APIs to be vendor neutral and modular.
2. Open Source Software
3. Rapid cycle of innovations can happen in terminal equipment (Transponders)
4. Clear separation of the behavior of the transponder and the line system (OLS)
5. Enable Services to be rapidly created, prototyped, tested
6. Support OLS that transport any kind of signal (Alien Wavelengths)
7. Modular and production ready platform
8. CI/CD pipeline for DevOps environment
Disaggregated Transport Networks

- Vendor Proprietary Network Controller
  - Proprietary and closed API
  - Vendor-specific data model
  - Vertically integrated
  - Single vendor

- Open Source Network Controller
  - Open and standard API
  - Common data models
  - Multi vendor
  - Disaggregated
ONF Projects & Platforms

Mobile Services
Mobile

Enterprise Services
Enterprise

Residential Services
Residential

XOS

Trellis

ONOS

Stratum

ODTN

ORAN
Radio Units

VOLTHA
PON OLTs

Shared Cloud Infrastructure

( Core)
Incremental Approach

ODTN gets developed one step at a time through:

- definition of use-case
- choice of common API(s) to achieve given use-case
- implementation in ONOS
- test, debug and trials

Each phase builds on top of the previous one with new and further enhancements
SDN and Disaggregation in Optical Transport Network

• Save Capex and Opex in Data Centre Interconnect deployments
• Rapid production adoption of innovations in terminal equipment
  • Enable vendors to innovate: speed, reach, QoT, …
  • Let operators reap benefits through simple bookending
• Better LCCA (Life Cycle Cost Approach) and optimize equipment life-span
• Future proof your network avoiding vendor lock-in
Open APIs

Only **Open APIs with public models** will be used.
Reach industry consensus and agreement on Open and Public APIs

Open and Standard API:
- provide **layers of abstractions**
- enable **plug and play**
- mandate interaction between software and hardware
- **mix and match** of components
- **multi-vendor** integration
Topology at Telefonica Lab (madrid)

- 2x Edgecore Cassini TXs with Lumentum ACO Cards
- 2x ZTE Transponders
- 2 x ADVA Transponders
- 1x ADVA OLS
ODTN Capabilities

1. Discover optical topology with details (devices, ports, links)
2. Expose topology details on the northbound TAPI API
3. Receive TAPI connectivity requests from an OSS/BSS on NB
4. Automated compute of end to end optical path with lambda
5. Install configuration for optical path to OLS controller and Transponders line side
6. Transponder cross connection for client to line side connection
7. Power configuration on line side ports (manual)
8. Modulation configuration on line side ports (manual)
9. ONOS is deployed in a three node instance for resiliency and failover

Vendor independent optical configuration and management workflow(s) based on Open APIs and Open source Software
ODTN Interaction

$onos <controller_address>
REST APIs: <onos-ip>:8181/onos/v1/docs/
UI: <onos-ip>:8181/onos/ui
Resilience and Failover

One of the onos Instance in a cluster is master of a given device (TX, OLS)

If that instance goes down another master is elected → device still managed
Current ODTN Architecture (ROADMS)

ODTN includes a complete OpenRoadm 2.2 driver

Mesh/ring ROADM network made of N ROADMS and N transponders (N≥2)
Topology at ONF Connect

- 2x Edgecore Cassini TXs with Lumentum ACO Cards
- 2x Groove G30 Infinera
- 2 x Lumentum ROADM-20
Joint Collaboration through Open Optical Packet Transport (OOPT) and Open Disaggregated Transport Network (ODTN)
Announced at OFC 19

What is TIP?

Telecom Infra Project (TIP) is a collaborative community accelerating and transforming the way telecom infrastructure is created, taken to market, and deployed.

Together We Build
TIP
Open Optical & Packet Transport

Our goal is to accelerate innovation in optical and IP networks and ultimately help operators provide better connectivity for communities all around the world.
OOPT - General Overview

Current Areas of Focus

- **Use Case Validation**
- **Programmable Interfaces**
- **Simulation**
- **Optical and IP Devices**

Diagram:
- Cell Site Gateway
- Optical Transponder
- Mux/Demux
- Amplifier
- Mux/Demux
- Optical Transponder

Together We Build

FOUNDED IN 2016

What is TIP?

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OOPT - General Overview

Current OOPT Technologies

Odyssey-DCSG

Voyager

Cassini

TAI

GNPy
ONF TIP Collaboration

Collaboration **Benefits and Goals**

1. **Reduce duplicated effort** in Optical Disaggregation
2. **Share** knowledge, resources, findings and development
3. Discuss and achieve a stronger industry **consensus in APIs and solutions**
4. Stronger **impact** and accelerate **trials** and **production deployments** of complete white box hardware and open source software in optical networks.
5. **Common test labs**
ONF ONOS Integration with TIP Cassini

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<th>ODTN / ONOS</th>
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<td>OpenConfig</td>
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<td>Network Operating System</td>
<td>OcNOS TAI</td>
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<td>ASIC ACO DCO</td>
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200G Coherent DSP (ExaSPEED 200)

ACO line card (NTT Electronics設計)
Project synergies

ONF brings network wide controller, SP requirements and API definition (tapi, Openconfig)

TIP brings open hardware, Optical module and component expertise, TAI, and optical network planning tool (gNPY)
ODTN with Stratum and Trellis

- P4Runtime
- OPENCONFIG
- STRATUM
- SDKLT
- TAI
  - libtai.so (for vendor B)
- BRCM Tomahawk +
- Transponder B
- TAI
  - libtai.so (for vendor B)
- Transponder B

ODTN + Trellis

vendor B
ODTN Roadmap

3 months time frame
1. FEC
2. OSNR retrieval
3. GUI extension with more information and parameters
4. Testing for an automated CI/CD with regression testing

6 months time frame
1. End to end Power configuration workflow with OLS negotiation
2. Platform hardening
Current and committed ODTN Work

1 year (and more) time frame

1. Alarms
2. Expanding pool of Transponders (Adva, Fujitsu, ZTE)
3. Expanding Pools of OLS/Roadm
4. Integration with Optical planning tools (gNPy)
5. In band control

- Mar. 2018
- Sept. 2019
- Jan. 2020
- March/April 2020

- P2P, TX + OLS/ROADM Resiliency, Power, Modulation
- P2P, TX + OLS/ROADM FEC, OSNR, GUI, Tests
- P2P, TX + OLS/ROADM E2E Power, E2E testing, Hardening
Trial Plans

ODTN is in different stages of lab/field trial with multiple operators with different vendors
Evaluation scenarios

1. Metro: Optical layer 1 interoperability with OEM O-SNCP devices.
2. Longhaul: Optical layer 0/1 reach performance in 100G and 200G mode.

Possible Extension of trial with OLS (Huawei) Feb/March ‘20
Community

Great Exemplar Platform Community, Thanks you!

Still lots to do, come and join us!

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Reference Design

Informational reference Design published April 2019

Use Case, API and project milestones definition


Please do provide comments and thoughts at

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or

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Takeaways

- ODTN is building, with the help of partners and collaborators, an open source software stack for optical networks
- ODTN Uses standard and open device APIs (OpenConfig for Transponders, TAPI for OLS, OpenROADM 2.2 for ROADMs)
- ODTN uses TAPI as a standard and open API on the northbound
- ODTN leverages architecture, performance e scalability of ONOS
- ODTN integrates a wide variety of vendors for network equipment.
- Incremental approach towards production readiness
- Lab trials with major operators → feedback loop of requirements and enhancements
- OOPT(TIP) and ODTN(ONF) create a common open source optical ecosystem with strong industry consensus
ONF’s 2019 Contributor Award

Designed to recognize **top ONF Community members** who are:
- Top Code Contributors (or Code Removers)
- Top Reviewers and Mentors
- Top Ambassadors or Advocates
- Contributors of Significant Components of a system
- Consistently "chopping wood and carrying water" (helping everyone be more productive)

Alessio Giorgetti  Ramon Casellas  Quan Pham Van  Konrad Mrówka  Andrea Campanella
Useful Info

ODTN Wiki: https://wiki.onosproject.org/display/ODTN/ODTN

Still lots to do, come and join us!

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Questions?

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Thank You
Why OpenConfig for TX

- Well know API
- Supported already by many vendors
- Proper abstraction model for transponder devices capabilities and information
- Defines capabilities at correct level for programmability but also abstraction from physical details
- Capability and Flexibility to support vendor specific features
- Can represent both multi-layer w/ and w/o OTN
- Extensible and Open Source
Why TAPI for ONOS Northbound and OLS?

- Well know API
- Extensible and Open Source
- Tested and deployed (See Interop Testing)
- **Proper abstraction** for high level optical domain programming
- Can represent both **multi-layer** end to end provisioning with optical parameters
- Great community of vendors and Service Providers
ODTN workflow and Capabilities

Service Provisioning

1. **OSS/BSS requests connectivity-service with TAPI**
2. Connectivity services and provisioning config is stored in distributed Maps for redundancy and failover
3. ONOS translates into **Optical Intent and TX configuration**
4. provisions a connectivity service through **TAPI** on OLS
5. Logical channel (cross-connection from client to line side) and wavelength Tuning through **Openconfig** on Transponders
Where ODTN Fits into Open Source Ecosystem

ODTN is the a carrier-grade optical transport open source project

open source software stack for control and management of optical networks

This ecosystem is poised to deliver robust solutions over time, from white box peripherals to orchestrated end-to-end solutions
Power Setup workflow

1) Retrieve target-power/range from RX transponder, also transmitting capabilities on TX Transponder
2) Request path computation to OLS with Transponder RX target-power range min/max and TX range min/max (from 2.2 TAPI → range target output power on SIP)
   a) If path computation success -> 3, 4 → answer need to contain a target power
   b) if path computation fail for power budget -> re-tune RX target-power transponder if possible -> 2
3) Configure wave and power on transponder TX. Power is the value returned from OLS.
4) Connectivity service establishment on OLS with constraints on min/max
Open Source Optical Simulation tool

Currently working in offline mode, with manual feedback to controller

Feedback loop with ONOS gathering information on current networks, through open and common API (TAPI)

Physical Simulation Environment (gNPY)