Autonomic Networking Retrospective

42nd NMRG - IETF 98

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Outline

Introduction

Autonomic Networking @ NMRG

ANIMA WG

Outlook
Introduction

- Minimum set of properties of an Autonomic System (AS)
  - Automatic, i.e. it can "self-control its internal functions and operations"
  - Adaptive, i.e. it can change its "configuration, state and functions"
  - Aware, i.e. it can "monitor its operational context"

- Different set of definitions for an AS
  - E.g., self-CHOP, MAPE-K

- Application to the complete network lifecycle (e.g. installation, commissioning, operating) → Autonomic Networking (AN)
Introduction

Figure 1: Simple sketch of an autonomic networking control loop

Introduction

- Autonomic Networking (AN) → focus of several research projects over the last decade
  - AN Architecture (ANA), Unified Management Framework (UMF), Generic ANA (GANA), etc
- Recent related efforts in the IETF/IRTF
  - SUPA, HOMENET, SDNRG, NFVRG, I2RS
- AN usually addressed by the Network Management Community (IM, NOMS, CNSM) → NMRG
Autonomic Networking @ NMRG

- 32nd NMRG Meeting (Vancouver, November 2013) - Autonomics for Network Management (Part I)
  - Definition of autonomic networking terms
  - Autonomic networking frameworks and architectures
  - Network configuration negotiation problem statement
  - Peer-to-peer detection of service level agreement violations
  - Bootstrapping trust on a homenet
- 33rd NMRG Meeting (London, March 2014) - Autonomics for Network Management (Part II)
  - Definition of autonomic networking terms (continuation)
  - Proactive self-healing mechanisms for IP networks
  - Gap analysis for autonomous networking
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- 34th NMRG Meeting (Toronto, July 2014) - Autonomics for Network Management (Part III)
  - Definition of autonomic networking terms (continuation)
  - Gap analysis for autonomous networking (continuation)
  - Lessons learned on using autonomics for network management
  - Real world experiences on using autonomic principles in network management

- 35th NMRG Meeting (Rio de Janeiro, November 2014)
  - 2 presentations on AN
  - Autonomic Networking Definitions Revisited
  - Autonomic Networking Use Case for Distributed Detection of SLA Violations
Autonomic Networking @ NMRG

- Focus on the definition of autonomic networking terms
- Internet-Drafts and RFC
  - Set of design goals and non-goals for AN
    [irtf-nmrg-autonomic-network-definitions] → RFC 7575
  - Standardization → open question and deployment limited to specific mechanisms
    [irtf-nmrg-an-gap-analysis] → RFC 7576
UCAN BoF

- Important outcome of the NMRG work
- Good popularity of the BoF (IETF 90)
- UCAN docs
  - Background
  - Use Cases
  - Solution space
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- Definition → “a system of autonomic functions that carry out the intentions of the network operator without the need for detailed low-level management of individual devices”
- Goal → “complete solution for full autonomic networking is an ambitious goal” → the specification of a min set of reusable infrastructure components to support autonomic interactions and use cases
- Focus → professionally-managed networks
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- Development of protocol specifications (or extensions)
  - Discovery for autonomic nodes
    - GRASP [draft-ietf-anima-grasp-10]
  - Negotiation for autonomic nodes
    - GRASP [draft-ietf-anima-grasp-10]
  - Bootstrapping a trust infrastructure
    - BRSKI [draft-ietf-anima-bootstrapping-keyinfra-05]
  - Separated Autonomic Control Plane
    - ACP [draft-ietf-anima-autonomic-control-plane-06]
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- Limited initial set of work items → avoid "boiling the ocean"
- Additional ("unchartered") docs
  - E.g., policy intent, use cases, Autonomic Service Agents (ASAs)
  - Encouraged as individual submissions or NMRG submissions
Some unchartered work remains in ANIMA → waiting for new phases/recharter
  ○ E.g., coordination, intent format and distribution, etc

Internet-Drafts and RFC
  ○ AN Use Case for Distributed Detection of SLA Violations
    [draft-irtf-nmrg-autonomic-sla-violation-detection] → WGLC
Outlook

● AN definitions, goals and gap analysis within the context of IETF → more consideration
● NMRG possible a home for the discussion ()
  ○ Goal of Autonomic Networking Definitions Revisited
    [draft-pentikousis-nmrg-andr] → active (?)
    ■ New contributors are welcome :)
Outlook

- Machine Learning (ML)
  - NMLRG <> AN
  - AN formulations seem to precede current ML development → room for investigations
- Intents
  - Controversial topic
  - Currently out of scope of ANIMA
  - E.g., SUPA [pentikousis-supa-mapping] (inactive)
    → infrastructures which are managed through intents
Outlook

- Fully programmable network elements and functions interesting for AN
- SDN and NFV principles → wider audience of researchers and practitioners
  - E.g., lots of interest on SDNRG and NFVRG
  - Desirable: programmability communities to think in terms of control, management, and operational planes (e.g., RFC 7426)
Outlook

- Deployment of new network technologies → typically a time-consuming and labour-intensive task
- A way forward → AN in NMRG in the context of programmable networks and through a more comprehensive manner
Thank you.

Questions?