Complex Features Extraction in Real Time

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In-network computing is an emerging research area in systems and networking, where applications traditionally running on the host are offloaded to the network hardware (e.g., switch, NIC). Recently, a paper published by Z. Xiong and N. Zilberman discussed the possibility of in-network classification, i.e., performing Machine Learning on a commodity programmable switch. One of the limitations was that inference was performed using information from packet headers and metadata, e.g., source and destination IP address, source and destination port number, etc. This limits us to just packet classification. However, some ML models require features that are more complex than just information from packet headers and metadata. At the moment, there is no previous work that looks into extracting these complex features.

My project aims to explore more complex feature extraction beyond headers and metadata, e.g., total duration of a flow or flow size. These complex features may require the use of counters or externs to store certain states for computation and the externs functionality might be target-specific. It might also be possible that some complex features cannot be extracted at all on a switch. Thus, the goal of the project is to demonstrate the possible functionality and explore the extent to which feature extraction is capable of, rather than achieving a great performance. The project will be done in P4 programming language on one of the two available platforms: *bmv2*, a P4 software switch, or *NetFPGA*, which I am familiar with from my Part II project.