

Preface

Initially, the Internet was invented to help people connect with each other at a very basic level. The maximum use of the Internet was to send and receive emails with some encoded text; in later stages, users were allowed to exchange limited-size images and textures with each other (known as the First Revolution in ICT). Later on, it started expanding to the new era of telecommunications, and we invented wireless phones. Similarly, we have witnessed Wi-Fi (802.11 family), which brought the Second Revolution in the world of telecommunications, where each user started to have an IP address. That IP address is used as an ID during communications. Furthermore, developers and various companies jumped in, and the socioeconomic competitive applications began. Moreover, news feeds—such as Yahoo News and MSN News—moved from being text based to video streaming in the form of live news channels. More precisely, the World Wide Web (WWW) enabled users to share a huge amount of “content” online.

Recently, it was stated that global IP traffic would be approximately 24 exabyte per month. This massive traffic is the result of the increasing number of users who access Internet on a daily basis to share large amounts of data. These statistics were collected by Cisco in its recent ICT forecast update report. Moreover, in 2019, it is expected that almost 4 billion users will be accessing the Internet using various mobile devices including tablets, cell phones, laptops, and smart wearables. In short, it is not a difficult assumption that the rapid increase in Internet use will bring several challenges to service providers. In the last decades, we have seen the demands of end users increase faster than research and development efforts in the area of telecommunications. For example, today we want to FaceTime, YouTube, and Skype on the go rather than use a simple landline audio call with fixed wires. Similarly, many essential software and systems require a significant amount of bandwidth. To be specific, the current Internet architecture was originally designed for fixed networking technologies along with the support of infrastructures. However, in the future, mobile devices will bring a new set of challenges, and these must be met in a new fashion. Therefore, we need to change the architecture of the Internet in the near future. These challenges called forth researchers, such as

Van Jacobson, to consider bringing about the third revolution in telecommunications, in which the host-centric focal point of communication becomes information-centric, and this is called an “information-centric network” (ICN). Since then, various architecture changes have been proposed by various thinkers around the globe. The main objective of this book is to describe those changes focusing on the known ones along with their possible applications in the future.

In this book, we first provide the overview of Internet communications and its varying and emerging architectures during the past decades. The purpose is to let our readers know the history of Internet technology. In the first introductory chapter, we discuss the history of the Internet and explain the reasoning to have new developments such as content distribution networks, peer-to-peer networks, and multi-cast communications. In addition, we perform a feasibility check of future Internet solutions presented in the literature as well as their requirements.

In Chap. 2, we discuss some serious efforts that have been made to bring about various architectures for the future Internet during recent years. Each of those architectures has one thing in common, i.e., to focus on content delivery rather than host-centric approaches. However, only few of them gained popularity due to their possible applications being investigated. Hence, we describe the overview of those varying future Internet architectures such as data-oriented networking architecture, content centric networking, named data networking, publish/subscribe, and network of information. The main objective of this chapter is to let our readers become familiar with the transformation of those architectures.

In Chap. 3 of this book, we focus on content-centric networks (CCN) proposed by Van Jacobson while working for the PARC Research Company. The main goal of the CCN was to change host-centric communication to content-centric communication. In CCN, the requester is known as a “consumer” who sends an “interest” to the network, and any node with the requested data can send back the “content” to the consumer by way of the same path. This simple overview seems superficial without explanation. Therefore, in this chapter, we provide readers with the history of CCN followed by its basic operations. Moreover, we describe the different components of CCN in detail as shown in the following examples show:

- What constitutes content? What is the structure of content and the interest message?
- How the interest can be forwarded and, in response, how can the data retrieval be efficient compared with the current Internet architecture?

We believe that this chapter will enable our readers to have a solid background in CCN, and in later stages, can become active researchers in the given field.

Due to them being in the early stages of development, content-centric networks (CCN) and their variants e.g., named data networks, are undergoing rigorous modifications to make them applicable to various future networks. Finally, in the fourth and final chapter of the book, we identify future research aspects and the issues that have been partially addressed or have not been properly tackled by the researchers. In addition, we also provide a road map for researchers in the relevant field.

The motivation for this book is to provide students and future information engineers with a useful collection of Internet standards, technologies, and techniques that derive from research projects for the management of distributed data. We wrote the book during a very exciting period of research advancements in the future Internet paradigm. We expect our readers to have a basic level knowledge of the Internet and wireless technologies.

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Content-Centric Networks

An Overview, Applications and Research Challenges

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