Development of an emulated network

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Project summary

Applications and telecommunication services today are intrinsically distributed, mobile and work across heterogeneous networks. Developing, validating and assessing such applications require a controlled network environment where parameters such as topology, link behavior, connectivity etc can be modified easily. Real networks do not offer this level of flexibility so a simulation approach if often adopted. Simulations, though, require that application behavior is modeled within the network simulator, a solution that is ineffective when the application is distributed and non-deterministic.

Imagine the task of testing out a peer-to-peer IPTV application using a network simulator such as NS-2 or Opnet. This would be a daunting task since in such applications we don’t know who connects to whom, when connections take place, or how long these connections last. Data streams are delivered in real-time and data rate depends on all sorts of factors such as coding, type of content or number of users.

This project aims at going one step further, developing an emulated network environment that allows the execution of real applications on top of complex ‘emulated’ networks. The first step is to specify the project requirements. Then a critical survey of existing open-source, emulation software will be carried out in order to select a suitable framework. Starting from existing software components and emulation routines, the student will design and prototype a programmatic interface allowing the creation of emulated networks. Example parameters of this network include: topology (number of nodes, links and interconnectivity), link properties (e.g. 802.11, Ethernet), link behavior (e.g., bandwidth, latency, packet loss). The next stage will be to carry out a methodic validation and evaluation of the network, running distributed applications (preferably P2P streaming applications) and determining the limiting factors of the emulated network (based on application instances, network nodes, link bandwidth etc).

The project provides an opportunity to get a thorough understanding of advanced networking and network programming. The student will appreciate the issues relating to complex, networked applications, familiarizing with the topical theme of network-aware application development.