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# Information-Centric Networking (ICN)

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**Abstract:** Information-Centric Networking (ICN) is novel paradigm considered for the future Internet, as well as for emerging architectures, such as the Internet of Things. Despite the significant research efforts that take place all around the world there are still many challenges and open issues related to the applicability of ICN. The papers of this special issue, six in total, identify such challenges, and propose solutions, design guidelines, and new research directions.

**Keywords:** future Internet; ICN research; networking architectures

## 1. Introduction

As the Internet evolves, new problems and concerns arise. The volume of content exchanged increases rapidly, users are using more and more mobile devices, data centers are becoming bigger and bigger, users are even more concerned about their security and privacy, the Internet consumes significant amounts of energy, and new paradigms, such as the Internet of Things, emerge. These observations raise the question: What is the role of Information-Centric Networking (ICN) in this emerging environment?

At the same time, new tools create opportunities for ICN to emerge. Software-defined networking, network function virtualization, blockchain-based technologies, edge computing, general purpose operating systems for constrained devices, programmable network and endpoint devices, and planet-wide testbeds. All these tools create the hopes that ICN can leave research laboratories and meet the real world.

This special issue includes six excellent articles that have been accepted following a rigorous review process. These articles are concerned with ICN security and trust, energy efficiency, mobility, caching, as well as the applicability of ICN in the Internet of Things (IoT).

## 2. Contributions

The papers included in this Special Issue of the Future Internet journal highlight some of the emerging issues that are associated with the ICN technology.

The first paper [1] provides name-based security solutions tailored for ICN architectures. This is achieved by leveraging identity-based encryption, identity-based proxy re-encryption, and decentralized identifiers. The paper presents constructions for outsourcing content storage, content integrity protection and content authentication, provenance verification, and access control.

The second paper [2] proposes a framework that integrates information-centric forwarding with the CDN technology, enabling more cost-efficient ICN-based telco CDNs. Furthermore, it designs a location-dependent pricing strategy that considers the spatially heterogeneous features of traffic in geo-distributed telco CDN sites that helps telco CDNs to manage their bandwidth more efficiently and to maximize their revenues.

The third paper [3] is concerned with the challenges of mobility management in ICN and it proposes design guidelines to overcome them. In particular, it highlights the functions that compose mobility management, based on the main architectural solutions developed for ICN, it identifies challenges that have not been overcome, and it provides a set of architectural guidelines towards a content-centric approach to mobility management.

The fourth paper [4] focus on the cache placement strategy and network performance of ICN, and proposes a cache placement strategy with energy consumption optimization. This is achieved by constructing a network energy consumption model for ICN architectures that transforms the problem of maximizing energy saving into an optimal stopping rule problem. Then, an algorithm for solving this problem is solved achieving this way the maximum expected value of energy saving.

The fifth paper [5] performs an overview of reputation-based approaches for trust management in ICN, and in particular in Named Data Networking (NDN). It examines and discusses whether existing credential-based mechanisms can be complemented by reputation-based solutions. To this end, it investigates various reputation-based trust management systems, and it identifies advantages, as well as open challenges.

The sixth paper [6] investigates push-based communication models for ICN architectures, focusing on their applicability in IoT systems. To this end, the paper discusses the properties of different push-based communication models, and it provides guidelines towards the integration of ICN pull and push communication models, particularly in the context of IoT.

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