

# Application Driven Forwarding (ADF)

NSF/DFG Workshop Puerto Rico

# Problem Statement

- Different user applications have different needs, e.g.
  - High performance bulk data
  - Low latency
  - Loss rate / reordering / path stability
- Today application do not have good visibility into and control of how their traffic is forwarded over the network. (Network are blind to the needs of an application's traffic)
  - Networks forward traffic according to their needs (traffic may not be forwarded according to the application's demands)
- Hypothesis: Allowing for explicit statement of requirements may benefit everyone

# Motivation

- Hardware these days is powerful, allowing us to put state, features, and embedded services into the network...
- Make forwarding decisions a process in which:
  - The content provider, network operator, end-host application, etc. can participate
  - All can achieve better efficiency, performance

# Current versus clean slate

## Current

- Classification of traffic for QoS determined by operators
- Limited ability to reserve resources
- Transport state is pushed to the edges

## Clean slate

- Let applications specify needs for their own traffic
- Provide resources on request subject to availability
- Transport now takes on the properties defined by the application needs
- The network may take an active role in transport

# Two use cases

## Bulk data transfer

- Latency not a concern
- Tolerate loss and reordering
- The network could/should:
  - Use compression, coding
  - De-prioritize for latency (queuing policy)
  - Utilize a buffer and burst transport model
  - Enable multipath to minimize maximum link utilization
  - Enable caching for replication

## Voice over IP

- Minimize latency / loss / jitter / reordering
- The network could/should:
  - Enable forward error correction service
  - Forward along shortest paths
  - Prioritize for latency (queuing policy)

# Experimental setup: bulk data transfer

## Experimental component

- Source transfers data to one or more sinks
- Network service elements
- Software-defined forwarding elements
- WAN links

## ...within Glab/GENI

- Reservable PCs (Emulab, PlanetLab, anything with a disk and network interface)
- NetFPGAs, SPP, specialized PCs
- OpenFlow switches, controller
- Layer-2 links (ION/NLR)

# Experimental design and expected results

- Define a set of metrics for performance gains from user and operator perspectives
- Validate each action taken by the network based on application needs actually delivers a benefit
- Validate that combined actions achieve benefit