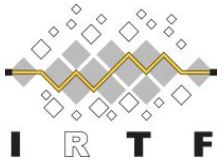
NMRG 79th meeting
ZSM-NMRG workshop
Dublin

Chairs: Laurent Ciavaglia, Jérôme François

Secretaries: Jéferson Campos Nobre, Pedro Martinez-Julia



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- If you participate in person and choose not to wear a red “do-not-photograph” lanyard, then you consent to appear in such recordings, and if you speak at a microphone, appear on a panel, or carry out an official duty as a member of IRTF leadership then you consent to appearing in recordings of you at that time
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- As a participant or attendee, you agree to work respectfully with other participants; please contact the ombudsteam (https://www.ietf.org/contact/ombudsteam/) if you have questions or concerns about this
- See RFC 7154 (Code of Conduct) and RFC 7776 (Anti-Harassment Procedures), which also apply to IRTF

Goals of the IRTF

The IRTF conducts research; it is not a standards development organization

The Internet Research Task Force (IRTF) focuses on longer term research issues related to the Internet while the parallel organization, the IETF, focuses on shorter term issues of engineering and standards making

While the IRTF can publish informational or experimental documents in the RFC series, its primary goal is to promote development of research collaboration and teamwork in exploring research issues related to Internet protocols, applications, architecture, and technology

See “An IRTF Primer for IETF Participants” – RFC 7418

Meeting useful links

- Materials:
  - https://datatracker.ietf.org/meeting/interim-2024-nmrg-04/session/nmrg
  - https://github.com/danielkinguk/nmrg-zsm-session

- Notes:
  - https://notes.ietf.org/notes-ietf-interim-2024-nmrg-04-nmrg

Guiding Agenda

1. Introduction by ZSM, Diego
2. Introduction by NMRG, Laurent/Jerome
3. A view of NDT from ZSM, Fernando
4. A view of NDT from NMRG side, Qin
5. Considerations of network/system for AI services, draft-hong-nmrg-ai-deploy, Yong-Geun Hong
6. A Standards Approach for Assured Automation for Emulation-based Digital Twins, Dan
7. IBN for whole-of-system automation, Chris
8. Intent-policy-enforcement-explainability loop, Diego
9. Intent Translation Engine for Intent-Based Networking, Pedro
10. Dataset and quality of data for AI, Jérôme

NMRG

Network Management Research Group

In a nutshell

A forum for researchers to explore new technologies for the management of the Internet

The NMRG is expected to identify and document requirements, to survey possible approaches, to consider new architectural frameworks, to provide specifications for proposed solutions, and to prove concepts with prototype implementations that can be tested in large-scale real-world environments.

https://datatracker.ietf.org/rg/nmrg/about/

- Started in **1999 (!)** with successive waves (management technologies, autonomic network management and…) → mid-term objectives **regularly updated thanks to participants' propositions and interests**

Current activities

- **Intent-based networking (IBN)**
- **Coupling of AI and network management**
- **Data-centric considerations in network management**
- **Network Digital Twins (NDT)**
- **Green Networking / Management of network sustainability**

RFC 9315 - Intent-Based Networking - Concepts and Definitions (October 2022)

- NMRG definition:
  - Intent = declaration of operational goals (declare the outcome)
  - Intent ≠ policy
- Core functionalities and life cycle

RFC 9316 - Intent classification (October 2022)

- Three main intent solutions: carrier network, DC, enterprise
- A general methodology to classify intents (identify users, type, scope, abstraction…)

Discussion on going on architecture driven by uses cases

- Network Measurement
- Interconnection
- Intent-Based Network Management Automation in 5G Networks
- Network Management Intent
- WAN data transmission intent

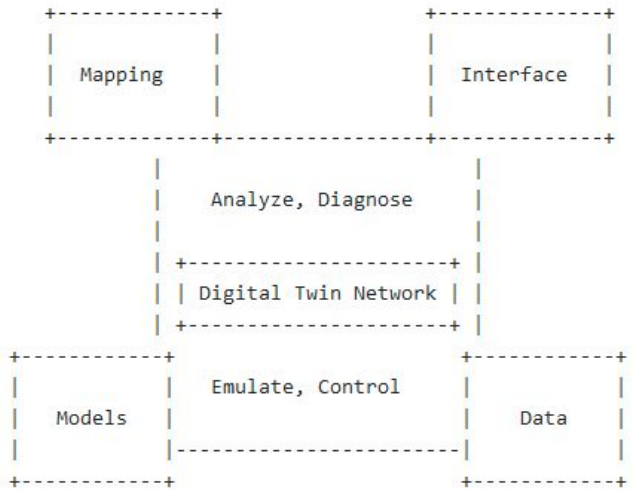
WIP, effort under consolidation

- **Provide consolidated view over the different use cases**
- **want to join?**
- **Probably the last work item on IBN in NMRG**

Network Digital Twins (NDT)

Digital Twin Network: Concepts and Reference Architecture (RG document):

- Concepts, basic definition and architecture
- Beyond simulator and emulator
- interactive virtual-real mapping and data driven approach to build closed-loop network automation.



Work item on the different element of the proposed DT architecture

- Interfaces between the twins and with applications (analyze, diagnose…) → **Requirements for Interfaces of Network Digital Twin**
- Data: get real-time information about the physical network to update the DT, protocol for data exchange → **Data Collection Requirements and Technologies for Digital Twin Network**
- Models: how to represent a real network as a digital twin → **Graph Neural Network Based Modeling for Digital Twin Network**
- Application of DTN for particular purpose / use-case → **Functional Design Aspects of Performance-Oriented Digital Twins**

→ **A lot of room for contributions**

Artificial Intelligence in Network Management

1. Document major research challenges in coupling AI and network management
2. Consider selected specific challenges to be refined with possible proposed solutions

Research Challenges in Coupling Artificial Intelligence and Network Management (RG document, informational RFC as target)

- Main challenges after several rounds of refinement
- ~~Provide answers/solutions~~
- Problem type and mapping, performance of ML and its impact on NM problems, lightweight and distributed AI, usable data, access to and quality of data, explainability and integration with current NM operations including human operators
- https://datatracker.ietf.org/doc/draft-francois-nmrg-ai-challenges/

Next steps / current discussions where contributions/presentations are welcome

- Solutions for a particular challenge (currently, one document on considerations of deploying AI services in a distributed approach)
- Challenge we may not have identified
- Data and dataset quality

Green networking

- On-going discussions in many areas and at the IETF
- Topic far beyond the scope of NMRG but network management will play a role (part of its next work items?)
  - **Challenges and Opportunities in Management for Green Networking** (draft-cx-green-ps-02): identify opportunities at different level (equipment, protocol, network, architecture) https://datatracker.ietf.org/doc/draft-cx-green-ps/

- How to assess the energy footprint of networking
  - Green Networking Metrics (draft-cx-green-metrics-02) https://datatracker.ietf.org/doc/draft-cx-green-metrics/

 Need to define value and contributions on NMRG in this area

- Topics?
- Expertise needed? (Transversal area)

Summary

- **Core topics but open to proposals and looking for newcomers**
  - Intent-based networking: consolidate use cases
  - Artificial Intelligence: document solutions for the identified challenges
- **Recent topics with a roadmap under definition with the help of all participants:**
  - Network Digital Twins: identify research questions and existing technologies to enable DT functionalities
  - Green networking: definition of a research agenda / contributions of NMRG in this area
- **Various types of contributions and outcome possible**
  - Draft / RFC (but not the only output)
  - Research/technical presentations (make your work visible to the IETF community as well)
  - Hackathon / PoC (joint implementation)
- **In practice:**
  - Start here: https://datatracker.ietf.org/rg/nmrg/about/ (access to the documents, mailing list..)
  - Subscribe to the mailing list
  - Collocated (in-person) meetings with the IETF week (fee waiver for online participation) + interim virtual meeting (no fee)
  - Any idea, questions, would like to propose something → contact us (nmrg-chairs@irtf.org)

Interested to participate…?

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- **IETF 122, Bangkok, 15-21 March 2025, https://www.ietf.org/meeting/122/**

- **ANRW, https://www.irtf.org/anrw/2025/**