

Towards Declarative, Composable, Reproducible, Verifiable Network and Service Configurations

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IAB Guidance on Network Management Standardization

1988 IAB Recommendations for the Development of Internet Network Management Standards

- Standardization of SNMP, SMI, ...
- Documented in RFC 1052

2022 IAB Network Management Workshop

- Standardization of NETCONF, YANG, RESTCONF, NMDA, ...
- Documented in RFC 3535

2024 IAB Next Era of Network Management Operations Workshop

- ...

IAB Network Management Workshop 2002

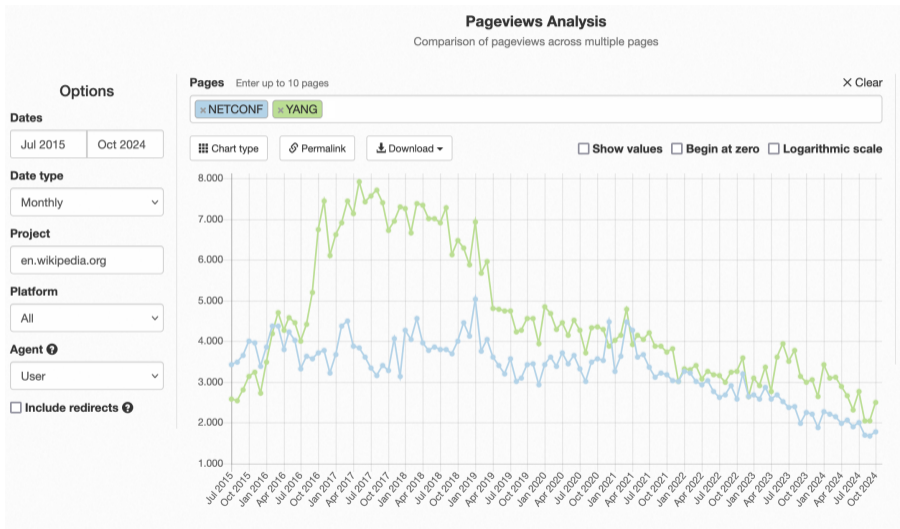
- Context
 - Configuration management using proprietary CLIs and screen scraping
 - Many competing technologies, nothing gaining real traction
 - Evolution of SNMP failed in the IETF
 - IETF struggling with the question what to do after the end of SNMP
- Results
 - Empowering the Area Directors to start new work
 - Phase 1: Standardization of a configuration protocol
 - Phase 2: Standardization of data modeling work
- Regrets
 - XML was seen as *the* data representation format

Notable IETF Milestones After the IAB Workshop

Date	Document	RFC	Pages	Citations*
2003-05	IAB Workshop Report	RFC 3535	20	59
2006-12	NETCONF 1.0	RFC 4741	95	370
2010-10	YANG 1	RFC 6020	173	237
2011-06	NETCONF 1.1	RFC 6241	113	576
2016-08	YANG 1.1	RFC 7950	217	143
2016-08	YANG JSON	RFC 7951	20	23
2017-01	RESTCONF 1	RFC 8040	137	163
2018-03	NMDA	RFC 8342	44	28
2022-07	YANG CBOR	RFC 9254	n/a	2

(*) Semantic Scholar as of 2024-11-25 (unreliable data, IETF datatracker statistics offline)

Wikipedia Popularity of NETCONF and YANG



Reflections on Success Factors and the Current Situation

- Success factors
 - Core team of people working closely together
 - Common goal to substantially advance network management standards
 - Good level of agreement on priorities within the core team
 - Commitment to create good and sound technology
 - Benefit of a niche project without much legacy to take care of
- Current situation
 - Success has led to many (competing) data models
 - Other SDOs are relying on IETF technology (IEEE, 3GPP, BBF, ...)
 - Original core team has meanwhile largely dissolved
 - New people are active but somewhat different ties and priorities
 - Work is more fragmented, lack of substantial and *architectural* reviews

Configuration Management Fantasy 1/2

Declarative:

Defining the desired configuration state while the configured systems determine themselves how to move from the current state into the desired state.

- + Independence of system states
- + Localization of error handling logic
- + Enabling analysis and reasoning

Composable:

Configuration can be assembled out of modular reusable configuration components to suit specific needs.

- + Modularity
- + Flexibility
- + Maintainability

Configuration Management Fantasy 2/2

Reproducible:

Configuration of a device, network, or service can be reliably and consistently recreated.

- + Simplifies testing, debugging, repair
- + Robust rollbacks
- + Predictable recovery from disasters
- + Supporting scalability

Verifiable:

Configurations allowing tools to (formally) verify properties of a given configuration.

- + Correctness
- + Robustness
- + Security
- + Compliance

Distance to Configuration Management Fantasy?

- How close are we to configuration that is ...
 - declarative XX %
 - composable XX %
 - reproducible XX %
 - verifiable XX %
- How well do we cover ...
 - device configuration XX %
 - network configuration XX %
 - service configuration XX %

