NDNoT: design and implementation of an IoT framework over Named Data Networking

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ABSTRACT

Named Data Networking of Things (NDNoT) framework is a set of libraries that aim to support application development in a home IoT environment. The design of the framework follows the guidelines proposed in ref, specifically providing functionalities that name home devices and their data, discover devices and services, bootstrap devices and define the trust model, and support application level publishing/subscribing. The rest of the abstract introduces Named Data Networking, then describes the design of NDNoT and its considerations for global Internet reachability and constrained devices, and concludes with the description of NDN-Flow, an application developed using this framework.

Named Data Networking (NDN) is a proposed future Internet architecture that shifts the network communication model from host-centric to data-centric. Instead of sending packets between source and destination devices identified by IP addresses, NDN disseminates named data at the network layer, and forwards directly using hierarchical and application-meaningful names. Moreover, NDN adopts content-based security and secures data at the time of its generation.

In NDNoT, each device, application, and piece of produced data are named. Names having a strong tie with application semantics, the pattern of data retrieval and security model definition makes namespace design a priority. In a home IoT environment, applications usually refer to things and their data using application-meaningful names, which could be different from the names of devices under the home context. For example, /MyHome/devices/wii-controller/2 could name a wii game controller device in my home, which provides user input for a game application *game1* that I run, under the namespace /MyHome/applications/game1/inputs/a. Separating these two namespaces reflects NDN's concept of naming the data the way the application wants, rather than naming the device that produces it. This is helpful in scenarios such as replacing a device with another one, but having

them serve the same purpose for the application, in which case application data retrieval won't be hindered because of the replacement.

In NDNoT, we also assume that the devices come with a manufaturer-configured identity, which is another name under the manufacturer namespace, for example, /com/nintendo/wii-controller/serial-1234. This identity corresponds with a certificate, which is another piece of named data that allows the user to verify if the device indeed comes from the manufacturer, before introducing it to the home and naming it accordingly.

To summarize, the namespaces that the framework supports are given in Figure .

Device and service discovery
Device bootstrapping and trust model definition
Application-level publishing and subscribing
Global reachability
Constrained devices
NDN-Flow application

1.