ShaPy - network emulation framework
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Problem
- Testing a complex peer-to-peer application
- Simulation is slow and requires reimplementation of the p2p protocol
- We need to test the real application
  - in real environment
  - without support from the app itself
  - its real speed

\[ \Rightarrow \text{emulation} \]

Network Emulation
- Many standard emulation solutions
- ... but they all require large amounts of HW
- The Bad: each app instance = 1 PC
- What if we could run more than one instance on one PC?

Local Network Emulation
- Multiple app instances on one PC
- network separation of app instances within one PC (no virtualization etc.)
- Otherwise local apps behave as if they were communicating over a real link
- The Bad: TCP/IP stack design doesn’t count with this type of use
- Linux allows us to circumvent this
  - instance identified by an IP address
    - one interface = multiple addresses
  - OS automatically assigns source IP when unspecified by the app
    - often source IP = dest IP ... wrong
    - override bind() and connect() in libc and inject the correct IP

Linux Traffic Control
- allows us to easily create a complex packet scheduler in the kernel
- the scheduler creates conditions similar to the real network (latency, speed etc.)

ShaPy
- configures and controls the scheduler
- comprehensive framework that allows to easily create a virtual network with the desired properties (e.g. latency)
- pure Python implementation
- example network (note the latencies):