Enabling Network Identifier (NI) in Information Centric Networks to Support Optimized Forwarding

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Draft History

- First presented in IETF'97
- Received comments from Dave
- The revision addresses most of these comments

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Draft Updates - Abstract

- On using application layer protocols for name resolution and need for network based NRS.
  - The focus of this draft is to formalize the NI name space without advocating how AI/NI mapping has to be designed.
  - Application level AI/NI binding is one possibility
  - Network based NRS opens the possibility to optimize network's storage and computing resources among multiple services, hence networks services like off-path caching/compute, mobililty, edge computing can be enabled
  - Global level NRS will allow scalable routing using a smaller network name set.
- We have modified the abstract to consider this comment.

Draft Updates - Introduction

- Addressed comment on using the term location when we refer to the location independence feature offered by AI
- Removed location reference

Section 2: AI vs. NI in ICN

- Clarification on security feature of self-certified names, replaced the term “variable” to “context-based” signifying they can be hash of the CO or hash of the public key.
- Comment on binding between AI to a set of NI instead of just one as stated in the earlier vesion.
  - This is a possibility
- On NI name ownership and management
  - NI are topological names of networked entities BS, POA, Hosts, Routers etc, they are managed by who ever owns it operators, enterprises etc.
  - NI could be hierarchical names or names of underlay transport network e.g. IP or Ethernet
- On growth of AI versus NI
  - This is comparable to size the DNS names to ~300M, ICN estimates 10^{15} named objects, to the size of the BGP table ~5OOK which is the number of sub-networks to connect end points
  - NI is a routing construct which can modified enroute using per-hop name resolution at domain boundaries hence the core routers size can be limited to the number of AS instead of the size of the end points.

Section 2 : AI vs NI in ICN

- The term persistent for AI has been used from the perspective that services wouldn't want to rename resources based on any network attributes like topology.
  - We have used "mostly persistent" considering application may use some other considerations to rename resources
- On unstable routing and forwarding using AI
  - The point here is that dynamism of resource objects due to replication or mobility will lead to churn in the routing and forwarding plane.
  - With NI, this is churn is limited to the edges of the network and the mapping system that manages the binding
  - Further techniques like late binding and symmetric routing of Interest/Data can be used to update the states of the edge nodes caching these mappings.
- Changed "designing NIs with aggregate-able property" to "designing routing state with aggregate-able property"
- Update on security bindings AI names with aggregatable property.
  - i.e. names have a topological component which causes applications to publish content using new name prefix

Section 3: NI based ICN forwarding

- Clarification on architectural support for NIs
  - AI based routing for local domains
  - NI are required considering global resources need to be fetched across domains
  - Implication on AI/NI security binding if NI are used across domain boundaries.

3.1 – Label Based Forwarding

- On optional Security Binding
  - Its optional within if the NI scope is only limited to a single administrative domain.
  - Across domain, the new domain can accept or reject the NI depending on the trust relationship with its neighbor domain.
  - Problems that needs to be addressed when designing a global NRS
- Clarification on Precedence and use of NI as a hint
  - Assumption is that domain receives the NI from a local mapping system operating under some optimization objectives, hence cost of two name lookup at every hop can be avoided
  - Domain's use of NI in the Interest is to optimize routing considering off path caching, or handle mobility, so it a optimization feature here and not a hint.
  - It can also serve as a hint where such optimizations are not being considered, hence across domains NI are muteable based on trust considerations
- One FL per packet and not multiple
  - Multiple FLs can be appended to the same Interest, but the overhead versus benefits trade-offs have to be considered.

Section 3: NI based ICN forwarding

Link Object based forwarding

- Why link objects constitute a map-and-encap ?
  - Included NDN's SNAMP paper to link the two notions.
  - Map-and-encap follows few other IP related proposals such as LISP

Link Object Versus Forwarding Label

- Comment on making the discussion more balanced
  - Link objects constraining the network operators from overwriting its intent which in some scenarios can lead to better service paths.
  - Forwarding labels require additional network service compared to link objects which are handled by the end points
  - Security binding in Link Objects is mandatory, it is optional for forwarding label considering its usage context. Hence without appropriate trust management support may also lead to route hijacking across domains
  - FL's application to a certain namespace
    - This comment was in the context of virtualizing ICN network among multiple services, where the storage/cache, compute resources is shared among services.
    - In this case, the ICN service edge routers can applying rules on namespace, and applying FL based on a particular network service it is enabled for, e.g. if the namespace requires mobility support FL is used for that, else for off path caching.

Comments and Next Steps

- This document proposes to formalize the network identifier name space in ICN for routing optimization and scalability
- We compare the two proposals towards that in detail– Forwarding Labels and Link objects
- Comments on adopting this draft to further the discussion on this topic.

Thank You!