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Named data networkingbased smart home

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Named Data Networking-based Smart Home

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ABSTRACT

Named data networking (NDN) treats content/data as a "first class citizen" of the network by giving it a "name." This content "name" is used to retrieve any information, unlike in device-centric networks (i.e., the current Internet), which depend on physical IP addresses. Meanwhile, the smart home concept has been gaining attention in academia and industries; various low-cost embedded devices are considered that can sense, process, store, and communicate data autonomously. In this paper, we study NDN in the context of smart-home communications, discuss the preliminary evaluations, and describe the future challenges of applying NDN in smart-home applications.

Index Terms: Named Data Networking, Future Internet, Internet of Things, Smart Home.

I. INTRODUCTION

Because of the recent plethora of connected devices, such as smart phones, tablets, smart watches, and laptops, the Internet industry and device manufacturers have enjoyed exponential economic growth. Similarly, Internet of Things (IoT) has gained much attention in the past few years because of its vast range of applications. According to the current definition of IoT, a collection of low-cost sensors and actuators embedded in various devices can sense, process, communicate, and react to the gathered data. In order to bring IoT into reality and benefit our daily life, various research and development efforts have been conducted by both industries and academia. For example, Internet Engineering Task Force (IETF) groups have executed several IoT projects, including IPv6 over Low Power Wireless Personal Area Networks (6LoWPAN), Constrained RESTful Environments (CoRE), Constrained Application Protocol (CoAP), and Routing Over Low power and Lossy networks (ROLL) [1]. The main objective is to support IPv6 in low-power and Lossy networks (LLNs), extend HTTP services to LLNs, and let these devices make decisions at the same time.

However, all of these efforts have one thing in common, namely, IP-based communication that forces the data to be tightly coupled with the communication channel and device-to-device addresses. In addition, the limited expressiveness of IP addressing that tends to serve both as a locator and identifier argues for a dedicated resolution system, mobility support, multicast, and enormous access under the rigorous performance requirements of IoT, hence providing challenges.

Meanwhile, the increasing demands of convergence among various heterogeneous networking devices, while keeping the information traversal robust and efficient, have motivated the research community to redesign the current Internet architecture. In this regard, named data networking (NDN) has been proposed as an extension to content-centric networks (CCNs) as a future Internet architecture [2]. NDN gives identity (i.e., a "name") to content as a "first-class citizen" within the network, in contrast to the naïve Internet, where some numeric IP addresses of the source/destination nodes and channel security are the focal points during communication. In addition, NDN secures each packet at the time of its production, enabling data caching (replication) at each node while preserving the security aspects of the data throughout the packet's lifetime.

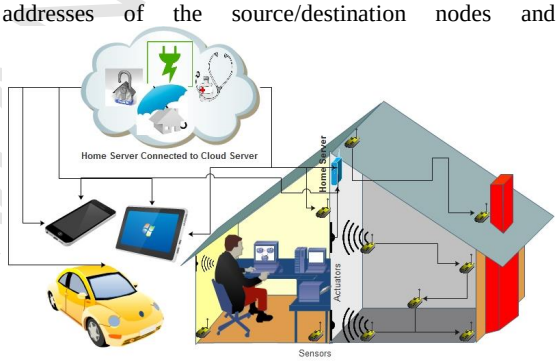

Figure. 1. NDN-based smart-home use case

In this paper, we take the "smart home" as a use case for IoT, as shown in Fig. 1, and propose an NDN-based smart home architecture. We also introduce a private cloud (PC) that acts as a database for storing the historical information from the home server (HS). This PC enables user(s) to retrieve the data when not in the proximity of the HS. In a smart home, we consider a set of sensors and actuators with a variety of applications, including energy management, security, health care, user care, and comfort. Enabling communication between those sensors via our proposed architecture is the main contribution of this work. We also verify our proposed architecture via preliminary evaluations.

II. SMART HOME AND NDN ARCHITECTURES

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