There is an increase in the surge of data over Internet due to the demand on multimedia content. It is estimated that 80% of Internet traffic will be video by 2022. At the same time, IoT devices on Internet will double the human population. While infrastructure standards on IoT are nonexistent, enterprises encourage cloud-based solutions, causing an additional surge of data over the Internet. This study proposes solutions to bring video traffic and IoT computation back to the edges of the network, so that costly Internet infrastructure upgrades are not necessary. The study provides the Event Query Language and processing environment to process events from various devices. It brings application developers, sensor infrastructure providers and end users together. It addresses device heterogeneity and pushes the data-intense tasks to the edge of the network. The second focus of the study is Video-on-Demand applications. Due to the popular content, same video traffic flows through Internet Service Provider's network as overlapping but separate streams. In previous studies on redundancy elimination, overlapping streams are merged into each other in link-level. In this study, these techniques are significantly improved by introducing a merger-aware routing method. Our final focus is utilization of Content Delivery Network servers on the edge of network to reduce long-distance video-on-demand traffic. The proposed system uses Software Defined Networks to route adaptive video streaming clients to the right CDN servers. While performing network assistance, the system does not reveal video request information to the network provider, thus enables privacy protection for encrypted streams. Request routing is performed in segment level for adaptive streaming. This enables to re-route the client to the best available CDN without an interruption if network conditions change during the stream.

Approved for distribution by Kien Hua, Committee Chair, on March 1, 2019.

The public is welcome to attend.