

65th NMRG Meeting

IETF 113, Hybrid

Chairs: Laurent Ciavaglia, Jérôme François

Local back-up: Diego Lopez

Secretaries: Jéferson Campos Nobre, Pedro Martinez-Julia



Note Well – Intellectual Property

- **The IRTF follows the IETF Intellectual Property Rights (IPR) disclosure rules**
- By participating in the IRTF, you agree to follow IRTF processes and policies:
 - If you are aware that any IRTF contribution is covered by patents or patent applications that are owned or controlled by you or your sponsor, you must disclose that fact, or not participate in the discussion
 - The IRTF expects that you file such IPR disclosures in a timely manner – in a period measured in days or weeks, not months
 - The IRTF prefers that the most liberal licensing terms possible are made available for IRTF Stream documents – see RFC 5743
 - Definitive information is in RFC 5378 (Copyright) and RFC 8179 (Patents, Participation), substituting IRTF for IETF, and at <https://irtf.org/policies/ipr>

Note Well – Audio and Video Recordings

- The IRTF routinely makes recordings of online and in-person meetings, including audio, video and photographs, and publishes those recordings online
- 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
- **If you participate online, and turn on your camera and/or microphone, then you consent to appear in such recordings**

Note Well – Privacy & Code of Conduct

- As a participant in, or attendee to, any IRTF activity you acknowledge that written, audio, video, and photographic records of meetings may be made public
- Personal information that you provide to IRTF will be handled in accordance with the Privacy Policy at <https://www.ietf.org/privacy-policy/>
- 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](#)

Online meeting etiquette

- **The session is being recorded.**
- Please keep your audio muted and video off when not presenting/speaking.
- When speaking, please start by stating your name

Useful links

- Materials: <https://datatracker.ietf.org/meeting/113/session/nmrg>
- Notes: <https://codimd.ietf.org/notes-ietf-113-nmrg>
- Meetecho: <https://meetings.conf.meetecho.com/ietf113/?group=nmrg>
- Video recording: <https://www.youtube.com/user/ietf/playlists>
(available post-meeting)

Agenda

- **Introduction and RG status**, RG Chairs, 5 min
- **Intent-based networking**, 15 min
 - Status on IBN documents
 - Sharing information on IBN ecosystem and events
- **AI in/for Network Management**, 20 min
 - Research Challenges in Artificial Intelligence for Network Management document
- **Network digital twins**, 45-60 min
 - "How to build a Digital Twin? Emulation vs. Simulation vs. Analytical vs. Neural Networks", Jordi Paillissé & Albert Cabellos, 20min. + Q&A
 - Network Digital Twin: Concepts and Reference Architecture, Updates and future directions, Cheng Zhou, 10 min.
 - Reflections on Network Digital Twin research: problem space, research challenges, questions and directions
- **Other topics**, remaining time (~10-20 min)
 - Evolution of Cooperating Layered SDN Architecture including Compute and Data Awareness, Luis Contreras, 10 min.
 - Reflections on CLAS evolution

Status of RG documents

- **In IRSG poll**
 - Intent-Based Networking - Intent Classification (*ends April 14th*)
<https://datatracker.ietf.org/doc/draft-irtf-nmrg-ibn-intent-classification/>
- **In IRSG review**
 - Intent-Based Networking - Concepts and Definitions (*under progress*)
<https://datatracker.ietf.org/doc/draft-irtf-nmrg-ibn-concepts-definitions/>
- **Recently adopted RG document**
 - Digital Twin Network: Concepts and Reference Architecture
<https://datatracker.ietf.org/doc/draft-irtf-nmrg-network-digital-twin-arch/>
- **Candidate RG document**
 - Network measurement intent - one of IBN use cases (*ends April 8th*)
<https://datatracker.ietf.org/doc/draft-yang-nmrg-network-measurement-intent/>

Sharing information on IBN ecosystem and events

- **Work of interest in other groups and fora (not exhaustive)**
 - **LFN Open Network Automation Platform (ONAP)**
 - Several IBN use cases in different releases <https://wiki.onap.org/display/DW/Intent+Based+Networking+Base+Use+Case+Page>
 - **ETSI Zero-touch network and Service Management (ZSM ISG)**
 - GR 011 - Intent-driven autonomous networks, latest draft:
https://docbox.etsi.org/ISG/ZSM/Open/Drafts/0011_IntentDrv/ZSM-011_IntentDrv014.zip
 - PoC on Automation of Intent-based cloud leased line service https://zsmwiki.etsi.org/images/4/4d/ZSM_POC_3.pdf
 - **ITU-T Focus Group on Autonomous Networks (FG-AN)**
 - Proof of Concept (PoC) and Proposal for a “Build-a-thon” for ITU AI/ML in 5G Challenge 2022
<https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-216.docx>
 - **TM Forum Autonomous Networks Project**
 - IG1253 Intent in Autonomous Networks, latest draft:
<https://www.tmforum.org/resources/standard/ig1253-intent-in-autonomous-networks-v1-1-0/>
 - Part of broader IBN related documents set (cf. next slide); also investigating IBN use cases

INTENT DELIVERABLES IN 2H2021

Stage 1

TMF921A
Intent API Profile

3 New Approved Guides

IG1253: Intent in Autonomous Networks

Stage 2

1253A:
Intent Modelling

1253B:
Intent Handling
Scopes and
Information
Models

1253C:
Intent API and
Life Cycle
Management

1253D:
Intent Handling
Capability
Management

1253E:
Using Unified
Intent - Use
Cases,
Scenarios and
Examples

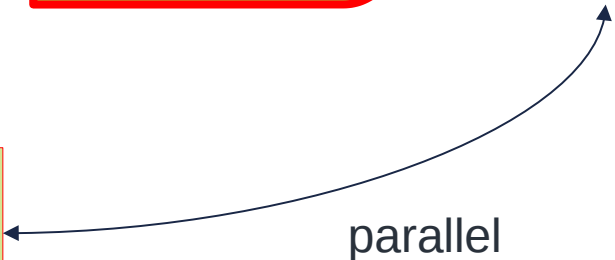
Stage 3

With FX /ISA /SID team now...

Intent in SID
Proposal being
Finalized

**Ontology
Development
Underway**

TMF921
Intent API
Specification



Sharing information on IBN ecosystem and events

- **2nd International Workshop on Intent-Based Networking (WIN'2022)**
in conjunction with IEEE Netsoft 2022m June 27, 2022 or July 1, 2022 // Milan, Italy
<http://www.adda-association.org/win-2022/> + hands-on tutorial based on TMF documents (TBC)
- **Research corpus continues to grow with more individual papers and special issues (extract):**
 - Special Issue on Zero-touch Network and Service Automation (ZSM), River publisher, Journal of ICT standardization
<https://journals.riverpublishers.com/index.php/JICTS/issue/view/729>
 - Intent-Based Software-Defined Networks, MDPI, Computers
https://www.mdpi.com/journal/computers/special_issues/intent_based_SDN
 - Intent-driven Autonomous Network and Service Management in Future Networks: A Structured Literature Review
<https://arxiv.org/pdf/2108.04560.pdf>
 - An Intent-Driven Orchestration of Cognitive Autonomous Networks for RAN management, CNSM 2021
<https://ieeexplore.ieee.org/abstract/document/9615505>
 - Orion: Google's Software-Defined Networking Control Plane, NSDI 2021,
<https://www.usenix.org/conference/nsdi21/presentation/ferguson>
 - End-to-End Intent-Based Networking, IEEE Communications Magazine, October 2021,
<https://ieeexplore.ieee.org/document/9627829>

Future meetings

- Interim meetings, follow-ups and new proposals
 - IBN use cases
 - incl. participation at WIN 2022
 - Designing, deploying and operating distributed AI
 - Looking to co-locate meeting with conference or workshop
 - ...
- July 2022, IETF 114, Philadelphia, USA

Future meetings

IETF 114 – Philadelphia, USA – July 2022

Interim meetings on

- Designing, deploying and operating distributed AI
- IBN use cases

Until further notice, the default mode of operation will increasingly rely on:

- (Monthly) Virtual Meetings
- Mailing list
- Collaborative platforms (e.g. Github, Google Docs, etc.)

Do not hesitate to share your questions, ideas or needs with the groups or chairs !

Reflections on Network Digital Twin research

•Global questions:

- 1 There seems to be a “gap” in the definition(s) of what a network digital twin is. The key point here being the network dimension. This discussion/question is linked to the relationship between the physical network/infrastructure and its digital twin/representation: what parts of a network / networking infrastructure / devices are represented in a network digital twin? – without imposing a limiting definition in the answer.
- 2 Can we have a network digital twin without digital twins of services/applications/users running on top of it? If no, is the digital twin a global concept that must encompass multiple levels?
- 3 What are the expected the benefits of using digital twins (for industry AND academia)?
- 4 What are the research questions for digital twins which differs from more common approaches (like simulation, virtualization, emulation) that already attempt to address scalability and accuracy issues (to model real systems).
- 5 Is the major difference a close coupling between the real system and a modeled system? For example, can a simulation model can be fed with real data? In that case are the questions focused on how to enable such interactions rather than building new models to “simulate” the original network?
- 6 For challenges: what are some of the major aspects impacting the development of network digital twins: is it on scalability, granularity... ? (cf. link with your question on currently available data/metrics collection)

•More concrete questions on enabling techniques:

- 7 Do we have metrics and measurement to evaluate the accuracy/fidelity of a digital twin? If no, what could be some orientations in regards to that?
- 8 How to test some operations on digital twins while still being synchronized with the original twin? How to return back a digital twin to a clean state in a soft manner?
- 9 What are the models (theoretical and experimental) that could be used to define a digital twin?
- 10 For enablers: clarify the role of some (fundamental) techniques/technologies for digital twins such as AI, what are other key enabling techniques/technologies essential to building and operating digital twins?
- 11 What is the gap between data we can already collect (regarding configuration or operation data) and what is necessary to build a digital twin network? Is the problem to acquire more data, more useful data or or filter all data we already have?
- 12 What would be the interoperability and federation needs for twins across network segments, actors, and technologies : what techniques, models for harmonization, (data and control) fusion and mappings, etc.