

NDN/CCN Harmonization:

Identifying NDN/CCNx1.x Commonalities and Differences

A High-Level Discussion Summary

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Where we all came from



2010: NSF funded Named Data Networking project

- PARC was part of the NDN team and received \$1.8M
- Until Jacobson resigned in October 2012

Since then

- ◇ NDN team:
 - Jacobson continues leading NDN development
 - take application-driven architecture development direction: at the end of beginning now?
- ◇ PARC: simplifying implementation, optimizing performance
- ◇ Different goals → spec partied the way

CCNx 0.8 as common starting point

- ◇ binary XML format
- ◇ allow data fetching by prefix
- ◇ with Selectors support
- ◇ data packet carrying “FreshnessSecond”
 - relative time, not assuming sync’ed clock
- ◇ Packet Naming
 - Full name : “/foo/bar” + implicit digest
 - Exact name : “/foo/bar”, 0 components after
 - Prefix name : “/foo/*”, 0 or more components afterwards

PARC's Protocol Changes

- ◇ Changed binary XML to fixed-header plus TLV
 - fixed header for end-to-end network layer with optional TLVs that can be added/modified HBH
 - followed by TLVs that describe ICN packet
 - TLV with fixed length field
- ◇ Encoded Interest Selectors into name
 - implication on data naming
- ◇ Support data fetching with exact match between Interest and data packet names only
 - Assuming synchronized clocks among all routers
 - change Data packet freshness to absolute expiry time
- ◇ Introduced heavy use of manifest
 - but nameless objects do have name (the hash)
- ◇ Intentionally use the same name for different data as the protocol needed

NDN's progress

- ◇ Trying out the architecture by developing a wide range of apps
 - exploring new design patterns
 - fill in missing pieces (e.g. gaining further understanding of naming conventions)
 - identify new issues and develop solutions
- ◇ single out security effort: a great challenge, with great progress made
- ◇ intentionally did not emphasize optimization
 - NFD Guideline: “emphasize modularity over performance, to enable others to experiment with the new architecture by adding new modules or modify existing ones”

Protocol changes

- ◇ WashU early work showed Exact name match between Interest-Data, with what we know today, enables significant performance gain (INFOCOM 2014 paper)
 - NDN team decided staying with fetching data by prefix, WashU developed new solutions

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NDN Naming

- ◇ In general a Data packet is uniquely identified by the exact name
- ◇ Full name as last resort under unexpected conditions

CCNx 1.x Naming

- ◇ Design goal: Interest-data names must complete match
- ◇ Object may not be uniquely identified by exact name
 - intentionally use the same name for different objects as needed
- ◇ Object is uniquely identified by the full name

Discussed Topics

- ◇ Loop detection/mitigation
 - both TTL and Nonce are important
- ◇ ICN packet structure
 - App experimentation (e.g., vehicular networking) suggest the need for ICN/network adaptation/link adaptation packet layering
- ◇ Packet encoding
 - Interest payload: beyond router optimization, more usage/apps needed to show what is better

Data Fetching

- ◇ NDN: data can be fetched by
 - Prefix name
 - Exact name, or
 - Full name
- ◇ CCNx 1.x: the design goal is
 - Do not support fetching data by prefix
 - Data requested must use either a full name or an exact name.
 - There are mechanisms to refine what is requested for exact name
 - Differentiates data with empty exact name and data without exact name

Other Discussed Topics

- ◇ Hop-by-hop fragmentation
- ◇ Interest retransmission
- ◇ Cache control
- ◇ Cache verification