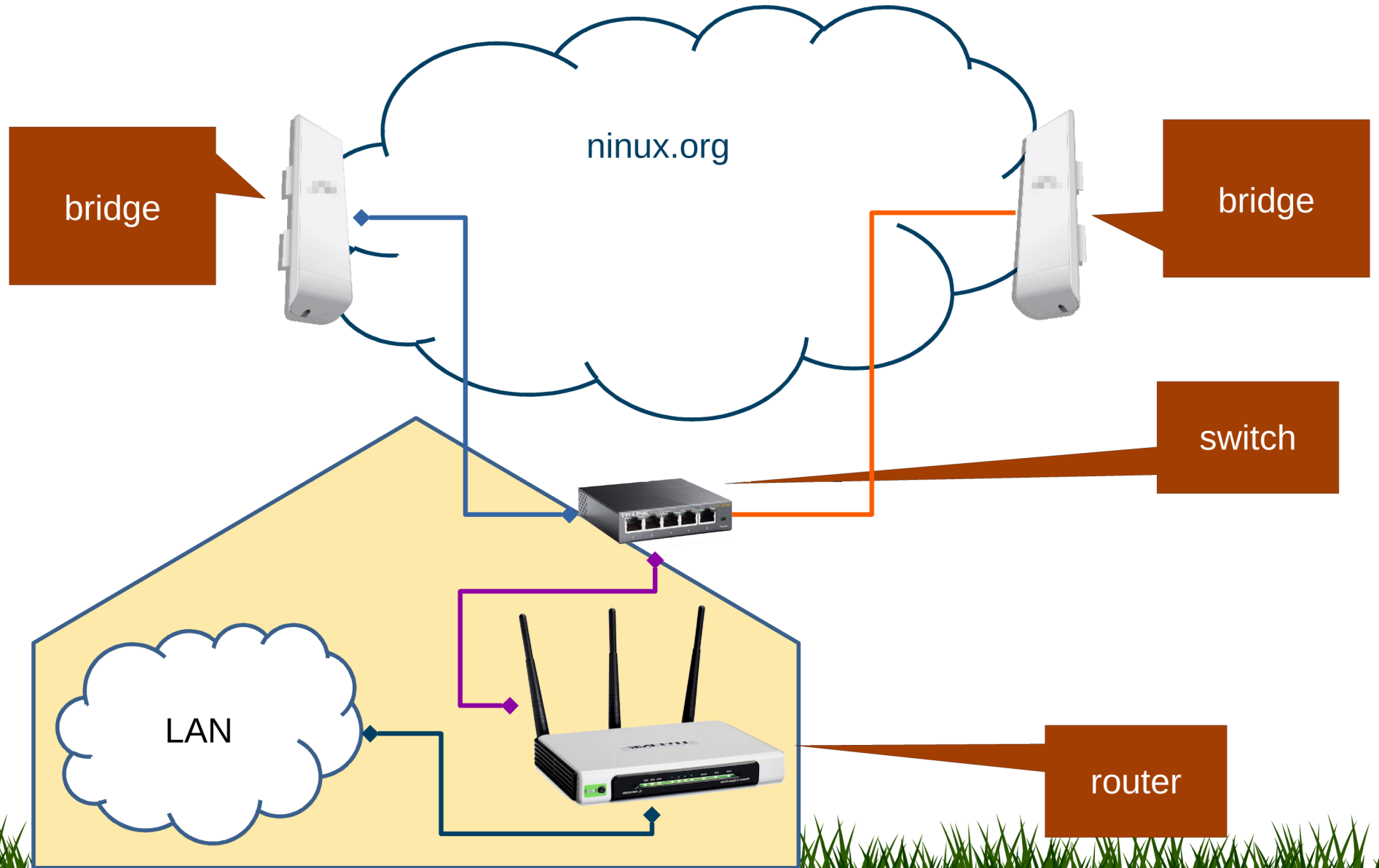


# GraaS - Ground Routing as a Service

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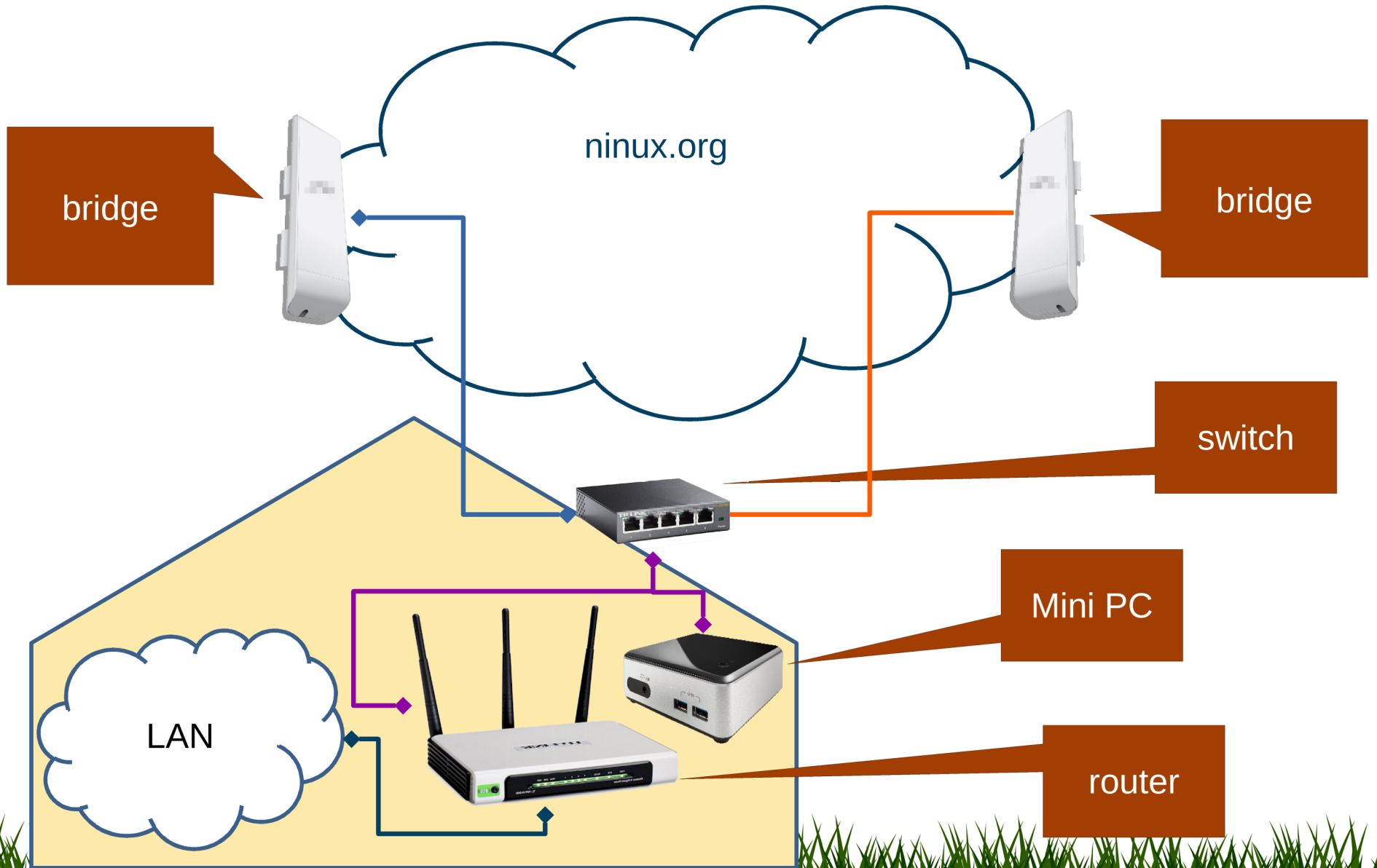
# Ground Routing



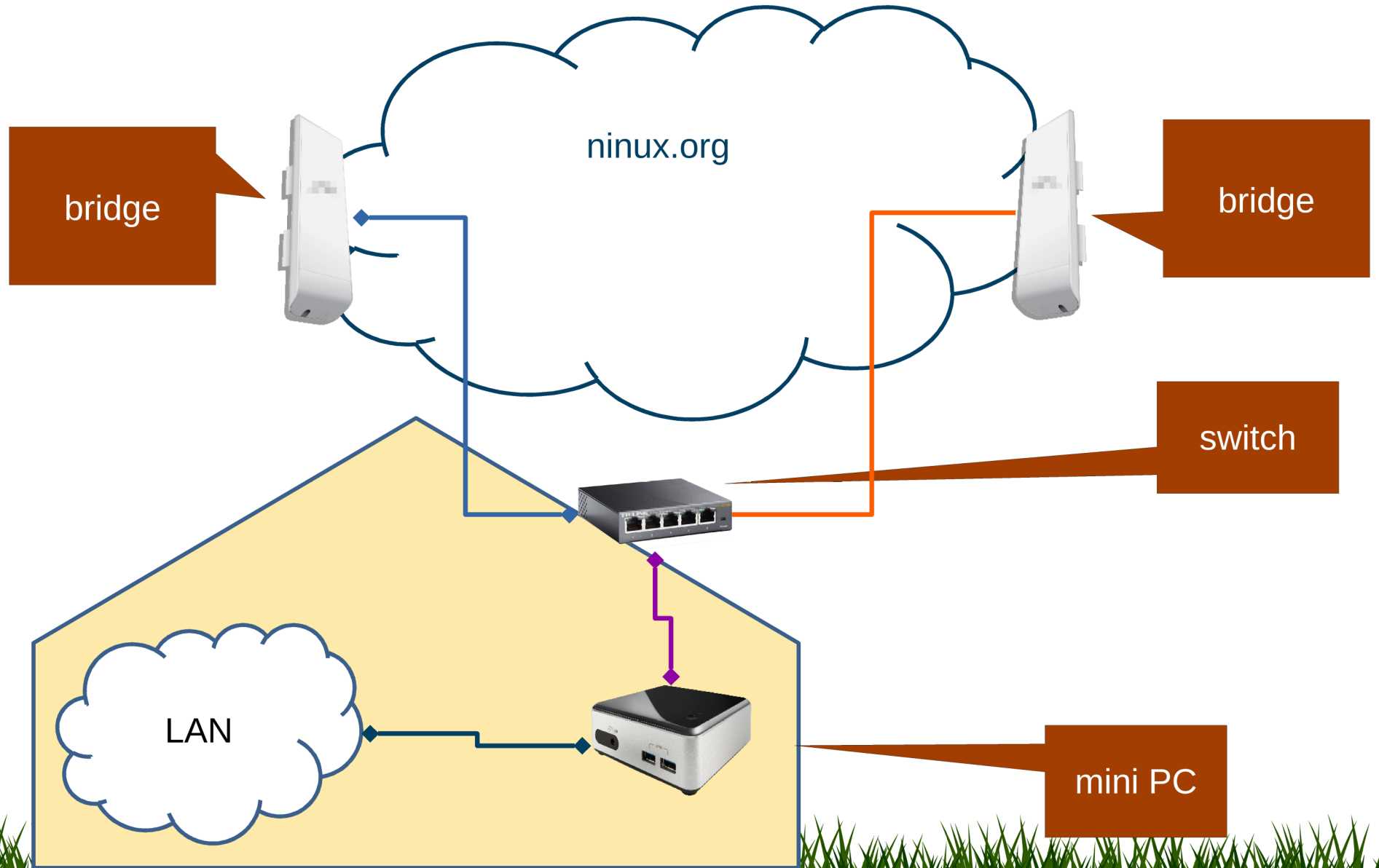
How many devices in this picture?



# Ground Routing



# Ground Routing





# Virtualized Ground Router

- Simplest approach:
  - ground router in VM or container
  - i.e. ground router Virtualized Network Function (NFV)

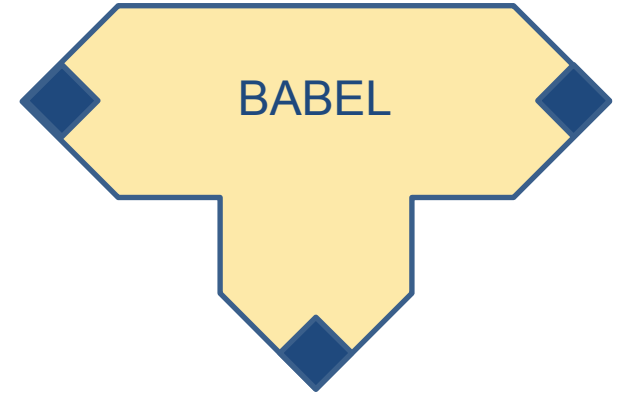
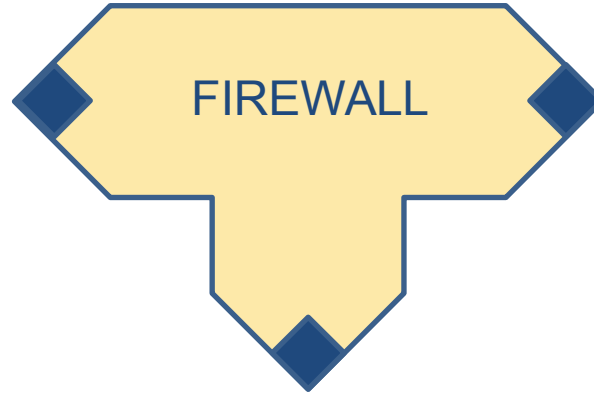
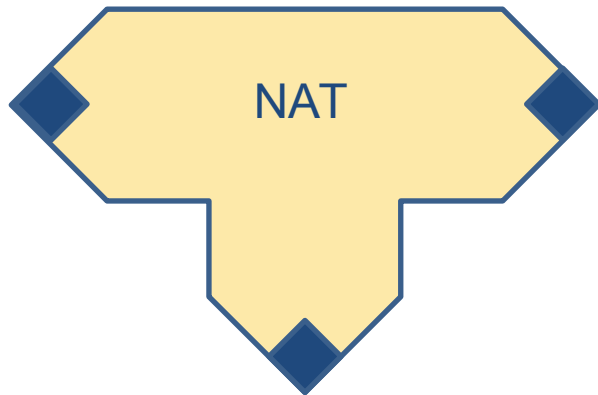
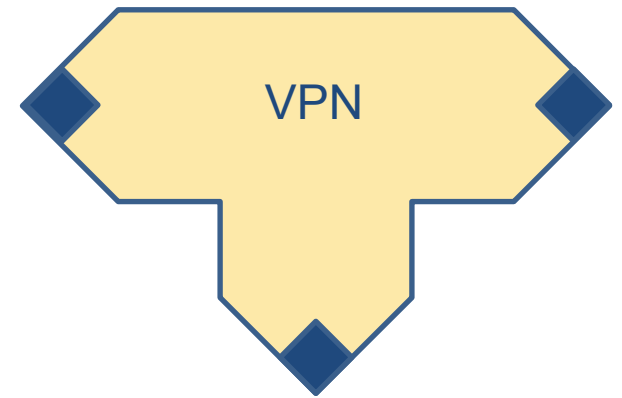


# Alternative Approach

- Divide the ground router VNF into modular micro-VNFs
  - each micro VNF has 3 interfaces
    - in, next, output
- Chain them



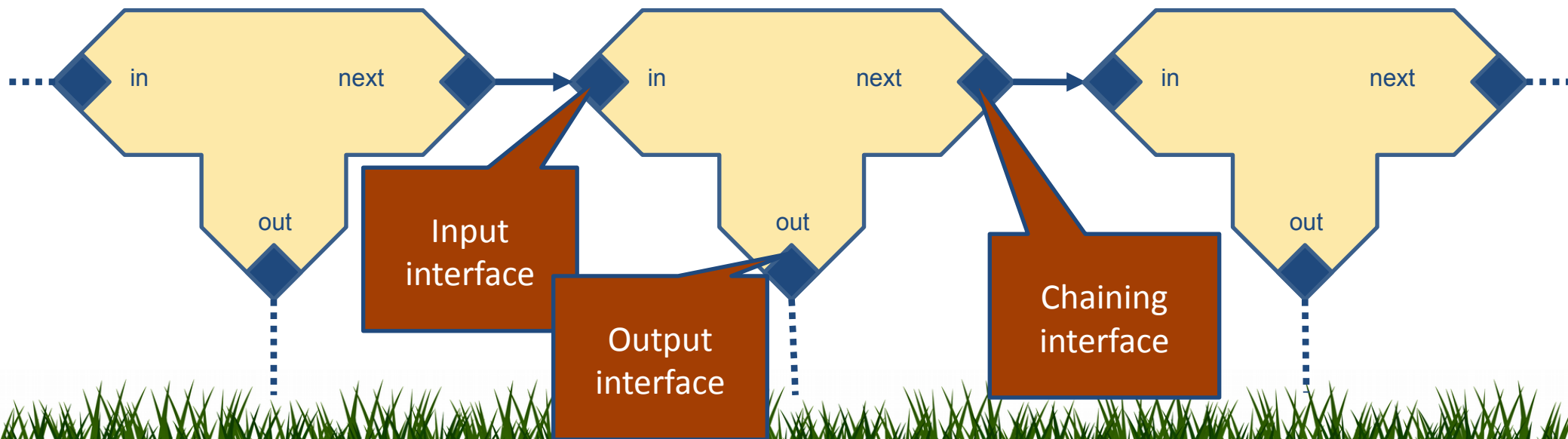
# Micro VNFs



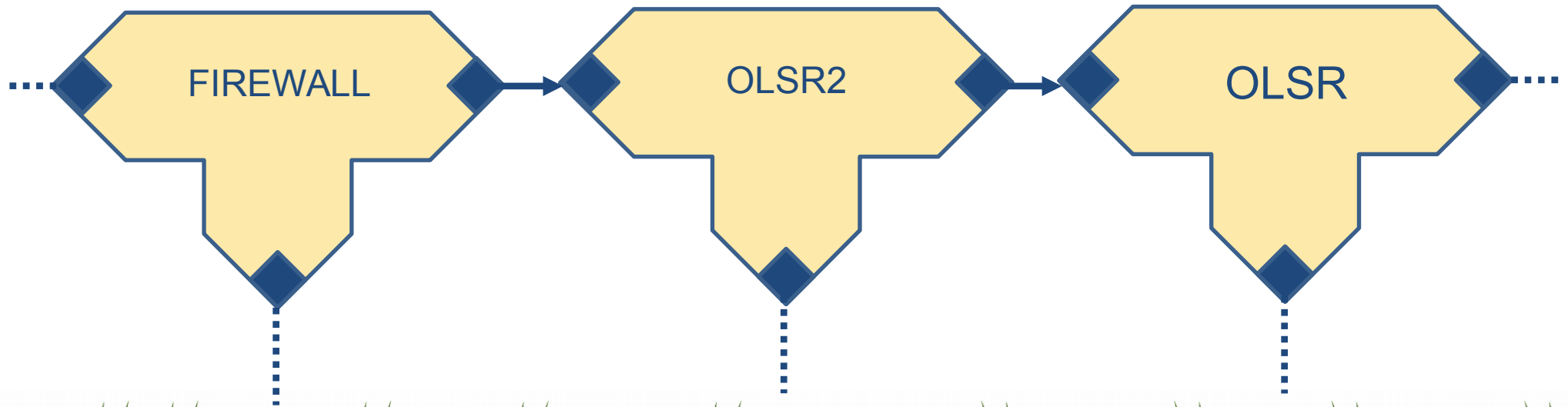
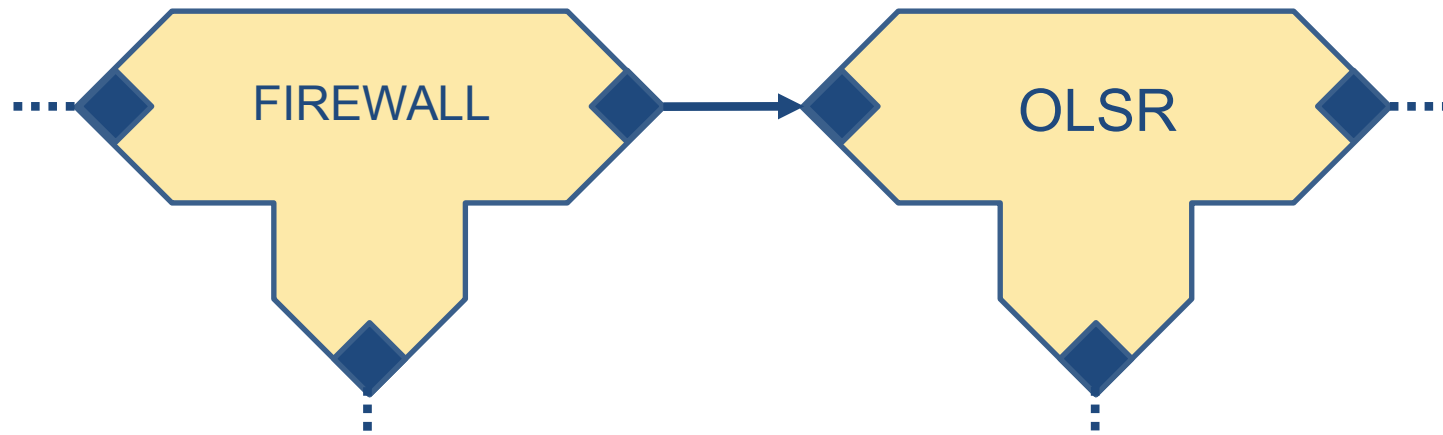


# Chaining

- Our Micro-VNFs have three interfaces:
  - **in**: input traffic
  - **next**: traffic to be forwarded to the next Micro VNF
  - **out**: output traffic
- Chain can be specified as an ordered sequence of Micro VNFs



# E.g. New Routing Protocol

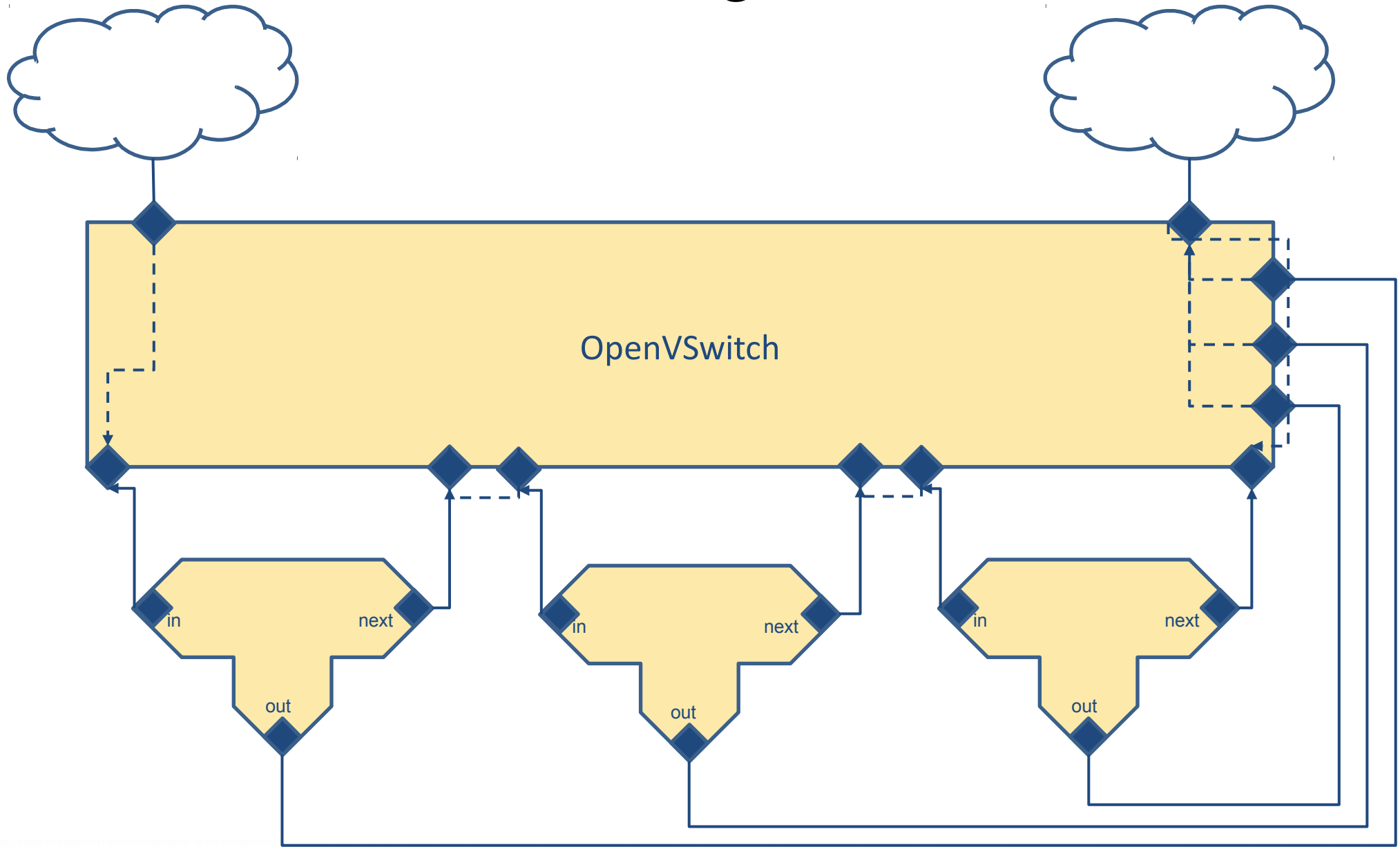


# Lightweight Virtualization

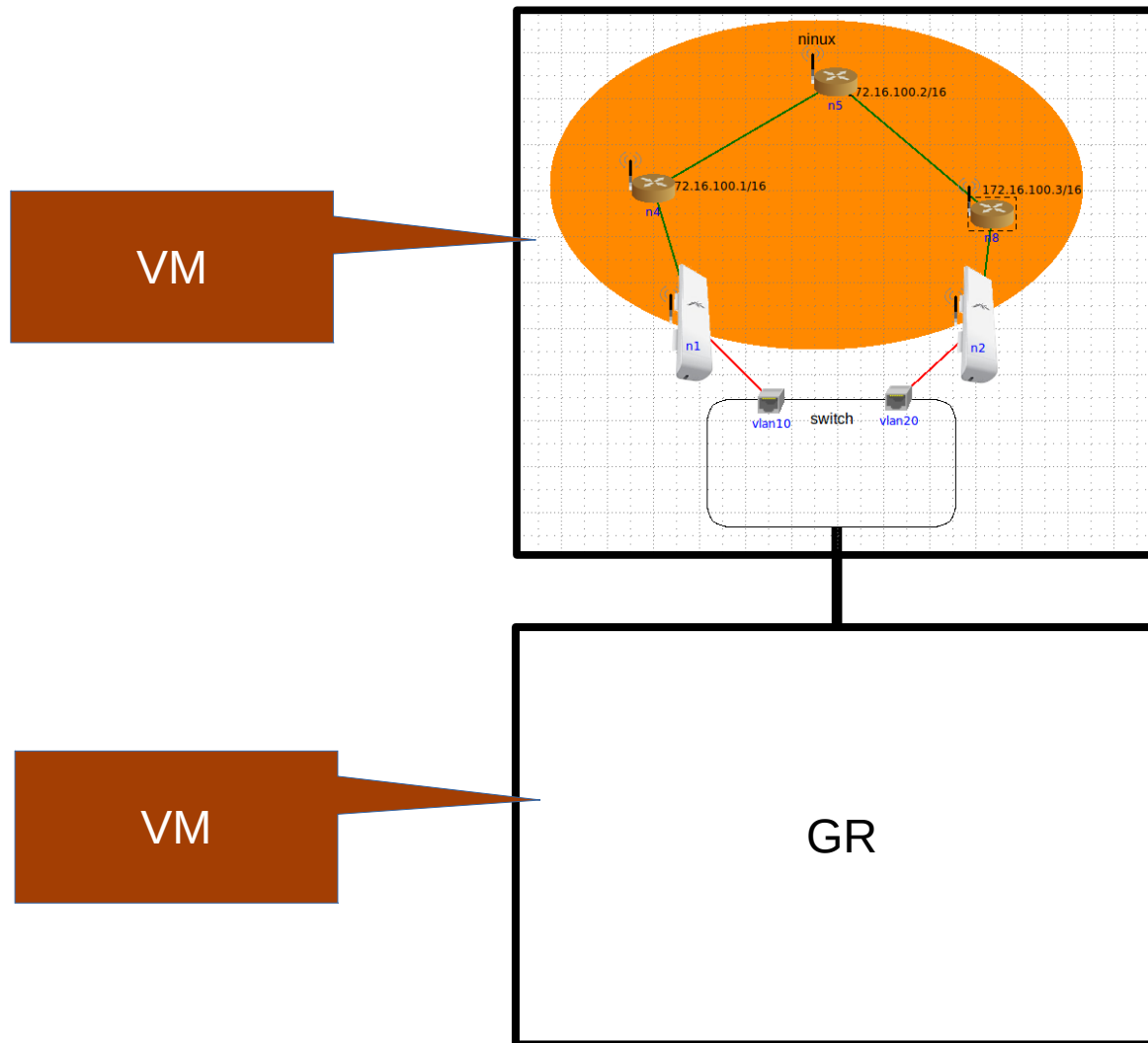
- Use only the Linux Namespaces that we need for the Micro-VNF
  - ip netns
    - network namespace
  - nsenter
    - process namespace
    - mount namespace
    - ipc namespace
    - ...



# RFB chaining with OVS



# Emulating the ninux network





# Pros and cons

- Pros:
  - modularity
    - downloadable single Micro-VNFs
  - simple chaining
    - simplified configuration
- Cons:
  - complexity moved to the internal of the blocks



# GRaaS status

- Work in progress
- TODO:
  - Micro-VNF repository
  - APIs
  - distributed authorization

