



Information/Data Models at the IETF

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Operations & Management Area Director

Internet Engineering Task Force

- The mission
 - Produce high quality, relevant technical and engineering documents that influence the way people design, use, and manage the Internet in such a way as to make the Internet work better.
 - These documents include protocol standards, best current practices, and informational documents of various kinds. [RFC 3935]
- Open process for Internet Standards
- “We make the net work”
- The Standard Development Organization that specifies the YANG language, some YANG data models and the NETCONF/RESTCONF protocols

Disclaimer

- Selected as Operations and Management Area Director
 - Focusing on data models and management protocol
- However,
 - The IETF is a voluntary-based organization
 - Where we participate as individual contributors
- So,
 - I don't speak for the IETF
 - I can't commit IETF resources

“We reject kings, presidents and voting. We believe in rough consensus and running code.”, Dave Clark

Clarification on IM versus DM

“The main purpose of an IM is to model managed objects at a conceptual level, independent of any specific implementations or protocols used to transport the data.
[...]

DMs, conversely, are defined at a lower level of abstraction and include many details. They are intended for implementors and include protocol-specific constructs.”

-- RFC 3444 On the Difference between Information Models and Data Models

IETF and IM/DM

- We don't specify many IM (any longer), we focus on DM
 - With YANG as THE data model language for configuration
- Why?
 - Timing: We need to move faster
 - Opensource: pressure versus standards
 - Operators: « give me something I could use », for automation
 - IETF: rough consensus and running code
- However, IM
 - Is good as a starting point
 - Should lead/help to DM definition

Data Models Create the APIs

- The industry migrates from [CLI to API](#)
- APIs derived from the data models:
 - The protocol: NETCONF or RESTCONF
 - The encoding: JSON or XML
 - The language: Python, Ruby, Java, C, Erlang, ...
- Industry focusing on YANG as *the* data modeling language for services and devices
- Scripting: easy to create, hard to maintain/clean-up
=> Data model-driven set of APIs

Data Models = APIs

YANG – A Data Modeling Language for Networking

- Human readable and easy to learn
- Hierarchical configuration data models
- Reusable types and groupings (structured types)
- Extensibility through augmentation
- Formal constraints for configuration validation
- Data modularity through modules and sub-modules...
- Well defined versioning rules

Why you should care:

YANG is a full, formal contract language with rich syntax and semantics to build applications on

```
list interface {
    key "name";
    unique "type location";

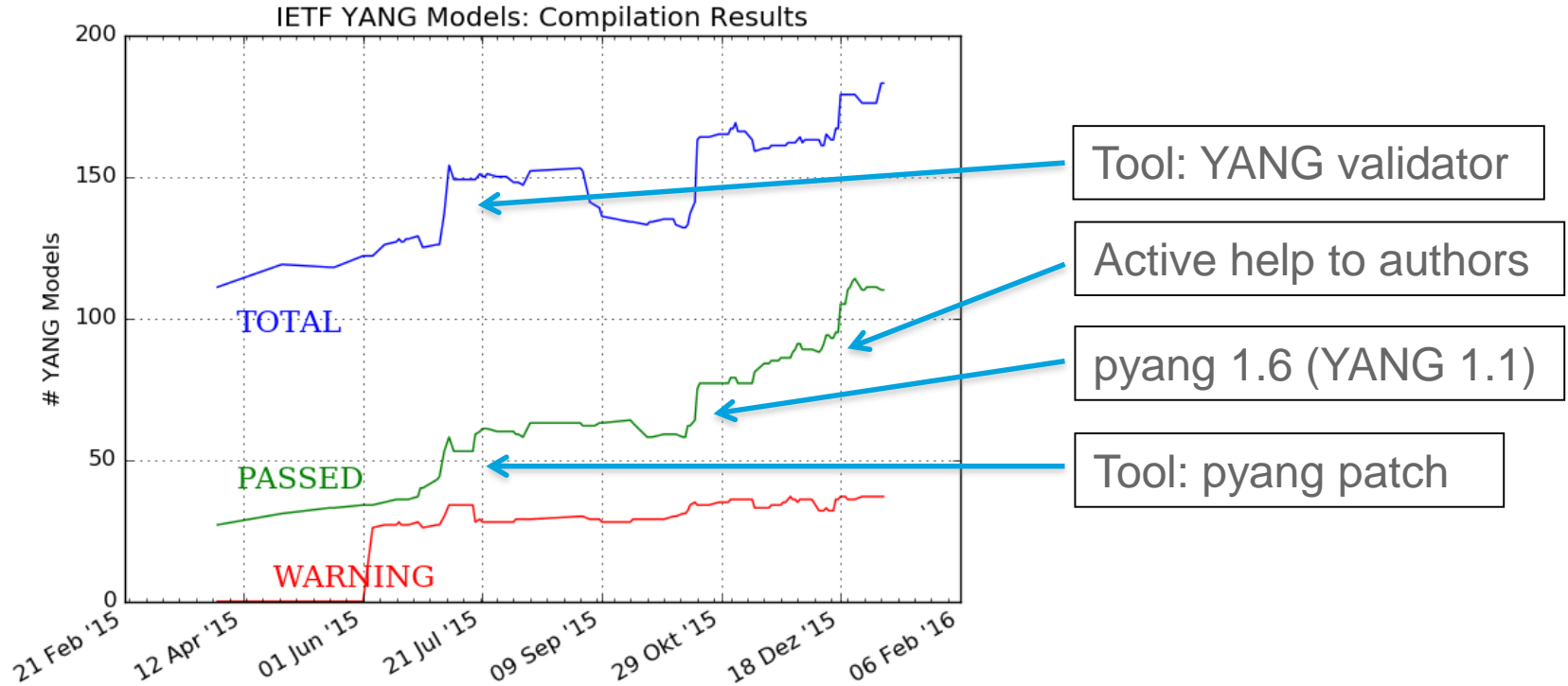
    leaf name {
        type string;
        reference
            "RFC 2863: The Interfaces Group MIB - ifName";
    }

    leaf description {
        type string;
    }

    container statistics {
        config false;
        leaf discontinuity-time {
            type yang:date-and-time;
        }
    }

    leaf in-octets {
        type yang:counter64;
        reference
            "RFC 2863: The Interfaces Group MIB - ifHCInOctets";
    }
}
```

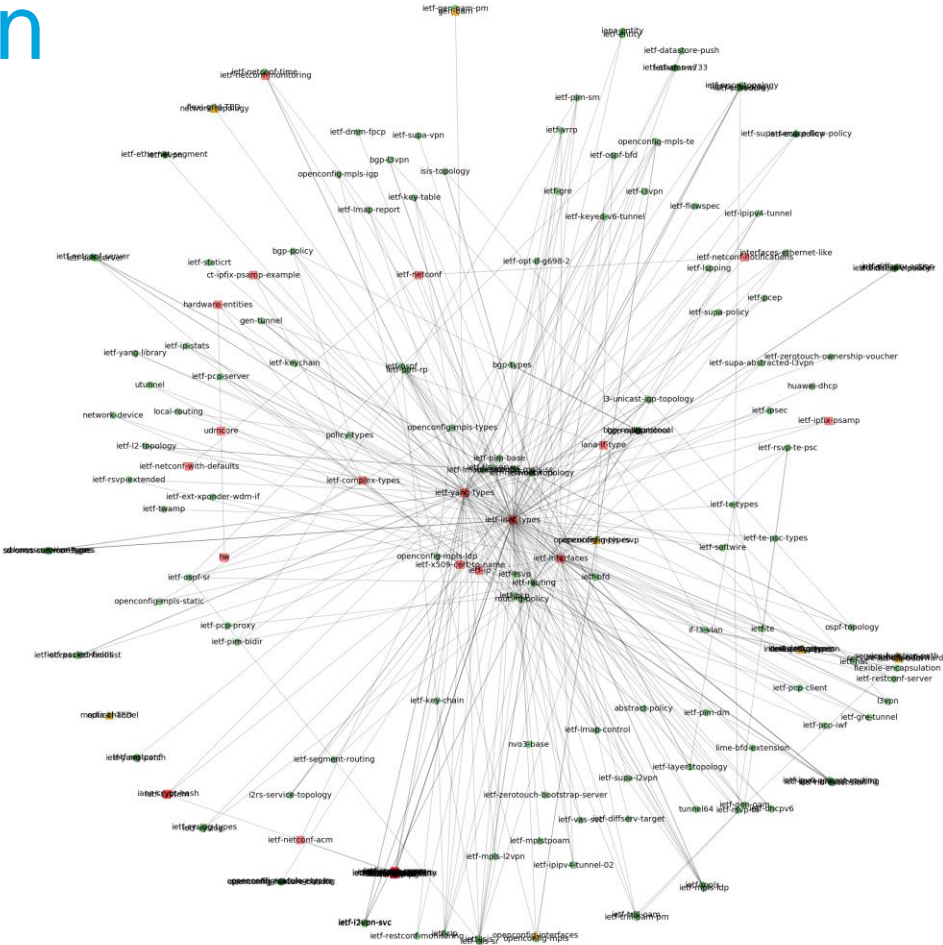
IETF YANG Models Growth



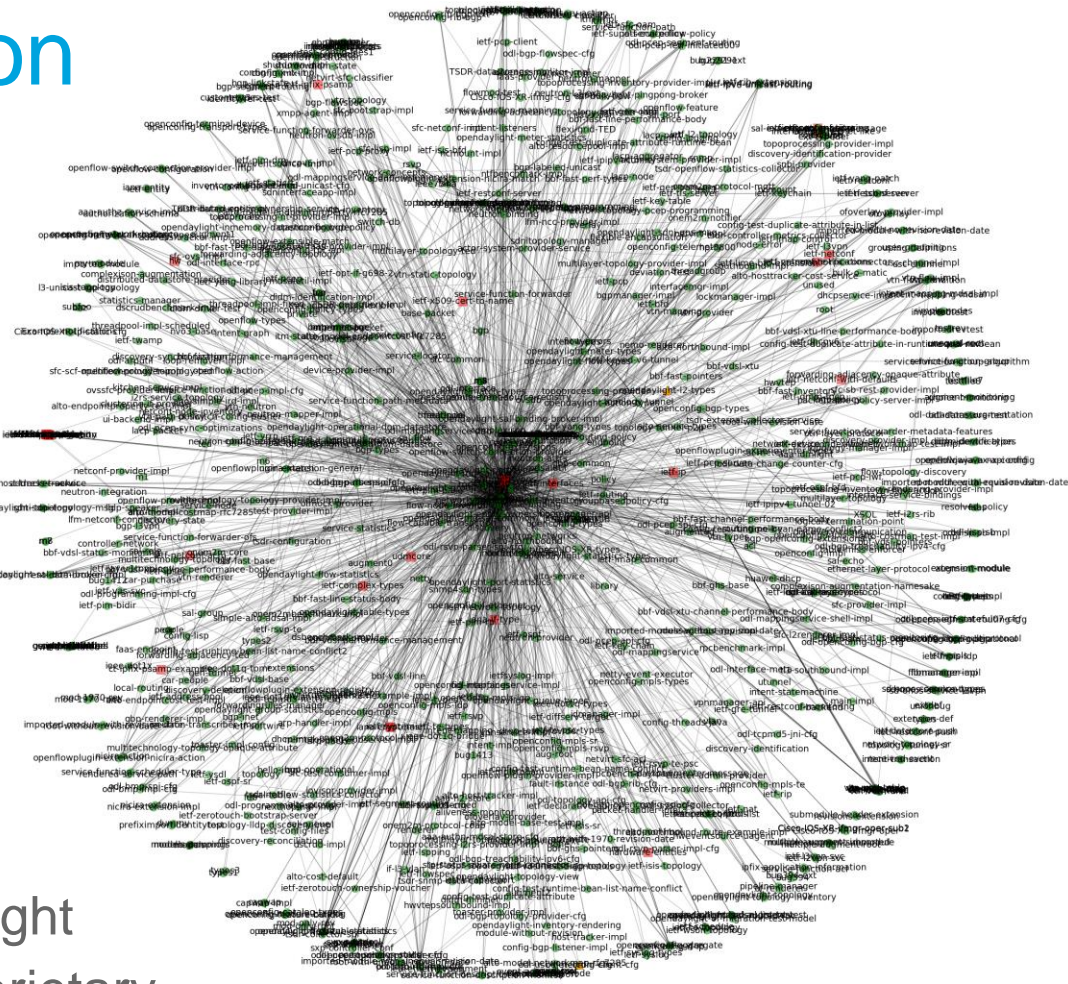
<http://claise.be/IETFYANGPageCompilation.png>

Coordination is Required

1.0
0.5
0.0
-0.5

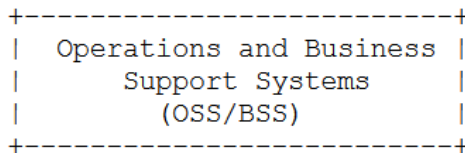


Coordination is Really Required, now!

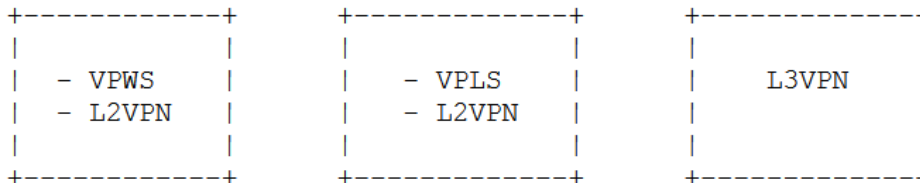


IETF, BNF, MEF,
IEEE, OpenDaylight
Openconfig, proprietary

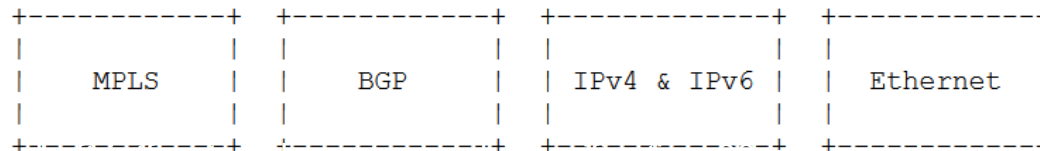
Data Model Location and Type



Network Service YANG data models



Network Element YANG data models



- Native models
- Standard models
- Proprietary extensions to standard models



IETF

YANG-related Activities

- L3SM Working Group, L3VPN Service YANG Module
 - Typically on top of a controller/orchestrator
 - Need to produce all device-central for this L3VPN Service YANG Module
- I2NSF, Interface to Network Security Functions
 - Focusing on security related YANG models
 - [Virtualized or not](#)
- SUPA Working Group, Simplified Use of Policy Abstractions
 - YANG data models for generic policies
- LIME Working Group, Layer Independent OAM Management in the Multi-Layer Environment
 - Focusing on OAM YANG data models for consistent configuration, reporting, and presentation

Key Messages

- Believe in data model-driven set of APIs
- YANG as the DM language
- More and more YANG models
- IETF not really focusing on virtualized functions

- IM and DM should meet somewhere



BACKUP SLIDES

Proposed Standard Status

IETF Standards and RFCs

IETF standards are published as RFCs

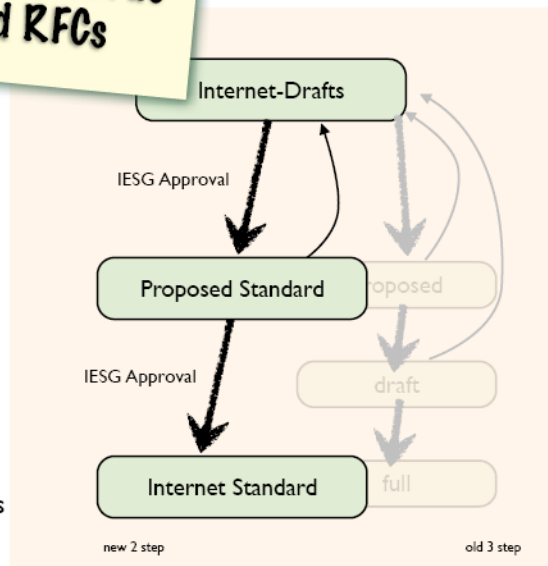
- Standards track
- Best Current Practices (operational)
- Informational and Experimental

RFC series also includes

- IRTF (Internet Research Task Force)
- IAB (Internet Architecture Board)
- Independent contributions

Standards Track documents are maintained by the IETF

- IESG approval: based on consensus process



Not all RFCs are IETF standards

IETF Organization

- Multiple Areas (containing Working Groups)
 - Applications and Real-Time
 - Internet
 - Operations and Management
 - Routing
 - Security
 - Transport
 - General
- Two Area Directors for each Area, except General Area
 - Benoit as Area Director for Operations and Management
- Internet Engineering Steering Group (IESG): ADs sitting as a body

IETF Working Groups

- Where the IETF primarily gets work done
 - Most discussion are on mail list
 - Face-to-face meetings focused on key issues
- Working group focused by charter with milestones
- Charter approved by IESG with advice from Internet Architecture Board
- No defined membership – just participants
- “Rough consensus and running code...”
 - No formal voting
 - Does not require unanimity
 - Disputes resolved by discussion
 - Decisions are verified on mail list

IETF NETCONF Working Group

- Network Configuration (NETCONF) working group:
<http://datatracker.ietf.org/wg/netconf/>
- Specified the NETCONF and RESTCONF protocols
- New charter as of October 2015:
 - “Develop a subscription and push mechanism that allows client applications to request notifications for changes in the datastore.”
 - Also called telemetry
 - “Update RFC 6536 (NETCONF Access Control Model) to introduce access control rights associated with actions“
 - “Enhance RFC 5277 (Event Notifications) with the ability to delete subscriptions without closing the client session, to modify existing subscriptions, and to have multiple subscriptions on a established client session.”

IETF NETMOD Working Group

- Network Modeling (NETMOD) working group:
<http://datatracker.ietf.org/wg/netmod/>
 - YANG language itself
 - YANG data models (access-list, syslog, QoS)
- New charter as of last week:
 - “The NETMOD working group has defined the data modeling language YANG, which can be used to specify network management data models that are **transported over such protocols as NETCONF and RESTCONF**. “
 - OLD: "manipulated by the NETCONF protocol"



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