ProtoRINA over GENI

Yuefeng Wang

in collaboration with

Ibrahim Matta and Nabeel Akhtar

Computer Science Department

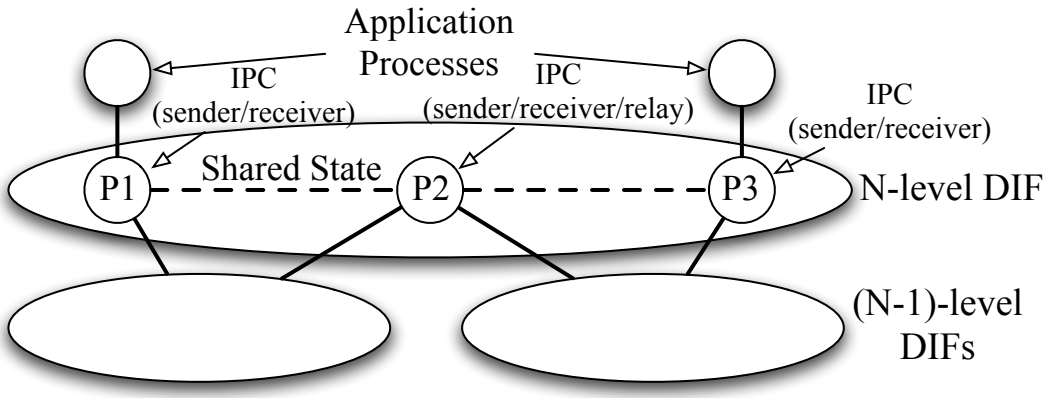
Boston University

Outline

- RINA: Recursive InterNetwork Architecture
- ProtoRINA: A User-space Prototype of RINA
- ProtoRINA Experiments over GENI

RINA: Recursive InterNetwork Architecture

- Networking is Inter-Process Communication
- Distributed IPC Facility (DIF) is the layer
- Separation of mechanisms and policies
- Better security, mobility support and manageability



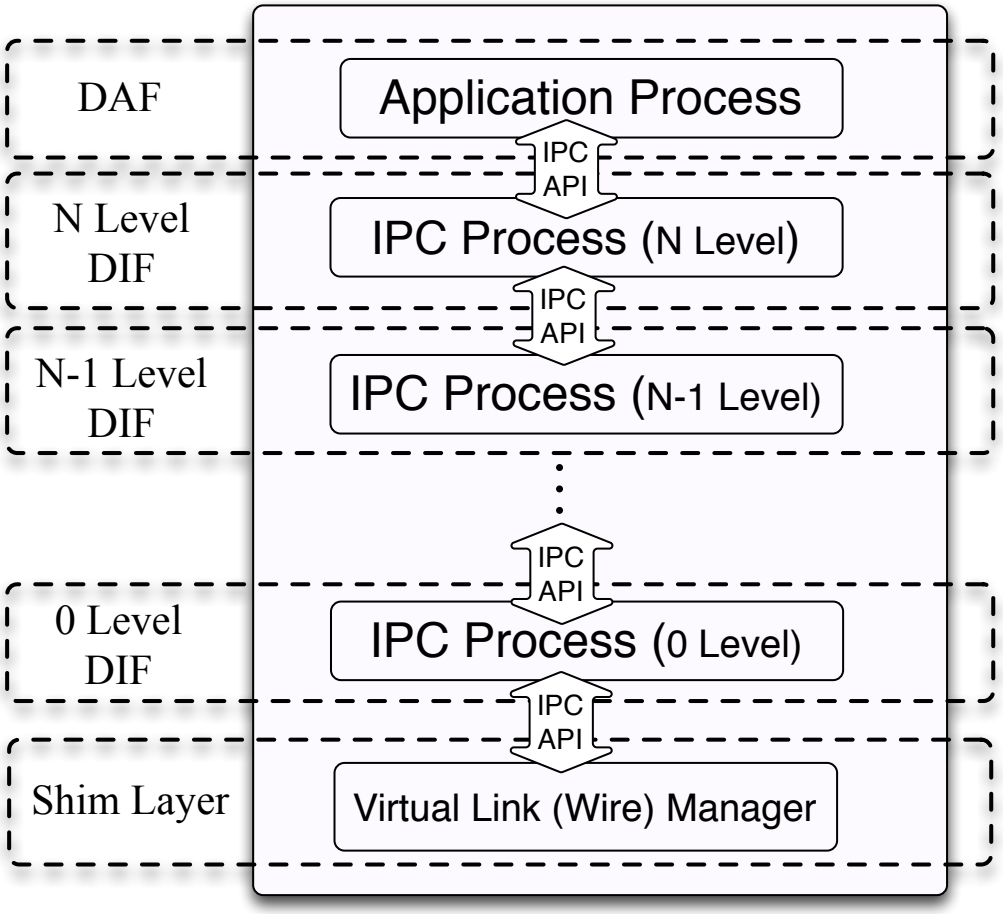
ProtoRINA

- **Overview**
  - Boston University's user-space prototype of the RINA architecture
  - An experimental tool for new (non-IP) applications / policies
  - A teaching tool for networking and distributed systems classes

- **Status**
  - around 55,000 lines of Java code
  - code and user manual now available online
  - tested on our local campus network and the GENI testbed
  - some preliminary cross-debugging with two other RINA prototypes (IRATI and TRIA)
  - more components continually being added

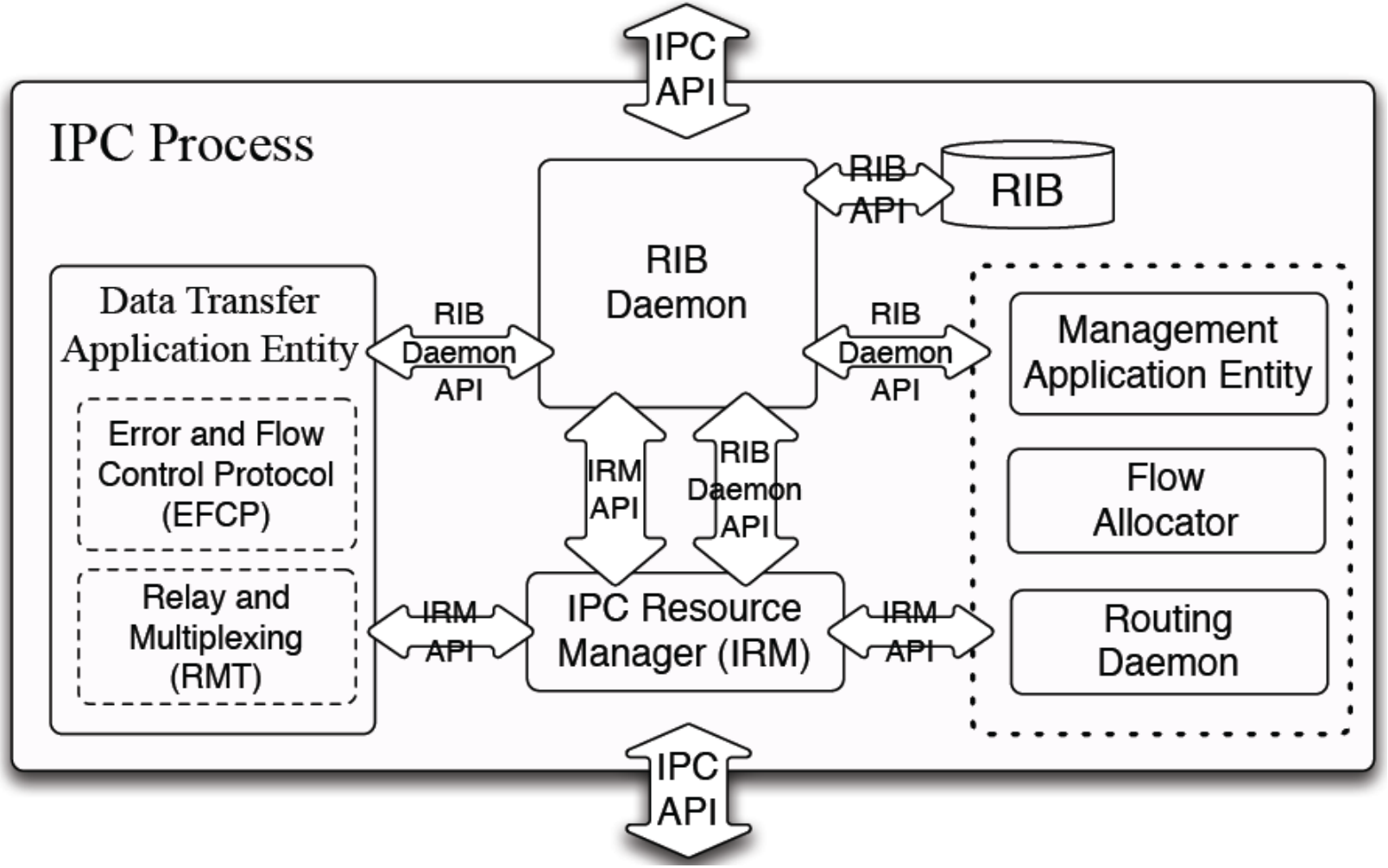
RINA Node

- Distributed Application Facility (DAF): a set of Distributed Application Processes cooperating to perform a certain function : communication, weather forecast, genomics, *etc.*
- A DIF is a specific DAF whose job is only to provide IPC



IPC Process and RINA APIs

- IPC: provides communication service for application processes or higher level IPC processes



ProtoRINA Experiments over GENI

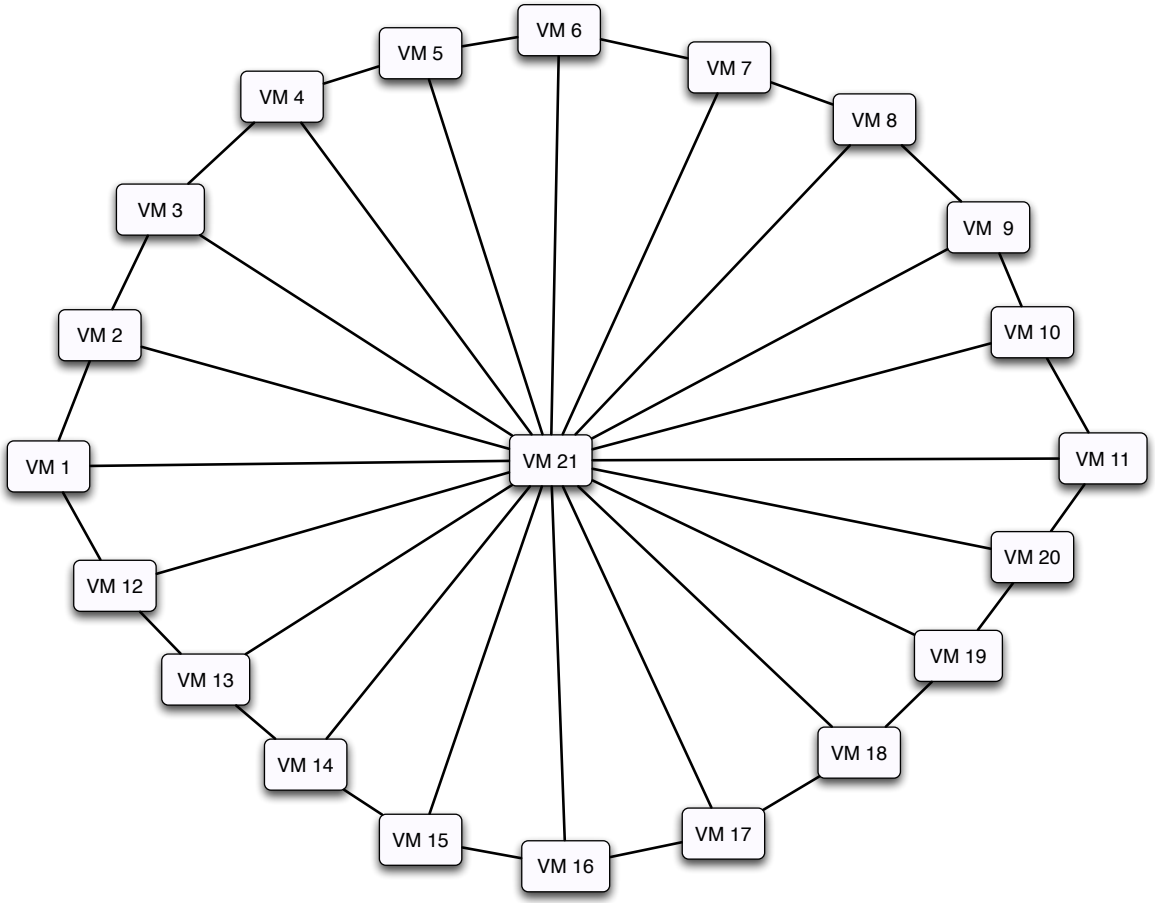
- RINA: Separation of mechanisms and policies
  - DIF (layer) repeated over different scopes
  - Policies tailored to scope of DIF
- Experimental design for our demo at GEC19:
  - Different DIF topologies and routing policies on hosts with same physical connectivity
- Tools: GENI Portal and SSH

To Run ProtoRINA Experiments over GENI

- Reserve VMs through GENI Portal
  - TCP connections between VMs to emulate physical connectivity between RINA nodes
- SSH to each VM:
  - Install Java Runtime Environment
  - Upload ProtoRINA code
  - Start RINA node process
- Get from VMs the log files generated by RINA nodes
- Analyze ProtoRINA log files

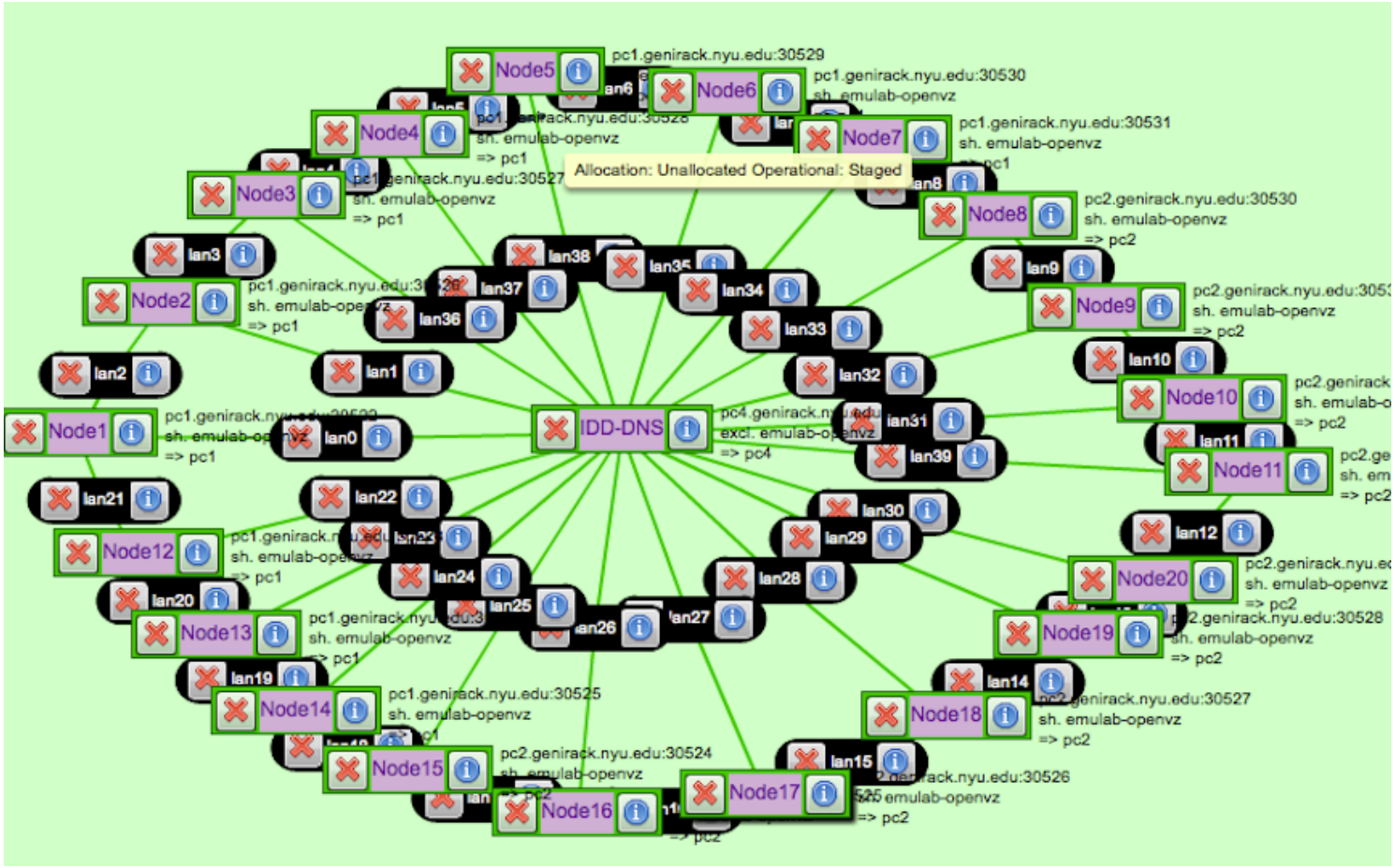
Physical Network Connectivity

- A network with 21 VMs

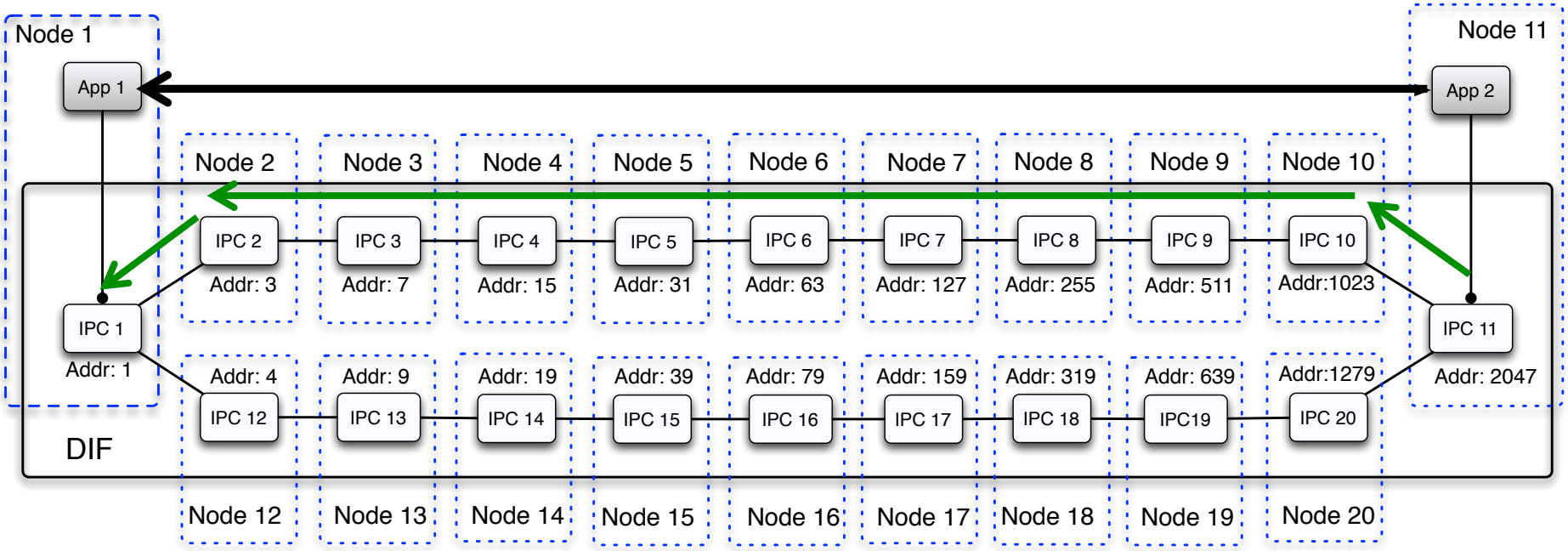


Physical Network Connectivity

- 21 VMs from NYU aggregate

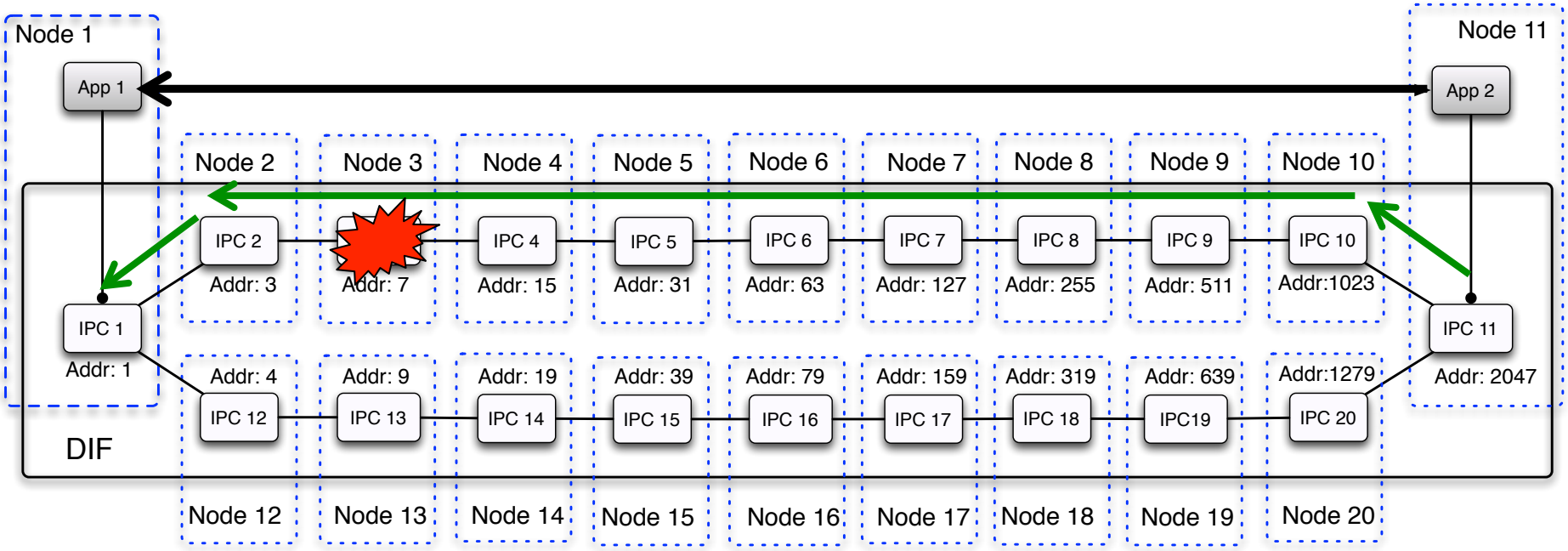


One-level DIF Topology



- Link-state routing information updated every 5 seconds

One-level DIF Topology



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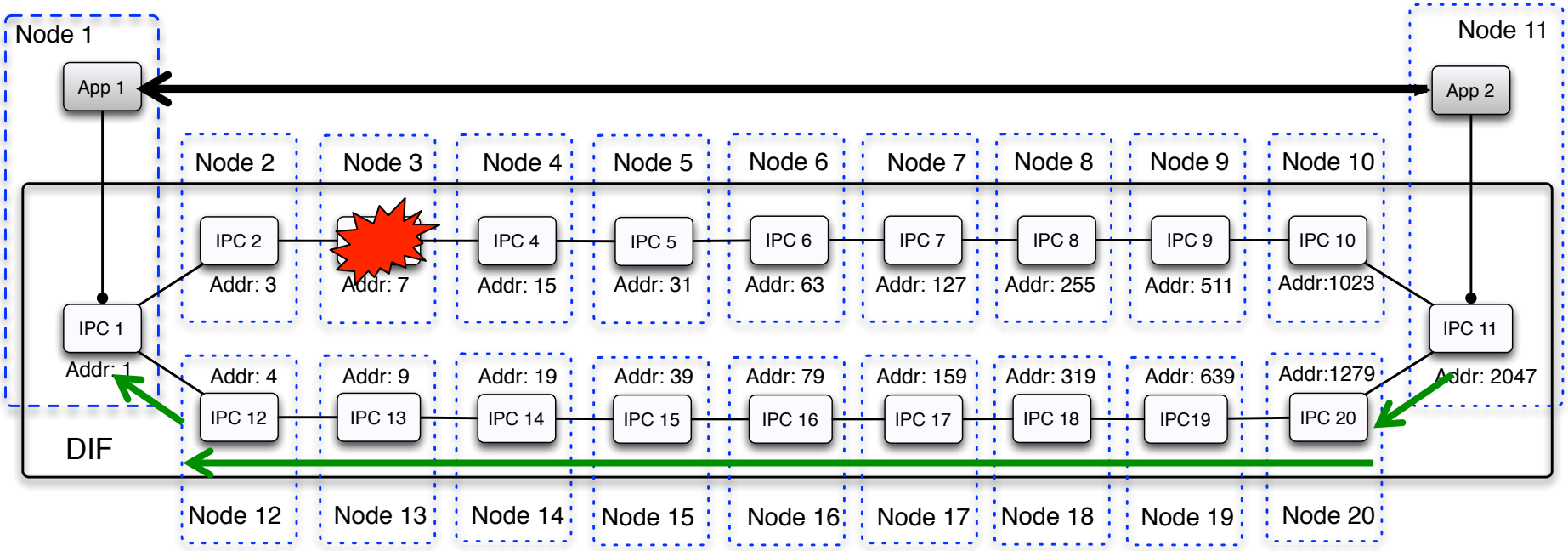

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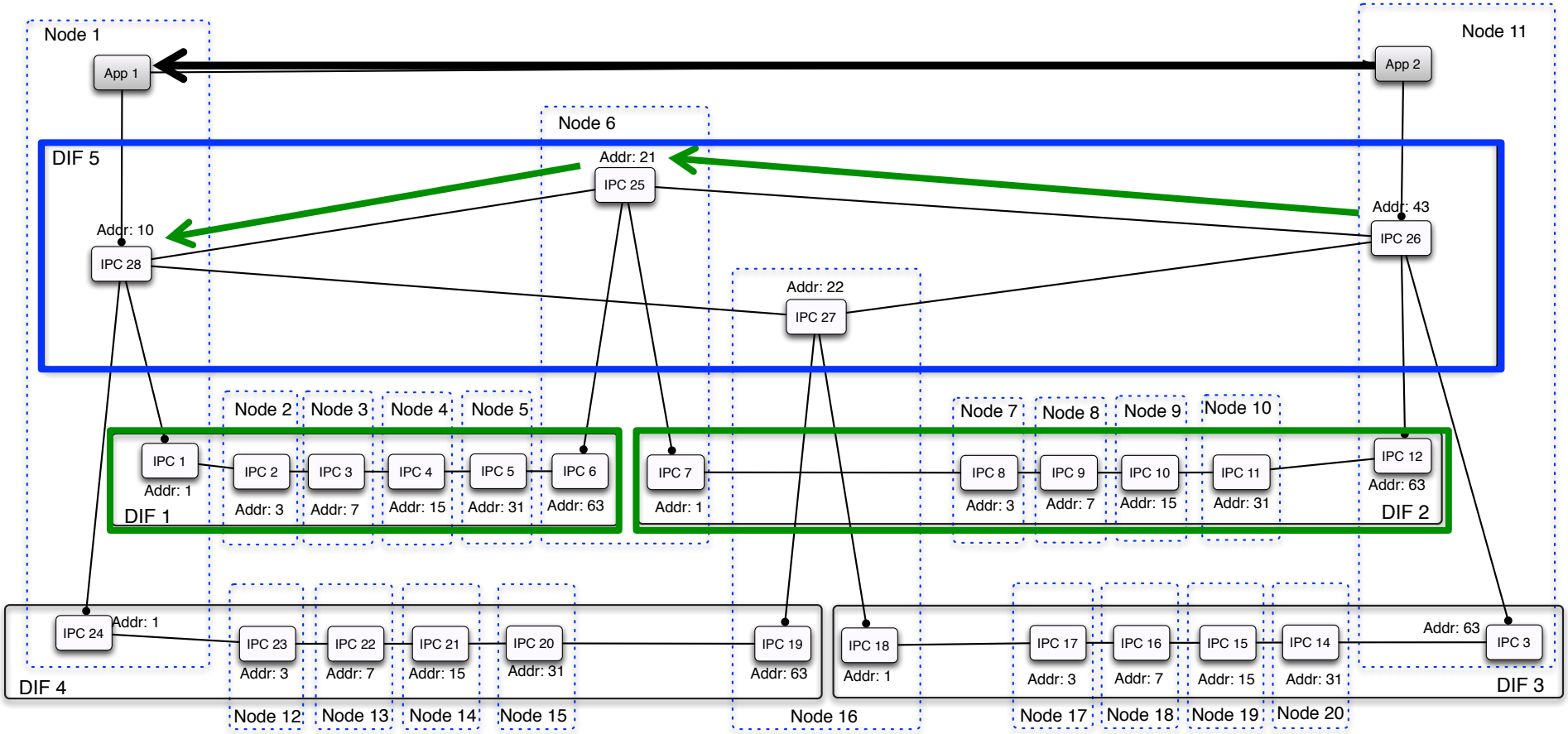
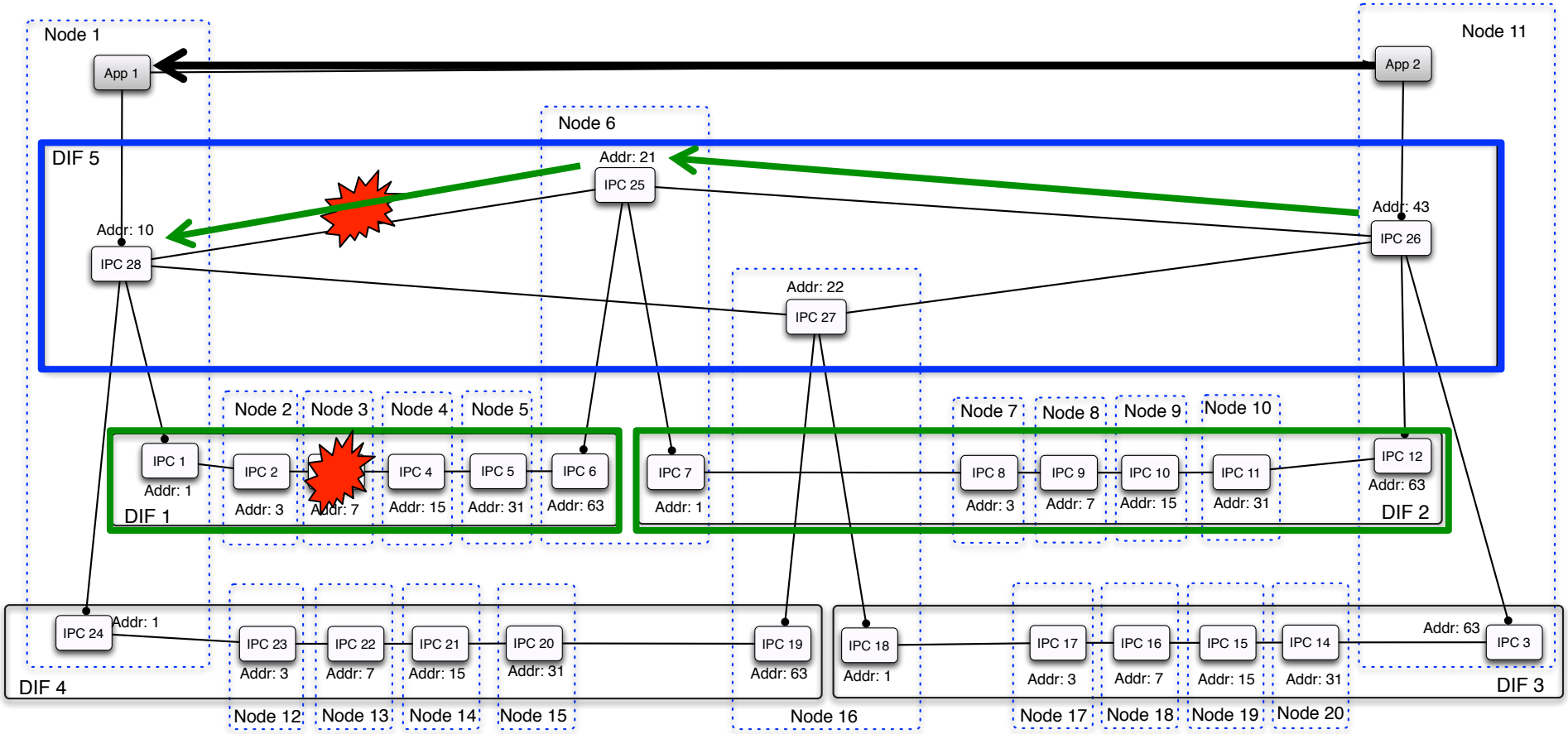
Two-level DIF Topology



- Level-0 DIF's link-state routing information updated every 5 seconds
- Level-1 DIF's link-state routing information updated every 2 seconds

Two-level DIF Topology



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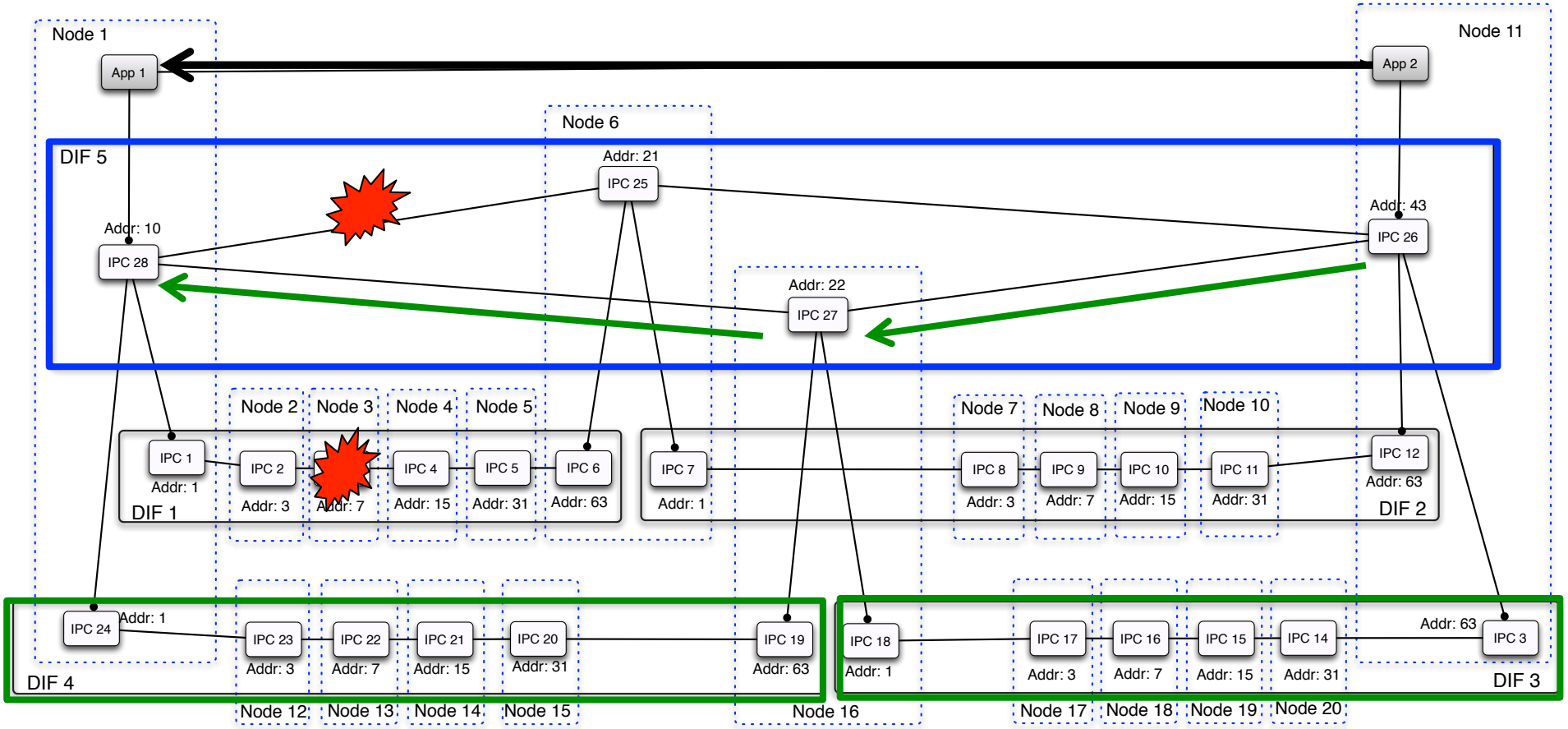
Two-level DIF Topology



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- Level-1 DIF's link-state routing information updated every 2 seconds

Experiences and Suggestions

- We wrote our own (bash and Matlab) scripts to:
  - Install Java Runtime Environment on VMs
  - Upload ProtoRINA code to VMs
  - Start or stop certain processes on different VMs
  - Download log files from different VMs
  - Analyze log files and visualize the result (live or offline)

  [LabWiki could be used to accomplish some of these tasks]
- Reserving a slice with many VMs is not always successful
- Debugging code on a VM needs a separate Terminal Window and SSH to that VM. But too many VMs
- Perhaps integrate these tasks into Flack ?
  - upload file, run or stop processes, show terminal for VMs, collect logs and visualize results

Future Work

- Larger scale RINA experiments for performance
- Multi-aggregate experiments over GRE tunnels then VLAN circuits
- Run ProtoRINA within a long-live slice, allowing researchers and educators to opt-in and experiment with programmable policies

Thank you !

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