Information-Centric Networking: A Unique Communication Paradigm

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The current host-centric networking architectures are facing daunting challenges owing to the complex protocols that employ, for instance, IP addresses in Internet-based communication and MAC addresses in resource-constrained internet of things (IoT) to locate a host node and to bring back the end-users requested content. To be precise, such networking architectures and communication protocols were designed to fulfil the early networking needs of scarce resource sharing. However, today's networks have significantly evolved from host-centric to a more content-centric model in which the users are only interested in the content they are looking for rather than the location of the content—i.e., the IP address of cloud or server node. According to an article published on the visual capitalist website, mobile downstream video content alone accounts for almost 49% of the overall traffic. The remaining content categories include social networking, web browsing, gaming, and file sharing, to name a few, again elucidating the importance of contents. To satisfy these gigantic content requirements, researchers introduced incremental patches such as content-delivery networks, peer-to-peer content sharing, and domain name systems, making existing address-centric protocols even more complex.

To resolve the issues presented above, information-centric networking and specifically its realisation named data networking (NDN) have as appeared promising solutions, paving the way for content-centric communication architecture by directly utilising hierarchical and semantically meaningful names on the network layer to forward the packets. NDN features various benefits, including request aggregation, multi-casting, in-network caching and content-level security, among others, owing to the use of content names for packet dissemination.

My research focuses on developing name-centric communication protocols for various technological domains, including IoTs—be it resource-constrained or rich, edge cloud computing, 5th generation communication, vehicular fog computing and ad-hoc networks, with aims at enabling in-network computations, reducing backhaul traffic, network congestion and latency. My research findings indicate that if practically applied, NDN has all the potential to replace the traditional networking architecture and can bring enormous benefits not only to end-users using these networks but also to the businesses providing network resources.

The NDN research so far proves its effectiveness mainly through simulation-based experimental evaluations, and little or no research and development efforts have been devoted to applying NDN protocol to real-world networking scenarios. These scenarios range from large scale Internet-based communication to local networking setups that include smart infrastructure, industrial automation and infrastructure-less ad-hoc communication. Therefore, through further research and implementation efforts in these directions, we can practically attain the potential benefits of NDN.

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