

Ben Mack-Crane's white paper for the Software Defined Infrastructure / Software Defined Exchange Workshop

As we move in the direction of increasingly software-defined infrastructure there is an urgent need to understand more fully the implications of changing network behavior via an update to the software implementing and controlling the network. There is an inherent order in the configuration of datapath functions and the subsequent control of those functions to provide network services. For instance, in a Match-Action datapath packet headers must be defined before they can be referenced in a match and actions must be defined before they can be invoked. In ASSP-based network equipment a substantial portion of this datapath functionality is determined in chip design. Working with fully programmable network platforms allows a broader range of variation in both network behavior and in the time at which aspects of that behavior are determined. However, some changes in network function can have a substantial impact on network services and even on network stability while other changes may impact only a single service or a single flow.

Developing an understanding of the relationships between various network functions and the sensitivity of the network as a whole to changes in these functions is essential to creating a robust network while maintaining the required levels of flexibility and performance. This research should also investigate the ripple effects of changes in network function, both across the network and into the control plane. This understanding will inform network developers as they decide which aspects of network behavior to determine as a part of datapath configuration (whether in software or chip design) and which aspects can be safely left to run-time control. It will also inform the development of network software update procedures that will be needed to safely install new network capabilities without unduly impacting active network services.

Research into the structure and relationships of various network functions will require testbeds that support flexible network function programming (and re-programming). Support for virtualization and sufficient performance to match anticipated practical network deployments are also desirable.

Ben Mack-Crane is a Principal Architect at Corsa Technology focusing on high performance applications of pure SDN using open protocols. Ben has experience with automated control across a broad spectrum of network technologies, from optical to packet and L0 through L7. He has been involved in behavioral specification and modeling of a wide variety of network elements over his career including packet switches and routers, transport systems, cable telephony, flexible multiplexers, and telephone switches. His current focus is on SDN and virtualization. Ben has been instrumental in numerous standards development efforts, including work in the ONF, MEF, IEEE, ITU, IETF, OIF, and ATIS. He is currently the ONF Specification Area Director, encouraging the application of SDN principles across the networking spectrum from optical to packet and from fixed transport to mobile applications. He is also leading the ongoing development and evolution of the OpenFlow protocol in the ONF Open Datapath Working Group.