

Enabling High Scale, High Performance Networking on Intel IPU: The SONiC-DASH Use Case

In the era of cloud computing, the demand for high-performance, scalable networking solutions is ever-increasing. SONiC-DASH (Disaggregated APIs for SONiC Hosts) emerges as a groundbreaking open-source initiative designed to harness the capabilities of programmable network hardware, such as the Intel IPU, to revolutionize networking within cloud environments. This project transcends traditional software-based approaches, targeting pivotal applications in high-performance Network Appliances and Smart Switches. SONiC-DASH's connection tracking mechanism introduces stateful processing into the packet pipeline, facilitating seamless bidirectional communication between virtual machines, irrespective of their physical locations. The architecture further boasts a sophisticated 5-stage ACL, dynamic routing, and cutting-edge functionalities including high availability, private link, and service tunneling.

Our session delves into the architectural intricacies of the DASH pipeline, as implemented on the Intel IPU2100—a 200Gbps smart network interface processor that epitomizes the fusion of networking prowess with smart switch capabilities. We will dissect the architectural nuances of the DASH pipeline, focusing on the P4-programmed implementation that underpins the inbound and outbound routing, forwarding, and the multi-tiered ACLs. We will present our connection tracking implementation, capable of managing up to 32 million bidirectional flows with flow aging. We will elucidate how the DASH pipeline is meticulously mapped onto the IPU hardware blocks, leveraging P4 tables for an optimized high-level design. We will also showcase empirical performance metrics, including Connection Per Second (CPS) rates, demonstrating the system's ability to handle high-scale environments with millions of concurrent flows. Join us as we explore the challenges, design decisions, and performance breakthroughs of implementing SONiC-DASH on the Intel IPU2100, setting a new benchmark for cloud networking efficiency and scalability.

We also plan to include a recorded tabletop demo that will showcase the Dash pipeline functionality and performance on Intel IPU.

Figure 1 shows the high-level picture of the Dash pipeline with SONiC deployment.

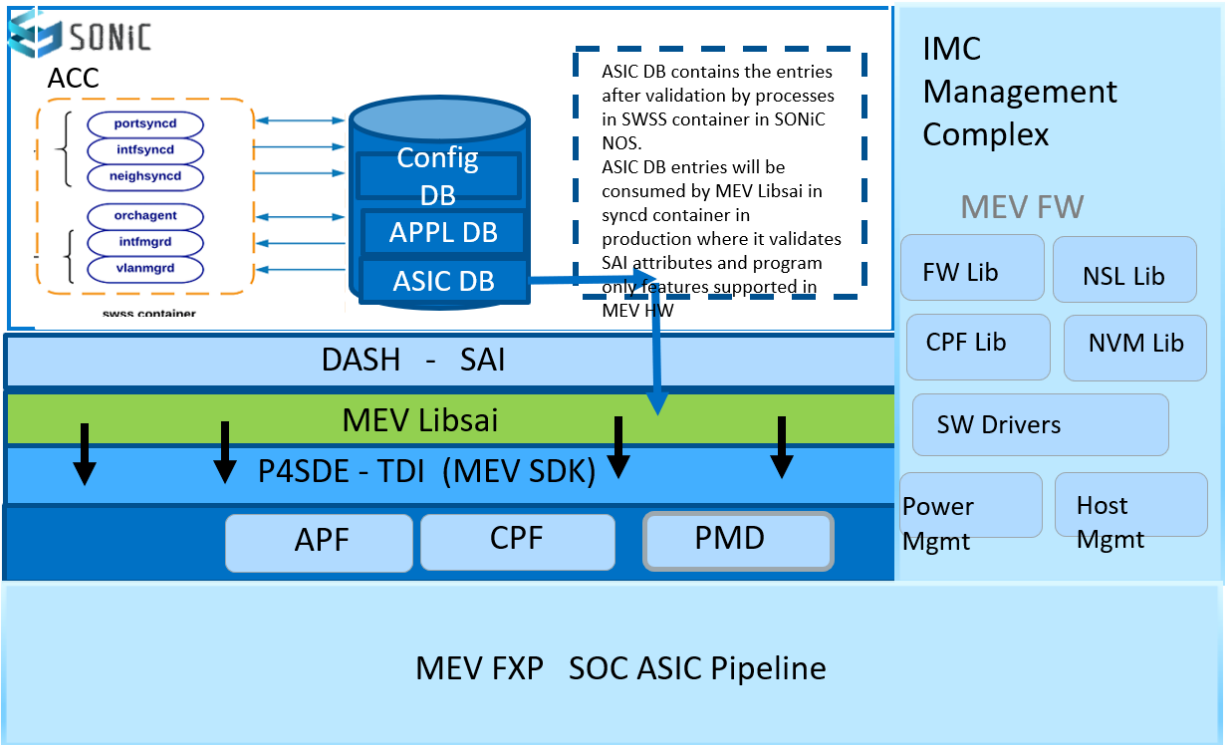


Fig. 1. SONiC Deployment with DASH on Intel IPU

Figure 2 shows the high-level architecture of the implemented pipeline.

The demo will showcase the working P4 pipeline complete with routing, ACLs and connection tracking. The P4 tables in the pipeline will be configured for scale (160K routes, 320K ACL rules). Traffic at high volume (30 million background flows, >3 million new connections) will be transmitted using Ixia traffic generator, forwarded through the IPU pipeline and we will demonstrate the CPS achieved.

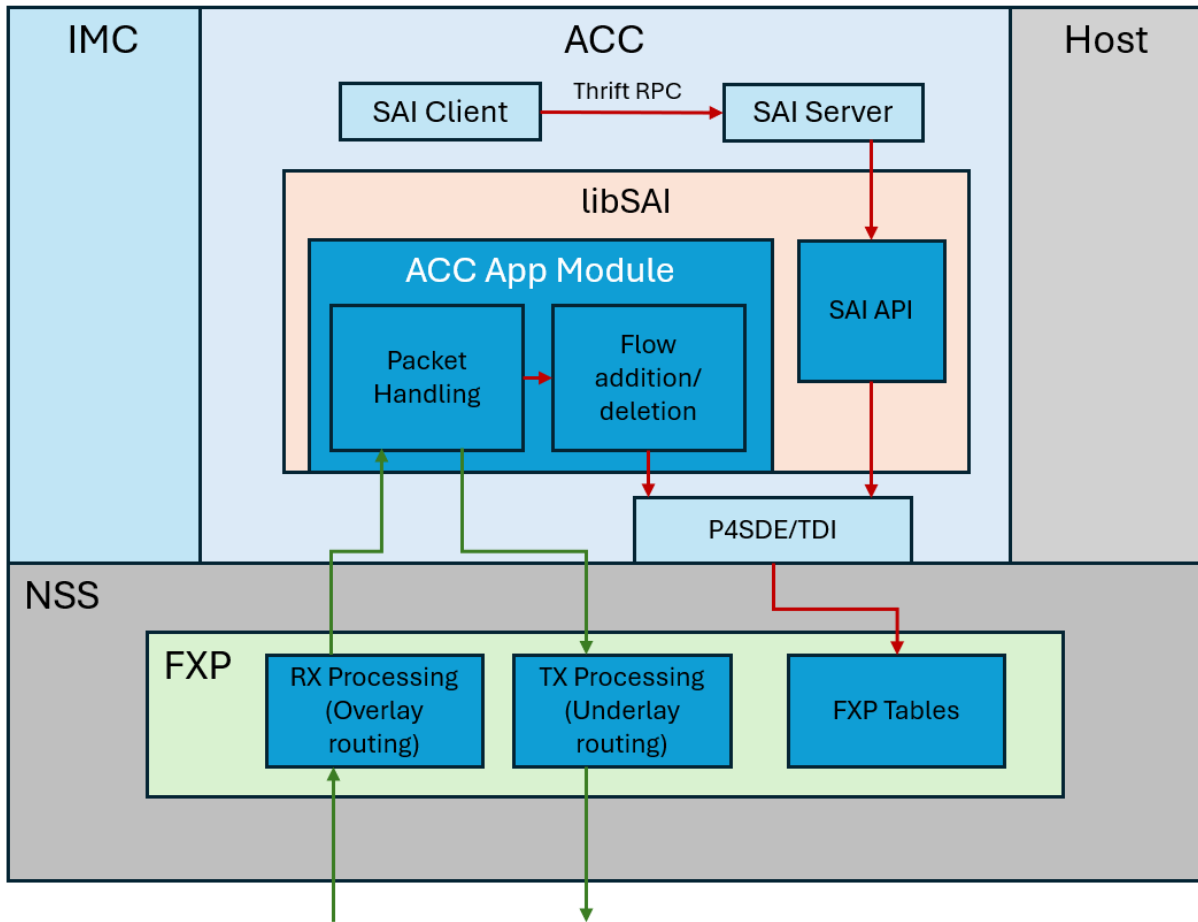


Fig. 2. High-level Architecture of DASH on Intel IPU