ICN Management Considerations
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Outline

- Introduction
- Why ICN Management
- The NDN Case
- Considerations on NetInf
- Conclusion

Introduction [1/2]

- IP was built with a low set of requirements
  - At the time
- Management, security, mobility
  - All came afterwards as "add-ons"
  - Difficult to integrate all "add-ons" simultaneously
- ICN establishes a new intercommunication paradigm
  - Taking into consideration not only today's requirements
  - But also enabling and facilitating its continuous evolution and support for new scenarios

Introduction [2/2]

- It is important to consider in ICN operational aspects, other than internetworking, right from the start
  - To collect requirements
  - Verify experiences
- But more importantly
  - To accelerate real-world deployment of ICN
  - To make it address future possibilities

Why ICN Management [1/2]

- It requires management...
  - How to optimize content dissemination
- It provides new challenges...
  - How to apply typical host-centric management procedures in an information-centric approach?
- It leverages its own mechanisms
  - How to use information centric procedures
    - To execute management procedures?

Why ICN Management [2/2]

- The "ICN Management Considerations" draft, aims to:
  - Draw attention to the importance of management procedures
  - ... in assisting ICN real-world deployments
  - Provide considerations for generic ICN deployment management procedures
  - Illustrate an example from an NDN deployment
  - Consider NetInf deployment

The NDN Case

- Provides hierarchical, human-readable namespace
  - To address and route data objects
  - Content is requested via *Interest* packets
  - Content is provided in *Data* packets
- Stores content locally on the nodes from the source to the requester (Content Store – CS)
- Keeps track of pending *Interests*, mapping them to a corresponding egress interface (PIT)
- Interfaces with other aspects (e.g., routing) to determine the *Strategy* in terms of *Interest* forwarding (FIB)

The NDN Case

- Several management opportunities arise in this NDN behavior
  - How to combine network-side and client-side information, in order to optimize the interface selection/forwarding strategy?
  - How to use NDN-specific mechanisms (*Interest +Data* exchange, names) to support those management procedures?

The NDN Case

- We defined a Management Agent
  - Residing in the Mobile Node
    - Interfaces with network adapters, applications and the NDN fabric
    - Able to read requirements (from applications), network conditions (from the adapters) and fine-tune NDN behavior
      - Optimized Interface Selection
  - Residing in the Network
    - Interfaces with Network Equipment and content sources
    - Able to determine the network status and interface with other network mechanisms (e.g., policing, AAA, etc.)
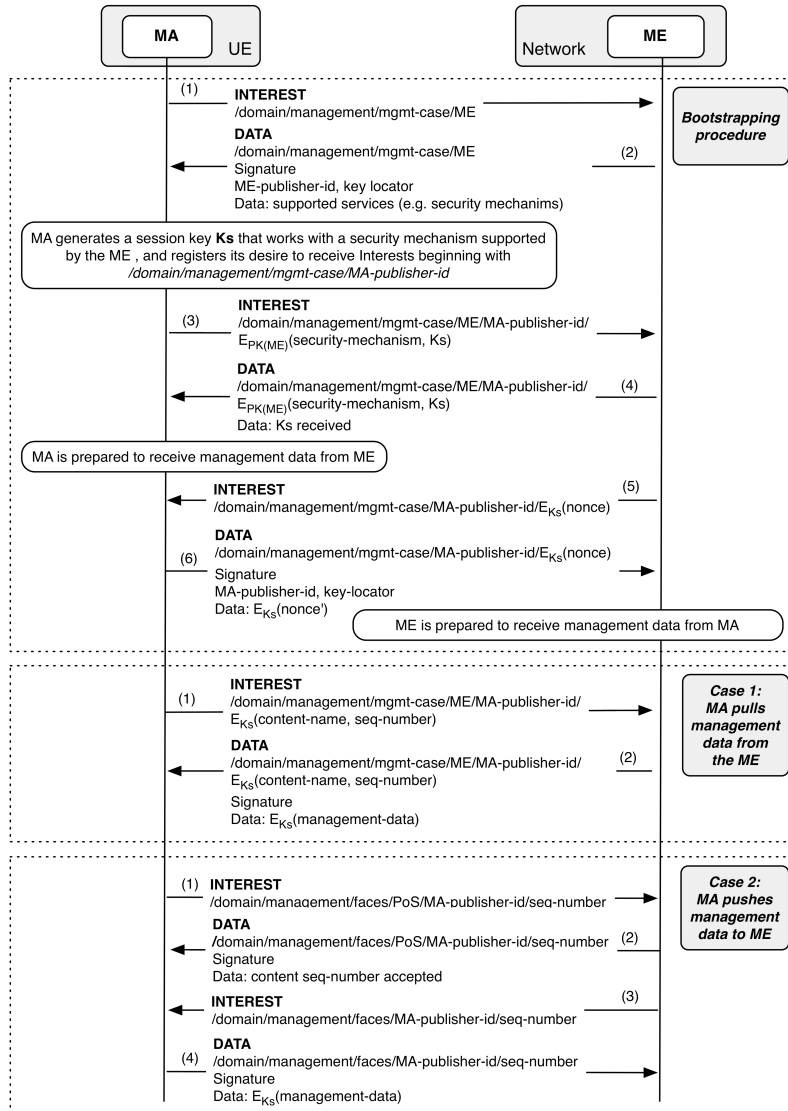
The NDN Case

- The MA in the network is able to interact with the MA in the Mobile Node
  - To produce an optimized connectivity solution for the Mobile Node
    - Taking into consideration current network conditions
    - And application/user requirements
  - Manage the network in different scenarios
    - E.g., Load Balancing

NDN Enhancements

- Besides allowing the NDN fabric to be controlled via a *Interest+Data* exchange

- Other mechanisms were needed:
  - Support of management procedures discovery
  - Asynchronous information exchange

- Both leverage from the intrinsic security procedures provided by NDN

The NDN Case

From:
Daniel Corujo, Ivan Vidal, Jaime Garcia-Reinoso, Rui L. Aguiar, "A Named Data Networking Flexible Framework for Management Communications", IEEE Communications Magazine, Vol. 50, no. 12, pp. 36-43, Dec 2012

The NDN Case

- These mechanisms were implemented and validated in a testbed based on the CCNx implementation

- Consider the Always Best Connected use-case scenario and deploy it

- Show that optimal link connectivity is one of the possibilities allowed by this generic management framework

NetInf

- New management primitives discussion
  - Allowing management to become information-centric, despite its traditional host-centric nature
- ICN suitability for self-management mechanisms
- Examples
  - Caching decisions
  - Controlling multi-access support
  - Content adaptation
  - Traffic Engineering

Thank you!

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