

Network virtualization: What? Why? How? Challenges?

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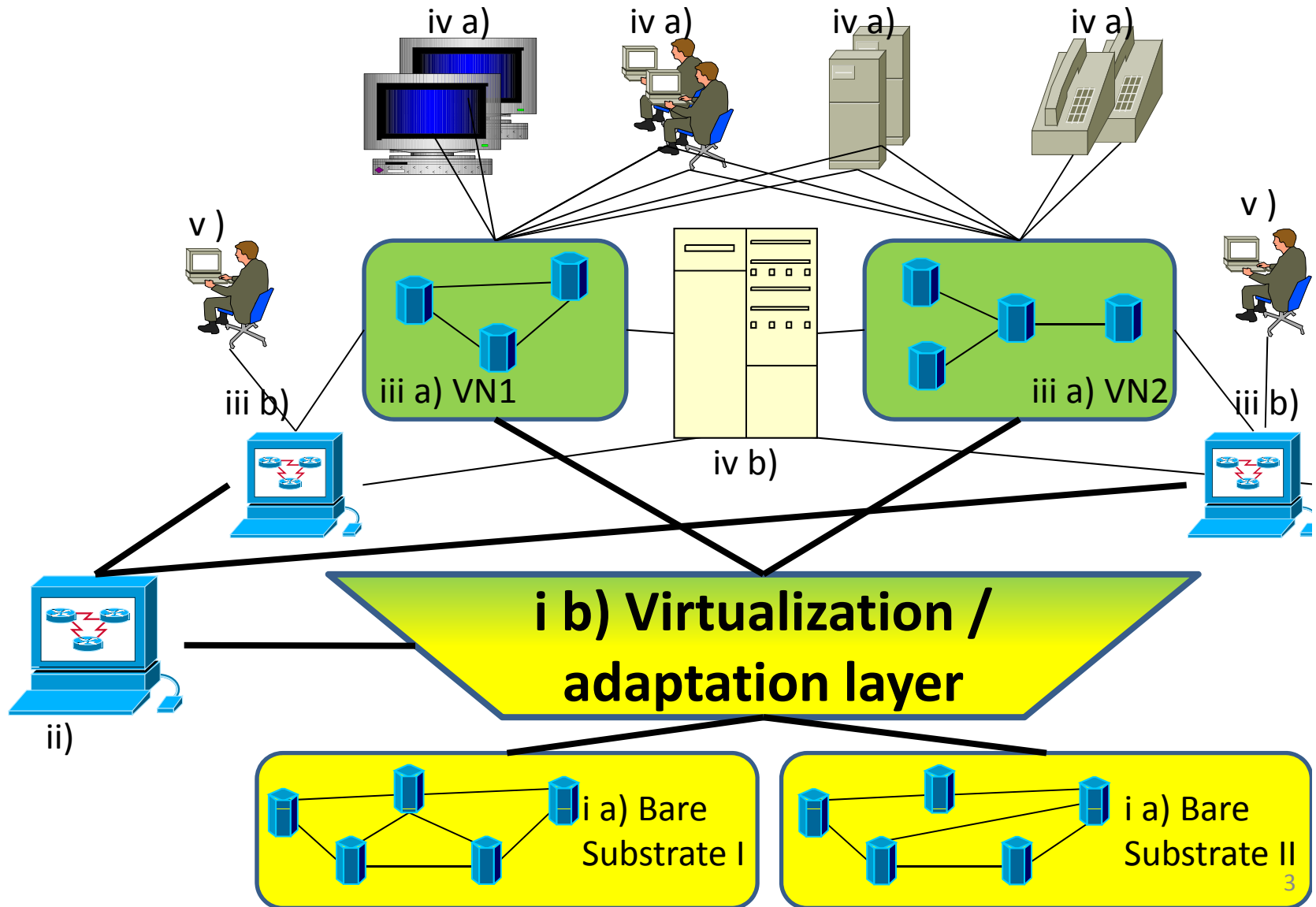
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Network virtualization: what?

- A virtual network:
 - is a ... that appears to be a NETWORK
 - but is VIRTUAL in the sense that it does not necessary correspond 1:1 to a physical network.
- More formal: a virtual network is a network build from virtual resources. Virtual resources:
 - Virtual Network Element =
 - Virtual NICs
 - Virtual Data Plane: E.g.,
 - Forwarding Engine: lookup plus modify headers (e.g., TTL decr)
 - QoS related functions: shaping, marking, classifying, queuing, scheduling, ...
 - Virtual Control/Mgmt Plane
 - Virtual links (or more general “virtual media” ...) connecting the virtual NICs.

Network virtualization framework



Virtualization layer

Virtual Network

Virtual resources (Overlapping address spaces in VNs).:

- appear as the other logical resources are not there
- guaranteed to be not influenced by other VN instances.

FE dedicated vs. 10G shared switch example by Sunay T. on July 13th: those that don't want to be impacted should pay for dedicated capacity (e.g., pseudo-wires)

Virtualization: isolation enforcement (e.g., VID to LID translation)

Logical resources = decoupled from implementation: e.g., logical queue with LID<x> can be implemented as part of shared queue or as dedicated hardware queue.

The abstraction to create logical resources, should also hide that they belong to different domains. (Cfr. My reply to Martin R. on July 13th).

Wrapping, multiplexing, labeling, ...

Data Plane of substrate should not be a "network", it is just a pool of interconnected resources.

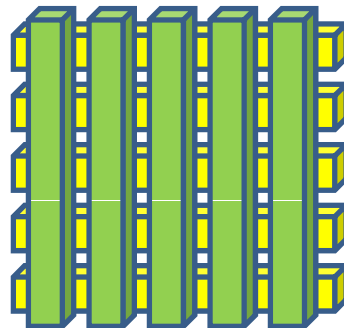
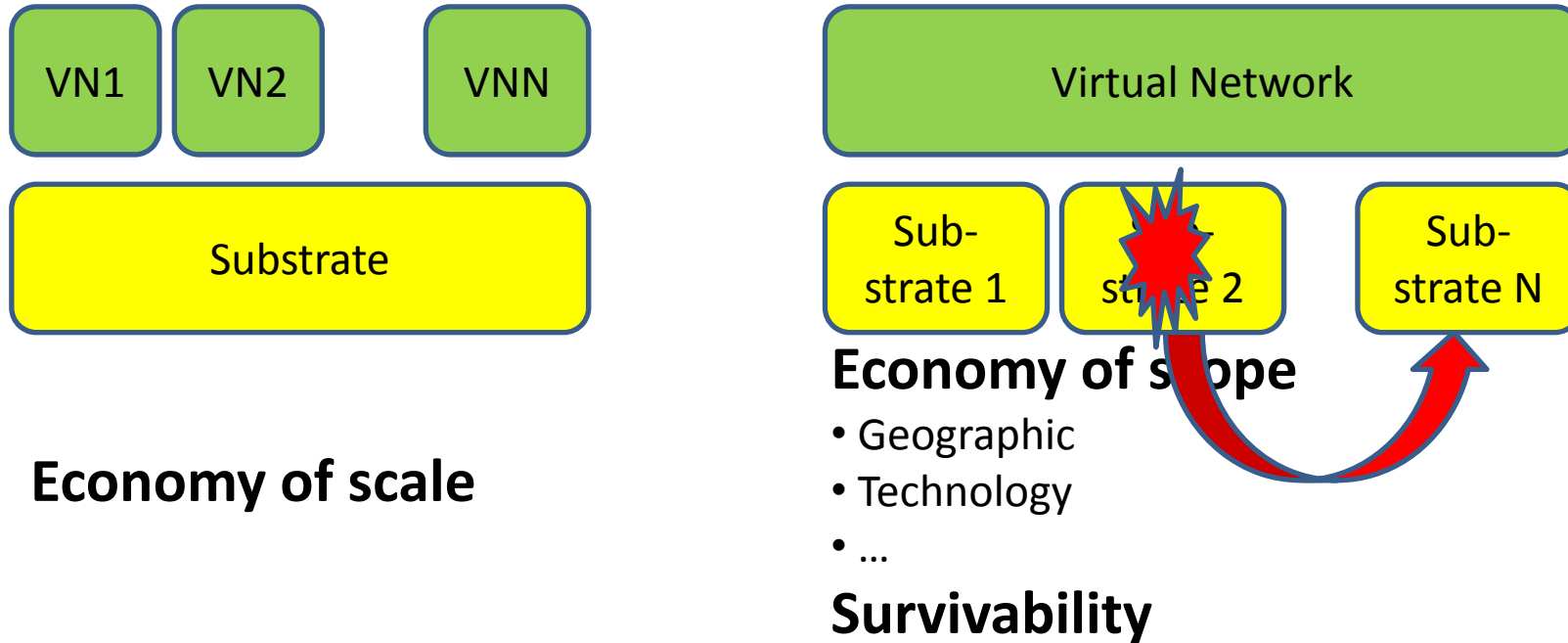
Substrate = resources

- Hardware: e.g., 10G line, FE (@ N pps), queues, ...
- Software: OSPFd, ...
- Logical/virtual: addresses, ...

Virtual resource

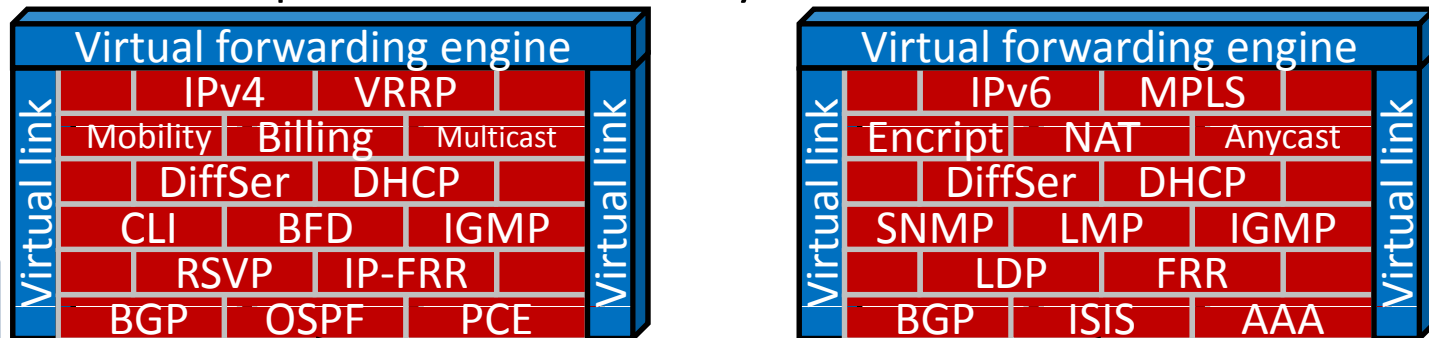
- Abstraction of implementation
 - Does not equal hiding (abstracted info like SRLG should still be visible to the VN owning the virtual resource)
- Relocation:
 - Is something the virtualization layer can do INVISIBLE to the VN owning the virtual resource.
 - If needed as property of the virtual resource, like SRLG info abstract location info should be available (e.g., customer endpoints).
- Interfaces:
 - Virtual Data Plane interfaces (e.g., a queue has an in and out).
 - Virtual config interface (e.g., let virtual control plane config the RED threshold)
 - Mgmt interface (let virtualization layer (ib) or VN instance mgmt system (ii) config the size of the queue).
 - Subject to proper indirection schemes (virtual2logical2physical).

Network virtualization: why?



Network virtualization: why?

- Separation of concerns:
 - Infra provider <---> Network provider
- Standardized interface between VN instance and virtualization layer
 - ==> improved portability
 - Does not avoid need for horizontal interoperability, but becomes a VN-instance INTERNAL problem ==> flexibility



Keep as simple as possible: specialization responsibility of VN ==> network programmability???

i b) Virtualization / adaptation layer

Network virtualization: challenges?

- Performance:
 - Control Plane: less time critical --> VID to LID to PID translation possible.
 - Data Plane: rather part of index into table than translations.
- VN instance isolation
 - Inside network: by design and/or proper indirection rules on virtual config interfaces.
 - Edge: translation, labeling, ... , but also traffic shaping, etc.
 - Bandwidth slicing:
 - Metro-core: often probably dedicated bandwidth slice (= no overbooking)
 - Access: customer decides /participates in decision when what VN instance is “active and thus guaranteed” (= huge overbooking)

Network virtualization: challenges?

- Accountability and fault localization: in case of problems: is the VN/VN operator or infra/infra operator responsible for any issue that may occur.
- Virtual Resource properties: abstracted information (e.g., SRLG)
- Gateways between VN instances: who? How? ...
- Demarcation point: where? How?
 - Customer-VNO demarcation
 - Customer-infra operator.

Questions

- ITU-T FG on Future Networks has set up a new standards group on Virtual Infrastructures / Networks
 - Should we align our work with their activities? / have a liaison with them?
- Does this group or do other such groups already have a blueprint for the answer on the questions posted by Joe on June 8th?