20 Years Network Management Research Group (NMRG)

Jürgen Schönwälder (1999-2011)

Olivier Festor (2011-2015)

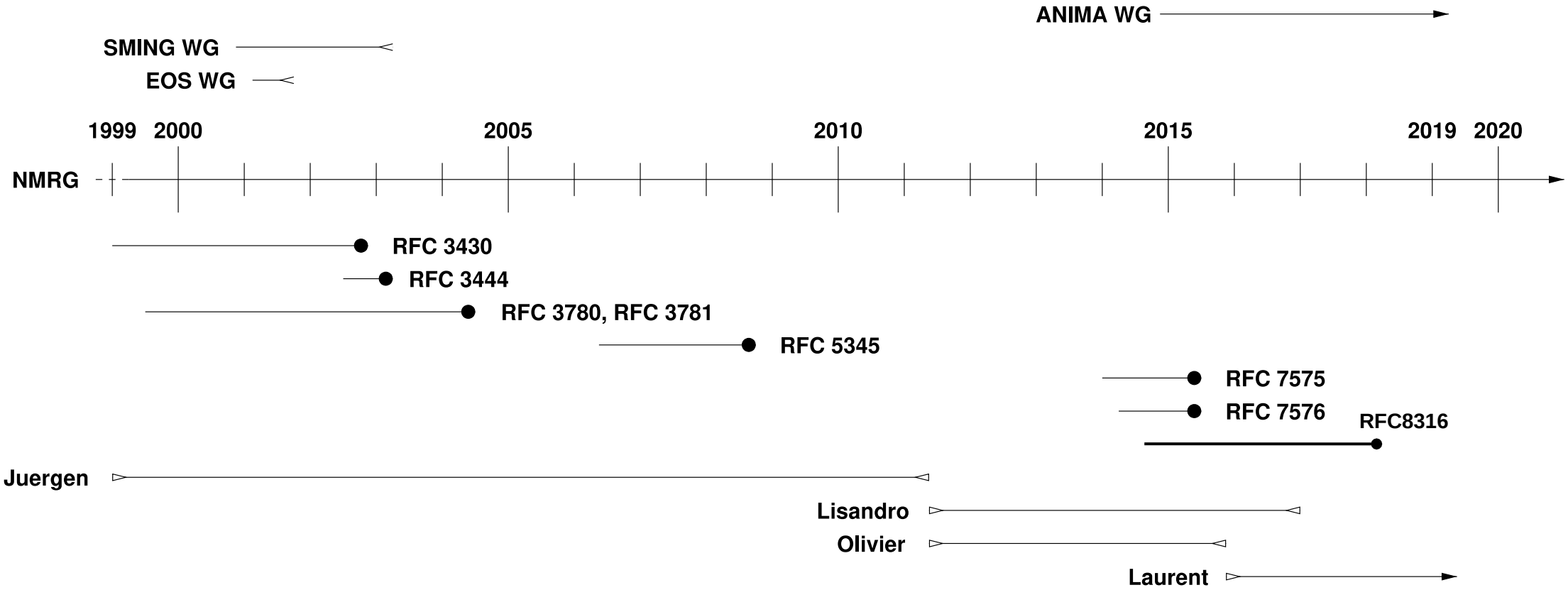
Lisandro Zambenedetti Granville (2011-2018)

Laurent Ciavaglia (2015-)

51 NMRG Meetings, 8 RFCs Published

- RFC 3430: SNMP over TCP
  (Mar 1999 - Dec 2002)
- RFC 3434: On the Difference between Information Models and Data Models
  (Jul 2002 - Jan 2003)
- RFC 3780: SMIng - Next Generation Structure of Management Information
  (Jun 1999 - May 2004)
- RFC 3781: SMIng Mappings to SNMP
  (Jun 1999 - May 2004)
- RFC 5345: SNMP Trace Formats
  (May 2006 - Oct 2008)
- RFC 7575: Autonomic Networking: Definitions and Design Goals
  (Dec 2013 - Jun 2015)
- RFC 7576: General Gap Analysis for Autonomic Networking
  (Apr 2014 - Jun 2015)
- RFC 8316: Autonomic Networking Use Case for Distributed Detection of SLA Violations
  (Jun 2014 - Feb 2018)

NMRG Timeline



Network Management 20 Years Ago

- Policy-based management (COPS, COPS-PR, SPPI)
- Directory-enabled networks (DEN)
- Policy information models (DMTF/IETF)
- Limitations of SNMP/SMIv2 were obvious
- SNMP technology evolution appeared to be deadlocked
- Experiments with “web-based” management protocols
  - use HTTP instead of SNMP
  - pushing data instead of polling data
  - technology fragmentation (WebServices, SOAP, BEEP, WBEM, …)
- Networking devices mostly closed boxes with proprietary CLIs
- Technology made robust automation difficult and expensive for operators

Meeting in Lausanne

- Meeting in Lausanne in November 1998 gave birth to the idea to propose a research group in the IRTF
- Lausanne meeting participants:
  - Aiko Pras (University of Twente)
  - Luca Deri (University of Pisa)
  - Ron Sprenkels (University of Twente)
  - Jean-Philippe Martin-Flatin (Swiss Federal Institute of Technology)
  - Bert Wijnen (IBM T.J. Watson Research, IETF AD)
- NMRG approved on March 14th 1999 by the IRTF chair Abel Weinrib (who soon afterwards stepped down).

Phase 1: management technology

- Goal #1: avoid fragmented and overlapping data models
  - integrate SMIv2, SPPI, … into SMIng, a protocol neutral modeling language
  - NMRG effort became a working group (SMIng)
  - working group managed to agree on objectives but not on a solution
- Goal #2: evolve the SNMP framework
  - structured data and not just flat tables
  - more efficient protocol primitives (getsubtree, filtering, compression, …)
  - effort became a working group (EOS = Evolution of SNMP)
  - working group failed to reach consensus on anything (EOS = End of SNMP)
- Goal #3: collect data how SNMP is used in real networks
  - provide evidence for the folklore (that was sometimes disputed)
  - created tools and data exchange formats for SNMP traces

Phase 2: autonomic network management

- Goal #1: Common understanding, gap analysis, use cases
  - Series of meetings at NMRG:
  - Gap analysis, definitions, network configuration, bootstrapping trust, P2P detection of SLA violations, Lessons learned, Real world experiences…
  - RFC 7575 and RFC 7576
  - UCAN BoF, ANIMA WG

- Goal #2: Autonomics 3.0
  - New application areas: 5G, IoT, Smart X: factory, city…
  - Highly-virtualized, programmable infrastructures
  - Network automation “mega” trend, self-driving networks, insight-driven networks
  - New wave of AI/ML I-D: [draft-pedro-nmrg-anticipated-adaptation-02]
  - Better link with real-world operations and needs: NANOG, RIPE, SRE/NRE
  - Effective deployment: reasons for lack of wide-scale deployment?

Phase 3: intent, machine learning, …

- Goal #1: Intent as a means for better usability and manageability
  - Abstractions and mechanisms
  - Transfer of knowledge and reasoning from human to machines
  - Higher degree of flexibility, adaptation… and user reward / incentive…

- Goal #2: Use of AI techniques for network management
  - Not new… but new techniques and capabilities
    - DNN, GNN, DRL, federating learning…
    - Data explosion, computing power, storage capacity, data processing techniques…
  - Challenges: beyond “ML hammer” to solve all “network nail problems”
    - Integration of AI/ML in-for Networks
    - Network specific AI/ML

Future of Network Management…

- Networks and Network Management have changed **a lot** in 20 years
- NMRG adaptation over time to address the changes (phases)

- Difficult to "predict" what future networks will be… however, necessary to think about:
  - What networks are today / near future
  - How they are designed, deployed, operated
  - What are the key (research) problems / challenges
  - Is network **management** the right "approach"