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Different Schemas for Naming In Information-Centric Networking

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Abstract | **Review Article**

The Internet usage has witnessed a huge development in the recent years, with enormous users pressing needs for accessing huge amounts of information, regardless of its physical location thus requesting more mobility with better security. To consider the needs, shift, the researchers worked to introduce a new communication model, which is information-centric networking (ICN). ICN focuses on the content being exchanged rather than which hosts or network entities are exchanging information. Thus, the network shifts from host-centric to content-centric. In this survey, author analyze, compare, contrast, and identify the key weaknesses in the naming mechanisms proposed by ICN.

Keywords: Information-Centric Networking, Content-Centric Networking, Named-Data Networking, Internet Architecture, Naming.

INTRODUCTION

Today's Internet needs has witnessed an enormous change so the current internet architecture which was built the 1960s and '70s became inadequate for the recent needs. The emergence of the modern aspects of internet usage of video streaming portals (e.g., YouTube), IPTV services, and video on demand (e.g., Netflix) causes a continuous and incremental Internet traffic. Diverse modifications were added to the Internet to face the new challenges as the designation and implementation of the Domain Name System (DNS) to resolve a name to an Internet host address, yet has shortcomings as the inability to perform content replication, movement, and location awareness [1]. After that, content distribution networks (CDNs), peer-to-peer (P2P) file-sharing systems (like Torrent and Gnutella Bit) were introduced to overcome the problems of fast content spread, multi-source content retrieval, inherent replication, and. These contributions evolved content access over the Internet but could not achieve optimal performance.

These challenges motivated the research community to search for an alternate architecture, which is Information-centric networking (ICN). ICN aims to shift the current host-centric toward a content-centric model. It relies on location independent naming, in-network caching, and name- based routing for effective distribution of content over the network. Numerous research challenges have to be addressed to bring ICN to life.

As naming is an essential issue of any ICN architecture, major ICN proposals have proposed different solutions for it. In this survey, we present a concentrated discussion of the naming schemes in these projects.

DONA

In DONA each content that represents information (or service) is associated with publishing entity called a principal. Names in DONA are of the form P:L, P is the cryptographic hash of the principal's public key P L is a label which identifies the information with respect to the principal uniquely. Names in DONA are flat, globally unique, persistent, and not bounded to any organizational boundaries. For immutable data, the label of data can be the cryptographic hash of the information itself, thus allowing any publisher to offer such data. Unlike structured DNS names, flat names in DONA are easy to map to any private namespace of human-readable names since they do not include a fixed administrative structure.

NDN

Names in NDN are hierarchical that are consisted of many components ordered in a hierarchy and may be similar to URLs (but unnecessarily), for example, an NDN name can be/aueb.gr/ai/main.html. knowing that, the first part NDN is not a DNS name or an IP address, moreover they have not to be human-readable. Thus, each name component in NDN can be a dot- ted human-readable string or a hash value and can be any string of arbitrary length. Names are generated and assigned by users. All NDN names include a SHA256 digest of the content to resolve ambiguity. Name to content mappings are digitally signed and delivered with the content to offer content authenticity and integrity. NDN names are human friendly and non-persistent due to the hierarchical structure.

PURSUIT

In PURSUIT, Information are identified by a (statistically) unique pair of IDs, the scope ID and the rendezvous ID. The scope ID forms the group of related information whereas the rendezvous ID is the actual identity for a certain part of information. Information may be included at least one scope and it may be included in many scopes (and may be with many rendezvous IDs). PURSUIT names are flat as in DONA, but the scopes in PURSUIT can be arranged in scope graphs of different forms, including hierarchies, thus a full name is composed of a set of scope IDs and a one rendezvous ID till popularizing the DONA naming scheme.

SAIL

In SAIL, Information names are “flattish”, i.e. they offer some structure that could be hierarchical, but they do not hold location or organizational information. SAIL defines the ni://A/L URI scheme in which names composed two parts: an authority part A and a local (with respect to the authority) part L. Each part can be a hash, thus permitting self-certification, or any other type of string which allows for regular URLs. In SAIL, as in PURSUIT, subscriber request will match a publisher information if and only if there is an exact name match between them, therefore this name comparison purposes made the naming considered flat. In addition, SAIL names can be hierarchical when used for routing, since routers, as in NDN, can depend on longest prefix matching to know how to route a particular message.

COMET

In COMET there is no precise naming scheme. Nevertheless, when the publishers register the information, the names for the information are provided by a Content Resolution System (CRS), thus names for related information would be explicitly aggregately, for instance, episodes of a particular TV series can have sequential names [2]. Therefore, allows the naming system will be broadening by using existing relationships between information.

CONVERGENCE

Naming in CONVERGENCE is most similar to NDN, thus hierarchical names are used or even URLs. Names is composed of a namespace ID and a name part. The name part format is determined by the namespace ID. However, the default format of CONVERGENCE names is similar to that in DONA, i.e., a flat P: L pair.

MobilityFirst

In MobilityFirst, a global naming service that uses Globally Unique Identifier (GUID) that translates human-readable names to GUIDs in each network entity. Every device in MobilityFirst must obtain GUIDs for itself, its information objects, and its services. Since all network entities are named in MobilityFirst, both name-based information delivery (by information GUIDs) and host-to-host communication (by device GUIDs) could be supported. GUIDs are flat 160-bit strings having no semantic structure.

PSIRP

Naming scheme in PSIRP is the same used as in DONA and content names are called resource identifiers (RIds). PURSUIT continues to use the same naming scheme. A PSIRP network depends on scopes, where scopes are identified by Scope identifiers (SIds) and where content publishers will publish and subscribers will subscribe to contents in a scope that they trust knowing that Content publication (publish) and content request (subscribe) depends on (SId, Rid) pairs.

CBCB

In CBCB, naming scheme is unique because it is different from traditional URL-based naming as well as from flat naming schemes used by other content-oriented network architectures. In CBCB, naming contents in the network depends on a set of attribute-value pairs. An attribute has a name, a type, and a set of possible values. However, name uniqueness and secure content names are not ensured in this mechanism [3].

NetInF

NetInf names, as in DONA, have two parts, P: L, where P is the hash of owner’s public key and L is a label chosen by the owner. L for a static content is different from dynamic content. In the first case, L is the hash of the content itself, but a fixed ID in the second case is used as L and a digital signature (stored in meta-data) allowing content integrity. In NetInf one owner may use many public/private key pairs since this scheme suggests connecting using the public/private key pair to the content in alternative to the owner. A public key chaining information stored in meta-data in

NetInf ensures owner authenticity and identification allowing secure content publishing even if it is unknown [4].

KBN

The semantics differentiate the KBN by classifying users having generalized common interests into semantic groups or clusters leading to refining and causing much less traffic participating in achieving the target of the users in finding the relevant information and rapidly. Thus, the ontologies constitute the core source of subscriptions.

Comparison between Different Architectures Regarding Naming

Table-1 shows the comparison between the different naming schema in the ICN architectures.

Table-1: Naming in ICN project

ICN architecture	Naming
DONA	Flat, P:L form
PURSUIT	Mixed, ScopeID; rendID form
SAIL	Ni: //a /L form
COMET	Unspecified
CONVERGENCE	Either flat or hierarchical
MobilityFirst	Flat, 160-bit unique IDs
NDN	Hierarchical, /A/B/C/ form

Source: Done by the author

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