Isolation Requirement of Network Slicing

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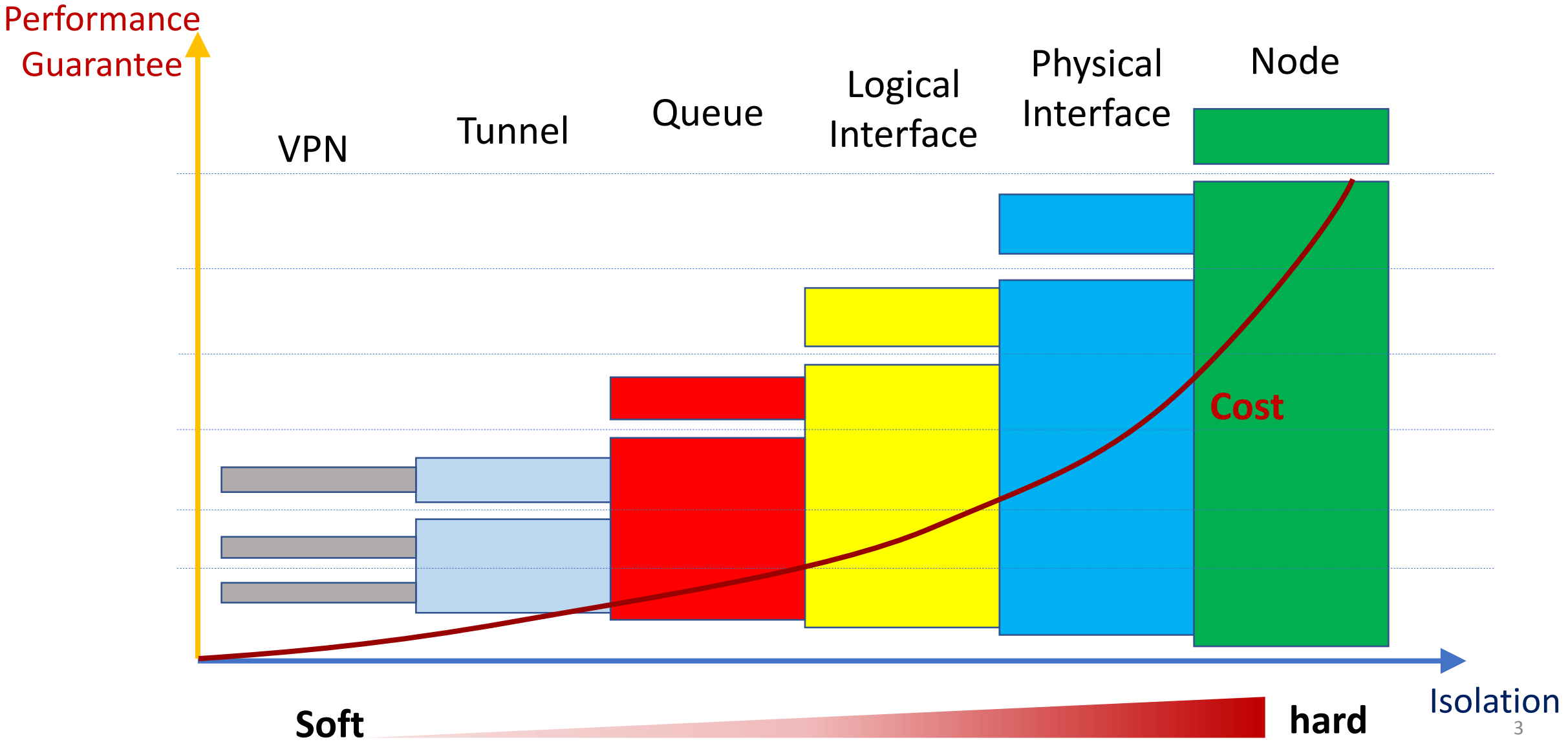
Isolation is Key for Network Slicing

- Isolation means no interference between different services/tenants in the same network in terms of
  - Traffic burst, congestion, failure, attacks, etc.

- The most expected consequence of isolation is guaranteed service SLA
  - Bandwidth, latency, jitter, packet loss, etc.
  - Critical for operators to enable diversified services and establish new business model in 5G
    - From best effort service to differentiated service commitment

Spectrum of Isolation



Soft Isolation

- Network resources are shared among different network slices
  - Pros: statistical multiplexing gain, better scalability
  - Cons: no end-to-end SLA guarantee

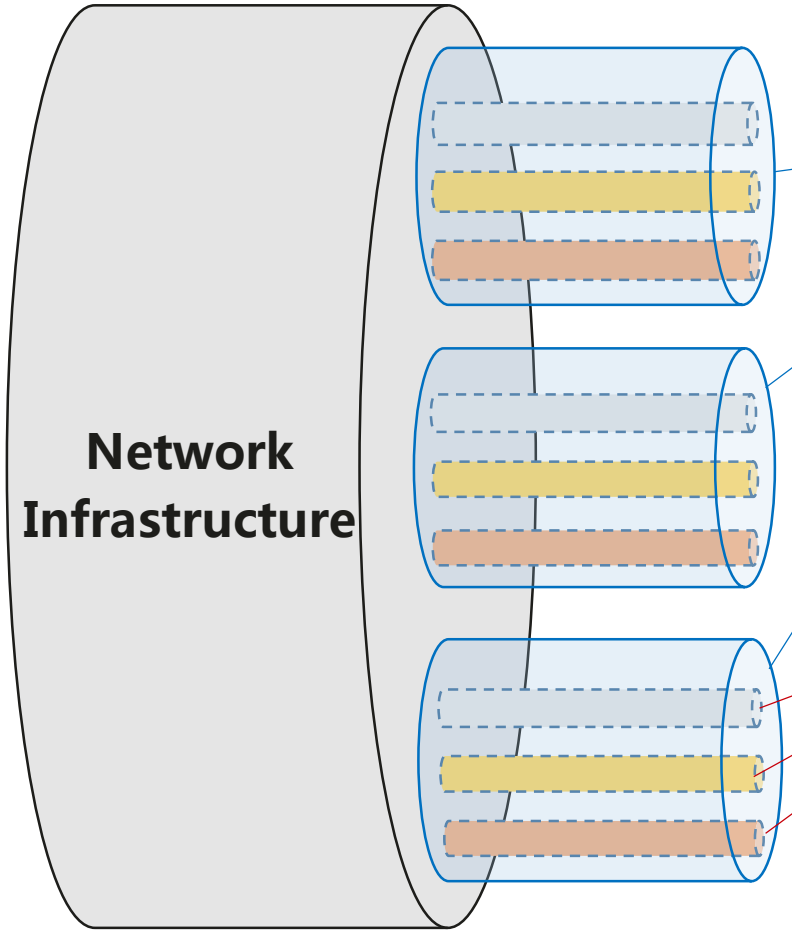
	Functionality	Limitation
VPN/VRF	Isolation of connectivity and accessibility	Only provide overlay connectivity, rely on underlay network to provide the required SLA
DiffServ QoS	Class-based queue scheduling and packet dropping	• Best effort in nature, can only provide "better than BE" for some traffic classes • PHB (Per-Hop Behavior) based, no end-to-end SLA guarantee • Limited number of classes
Traffic Engineering	Steer traffic along different paths according to constraints	• Rely on path diversity • No SLA guarantee if multiple paths merge at some points

Hard Isolation

- Dedicated network resource is allocated to different network slices
  - Pros: Guaranteed/bounded SLA
  - Cons: Complexity, scalability

	Capability	Limitation
IntServ QoS	Per-path/flow end-to-end resource reservation	• Per-flow state maintenance, not scalable • Difficult to implement in data plane (per-flow buffering and scheduling)
Detnet	Per-flow or aggregated flows resource reservation	Details are to be specified
Per-slice resource reservation	• No per-flow state • Avoid interference between different slices • Allow sharing within slice	• Require network planning to determine the resource needed • Less determinism than per-flow resource reservation

Soft and Hard Isolation in One Picture



- **Hard isolation**
  - Dedicated resource
  - No interference
  - Reduced multiplexing
  - Guaranteed or bounded SLA

- **Soft isolation**
  - Shared resource
  - Differentiated treatment
  - Statistical multiplexing
  - Target at upper-bound of SLA

Network Slicing requires both hard and soft isolation to meet different levels of SLA requirement, and find a balance between complexity/cost and service fulfillment

Conclusions

- Isolation is the key requirement for network slicing
- Both soft and hard isolation are needed
- Per-slice resource reservation can be used for network slicing