

Some terminology

A top-down approach

Composites

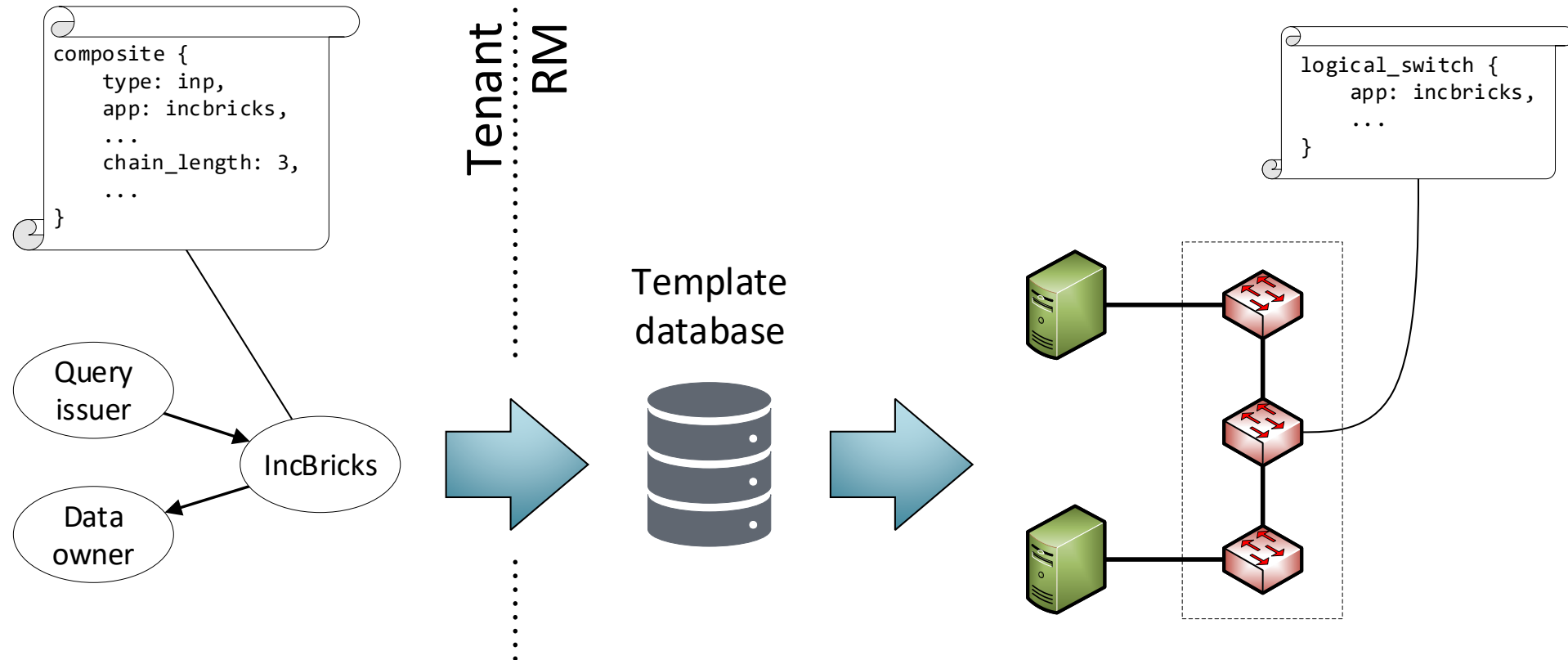
- A composite is a template that describes high-level logical components
 - It can be of two types:
 - Server (e.g., “*web server*”, “*database*”, ...)
 - INP (e.g., “*IncBricks caching system*”, “*NetChain locking system*”, ...)
 - With generic groups it would be possible to specify generic application *types* (like “*in-network data aggregation*”) rather than specifying specific solutions (like *Daiet*)
 - It can be made out of
 - Other composites
 - A composite *loop* must not be valid, since it would be impossible to place
 - Logical resources (next slide)

Logical resources

- Logical resources are logical representations of physical resources
- They can be of three types:
 - Server (e.g., VMs, containers, ...)
 - Switch (performing specific in-network functions)
 - Edge (expressing bandwidth/latency demands)
- They represent the input of the placement algorithm

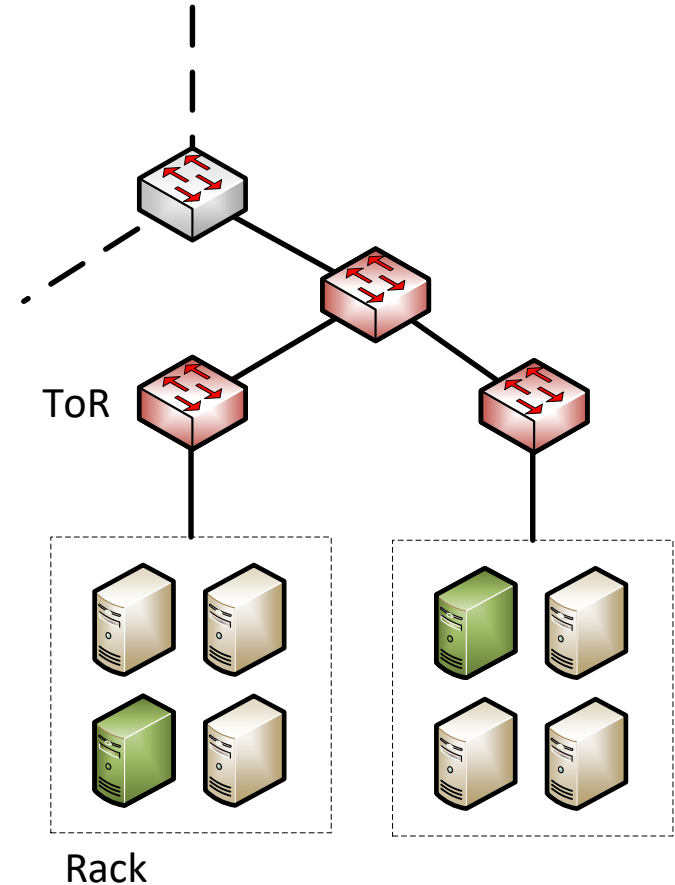
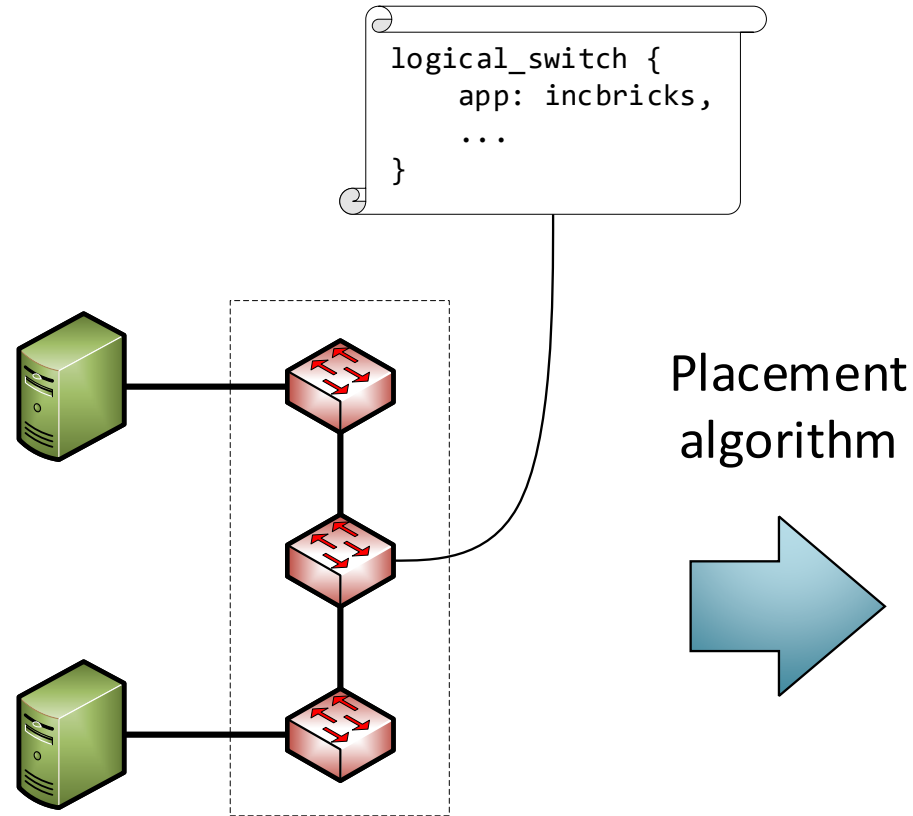
Mapping composites to logical resources

- Composites must be translated into logical resources
- This is done by using a *template database* managed by the RM

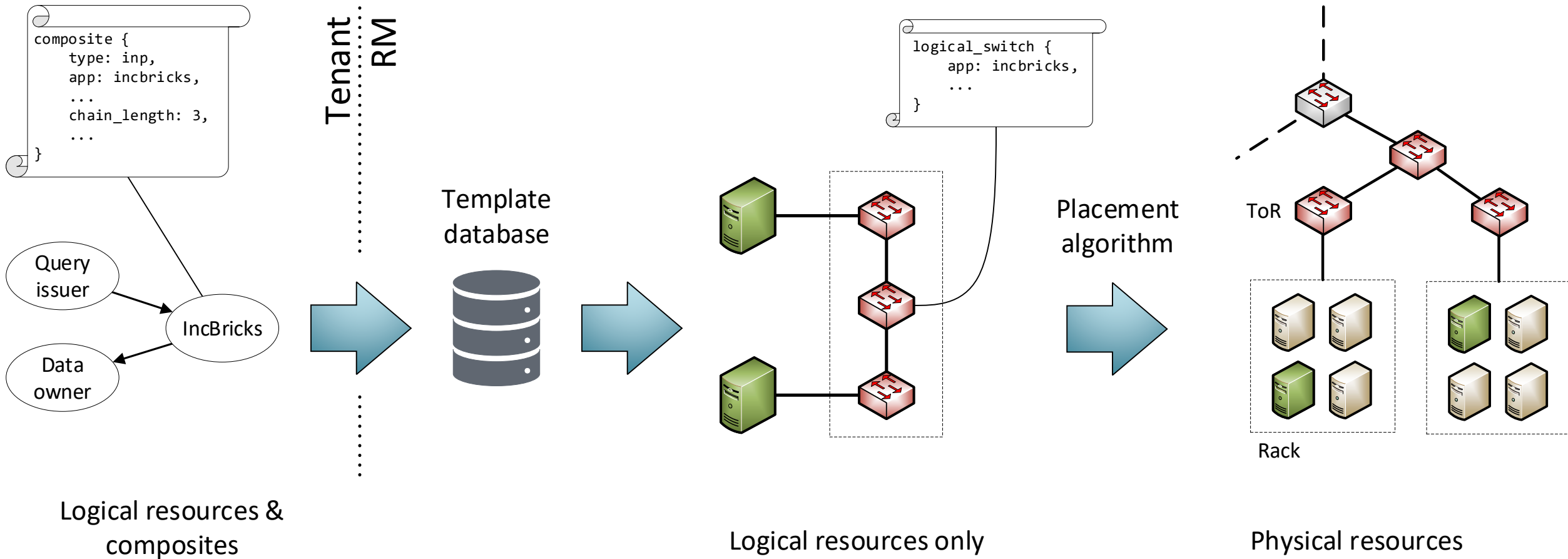


Physical resources

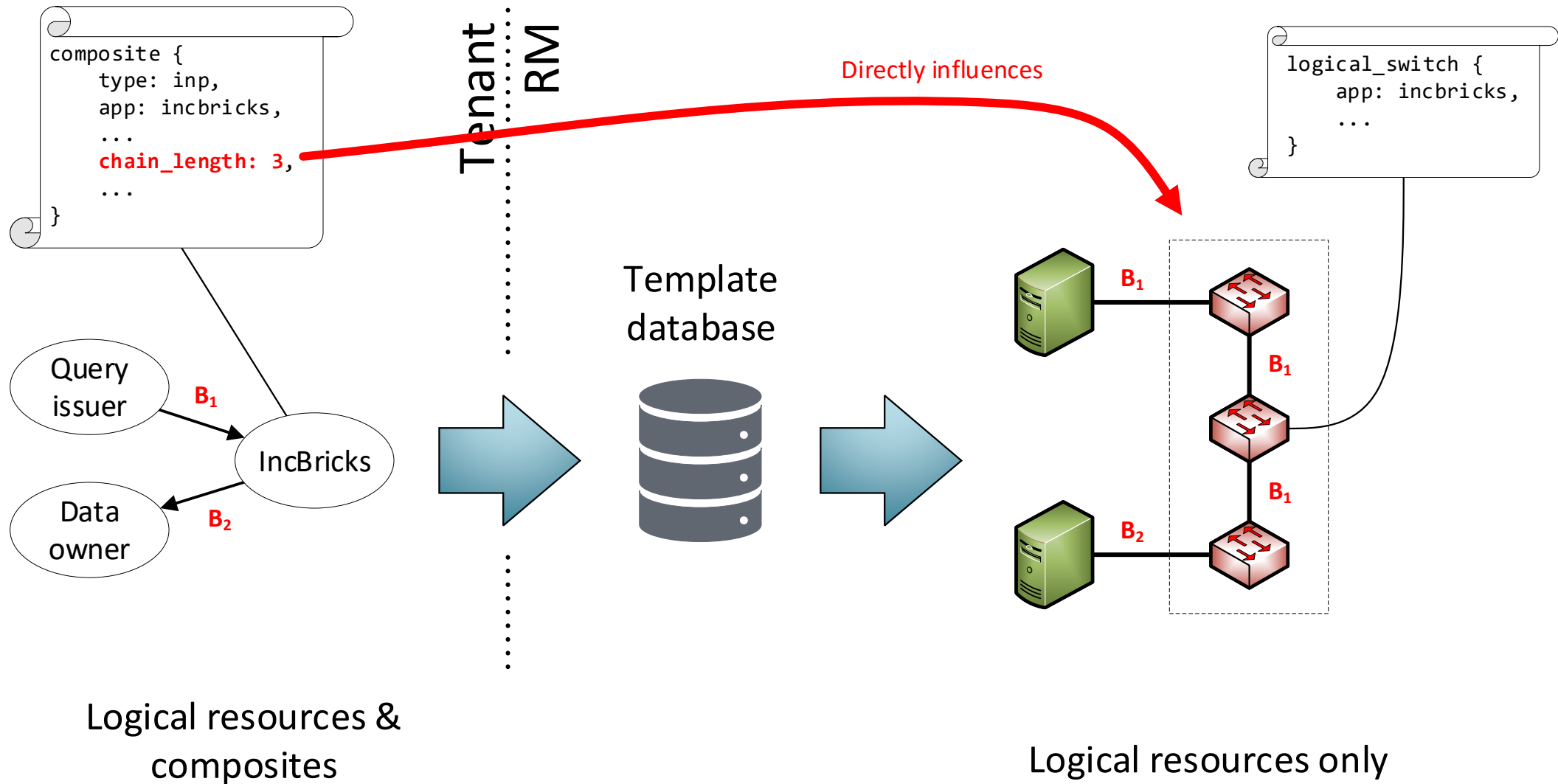
- The placement algorithm places logical resource into physical ones
- Three types of physical resources:
 - Server
 - Switch
 - Links



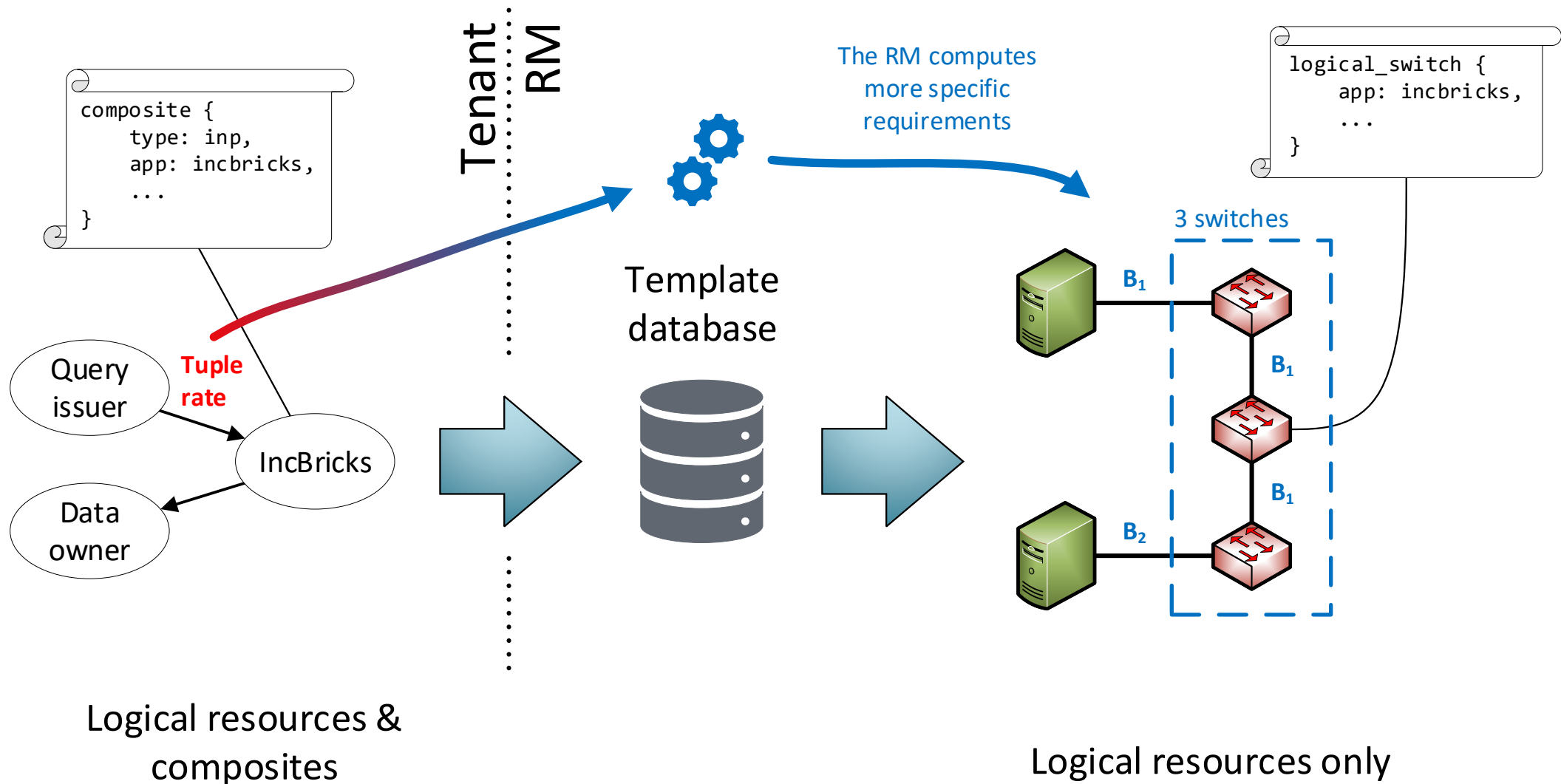
The whole picture



1st alternative



2nd alternative



Resource model

- Model capable of describing composites and logical resources.
- The model exposed to tenants and the one internally used by the RM could be different.
 - **Tenant-side** model: resource model exposed to tenants by the system API.
 - **RM-side** model: resource model internally used by the placement algorithm in order to allocate logical resources.

A model for INP resources

Requirements

Some model requirements

- **FR1** The tenant-side model must be able to describe server and INP composites.
- **FR2** The tenant-side model must be able to describe all kinds of logical resources.
- **FR3** The RM-side model must be able to describe all kinds of logical resources.
- **FR4** The tenant-side model must allow the tenant to specify logical edge resources.

Some model requirements

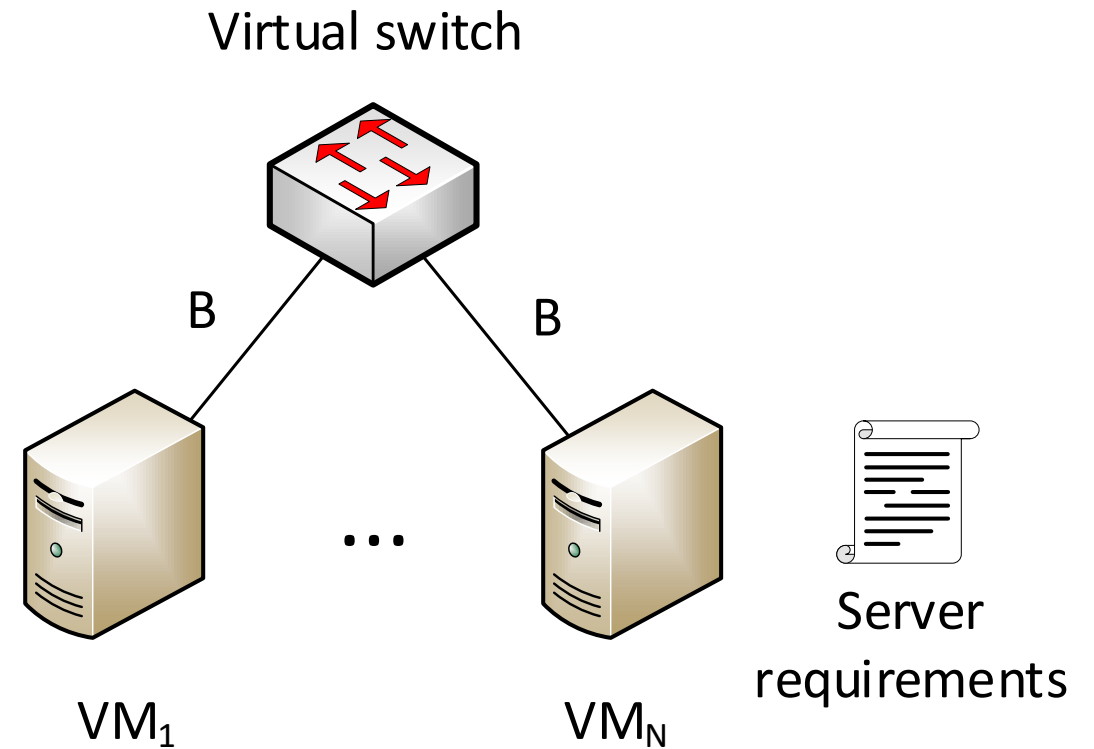
- **FR5** The tenant-model must be able to describe any kind of network topology.
- **FR6** The tenant-side model (and the corresponding APIs) must not change upon the release of new INP solution or version.
- **FR7** The translation from composite requirements to logical resource requirements must be done by the RM and not by the tenant application.

A model for INP resources

Design sketch

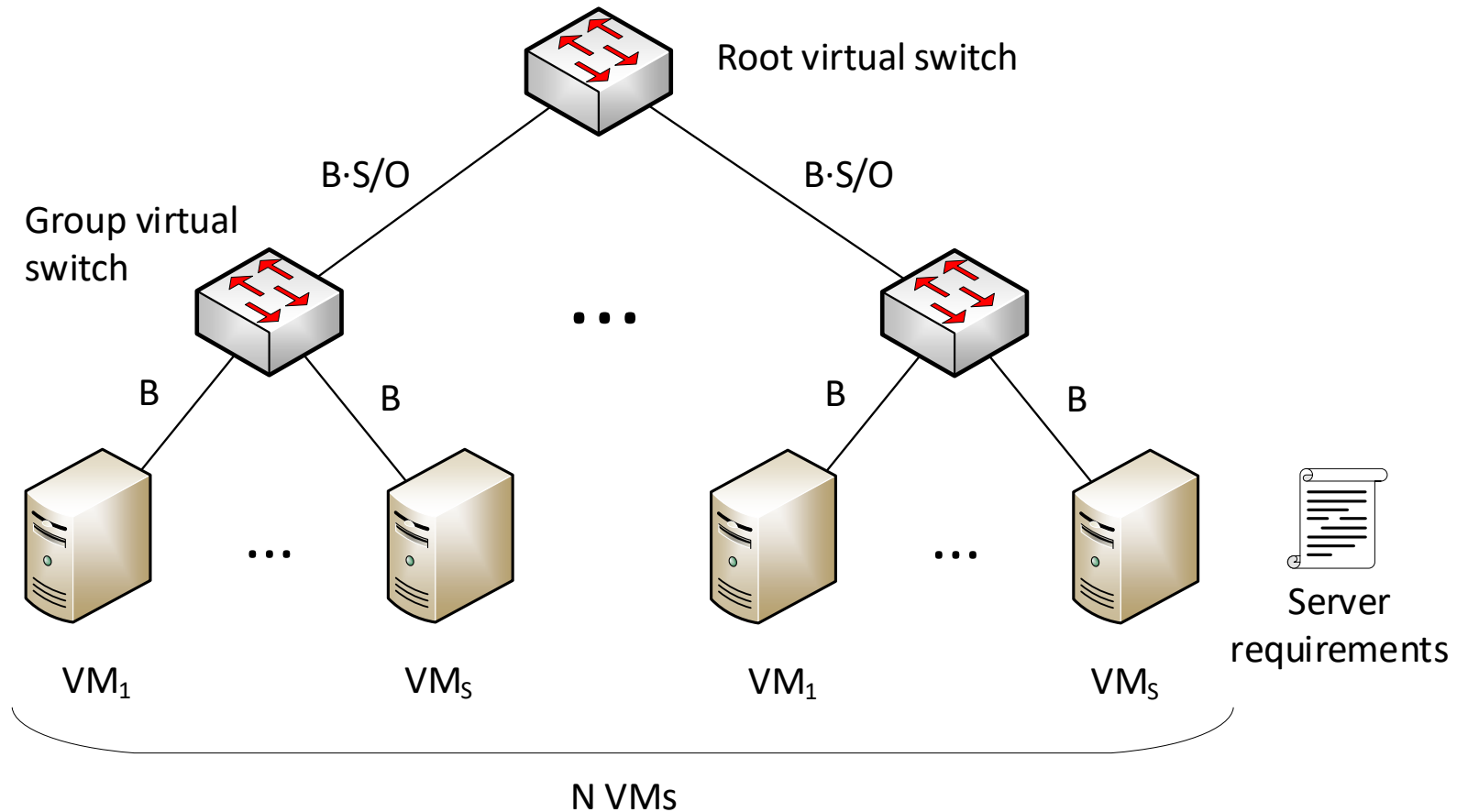
Virtual Cluster (VC)

- All VMs require the same bandwidth (**XFR4**)
- A one-level tree topology is restrictive (**XFR5**)
 - No switch chains
 - No switch trees
- It is not possible to express logical switch resources (**XFR2**)

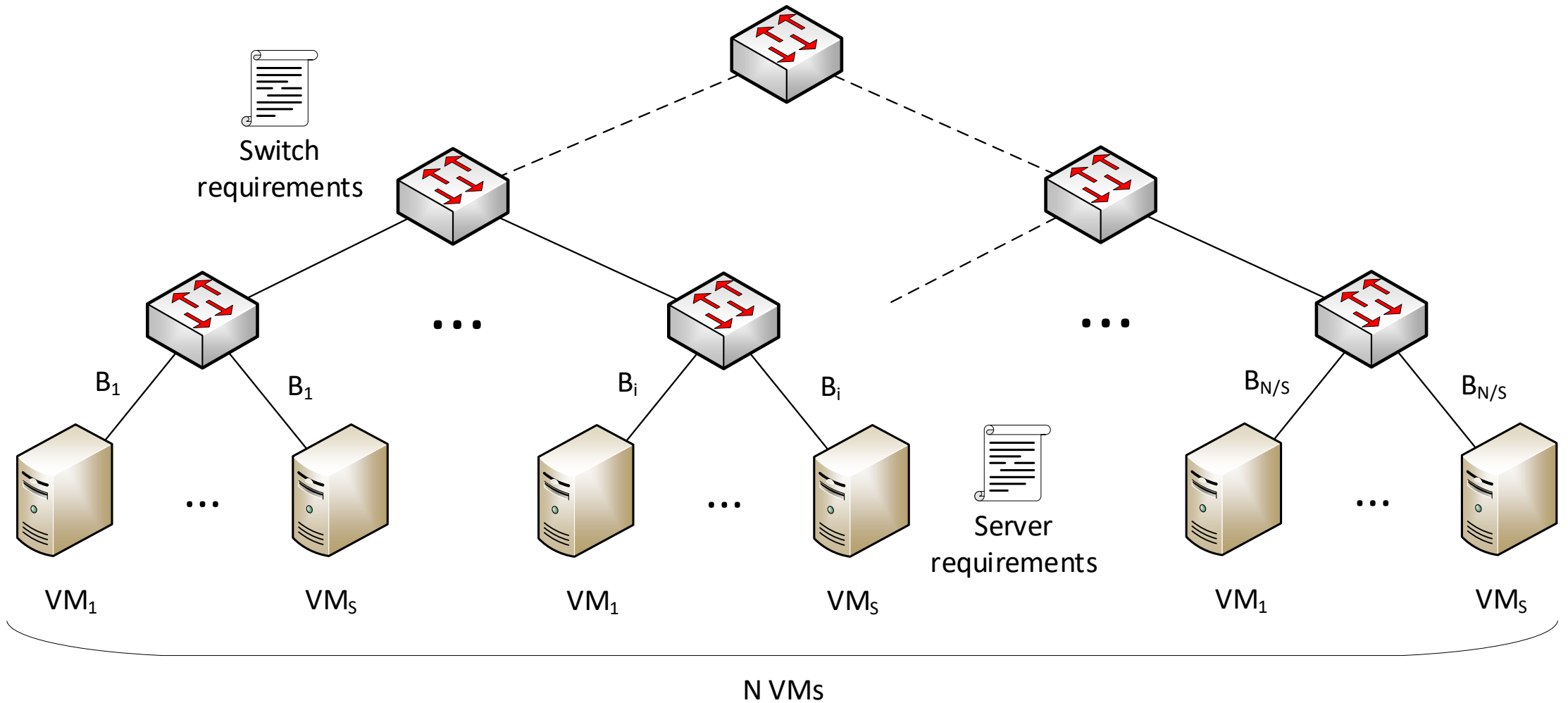


Virtual Oversububscribed Cluster (VOC)

- VM groups might require different bandwidth values (**✗FR4**)
- Still a fixed-height tree topology (**✗FR5**)
- Still not possible to express logical switch resources (**✗FR2**)



A VOC variant

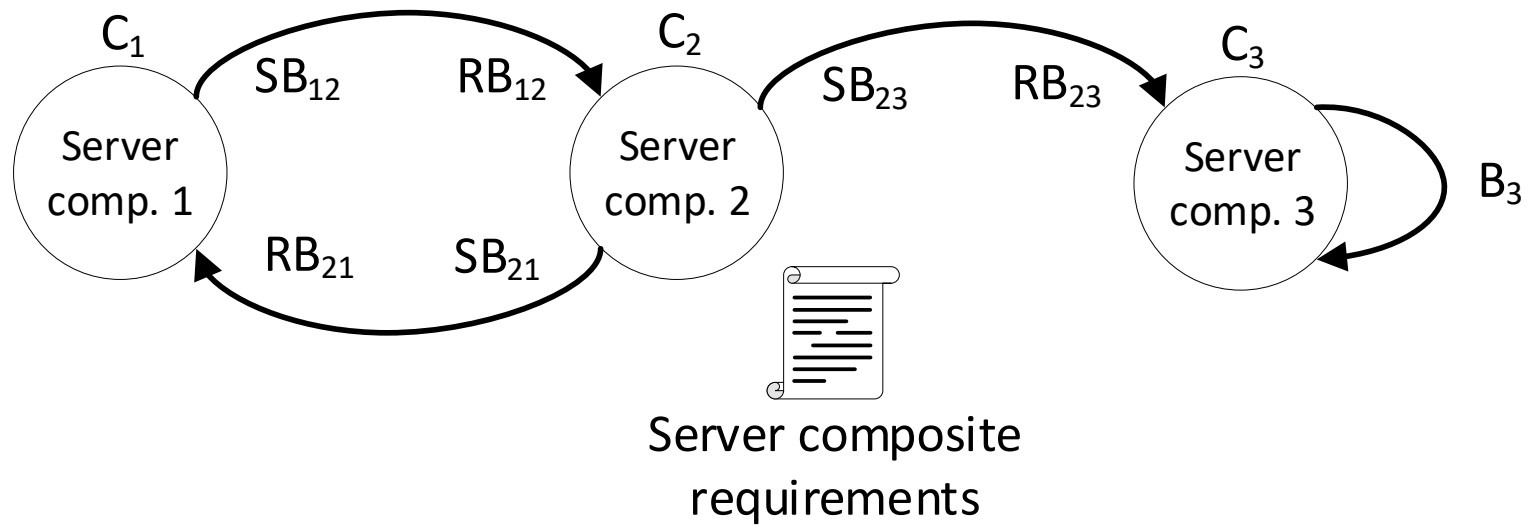


A VOC variant

- Features
 - Arbitrary height h
 - Different bandwidth demands for different VM groups (✓FR4)
 - Switch resources included (✓FR2)
- Drawback
 - Tenants cannot express any kind of switch topology (e.g., a switch loop for an in-network DHT chord) (✗FR4)
 - Tenants must convert INP high-level requirements (e.g., in-network total cache size, lock requests per second, ...) into switch resource requirements (✗FR6)

Tenant Application Graph (TAG)

- It cannot describe INP composites (**XFR1**)
- It cannot describe logical switch resources (**XFR2**)



A TAG variant

- Capable of describing all composites (✓**FR1**) and logical res. (✓**FR2**)
- Different bandwidth demands (✓**FR4**) and topologies (✓**FR5**)
- Composite → logical res. translation not made by the tenant (✓**FR7**)

