On Modeling and Optimizing Transport Protocol for Content-Centric Networking

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Recently, Content-Centric Networking (CCN) has been extensively studied by networking researchers as one of the promising network architectures for realizing information-centric networking. CCN adopts a fundamentally different communication paradigm from that of the conventional IP (Internet Protocol). Therefore, advanced transport protocols developed for IP cannot be directly used in CCN. However, transport protocol designers for CCN should be able to learn from ideas and experiences in TCP (Transmission Control Protocol) development. In this thesis, we focus on a loss-based AIMD (Additive Increase Multiplicative Decrease) window flow control mechanism as a transport protocol for CCN. In CCN, rapid detection of packet losses in the network using timeouts is difficult because of CCN-specific problems such as multiple sources, content caching, and Interest packet aggregation. In this thesis, we therefore propose a fast packet loss detection mechanism called *Interest ACK (ACKnowledgment)* for CCN, which is inspired by the SACK (Selective ACKnowledgment) option in conventional TCP , and investigate the fundamental characteristics of a loss-based AIMD window flow control mechanism with Interest ACK through simulations. Simulation results show that Interest ACK reduces the number of packet losses at the repository by 10%–20%. In

this thesis, we also develop a fluid model of a CCN network comprising of entities running a loss-based AIMD window flow control mechanism, routers with content caching and Interest packet aggregation, and repositories, which makes it possible to analyze the dynamics of transport protocols in large-scale CCNs.