

Integration of a Cloud-Edge Simulator with Mininet

Proposal

The ECLYPSE simulator provides a modular framework for the simulation and emulation of applications and services distributed across the Cloud-Edge continuum, relying on Ray for computational resource management. However, the representation of the underlying network (links, latency, bandwidth, congestion) remains abstract and is not directly emulated.

The goal of this thesis is to integrate ECLYPSE with Mininet, to obtain a co-simulation platform that combines:

- the modelling of distributed services and tasks provided by ECLYPSE, and
- the realistic virtual network offered by Mininet (custom topologies, bandwidth limits, delays, packet loss).

The work includes:

- the definition of a software bridge between ECLYPSE and Mininet (e.g., via API or sockets),
- the ability to map ECLYPSE logical nodes onto Mininet virtual nodes,
- synchronized control of simulation and emulation (coordination of Ray-Mininet events),
- joint logging of network and service events for integrated analysis.

This integration will make it possible to run realistic edge computing experiments, where the network plays a key role in application performance, and to reliably validate placement, offloading, and orchestration strategies.

Tools and Technologies

- Python
- ECLYPSE
- Ray (for computational emulation)
- Mininet (for network emulation)
- Pandas / Matplotlib (for logging and analysis)

Objectives

1. Analyse the interfaces and architecture of ECLYPSE and Mininet.

2. Define a co-simulation model and a synchronization protocol between the two environments.
3. Implement an ECLYPSE–Mininet bridge that enables automatic creation of consistent topologies.
4. Run experiments with multi-node scenarios (Edge + Cloud) measuring network impacts on response time and throughput.
5. Extend the system with combined logging (network + services) for analysis and visualization.

Prerequisites

- Good knowledge of Python.
- Basic knowledge of computer networks (latency, bandwidth, topology).
- Interest in distributed systems and Cloud-Edge computing.