NETCONF / YANG

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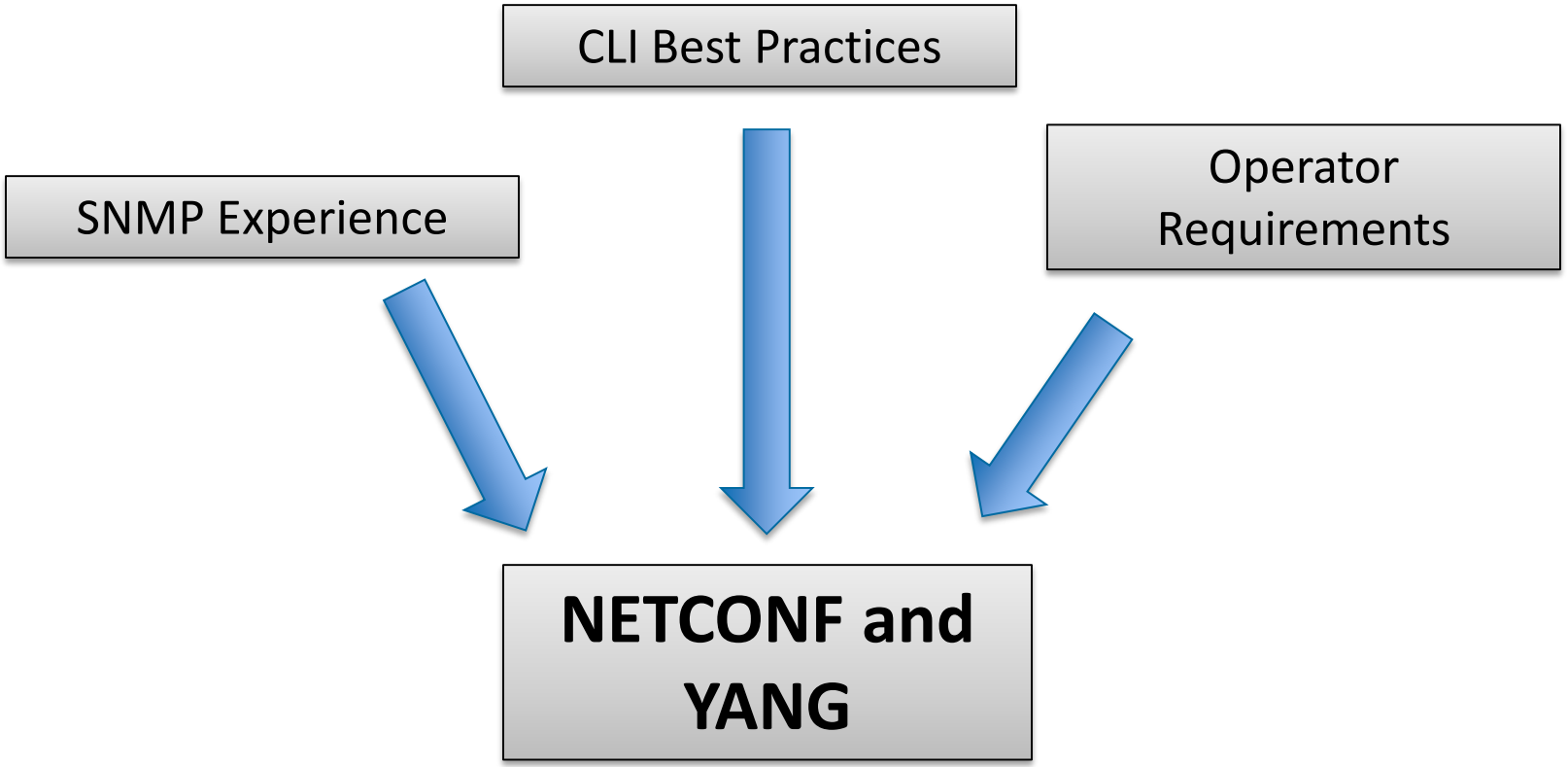
Origins of NETCONF and YANG (the Beginning)

- Several meetings at events in 2001 (NANOG-22, RIPE-40, LISA-XV, IETF 52)
  - Operators expressing opinion that the developments in IETF do not really address requirements configuration management.
- June of 2002, the Internet Architecture Board (IAB) held invitational workshop on Network Management [RFC3535] to
  - Identify a list of technologies relevant for network management with their strengths and weaknesses
  - Identify the most important operator needs.
- Initial standard already published by 2006 (RFC 4741 - NETCONF)
- Why so much boom today? SDN buzz made people realized that most use cases could be achieved by a better management plane

Best Practices Coming Together



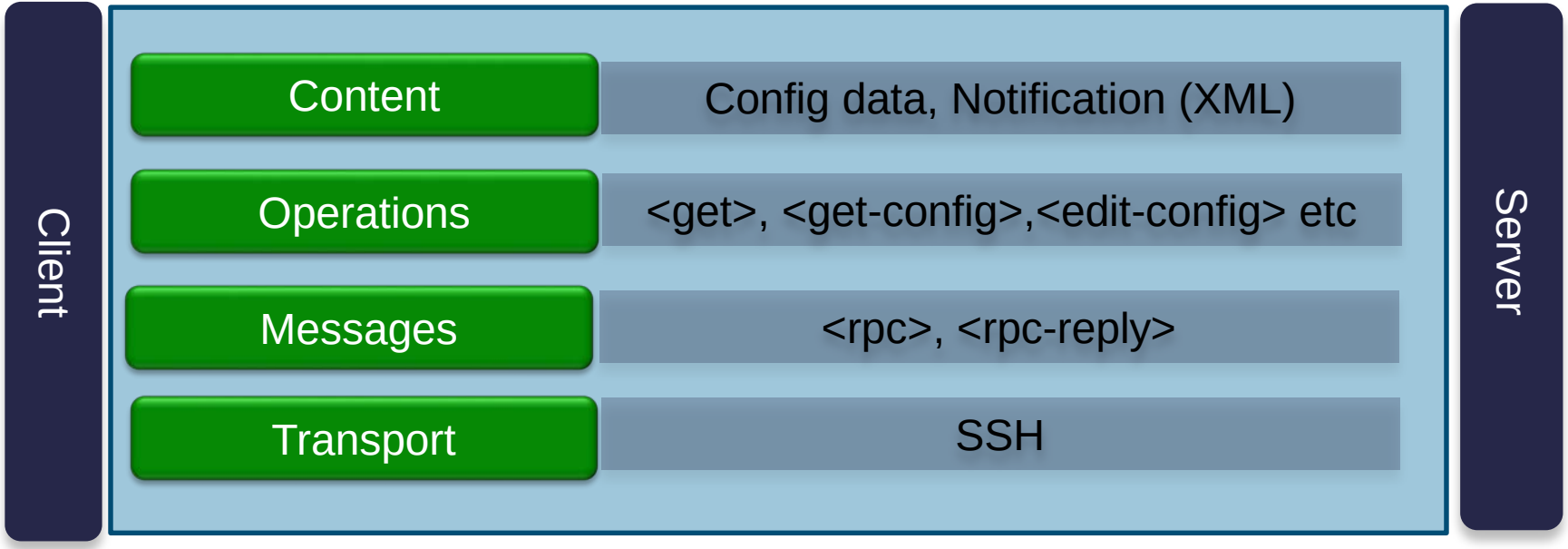
NETCONF – A Protocol to Manipulate Configuration RFC 6241

- IETF network management protocol
- Distinction between configuration and state data
- Multiple configuration data stores (candidate, running, startup)
- Configuration change validations
- Configuration change transactions
- Selective data retrieval with filtering
- Streaming and playback of event notifications
- Extensible remote procedure call mechanism

Why you should care:

NETCONF provides the fundamental programming features for comfortable and robust automation of network services

NETCONF Protocol Stack Summary



YANG – A Data Modeling Language for Networking RFC 6020

- Human readable, and easy to learn representation
- Hierarchical configuration data models
- Reusable types and groupings (structured types)
- Extensibility through augmentation mechanisms
- Supports definition of operations (RPCs)
- 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";
          }
```

YANG standard models

- **Base document: RFC 6020**
- YANG + NETCONF: RFC 6241
- IETF approved documents:
  - Common types (RFC 6991)
  - IANA Interface types (RFC 7224)
  - Interface management (RFC 7223)
  - IP management (RFC 7277)
  - System management (RFC 7317)
  - IPFIX configuration (RFC 6728)
  - SNMP configuration (RFC 7407)
- In the making:
  - Syslog configuration
  - ACL configuration
  - Network topology, L3 topology
  - BGP, OSPF
  - Netconf monitoring, Netconf access control (NACM)
  - L2VPN, PIM, MPLS-LDP,

- Content library still small but rapidly growing
- Most foundational models are in place

YANG and NETCONF in the Orchestration Soup

- Service Models Typical process

Fluffy Service Model

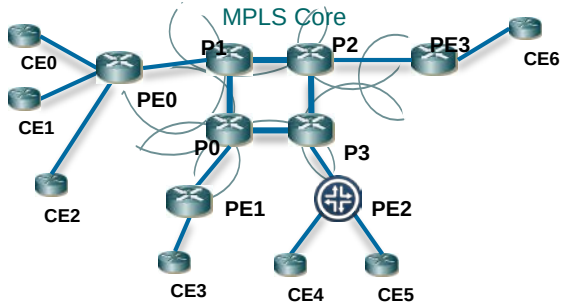
Diagrams
UML
Doc

Months

- With Formal Concrete Service Models

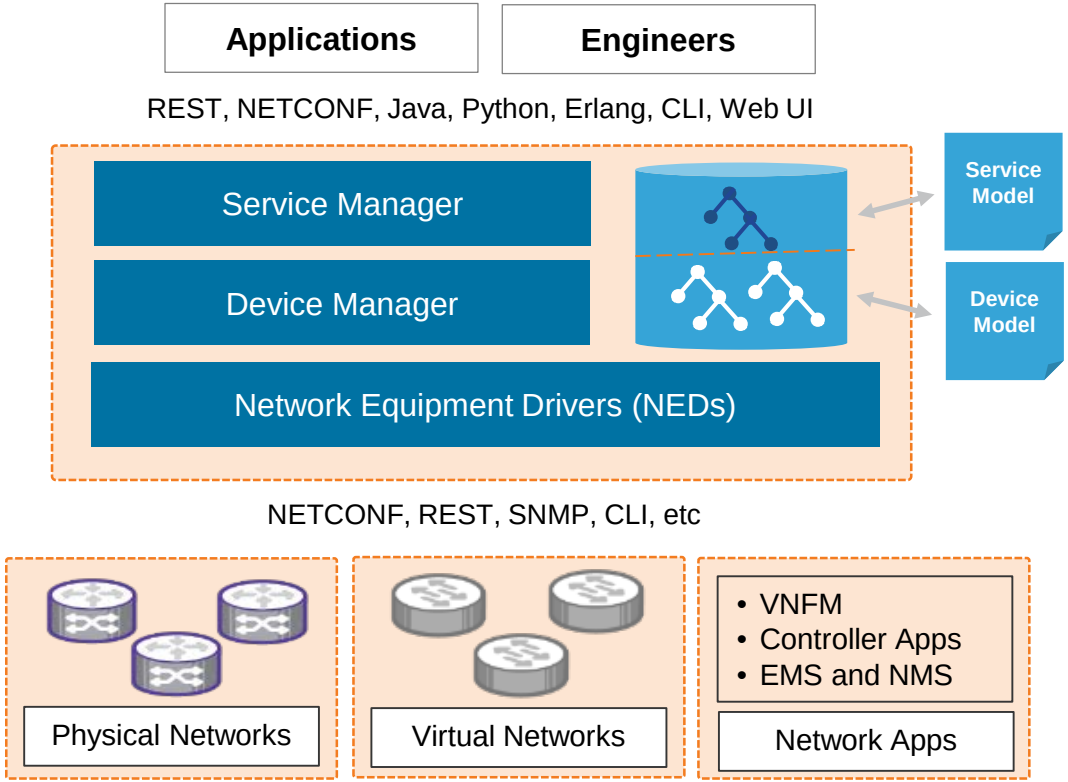
YANG Service Model

Render Orchestrator!



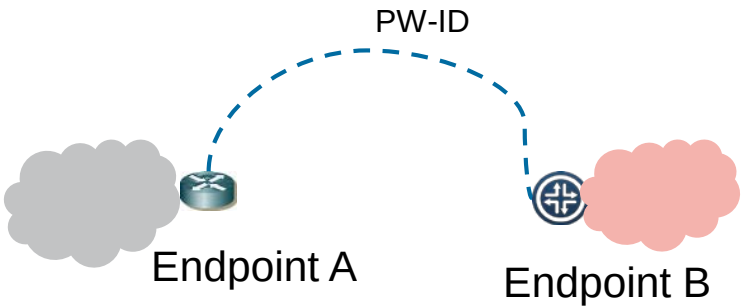
Days

Cisco Network Service Orchestrator (NSO) enabled by Tail-f



- Logically centralized network services
- Data models for data structures
- Structured representations of:
  - Service instances
  - Network configuration and state
- Mapping service operations to network configuration changes
- Transactional integrity
- Multiprotocol and multivendor support

The Demo: L2 VPN



- What do I need for a L2VPN?
- PW-ID
- Two end-points
- For each end-point:
  - Exit interface
  - IP of remote node

Take-Away

- NETCONF / YANG are mature technologies set to be the industry’s next generation configuration management standards
- NETCONF / YANG adoption is growing rapidly
- NETCONF / YANG will require that you re-think your provisioning toolkit

Thank you!

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