Satellite-Assisted Content Delivery Network using MobilityFirst Future Internet Architecture

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Abstract

This thesis presents the design of a satellite-assisted CDN that utilizes the MobilityFirst Future Internet Architecture (MF-FIA) for content delivery. Current CDN solutions require an overlay control framework on top of IP to deal with content caching and delivery. However these features can be integrated into the network layer in an ICN based design. The proposed CDN solution uses MobilityFirst, a representative example of ICN to show the benefit of an integrated network layer solution. The framework uses in-network caches to reduce the latency of content delivery relative to overlay CDN designs. Content requests are efficiently routed to the nearest content source using the MobilityFirst routing protocol. As content providers are aware of content popularity and its distribution, the framework supports a pushing mechanism where content providers can pro-actively push popular contents to designated cache locations. This can be efficiently done using services such as multicast or broadcast which are natively supported in MobilityFirst. The routing mechanism can choose to deliver contents either through a terrestrial network or through a broadcast medium such as a satellite. Finally the proposed architecture uses self-certifying content names that enable efficient content validation.

A proof of concept prototype was created to demonstrate the feasibility of this solution and to conduct performance studies on the effectiveness of content caching in the network. The prototype includes Click based MobilityFirst routers, a GNRS, a content provider and a Click based satellite emulation. The benefit of in-network caches was studied by requesting contents with popularity drawn from a Zipf distribution. Results obtained with the prototype system demonstrated that clients experienced reduced delay due to in-network caches and that a fairly high cache hit ratio was achieved in some content distributions even when the cache only stored a small portion of the total contents. The evaluation was also used to study the impact of key

parameters such as the Zipf distribution parameter and cache size on metrics such as delay and cache hit ratio.

Defense Committee: Prof. Dipankar Raychaudhuri (chair), Prof. Wade Trappe and Prof. Badri Nath.