Prototyping and Evaluating SDN-based Multicast Architectures for Live Video Streaming

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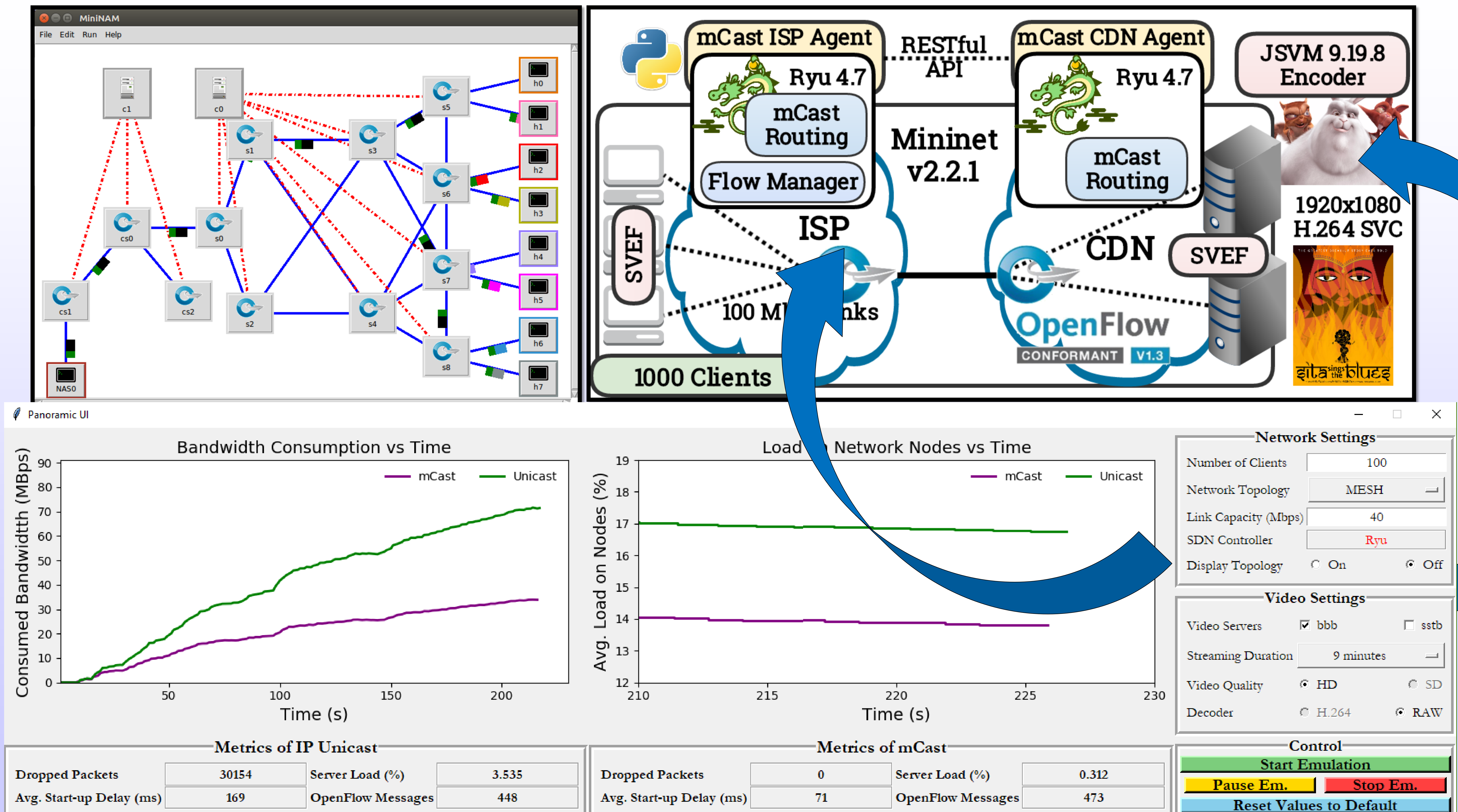### Dept. of Computer Science, University College Cork, Ireland

Introduction

Significance: Internet video to TV will continue to grow at a rapid pace, increasing 3.6-fold by 2020. Live video streaming services constitute of **40 percent** of consumer Internet video traffic. [Cisco2015]

Contribution: A generic platform to evaluate and compare various SDN-based multicast architectures or algorithms. Benchmark the performance against standard IP unicast. Provide **a mechanism to modify various evaluation parameters and monitor the effect on output** in form of graphs and live statistics. **Implement a prototype of mCast** and compare it with IP unicast.

Evaluation Platform: Testbed Setup and GUIs

Panoramic UI

Bandwidth Consumption vs Time — mCast, Unicast

Load on Network Nodes vs Time — mCast, Unicast

Metrics of IP Unicast			
Dropped Packets	30154	Server Load (%)	3.535
Avg. Start-up Delay (ms)	169	OpenFlow Messages	448

Metrics of mCast			
Dropped Packets	0	Server Load (%)	0.312
Avg. Start-up Delay (ms)	71	OpenFlow Messages	473

Network Settings
- Number of Clients: 100
- Network Topology: MESH
- Link Capacity (Mbps): 40
- SDN Controller: Ryu
- Display Topology: On / Off

Video Settings
- Video Servers: bbb / sstb
- Streaming Duration: 9 minutes
- Video Quality: HD / SD
- Decoder: H.264 / RAW

Control
- Start Emulation
- Pause Em. / Stop Em.
- Reset Values to Default

mCast: An SDN-based Resource-Efficient Live Video Streaming Architecture with ISP-CDN Collaboration

Key Features

Inter-domain network layer multicast – **Dynamic multicast tree construction**

Full control of CDNs over their clients – **Transparent delivery** to clients

Components and Functions

mCast CDN Agent: Identifies clients and **triggers mCast**.

mCast ISP Agent: Interfaces with CDN and orchestrates mCast operations in ISP.

mCast Streaming Server: Implements an API to communicate with mCast CDN Agent.

mCast CDN Routing Module: Consults mCast CDN Agent before proceeding with the default routing.

mCast ISP Routing Module: **Constructs multicast trees** based on the routing logic.

mCast Flow Manager: Installs multicast entries in network nodes with **higher priority** than IP unicast and installs **transparency rules** on the egress switch.

Results and Benefits

Reduced load on CDN servers - Energy savings for CDNs

Reduced inter-domain and intra-domain traffic for ISPs - Better video quality
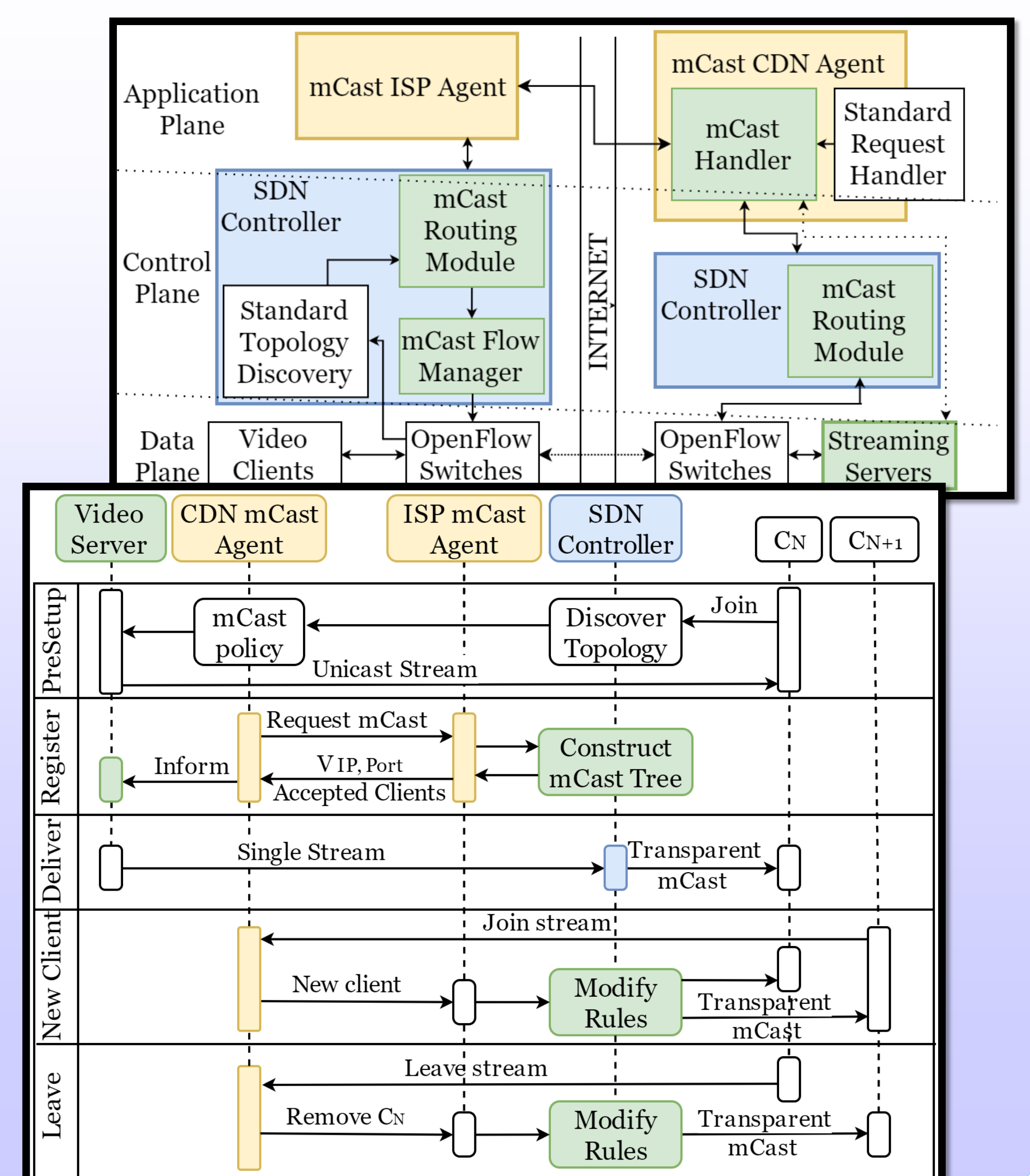
Evaluating other algorithms

The platform consists of **discrete scalable and reusable modules**, with every module independent of others.

To implement any other algorithm, its code can be added to the relevant module of the platform as a plug-in.

For very large scale evaluations, real-time statistics can be disabled and **logs can be gathered for post-processing**.

QR code for a link to details, examples and videos of the platform.

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