Extending the Software-Defined Network Boundary
Oliver Michel, Michael Coughlin, Eric Keller

Intra-Application Networks
Applications often implement custom internal, intra-application networks with responsibilities very similar to traditional networks. Especially stream processing systems:
- Real-time Analytics (e.g. Storm, Samza, S4)
- Sensor Network Systems (e.g. DataTurbine)
- Network Processing (e.g. NFV, Click)

Example Processing Topology in Storm

Today: Two Separate Networks with Different Control Interfaces
Complexity/Flexibility Tradeoff:
- Flexibility problems in current implementations
  - e.g. Rebalancing in Storm
  - e.g. Click graphs local to a single machine
- Possible to get around some of these issues with additional patches (increased complexity) but nonuniversal solution

A Unified Network: Push the SDN-Controlled Network into the Application Layer
- Free applications from network management tasks
- When network functionality is extended all applications benefit from it
- Revisits the question of a new network interface
  - Initial attempt is implemented in our prototype
- SDN is an enabling technology

Prototype/Application Integration
- Prototype controller and application switch leveraging Linux D-Bus technology
- Integration into two existing systems
  - Storm stream processing framework through custom processing elements
  - Click modular router through custom source and sink Click elements