

IETF/IAB: NM Workshop 2024

Next Era of Network Management Operations (NEMOPS)



NEMOPS Workshop Program Committee:

- IAB Members: Wes Hardaker, Qin Wu, Suresh Krishnan, Dhruv Dhody
- IETF Ops Area Directors: Mahesh Jethanandani and Warren Kumari
- NMOP WG Chairs: Med Boucadair and **Benoît Claise**
- NETCONF/NETMOD WG Chair: Kent Watsen

24-OCT-2024 ·

Why Are We Here?

- To announce that the IETF/IAB is conducting a workshop on the **Next Era of Network Management Operations (NEMOPS)**

- Host: The Internet Architecture Board (IAB)
- Where: Virtual Online
- When: December 3-5, for 3 hours/day
- ***You're invited!***



Survey

- To kindly request filling out the survey (see QRC code) & providing feedback
- Mirja and I are here to help, during the week: questions, feedback, helping with the survey, etc.
- [Survey: https://ietf.iad1.qualtrics.com/jfe/form/SV_9vQxBRiZqDntarc](https://ietf.iad1.qualtrics.com/jfe/form/SV_9vQxBRiZqDntarc)

Working Together

IETF has a long tradition of collaborating with NOG

- To listen to operator's concerns when developing new protocols.
- To explore technology and operational issues on IETF work.
- To bridge the gap between IETF work and real-world deployments

IETF wants to understand Operator's current and perceived future issues

- Operators are currently not well represented in the IETF
- Concern that Operator voices are currently not heard

To address this:

- IETF created a new working group (Network Management Operations - NMOP) to focus on Operator Network Management
- IAB created the NEMOPS program committee that:
 - Published a survey and is currently collecting responses
 - Is reaching out to Operators: NANOG, RIPE, LACNOG, AutoConn, Apricot, etc.
 - Will synthesize the survey results before the workshop (into a "position paper")
 - Will conduct the NEMOPS Workshop 2024 and publish a workshop report

Showcase: Swisscom, NTT, INSA, and Telefonica

In 2020, several operators started to engage the NETCONF WG to improve telemetry collection.

Background:

- RFC 8639 (Subscription to YANG Notifications) only defines support for dynamic subscriptions, but this was insufficient for these Operators

Goals:

- To be able to configure subscriptions
- To be able to receive telemetry data over UDP
- To be able to send telemetry from line-cards
- To be able to annotate telemetry with metadata
- To be able to import telemetry into time-series databases

Current NETCONF WG Status:

- Operators have one draft that is currently post NETCONF WG Last Call
- Operators have two drafts that are about to enter NETCONF WG Last Call
- Operators have three drafts that are about to be adopted by the NETCONF WG

With hackathon implementations!

Internet Society Survey Results

“Operators and the IETF”

Some issues are easy to solve:

- Don't know what IETF does: 8%
- Don't know how to participate: 58%
- Aware that the work in the IETF happens on mailing lists: 54%

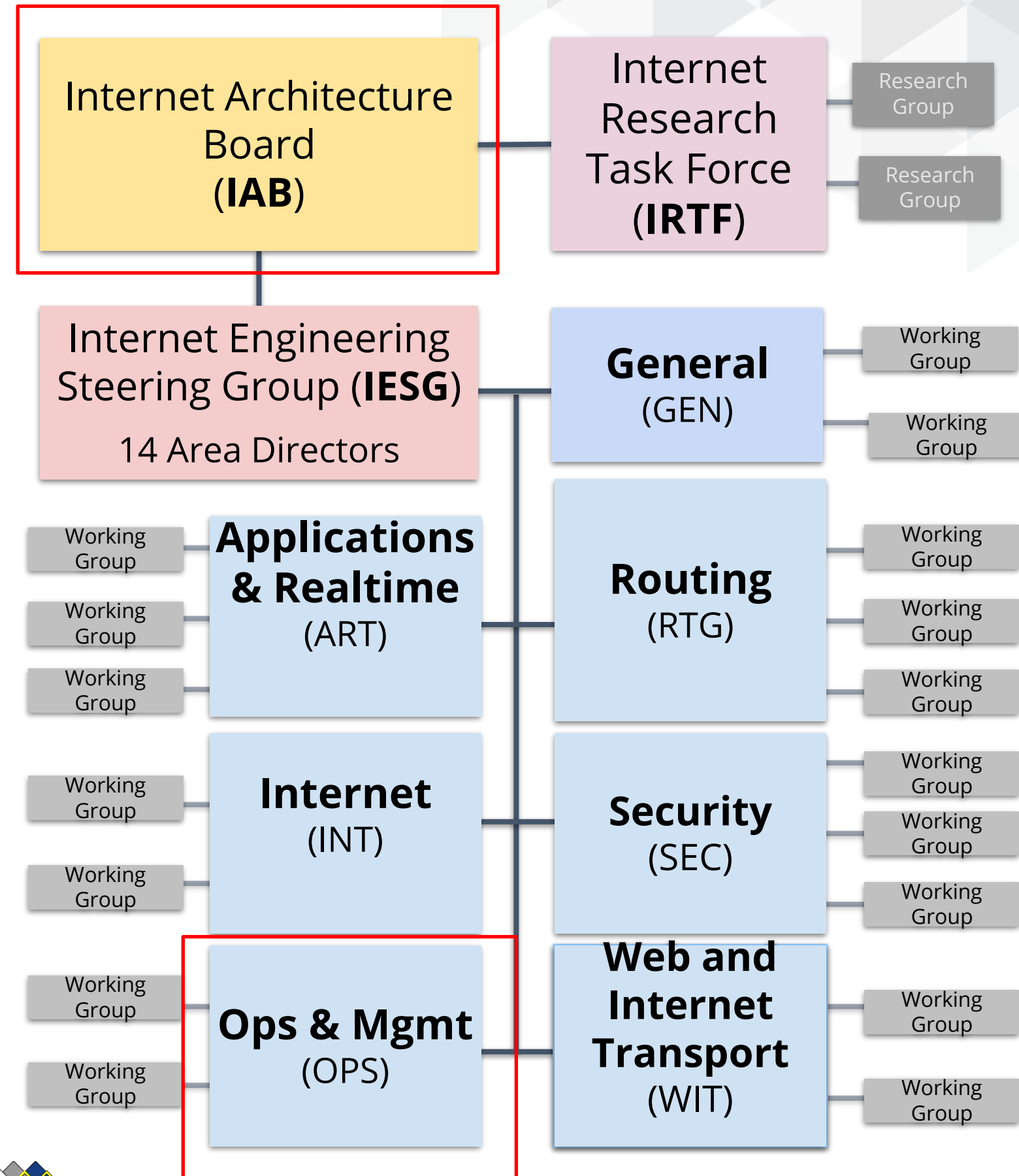
Some are harder:

- Don't have enough time: 64%
- Don't feel my operator input is welcomed: 44%

Source: <https://www.internetsociety.org/deploy360/projects/operators-and-the-ietf/>

Internet Architecture Board (IAB)

- Architectural oversight
- Runs workshops to:
 - address current challenges
 - explore emerging technologies
 - **create input for future work within the IETF and IRTF**
- Runs programs to address long term perspectives/issues
- Liaison management



First IAB Workshop on Network Management

1990-2000

- IETF OPS area has been collecting network management requirements
 - Configuration requirements
 - Monitoring requirements
 - Security requirements

April, 2001 ~ May 2002

- OPS-NW Road Show visits Operators at RIPE, NANOG, and LISA
 - Unusable configuration management
 - Network monitoring is complex with so many alternative protocols and tools

June 2002

- 3-day IAB workshop on Network Management in Reston, VA, USA



RFC 3535: Overview of the 2002 IAB Network Management Workshop

3. Operator Requirements

During the breakout session, the operators were asked to identify needs that have not been sufficiently addressed. The results produced during the breakout session were later discussed and resulted in the following list of operator requirements.

1. Ease of use is a key requirement for any network management technology from the operators point of view.
2. It is necessary to make a clear distinction between configuration data, data that describes operational state and statistics. Some devices make it very hard to determine which parameters were administratively configured and which were obtained via other mechanisms such as routing protocols.
3. It is required to be able to fetch separately configuration data, operational state data, and statistics from devices, and to be able to compare these between devices.
4. It is necessary to enable operators to concentrate on the configuration of the network as a whole rather than individual devices.
5. Support for configuration transactions across a number of devices would significantly simplify network configuration management.

From RFC 3535

6. Recommendations

1. The workshop recommends that the IETF stop forcing working groups to provide writable MIB modules. It should be the decision of the working group whether they want to provide writable objects or not.
2. The workshop recommends that a group be formed to investigate why current MIB modules do not contain all the objects needed by operators to monitor their networks.
3. The workshop recommends that a group be formed to investigate why the current SNMP protocol does not satisfy all the monitoring requirements of operators.
4. The workshop recommends, with strong consensus from both protocol developers and operators, that the IETF focus resources on the standardization of configuration management mechanisms.
5. The workshop recommends, with strong consensus from the operators and rough consensus from the protocol developers, that the IETF/IRTF should spend resources on the development and standardization of XML-based device configuration and management technologies (such as common XML configuration schemas, exchange protocols and so on).

From RFC 3535

Key Outcomes



Importantly, all IETF WGs work together to develop a cohesive collection of YANG data models, at both the element and service levels

Some Current IETF Network Management Topics

NETCONF (NETwork CONFiguration) WG

- NETCONF-next, RESTCONF-next, configuration of clients and servers, list pagination, transaction correlation, YANG-push transports (Protocols and YANG models)

NETMOD (NETwork MODelling) WG

- YANG-next, YANG versioning, system configuration, data immutability (Language and YANG models)

NMOP (Network Management Operations) WG

- YANG-push integration with Apache Kafka & time series databases, anomaly detection and incident management, digital map modelling

Network Inventory (IVY) WG

- Hardware & software components, physical location, etc. correlating with existing IETF models (topology, service attachment points)

Getting Ready for Energy-Efficient Network (GREEN)

Brand new Working Group (First meeting next week, @IETF in Dublin)

The GREEN Working Group is chartered to explore use cases, derive requirements, and provide solutions for identifying and characterizing energy efficiency metrics, methods related to energy consumption of network devices, and optimizing energy efficiency across the network. The Working Group will concentrate on the following:

- Collecting and updating requirements for the management of energy-efficient networks.
- Defining use cases for managing energy-efficient networks.
- Defining terms and definitions related to energy efficiency metrics. Where possible, terms and definitions in existing RFCs will be reused.
- Developing YANG models to enable measuring and reporting of energy usage through metrics and attributes at component, device, and network levels.
- Providing YANG models to allow operators to optimize energy usage in network components, devices, and across the network, via configurable energy efficiency capabilities.
- Developing or selecting a framework for energy efficiency monitoring, energy efficiency capability discovery, and management within a network domain.

<https://datatracker.ietf.org/wg/green/about/>

22 Years Later, It Is Time To Review Where We Are (Again)

IAB / IETF NM Workshop 2024

Next Era of Network Management Operations (NEMOPS)

December 3-5
Virtual Online

Objectives

- **Review the outcomes** and results of the 2002 workshop (e.g., current deployments, state of the art) and **identify any operational barriers** that prevent these technologies from being widely implemented (limitations, hurdles).
- **Explore new requirements** for future network management operations in a collaborative manner with the industry, network operators, and protocol engineers.

Discussion topics will include, but are not limited to:

- Tooling, open source, experimentation, proof of concept, multi-vendor interoperability test (e.g., EANTC), and system integration
- Data consistency to support richer observability (Data & Knowledge)
- Integration issues with the business layer
- Automation, orchestration, and autonomy

- Develop a **plan of action and recommendations** for the IETF.

How to Participate with NEMOPS

To participate in the Workshop (online call)

- Submit a short "position paper" or "expression of interest" to nemops-workshop-pc@iab.org
- Deadline: November 17th

Submit the online NEMOPS survey (online).

Speak with NEMOPS program committee members at various operator community events including this one. (onsite) => **Benoit Claise and Mirja Kuehlewind here during the entire week**

Recording of the workshop will be made available.



Survey



Time /
Commitment

Thank You (Q&A)

NEMOPS Workshop Page:

- <https://datatracker.ietf.org/group/nemopsws>
- Survey: https://ietf.iad1.qualtrics.com/jfe/form/SV_9vQxBRiZqDntarc

Feel free to contact the program committee with any further questions: nemops-workshop-pc@iab.org.

We need your voice! Join the mailing list:

- nemops-interest@iab.org

Please consider attending the workshop!



Survey

Survey Question Examples

Context: Configuration

- What tools do you use for configuration management? What protocols do those tools use? Which issues did you encounter with those?
 - Tools examples: Please provide the name of specific open-source, vendor-supplied, in-house developed, and/or proprietary tools you use (e.g., Ansible, MG Soft, CLI, etc.).
 - API/Protocol examples: Please provide the name of specific APIs and/or protocols those tools use. (e.g., libyang, SNMP, NETCONF, RESTCONF, gNMI)
- What requirements & recommendations for network configuration management do you have for the IETF?

Context: Monitoring

- What tools do you use for network monitoring? What protocols do those tools use? Do you use streaming telemetry? Which issues did you encounter with those?
 - Tools examples: Please provide the name of specific open-source, vendor-supplied, in-house developed, and/or proprietary tools you use (e.g., Nagios, Prometheus, Kentik, etc.)
 - API/Protocol examples: Please provide the name of specific APIs and/or protocols those tools use. (e.g., Syslog, SNMP, BMP, IPFIX, YANG-Push, GNMI)
- What requirements & recommendations for network monitoring do you have for the IETF?

Context: Others

- Apart from tools already mentioned, are there any other network management tools (and underlying protocols) do you use today? Which issues did you encounter with those?
Examples - Automation, Visualisation, Security Management, Audit & Accounting etc. (Feel free to name the tools)
- Any other requirements & recommendations for network management do you have for the IETF?

Thank You (Q&A)

NEMOPS Workshop Page:

- <https://datatracker.ietf.org/group/nemopsws>

Feel free to contact the program committee with any further questions: nemops-workshop-pc@iab.org.

We need your voice! Join the mailing list:

- nemops-interest@iab.org

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Survey

Backup Slides

The Dream

In a perfect world...

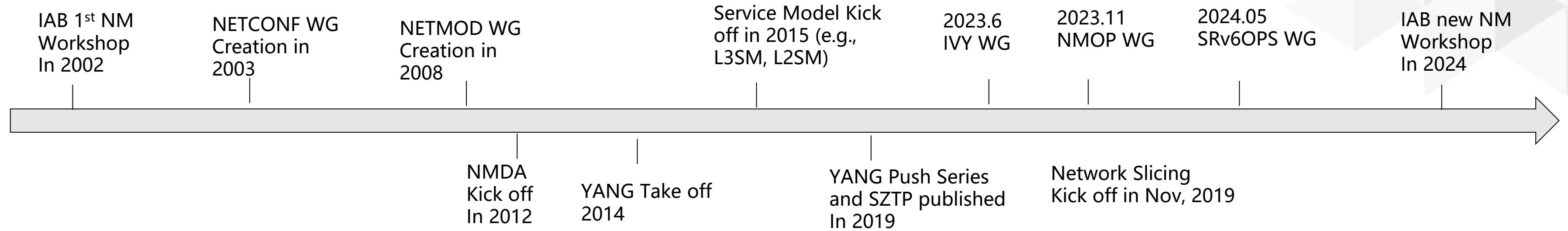
- The IETF creates standard protocols with operator input and they work great.
- Deployment and operationalization concerns are consistently addressed.
- The level of operator engagement balanced with vendors and academics.
- Operators always know when their input is needed.
- Operators always provide their input when it's needed.

The Reality

Operator engagement not balanced with vendors and academics

- Academics and vendors rule many decision making processes within the IETF
- The operators expected to deploy these technologies, often don't even know that they are being developed
- Critical new technologies are developed with little to no direct operator input
- Things may be and often are broken...

RFC3535, 22 Years Later



- L3SM: L3VPN Service Model
 - YANG Data model for L3VPN Service.
- L2SM: L2VPN Service Model
 - YANG Data model for L2VPN Service

- NMOP: Network Management Operations
 - Network Management problem faced by operators such as YANG Push integration with Kafka, Anomaly detection and incident management
 - updating RFC 3535-bis (collecting updated operator requirements for IETF network management solutions)

- SRv6OPS: SRv6 Operations
 - operational aspects of deploying and managing SRv6 networks.

- [IVY](#): Network Inventory YANG
 - Core model for Inventory of network equipment including correlation with existing IETF models