Design and Analysis of Forwarding Strategies for Host and Content Centric Networking

Starting from the evidence of the Internet’s actual limits, in this Thesis we investigate different aspects of two directions the Internet is evolving toward. In particular, we consider more flexible ways to reach hosts, and to distribute content. Host Centric Networking (HCN) is the name we give to the umbrella architectures which try to decouple host location and identifiers. Basically, they identify each device by the means of flat labels which do not locate the host within the network. HCN architectures leverage Distributed Hash Table (DHT) approaches for retrieving the host position from the corresponding label. However, routing and forwarding underlying the DHT, heavily rely on traditional single path algorithms. Thus, in the first part we propose APLASIA, an alternative routing architecture mainly composed by a path-finding algorithm, namely APL, and by an autoforwarding data plane. By adding a slight amount of message complexity to the canonical approaches, APL is able to find optimal disjoint paths, still reducing computational algorithmic complexity. The trade-off between communication cost and path optimality is tuned by a single system parameter, easily set and by the way not critical for the correct Aplasia functioning. Besides, we provide a model which forecasts static and dynamic costs of our approach. APLASIA leverages an autoforwarding data plane that completely specifies paths in the packet header. This kind of design makes removing FIBs from the network core possible, following the impetus toward simplifying core devices, and shifting complexity to the edge. Finally, we evaluate APLASIA’s autoforwarding by the means of a Click testbed. Information Centric Networking (ICN) makes content directly addressable by network hosts. The basic idea is to send packets carrying the content identifier, rather than the host address. As content can be easily cached within network devices, an ICN network can be modeled as a receiver driven network of caches. Indeed, in the second part of this work, we consider caching algorithms deployed over a network of caches. Each of these algorithms is a triplet composed by forwarding (which path is worth following), meta-caching (what content is worth caching), and replacement (what content is worth replacing) strategies. We develop ccnSim (distributed like open source software) in order to inspect which (exogenous and endogenous) factors mostly influence caching performance: popularity models, topologies, strategies, and henceforth. Then, we focus on the forwarding part, pointing out that coupling meta-caching and forwarding strategies produces a notable performance gain. We then propose a theoretical model for an ideal forwarding strategy, in which the nearest copy of the content is instantaneously provided by an external oracle. Finally, we design two different forwarding implementations of the oracle-based approach.