ONF Core Model

Introduction to models, guidelines and tooling from
ONF Open Information Model & Tooling project

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ONF Open Information Modeling and Tooling (OIMT) Project
- Core Information Model - TR-512 v1.4
- Technology agnostic core modeling framework – patterns and methods

OTCC sub-Project – Transport API (TAPI)
- CIM pruned and refactored for Transport SDN NBI
  - *K. Sethuraman Presentation Wed. 2:30pm ODTN Track*

OTCC sub-Project – Open Transport Info. Modeling
- Models for wireline transport technologies
- Ethernet, OTN, Photonic Media Models

OTCC sub-Project – Wireless Transport model
- CIM-aligned models for wireless transport – TR-532
- PoCs testing interoperability of TR-532 implementations
  - *L. Ong/T. Brakle Presentation Tue 5:30pm Mobile Track*

OTCC sub-Project – Device Management Interface Profile
- Profile/Requirements for Netconf – TR-545
- Interoperability Requirements based on PoC Testing
Modelling SDN

The Core model provides a standardized implementation neutral representation of things and the relationship between those things in the SDN problem space

• Network functions. Model focus:
  § Virtualized termination/forwarding in any network
• Physical Equipment supporting the network. Model focus:
  § Field Replaceable Units (FRUs), non-FRUs, strands etc.
• Control functions supporting the network. Model focus:
  § Representation of functions related to closure of control loops
  § Presentation of views of the resources for the purpose of control
• Processing functionality supporting/using the network. Model focus:
  § Any abstract function
• Resource/System/Scheme specifications. Model focus:
  § Constraints, rules and specs for the of the overall systems
• Software supporting the control
  § Files, Installed Software, Containers, VMs,

Most recent focus has been on Analogue Guided Media networks, using photonic networks as the key application.

TR-512.A.4 provides the explanation of the use of the Core Model for photonic networks.

This work has been used extensively by OTCC and Facebook TIP
Model to create a common language

- **Goals:**
  - A well defined widely applicable representation of the semantics of managed network functionality that is lightweight, has a modular architecture and is technology/technique agnostic
  - Reduce the formation of overlapping inconsistent implementations which hinder overall progress

- **Approach:**
  - Leverage industry best-practices, patterns and tools to close the model to implementation round trip loop
  - Use Agile modelling methodology to construct a formal model using Papyrus UML
    - A graphical modeling language highlights underlying patterns
    - The environment provides a framework for:
      - Development of understanding about control of networks
      - Capturing a representation of the understanding
      - Maintaining growing insight
  - Promote Core Model use/extension

- **Use:**
  - Derivation of Interface/database models using generators to generate consistent artefacts in JSON, Yang etc.
Canonical network model (virtualized/functional):
Forwarding, Termination and Topology

Derived from ITU-T and TMF work
From TR-512.2

Model for any networking, for any network technology, with any degree of virtualization, at any scale, at any abstraction and in any interrelated view.
Using the model entities to represent photonics at all scales gives a consistent model regardless of the degree of aggregation etc.
 Canonical physical model

Represented truly physical things, i.e., things that can be measured with a ruler.

Derived from ITU-T and TMF work

From TR-512.6

Model for any physical components that are rack/cabinet/shelf based or stand-alone in a data center or telco environment.
Strong separation of concerns of physical from functional yields a model that deals consistently with a wide range of physical structure.
Model of generalized processing and constraint

From TR-512.11

Follows the Component-Port and Component-System patterns

Model for any arbitrary functions/constraint, views of abstractions of functions/constraints, interconnection of functions to networking.
Association between physical and functional model

CD provides boundary around equipment to represent NE/Device/Controller etc

PC represents Equipment functional boundary grouping PCs

Functions emergent from complex processing represented by PC

Derived from ITU-T and TMF work

Basis for model for the understanding of the physical realization of functional things (regardless of how “virtual” they are).
Model of control access and view

From TR-512.8

ViewMapping provides the relationship views defined by CD that are offered through different ExposureContexts.

CD groups/constrains any structures including ControlConstruct.

ControlConstruct provides access via its ports to enable observation/control. ControlPort provides the messaging/signalling.

The ControlPort is bound to LTP allowing control messages to enter the network.

ExposureContext provides definition of what is exposed through a ControlPort using ConstraintDomain (and hence including ControlConstruct).

Model for the control functions in the network, for control of those control functions, and modelling of Control itself, for control of the Controller.
Other further key coverage in TR-512 V1.4

- Replacement of the NE and the SDN Controller with a uniform model of ControlConstruct, ExposureContext and ConstraintDomain [TR-512.8]
- Model of Control of Switching etc. using the ConfigurationAndSwitchController (CASCC) [TR-512.5]
- Component-System pattern and Component-Port pattern [TR-512.A.2]
- Augmentation via decoration defined by machine readable specification [TR-512.7]
- Modelling of Software [TR-512.12]
ONF Tooling evolution

- **2005**
  - TMF SID
  - NVP extension
  - CORBA IDL & XSD
  - OssJ
  - Java & XSD
  - Tooled Generation

- **2011**
  - TMF TIP
  - TMF MTNM / MTOSI
  - Manual P&R
  - Tool Assisted P&R
  - Mapping
  - Tool Assisted P&R
  - Mapping
  - Manual process
  - Tool assisted process
  - Model migration
  - Experience, lessons, insight

- **2017**
  - ONF IM
  - ONF Spec Approach
  - Tool Assisted P&R
  - Tool Assisted P&R
  - Mapping
  - IBM RSA (Eclipse, Proprietary)
  - TigerStripe (Cisco, Open Source)
  - Papyrus (Eclipse, Open Source)
  - IISOMI (Java Script, Open Source)
ONF Core model to TAPI and WT models

- WT model is pruned from the Core model
  - The classes are unchanged in name and scope
  - Some classes/associations/attributes have been removed
- TAPI model is pruned and refactored from the Core model
  - The figure sketches the more complex relationships
  - The model is pruned in a similar way to WT
  - Some classes from the core are split
    - E.g., FD becomes Node and Topology in TAPI
  - Some classes are cloned and narrowed
    - E.g., FC becomes Connection and ConnectivityService
  - Renaming of classes is carried out to assist adoption in the application context
Ongoing work update

• Continue work with other bodies
  ▪ MEF
  ▪ OASIS-TOSCA
  ▪ ONAP
    ▪ ITU-T (publish TR-512 as G.7711)
    ▪ TMF (in the process of adopting TR-512.2, TR-512.4 and TR-512.7 in place of the TMF SID 5LR model)
  ▪ TIP
    ▪ ITU-T/IEEE/MEF on Ethernet, OAM etc.

• TR-512 v1.5
  ▪ Adopting the OAM model from TAPI
  ▪ Enhancing the resilience model
  ▪ Refining the Entity lifecycle

• TR-512 v 2.0
  ▪ Consider adding ports to the LTP
  ▪ Consider restructuring the model packaging
• Core model: TR-512 V1.4 (November 2018)
  • V1.4 can be found at https://3vf60mmveq1q8vzn48q2o71a-wpengine.netdna-ssl.com/wp-content/uploads/2018/12/TR-512_v1.4_OnfCorelm-info.zip
  • See also https://www.opennetworking.org/software-defined-standards/models-apis/
• TAPI: V2.1.0
  • https://github.com/OpenNetworkingFoundation/TAPI
• Microwave model
  • TR-532 documents the model (see https://www.opennetworking.org/images/stories/downloads/sdn-resources/technical-reports/TR-532-Microwave-Information-Model-V1.pdf)
• UML Modeling Guidelines (IISOMI 514)
  • Last published version → v1.3 info (at https://www.opennetworking.org/software-defined-standards/models-apis/)
  • Latest working draft → Draft v1.3.01 (11/2018) (at https://wiki.opennetworking.org/display/OIMT/Infrastructure+Sub-team+Guidelines)
• UML Profiles and Style Sheets
  • Github repository: UmlProfiles (formal)
    • OpenModelProfile, v0.2.13
    • OpenInterfaceModelProfile, v0.0.8
    • ProfileLifecycleProfile, v0.0.4
    • Style sheet for class diagrams
• Papyrus Guidelines (IISOMI 515)
  • Last published version → v1.3 info (at https://www.opennetworking.org/software-defined-standards/models-apis/)
  • Latest working draft → Draft v1.3.01 (11/2018) (at https://wiki.opennetworking.org/display/OIMT/Infrastructure+Sub-team+Guidelines)
• Papyrus https://www.eclipse.org/papyrus/
• UML to YANG Mapping Guidelines (IISOMI 531)
  • Last published version → v1.1 info (at https://www.opennetworking.org/software-defined-standards/models-apis/)
• UML to YANG Mapping Tool
  • Github repository: https://github.com/OpenNetworkingFoundation/EagleUmlYang
Questions?

Thank you 😊
Information Model evolution

**Formal UML model**
- **Concepts**
- **Network Technology Definition**

**ITU-T**
- G.774.x SDH IM
- G.874.1 OTN IM
- G.809

**TMF**
- M.3100
- MTNM/MTOSI
- SID Converged Network ABE
- Touch points

**ONF**
- ONF Core Model
- TR 215
- TR 225
- Touch points
- Onf and Opm

**MEF**
- MEF 7
- MEF 7.1
- MEF 7.2
- MEF 7.3
- Reference
- Touch points

**ETSI-NFV**
- ETSI-NFV Core Model
- Touch points

**History**
- 2000
- 2010
- 2015
- 2016
- 2018

Technology specific model in ONF spec form

Backbone technology models

Inspiration
- G.800
- G.840.1
- G.874.1 OTN IM
- G.805
- G.809
- G.840.1

Coverage and approach
- G.800
- G.7711 Gen IM
- G.8152 MT IM
- G.8152 MTM IM
- G.774.x SDH IM
- G.774.x SDH IM
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT

Essence, structure and approach
- G.800
- G.7711 Gen IM
- G.8152 MT IM
- G.8152 MTM IM
- G.774.x SDH IM
- G.774.x SDH IM
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT

Explore...
- G.800
- G.7711 Gen IM
- G.8152 MT IM
- G.8152 MTM IM
- G.774.x SDH IM
- G.774.x SDH IM
- G.741.x NETWORK MGMT
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- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT

Alignment
- G.800
- G.7711 Gen IM
- G.8152 MT IM
- G.8152 MTM IM
- G.774.x SDH IM
- G.774.x SDH IM
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT

Update
- G.800
- G.7711 Gen IM
- G.8152 MT IM
- G.8152 MTM IM
- G.774.x SDH IM
- G.774.x SDH IM
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT

Shared network resource model
- G.800
- G.7711 Gen IM
- G.8152 MT IM
- G.8152 MTM IM
- G.774.x SDH IM
- G.774.x SDH IM
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT

Reference
- G.800
- G.7711 Gen IM
- G.8152 MT IM
- G.8152 MTM IM
- G.774.x SDH IM
- G.774.x SDH IM
- G.741.x NETWORK MGMT
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- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT

ETSI-NFV
- ETSI-NFV Core Model
- Touch points
- Federation

Specific and general
- G.774.x SDH IM
- G.774.x SDH IM
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT

P&R
- G.800
- G.7711 Gen IM
- G.8152 MT IM
- G.8152 MTM IM
- G.774.x SDH IM
- G.774.x SDH IM
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT

MEF Service General and Specific
- G.800
- G.7711 Gen IM
- G.8152 MT IM
- G.8152 MTM IM
- G.774.x SDH IM
- G.774.x SDH IM
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
- G.741.x NETWORK MGMT
Abstract

• This presentation will explain the ONF Core model TR-512, a standardized implementation neutral representation of things and the relationship between those things in the SDN problem space. The presentation will show how the model has been developed through many years of practical experience.

• The presentation will work through the things explaining their relevance and application including: • Specific network functions focussing on virtualized termination and forwarding designed to represent any network • Generalized processing functionality designed to represent any abstract function • Real physical equipment specifically representing FRUs, non-FRUs, strands etc • Control functions related to presentation of views, closure of loops etc • System/scheme specifications representing the structures of systems

• The presentation will explain how the model can be applied at any level of abstraction to any control/orchestration/automation layer and will work through the approach used to construct view model using TAPI as an example. The TAPI model is a Pruned and Refactored derivative of the Core model. The presentation will highlight how the TAPI model drives tooling to generate Yang and via Yang to generate Swagger definitions etc.

• Some of the general principles and patterns, such as the Component-System and recursive abstraction patterns, will be exposed during the presentation.
Key areas

- 5G – No new capabilities required. All capabilities required already appear for other existing technologies from a management/control perspective
  - E.g., slicing is not new from a management-control perspective
- Access Networks – a network is a network
- Automation and Orchestration – MCC and the Control models
- Containerization – Software model and ConstraintDomain
- Disaggregation – Natural aspect of the model
- Implementation – Tooling approach to generation of Yang etc. from models
- Standardization – Direct via ONF and in collaboration with ITU-T, TMF and MEF
- Virtualization – All functions are naturally virtual/emergent, strong separation of concerns of functional from physical (i.e., something that can be measured with a ruler) and support for distinct, related views of networks ensures support for virtualization