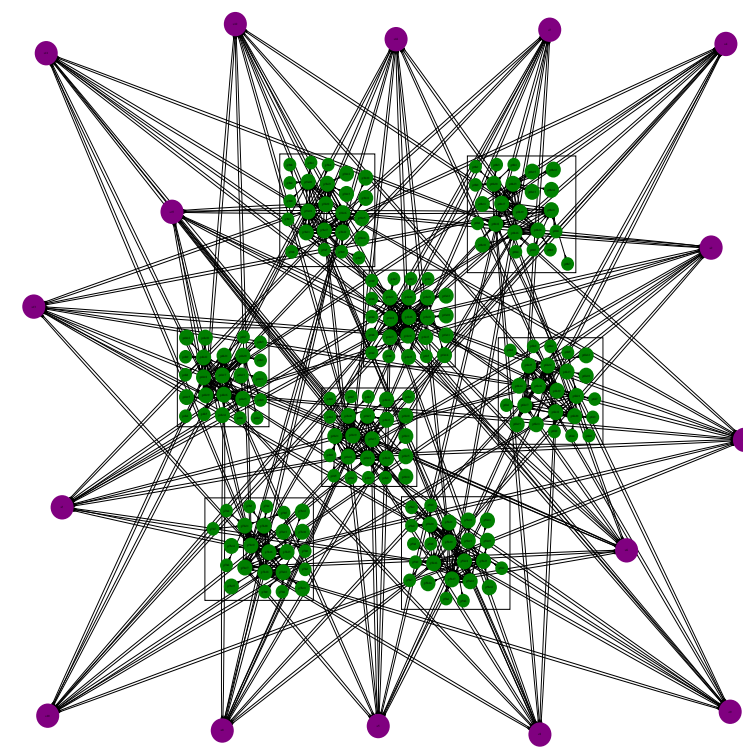


INTRODUCTION

- Access to research resources aided by:
 - affordability of hardware
 - support of virtualization
- Tools like Mininet provide
 - enable larger-scale network simulations
 - feature full third-party software
 - support simulated programmable switch data planes
- Requires topology and configuration generation system to support reproducible research



EXAMPLES

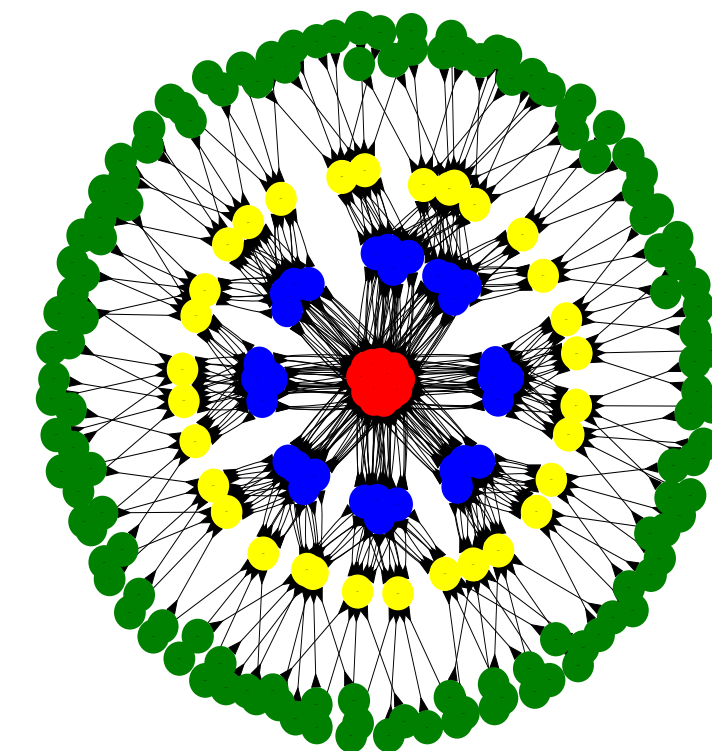


Mesh Topology

- The topology models a college housing network.
- Servers (purple nodes on the periphery) provide a shared file store
- Each sub-cluster (boxes with green nodes) is a college house
- To provide fault tolerance, multiple connections are enabled between servers and hosts, and hosts of the same sub-cluster
- Hosts represent the computer machines, printers, students' personal electronic devices within every college housing

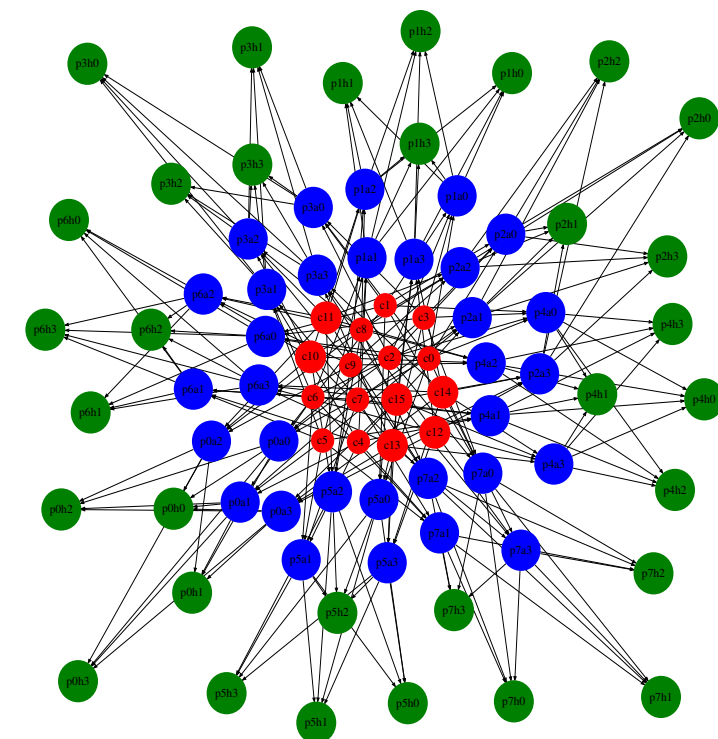
Fat-tree topology

- Features core switches (red nodes), aggregator switches (blue nodes), edge switches (yellow nodes) and hosts (green nodes).
- Such topology might be used in datacenter networks with typically high bisection bandwidth between host pairs.

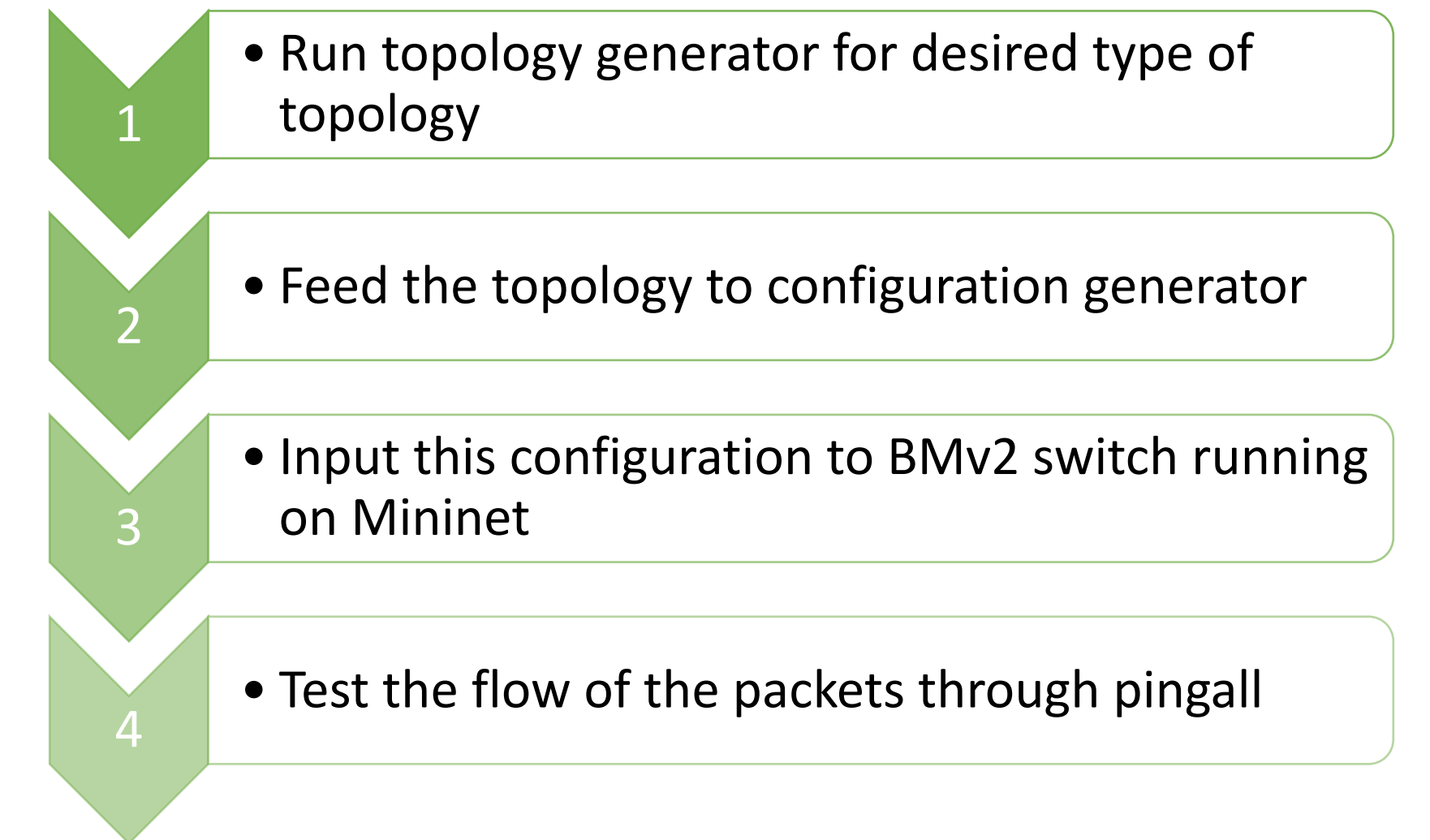


Hierarchical Topology

- The topology shows a hierarchy of backbone switches (red nodes), aggregator switches (blue nodes) and hosts (green nodes)
- This models a corporate campus environment
- The backbone switches are distributing the packets to aggregator switches specific to business units, which in turn forward traffic to the hosts on which employees work



APPROACH



MOTIVATION



- Topology generators produce large topologies quickly and correctly
- Enable larger-scale, reproducible evaluation of research ideas



- Detailed configuration information required like:
 - addressing
 - multi-layer information
- Leads to laborious task, could be error-prone to author manually
- Configuration generators that generalise the topology



- Network topologies found on campuses, enterprises, and metropolitan areas
- Capture auxiliary features including:
 - access control
 - resource isolation
 - decentralised management

RESULTS

```

p3e0 :
  interfaces:
    - link: p3h0
      mac: '02:00:00:fc:66:ad'
    - link: p3h1
      mac: '02:00:00:00:d2:87'
  ...
  cmds:
    - table_add mac_forwarding
      ↪ mac_forward_set_egress 02:00:00:50:36
      ↪ :b7 => 2
    ...
    - table_add next_hop_arp_lookup
      ↪ arp_lookup_set_addresses 192.3.0.2
      ↪ => 02:00:00:a2:15:b9
    ...
    - table_add ipv4_forwarding ipv4_forward
      ↪ 0xC0030003&&&0xFFFFFFFF =>
      ↪ 192.3.0.3 2 0
    ...
  
```

Snippet from our auto-generated topology and configuration output for a fat-tree network. 'cmds' list entries that are initially placed into the flow tables of the switch labelled p3e0. 'interfaces' list the interface address and whether it is linked to another network element