

For Long Future Group

Cloud (Supercomputer) over TIPN Questionnaires

2015. 8

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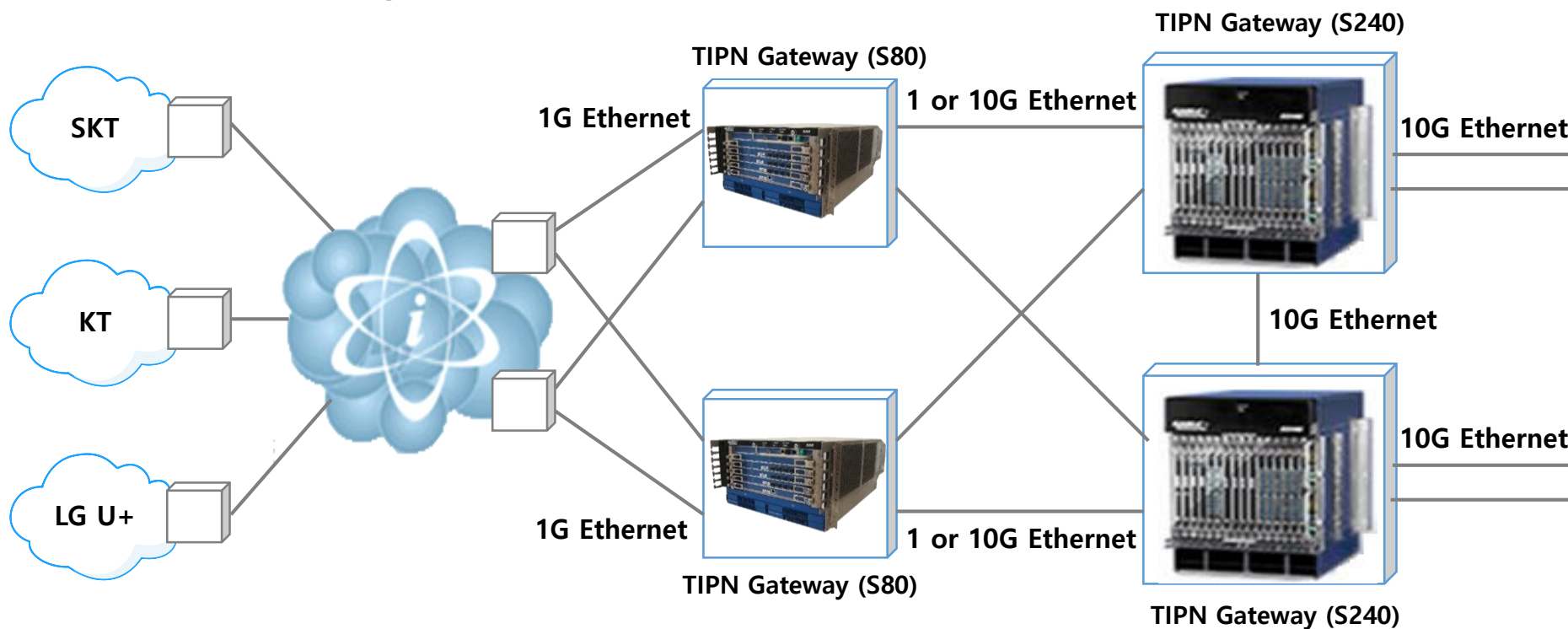
1. TIPN Topology

TIPN – Wireless IP Connectivity



Via Internet IX : Wireless Carrier's Private IP Network

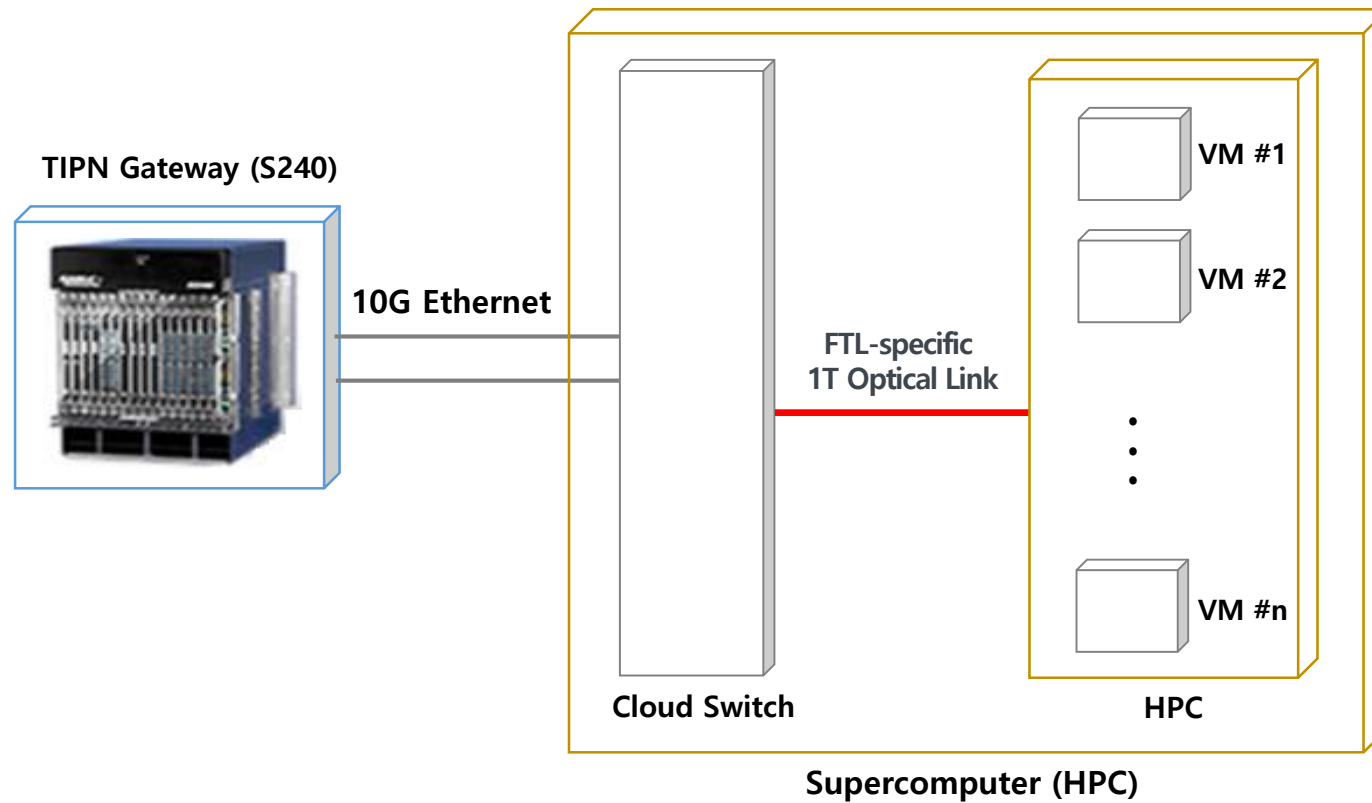
- IX Border Router ↔ TIPN Gateway
 - IX : KT, LG U+ or SKT
 - Inter-networking : BGP



TIPN – Data Center



Basic Configuration

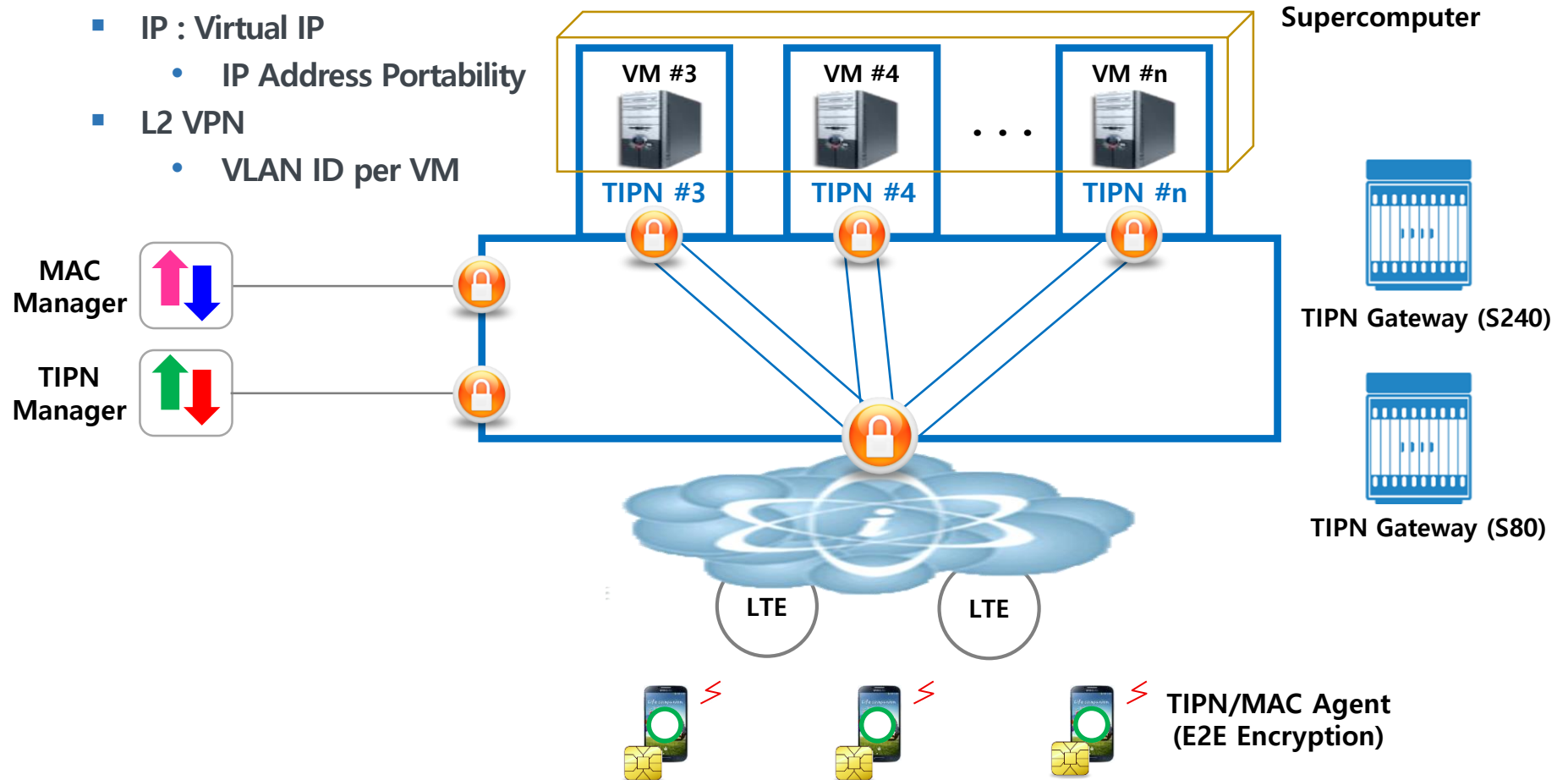


2. Cloud (Supercomputer) over TIPN

Cloud (Supercomputer) over TIPN

VM(Supercomputer) ↔ TIPN Gateway

- Per VM
 - MAC : Virtual MAC
 - IP : Virtual IP
 - IP Address Portability
 - L2 VPN
 - VLAN ID per VM



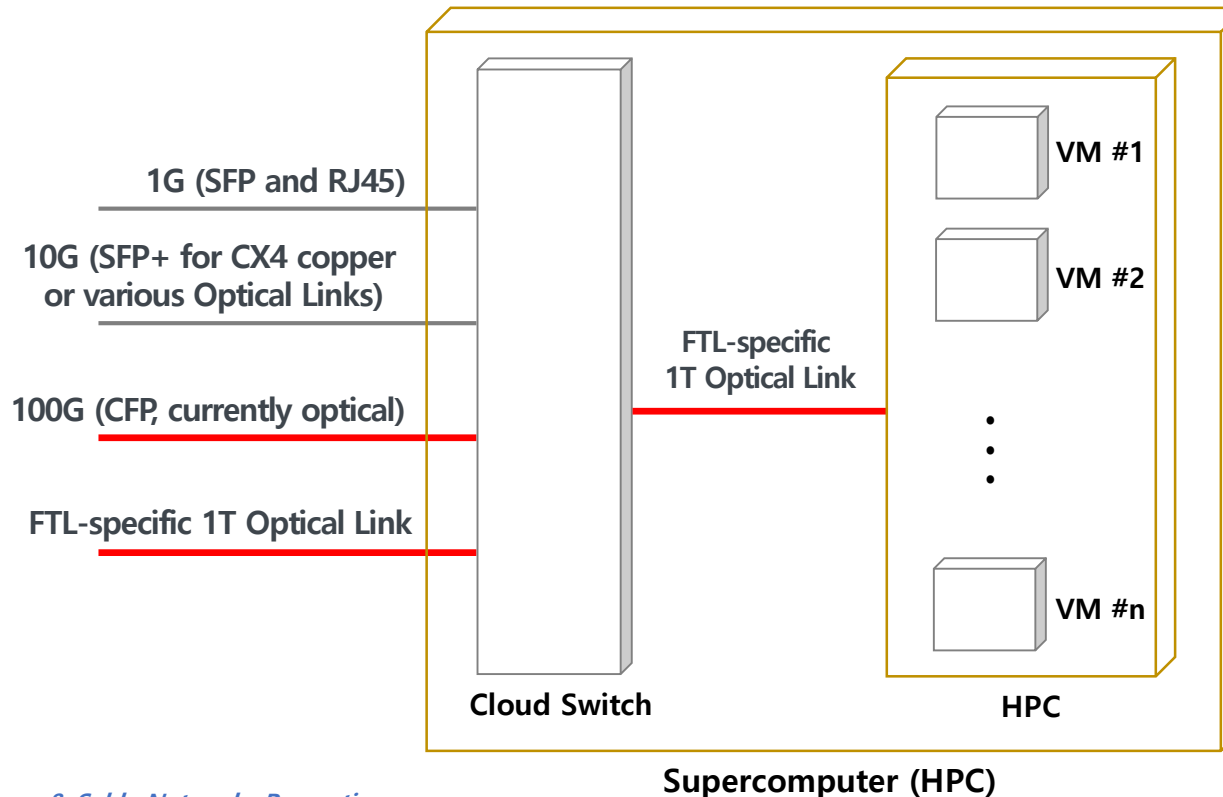
3. Questionnaire

Supercomputer – Physical Interface (1)



Physical Interface

- Physical Interface
 - 1G (SFP and RJ45)
 - 10G (SFP+ for CX4 copper or various Optical Links)
 - 100G (CFP, currently optical)
 - FTL-specific 1T Optical Link : IPV4 or preferably IPV6

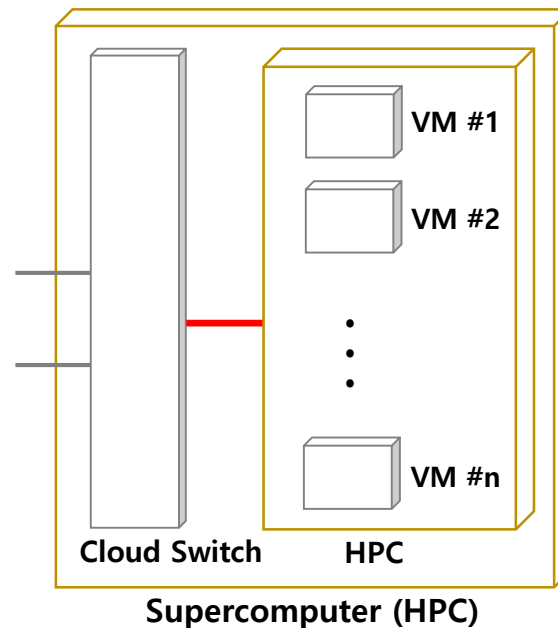


Supercomputer – VM (2)



Isolation per VM

- supports isolation between VM
 - Caveats are that two or more VPN
 - may communicate via standard IPV4/IPV6 UDP and TCP
 - File system mounts depending on VM firewall configurations.
- A single VM
 - may virtualize more than one CPU and more than one thread.

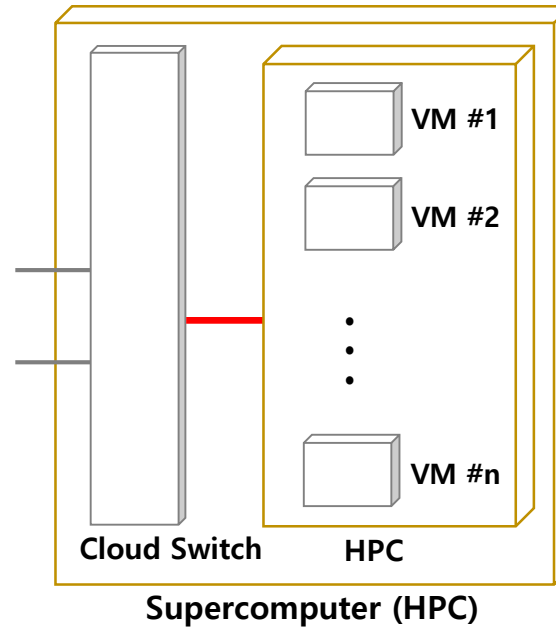


Supercomputer – VM (3)



VM Identifier

- VM Identifier
 - More than one MAC and IP

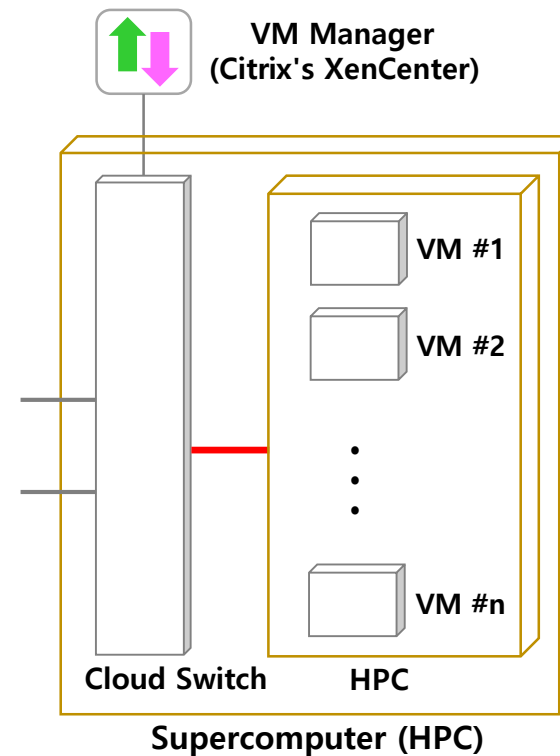


Supercomputer – VM Manager (4)



VM Manager

- Administrative Functions using XenCenter
 - Creating VM
 - Prioritizing
 - Backing up
 - Deleting VM
 - Generally analogous to Citrix's XenCenter
- The next generation
 - XenCenter not available (Not scale to our HPC)

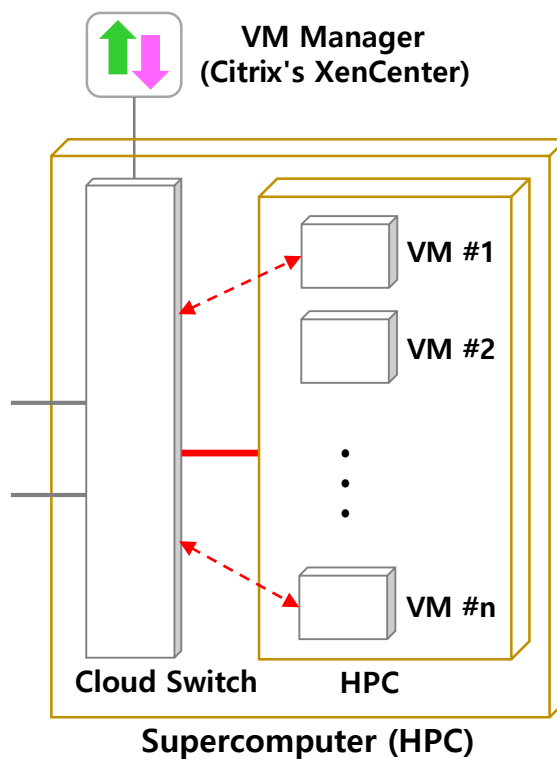


Supercomputer – Cloud Manager (5)



Cloud Manager, VM Identifier

- VM Identifier
 - VLAN
 - More than one MAC and IP
- Cloud manager conceptually analogous to XenCenter.

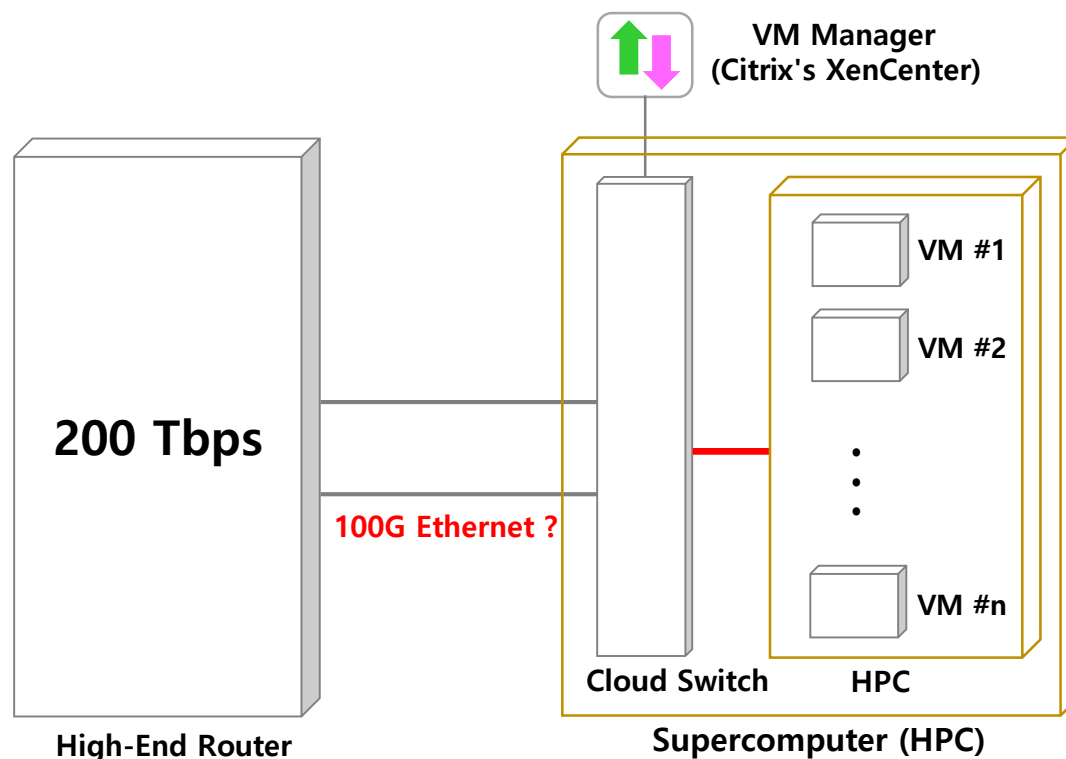


Supercomputer(VM) over IP Network – Thin Client (1)



Physical Interface, Capacity Planning

- Bandwidth Requirement per Thin Client
 - 300 M ~ 1 Gbps
- Max No. of Concurrent Users : 100,000 Users
 - High-End Router Capacity : 200 Tbps
 - Actual Bandwidth : 30 T ~ 100 T

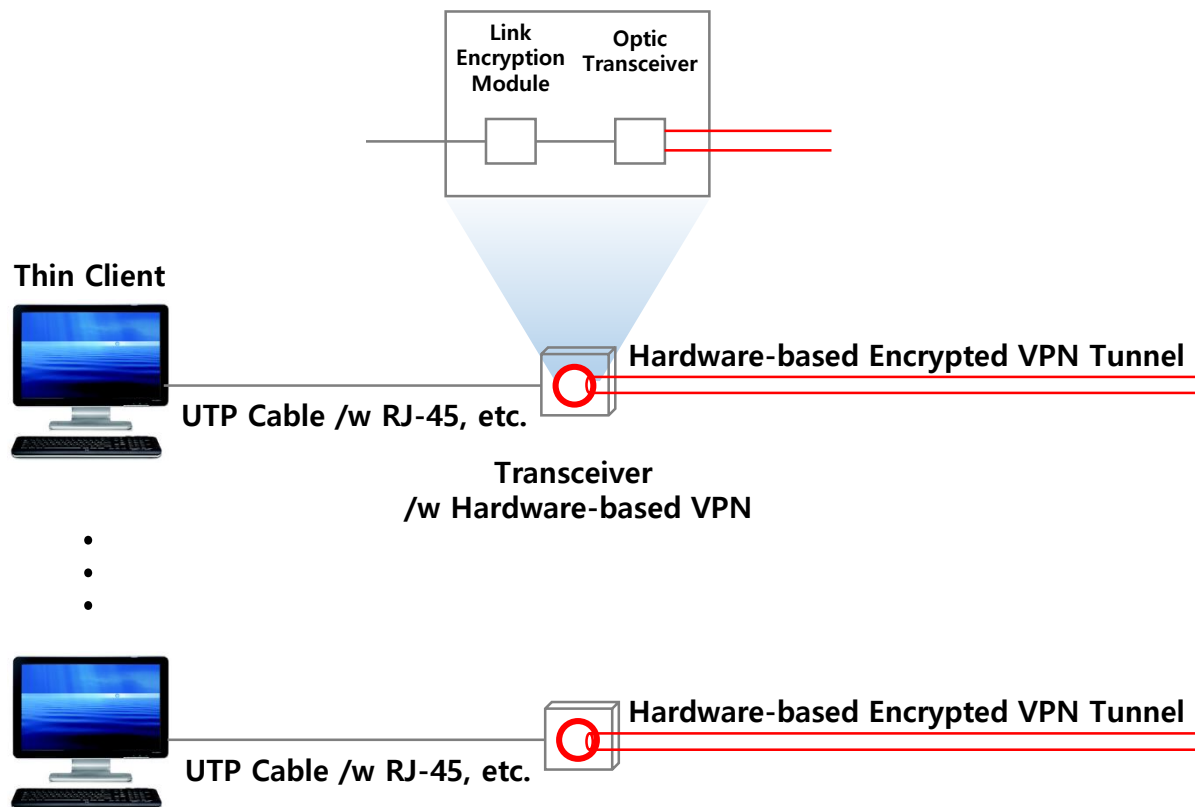


Supercomputer(VM) over IP Network – Thin Client (2)



Thin Client : Hardware-based VPN

- Hardware-based VPN Agent
 - Thin Client : Transceiver /w Hardware-based VPN
 - Interface : UTP Cable /w RJ-45, etc.

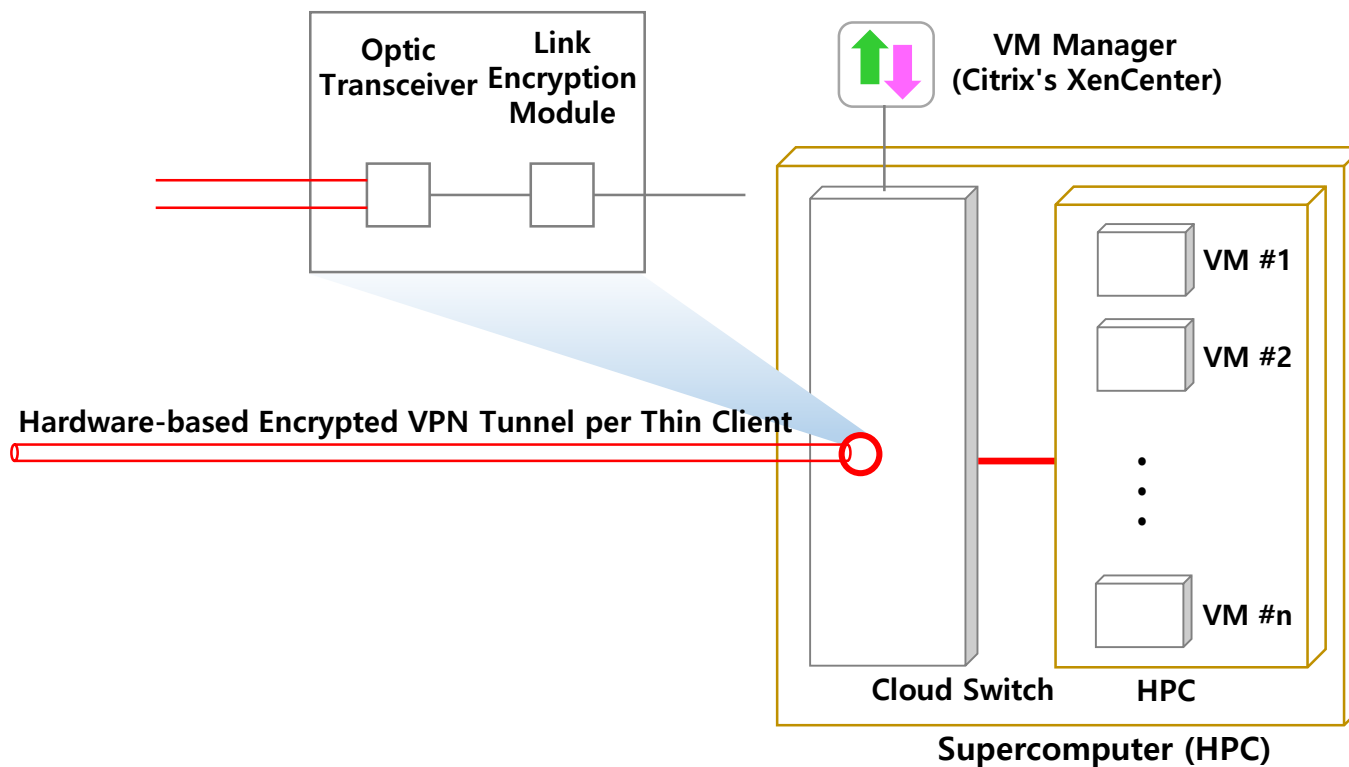


Supercomputer(VM) over IP Network – Thin Client (3)



Supercomputer : Hardware-based E2E VPN

- Hardware-based VPN Agent
 - Cloud Switch : Optical Transceiver /w Hardware-based VPN
 - Interface : Fiber Optic, etc.

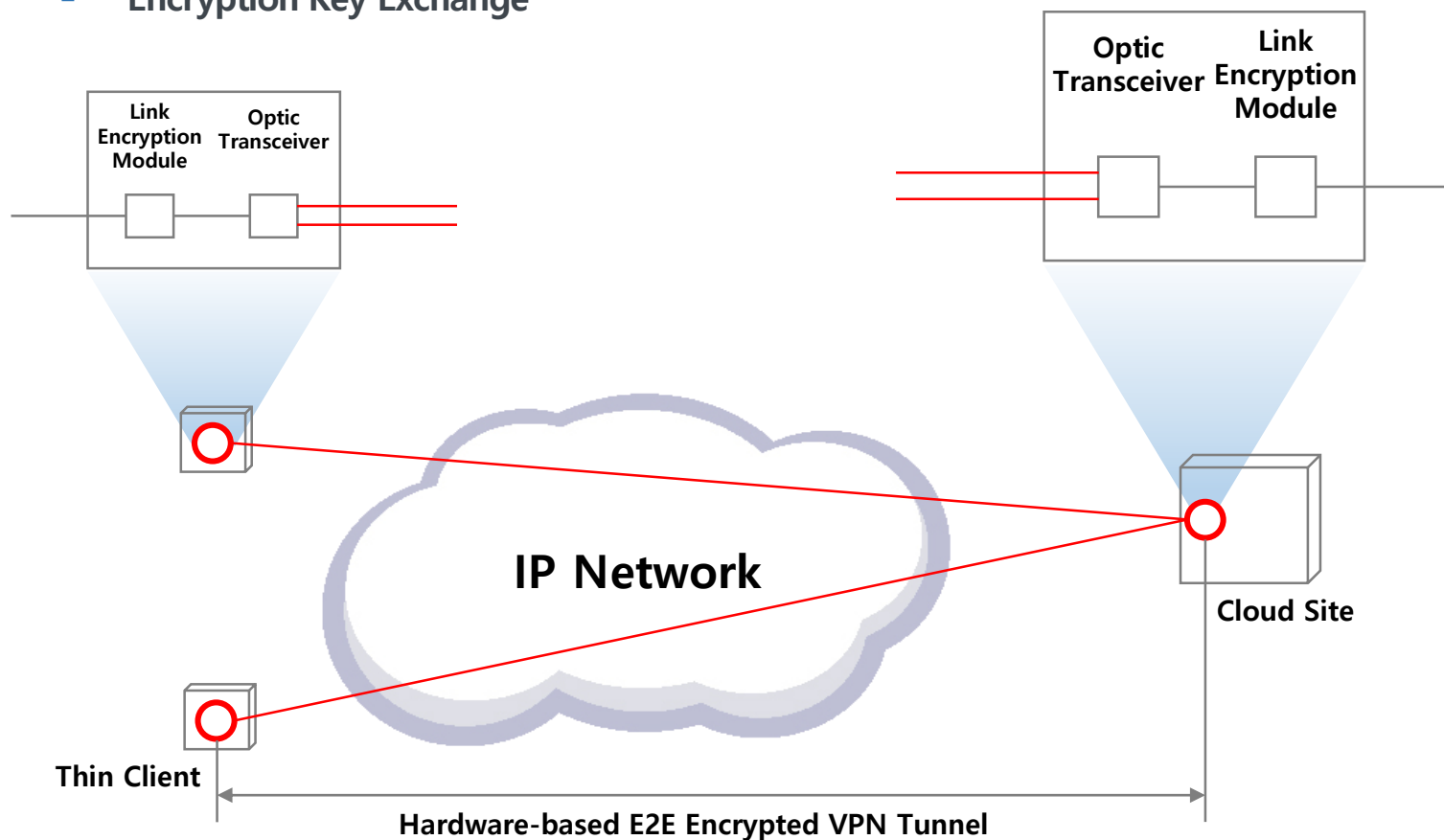


Supercomputer(VM) over IP Network – Thin Client (4)



Hardware-based E2E VPN : Link Encryption

- E2E Link Encryption
 - Hardware-based Encryption
 - Encryption Key Exchange

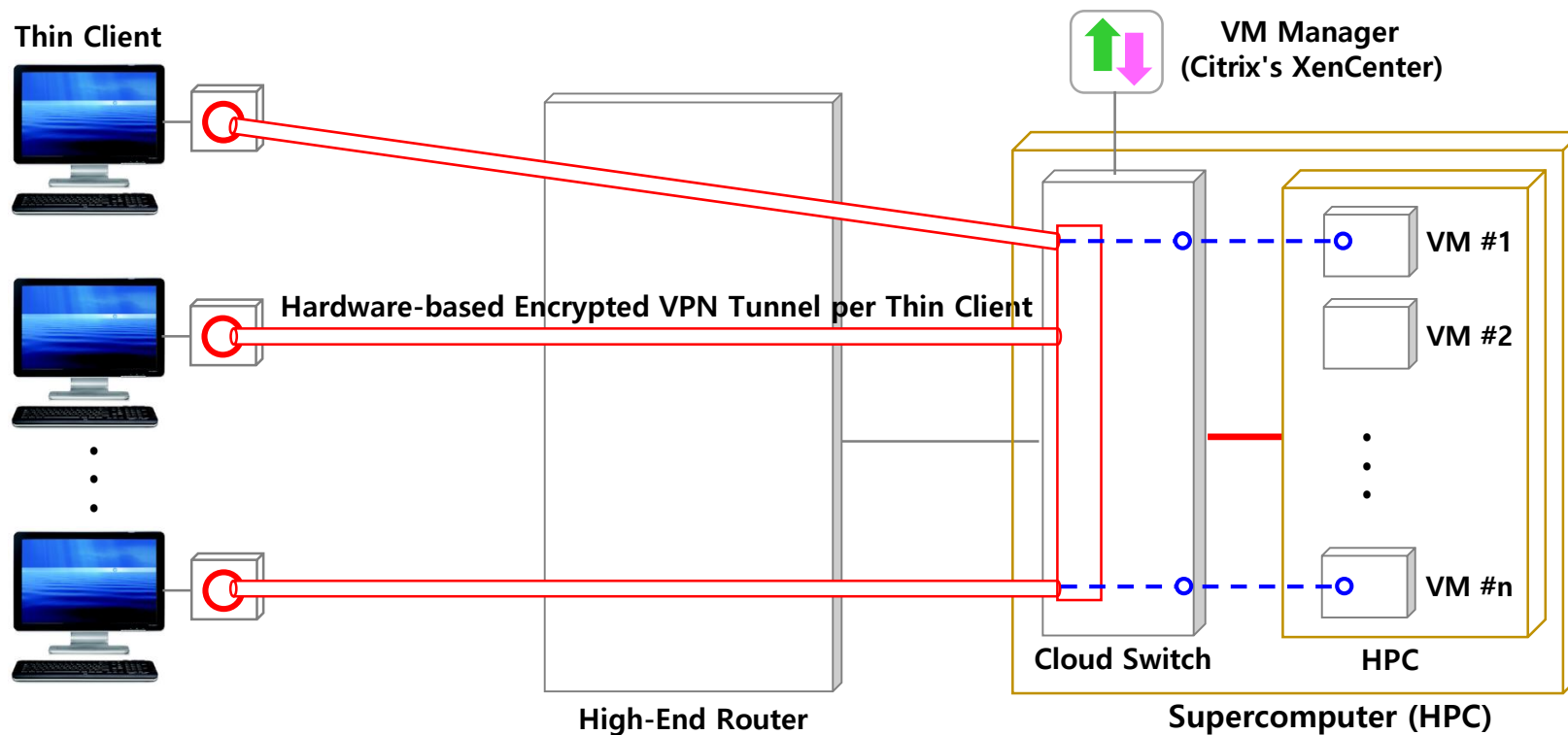


Supercomputer(VM) over IP Network – Thin Client (5)



Thin Client ↔ Supercomputer(VM) E2E VPN Connectivity

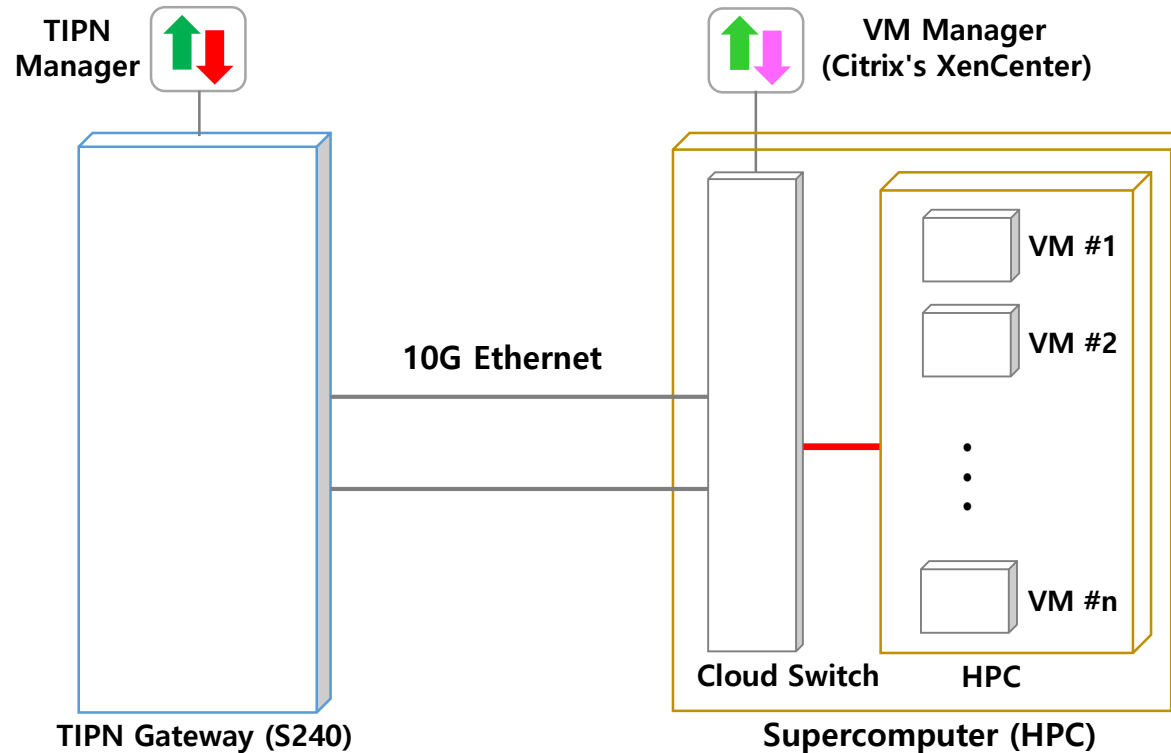
- Hardware-based Encrypted VPN Tunnel per Thin Client
- Supercomputer(VM)
 - Hardware-based Encrypted VPN Tunnel Map to Designated VM



Supercomputer(VM) over TIPN – Smart Device (1)

TIPN Gateway ↔ Supercomputer Physical Interface : 10G Ethernet

- TIPN Gateway ↔ Supercomputer
 - 10G Ethernet

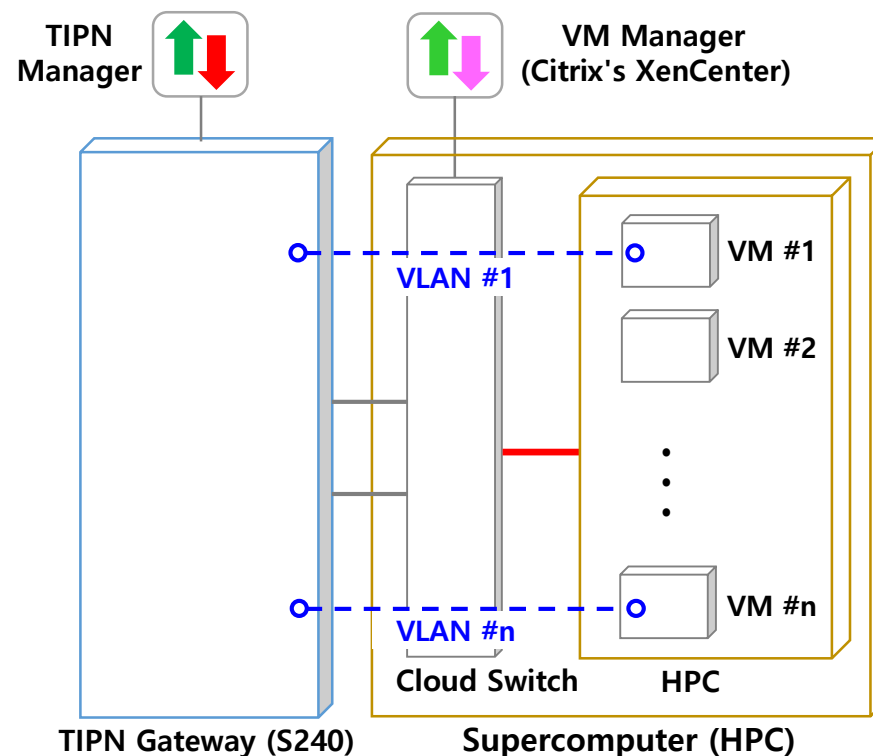


Supercomputer(VM) over TIPN – Smart Device (2)



TIPN Gateway ↔ Supercomputer Interface : VLAN

- Supercomputer
 - Cloud Switch
 - Per VM
 - VLAN ID
- Per VM
 - More than one VLAN
 - More than one MAC/IP Address

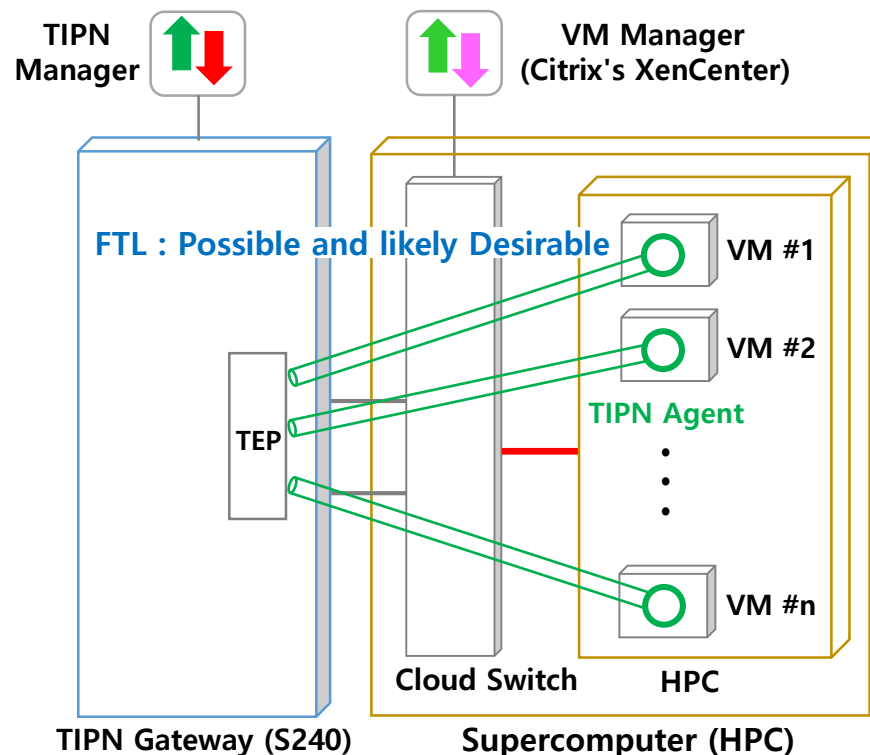


Supercomputer(VM) over TIPN – Smart Device (3)



TIPN Agent per VM

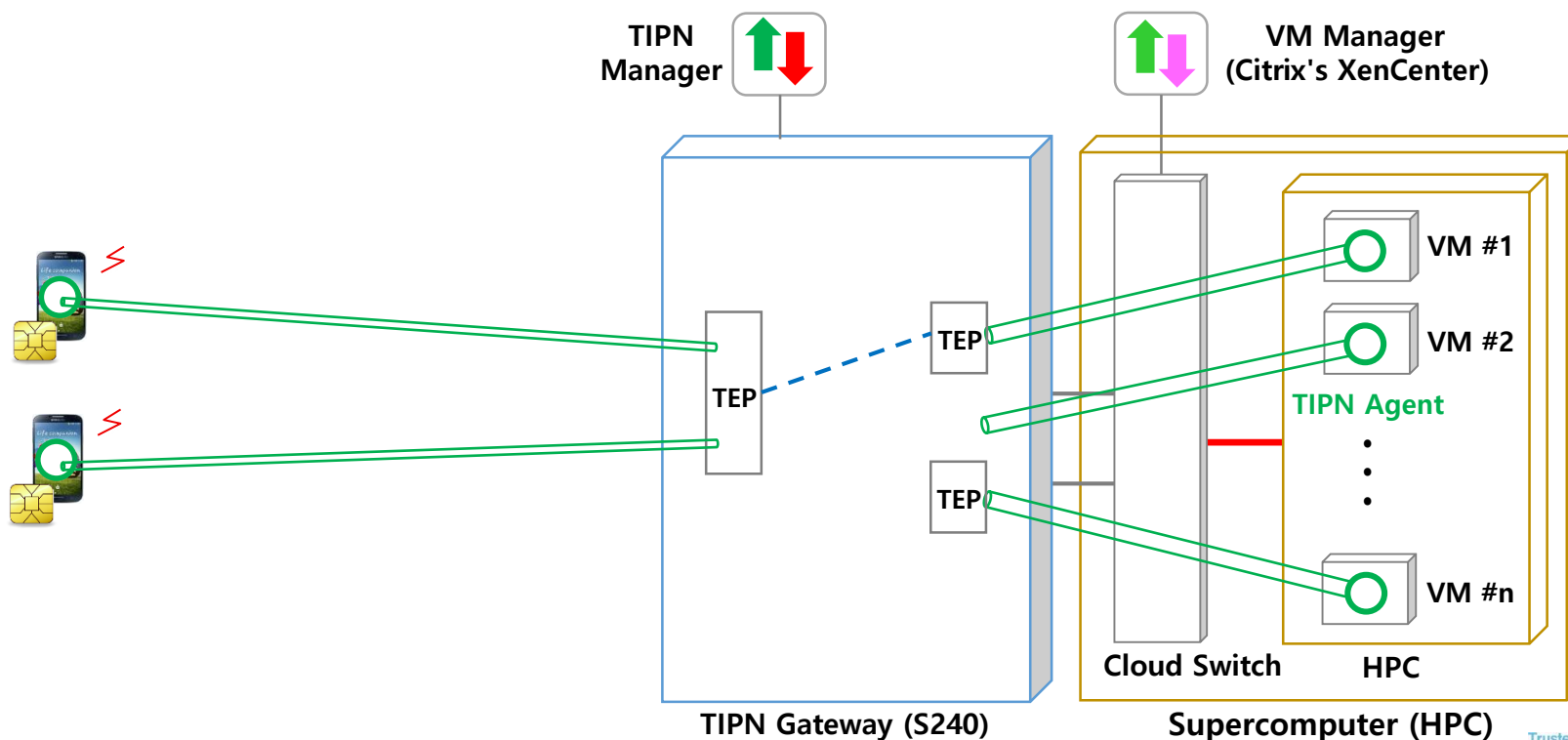
- TIPN Agent per VM
 - Authentication
 - Protocol : TLS
 - MFA (Multi-Factor Authentication)
 - Authentication Packet Encryption
- Network VPN Tunnel Management
 - TIPN Manager
 - Smart Devices
 - VM



Supercomputer(VM) over TIPN – Smart Device (4)

Internetworking between TEP(Smart Device) and TEP(VM)

- TIPN Manager
 - TEP(Smart Device) : Network VPN Tunnel per Smart Device
 - TEP(VM) : Network VPN Tunnel per VM
- Interworking between TEP(Smart Device) and TEP(VM)
 - Same Routing Domain Separation per TEP Group

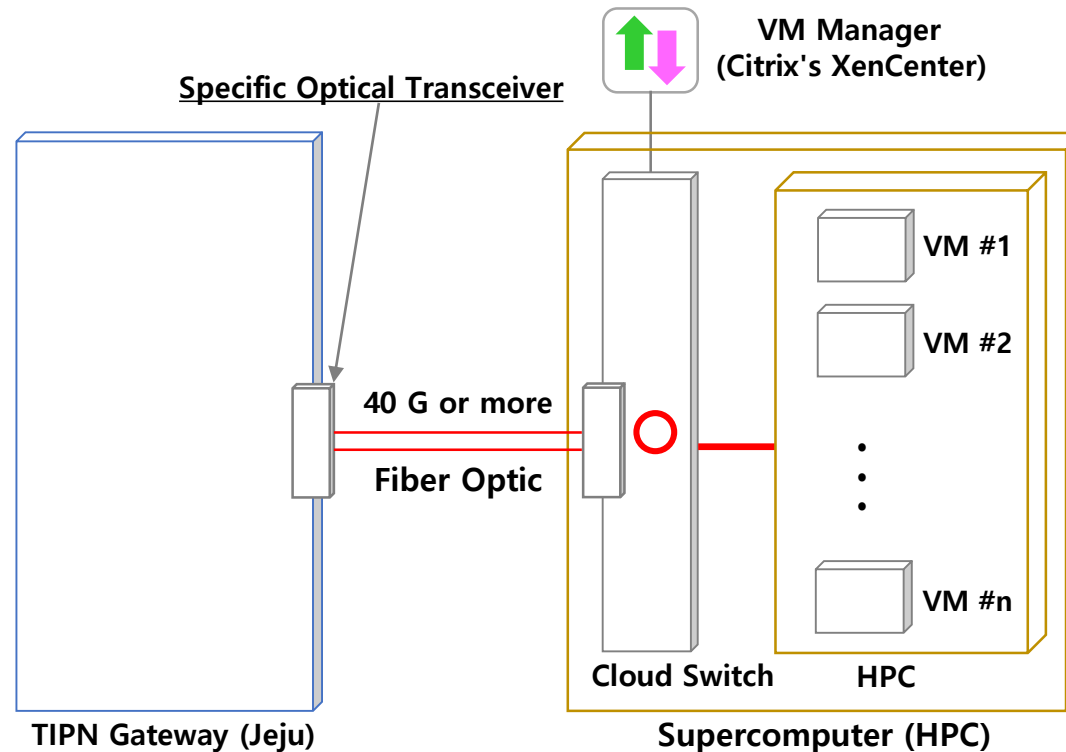


Supercomputer(VM) over TIPN – High-Speed Interface



TIPN Gateway High-speed Interface : 40G or more

- High-Speed Interface : 40 ~ 100 Gbps
 - Specific Optical Transceiver (FTL)
 - Interface Specification : TBD

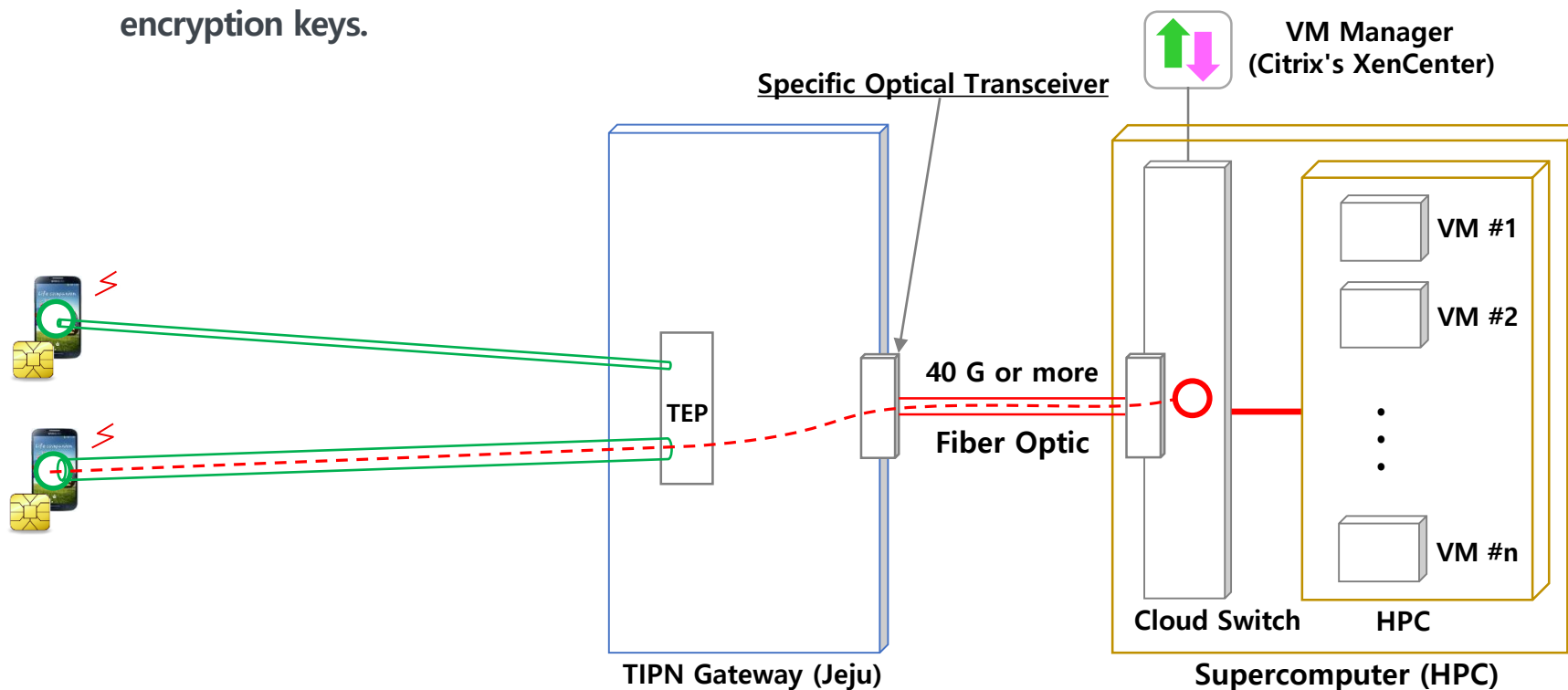


Supercomputer(VM) over TIPN – E2E Encryption



E2E Encryption : Smart Device ↔ HPC

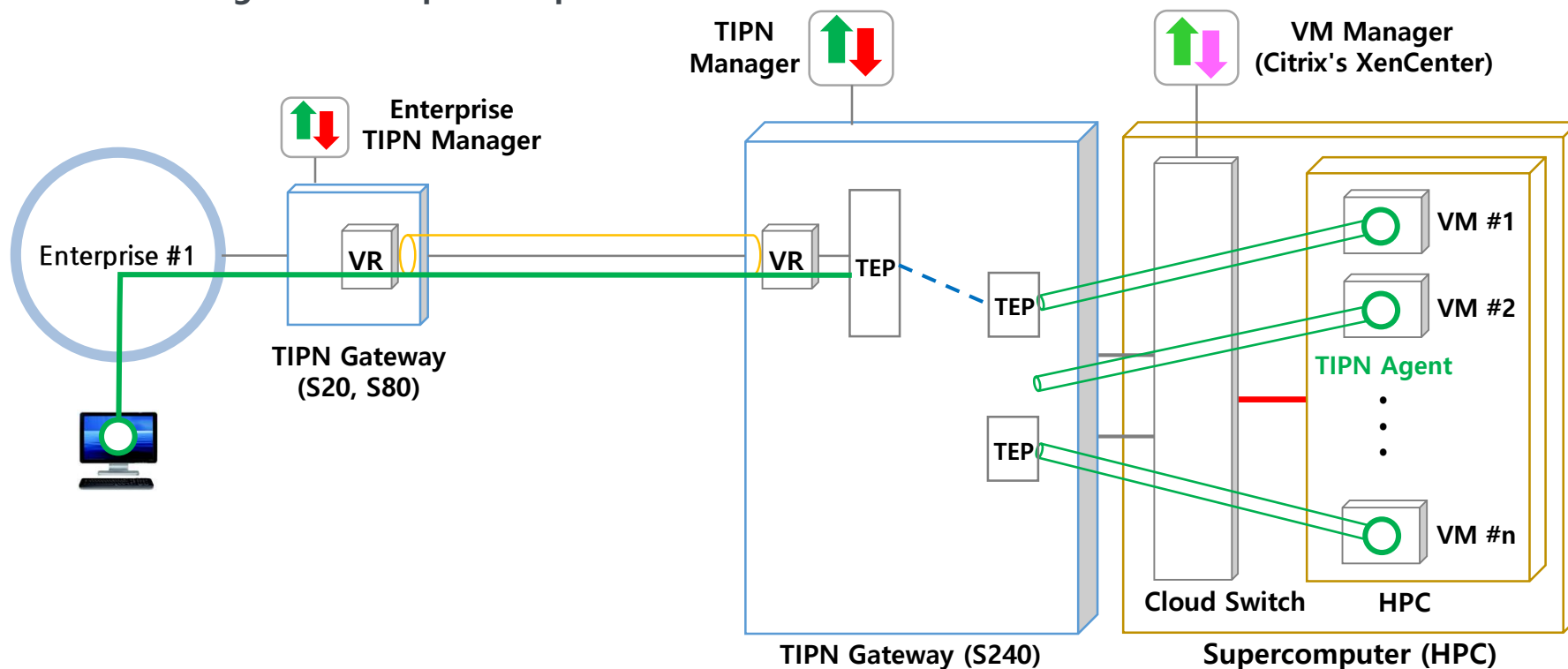
- HPC : FTL's Hardware-based Encryption
- Smart Device : Software-based Encryption (FTL)
- Considerations
 - Would require re-compilation for FTL binary.
 - Interfaces provide metadata used to create a VM image and pass information such as encryption keys.



Supercomputer(VM) over TIPN – Enterprise

Internetworking between TEP(Smart Device) and TEP(VM)

- TIPN Manager
 - TEP(Smart Device) : Network VPN Tunnel per Smart Device
 - TEP(VM) : Network VPN Tunnel per VM
- Interworking between TEP(Smart Device) and TEP(VM)
 - Routing Domain Separation per TEP

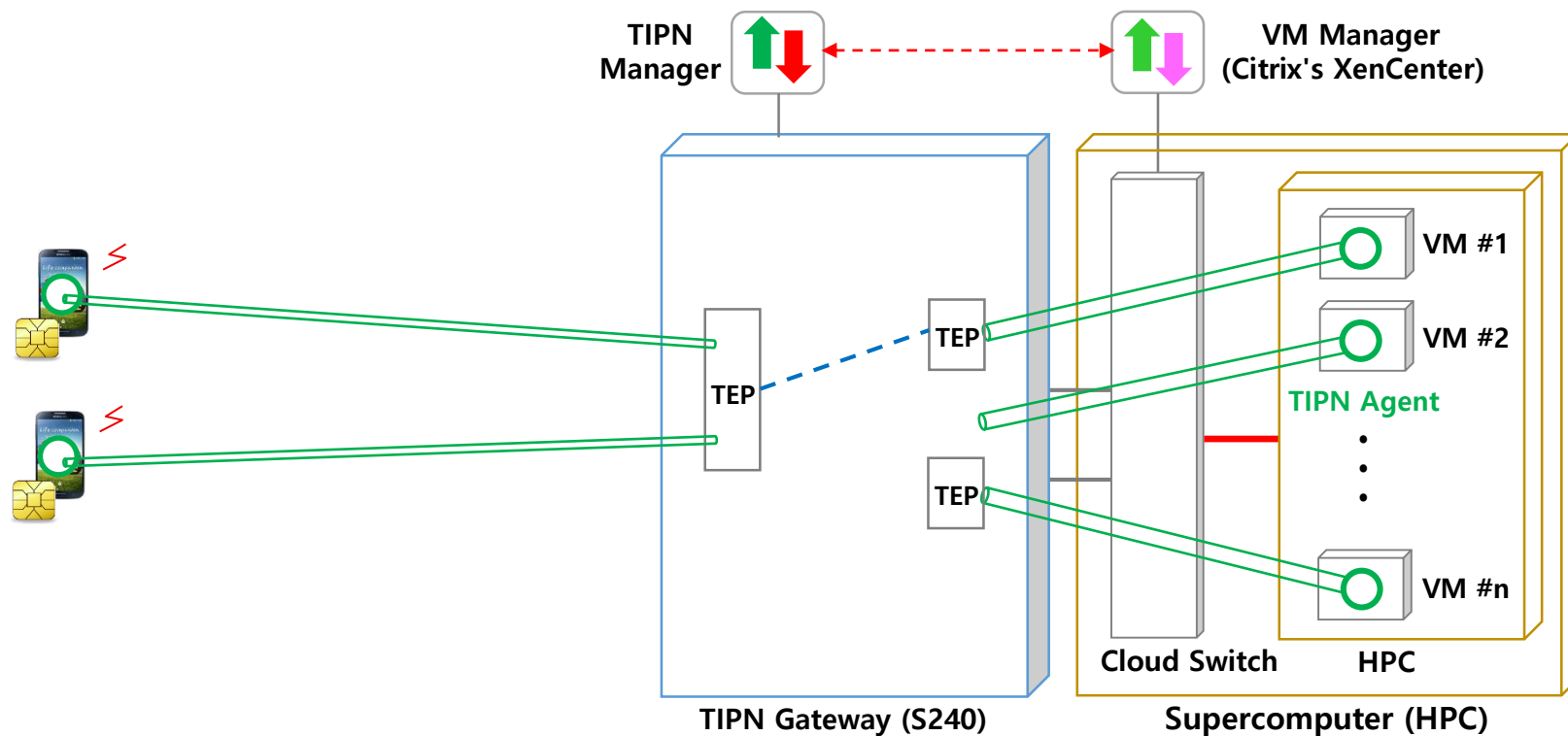


Supercomputer(VM) over TIPN – VPC Manager



Interworking between TIPN Manager and VM Manager

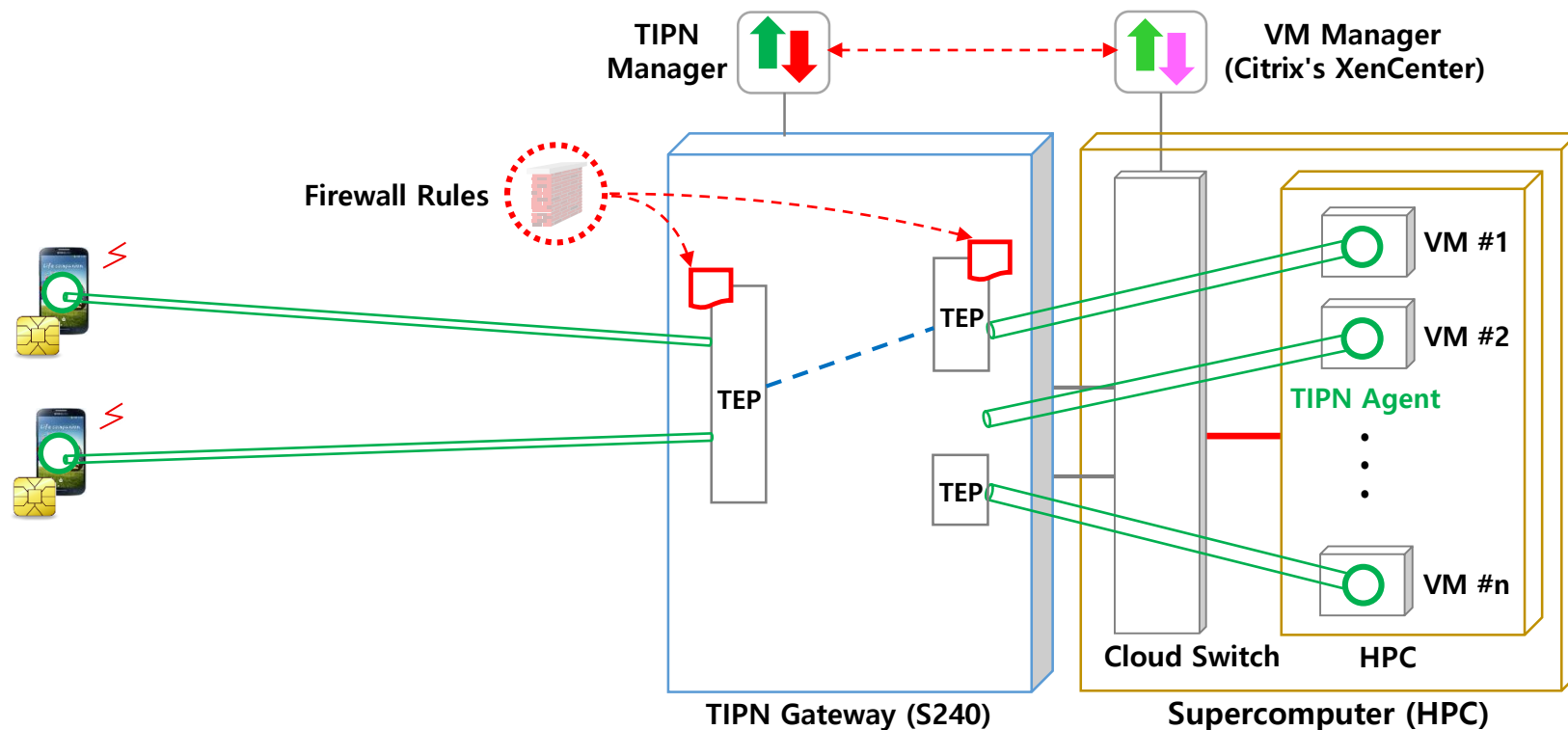
- TIPN Manager
 - Per Smart Device
 - Per VM
- VM Manager : VM



Supercomputer(VM) over TIPN – “Firewall Rules”

Seamless Secure Connection between Smart Device and Cloud

- White List (Firewall Rules)
 - TEP per Terminal, (per Enterprise)
 - TEP per Virtual Machine



Supercomputer(VM) over TIPN – Others



Other Items

- VPC Manager
 - MC/Sable : TIPN Manager
 - FTL
 - Current : Citrix's XenCenter
 - HPC : To be defined
 - Cloud over TIPN Manager : To be defined

- Scalability
 - 100,000 Users : very Large No. of Connections

- [Shared] File System Access

- Backup : High Availability

- Load Balancing

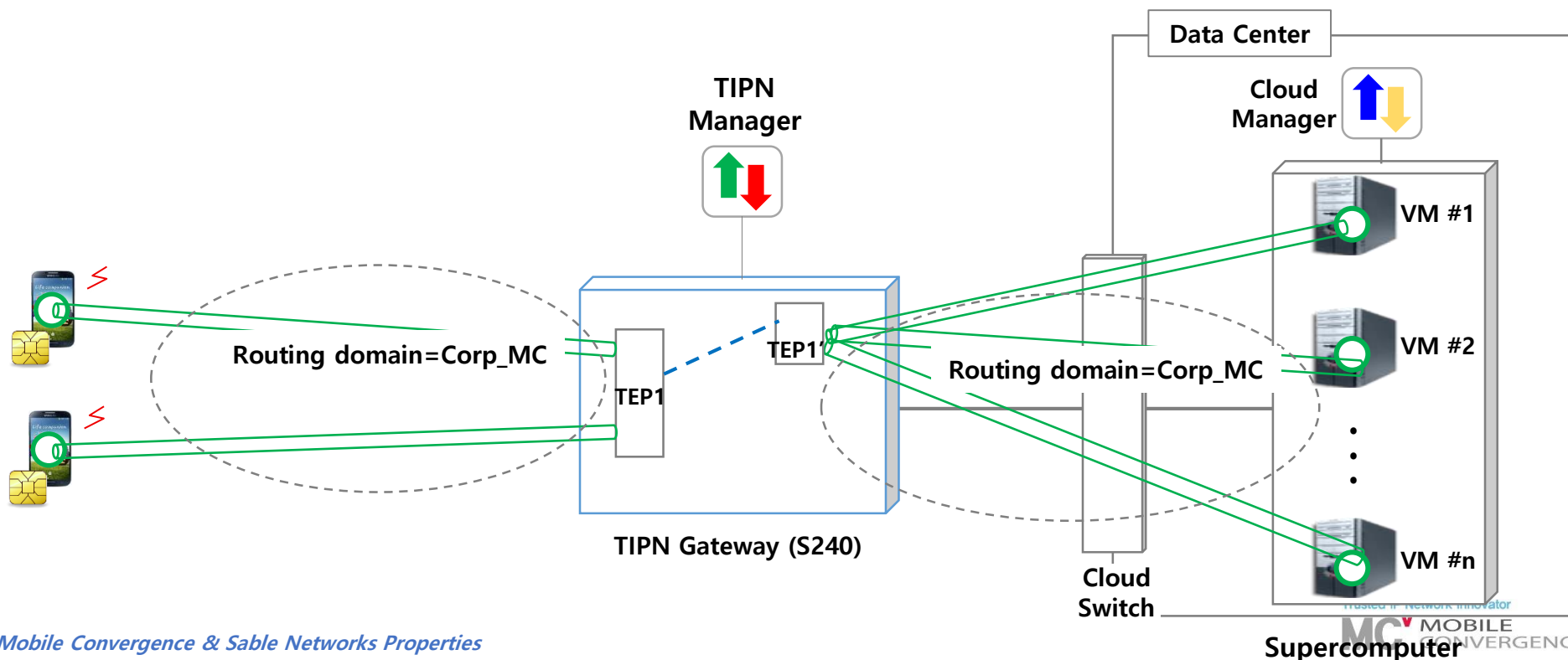
Thank you

Supercomputer (VM) – Network VPN Management (10a)

Interworking Model : TIPN Agent per Smart Device ↔ TIPN Agent per VM

● Example 1 – Single Routing Domain = Corp_MC

- SmartDevices terminate at GW using TEP1 in Routing domain = Corp_MC (regardless of number of devices)
- Within Routing domain=Corp_MC, TIPN tunnels are setup towards the VMs using TEP1' (regardless of number of VMs). Terminated traffic from SmartDevices is tunneled using TEP1' towards VMs
- Minimal use of TEPs in same routing domain – ensures seamless interworking

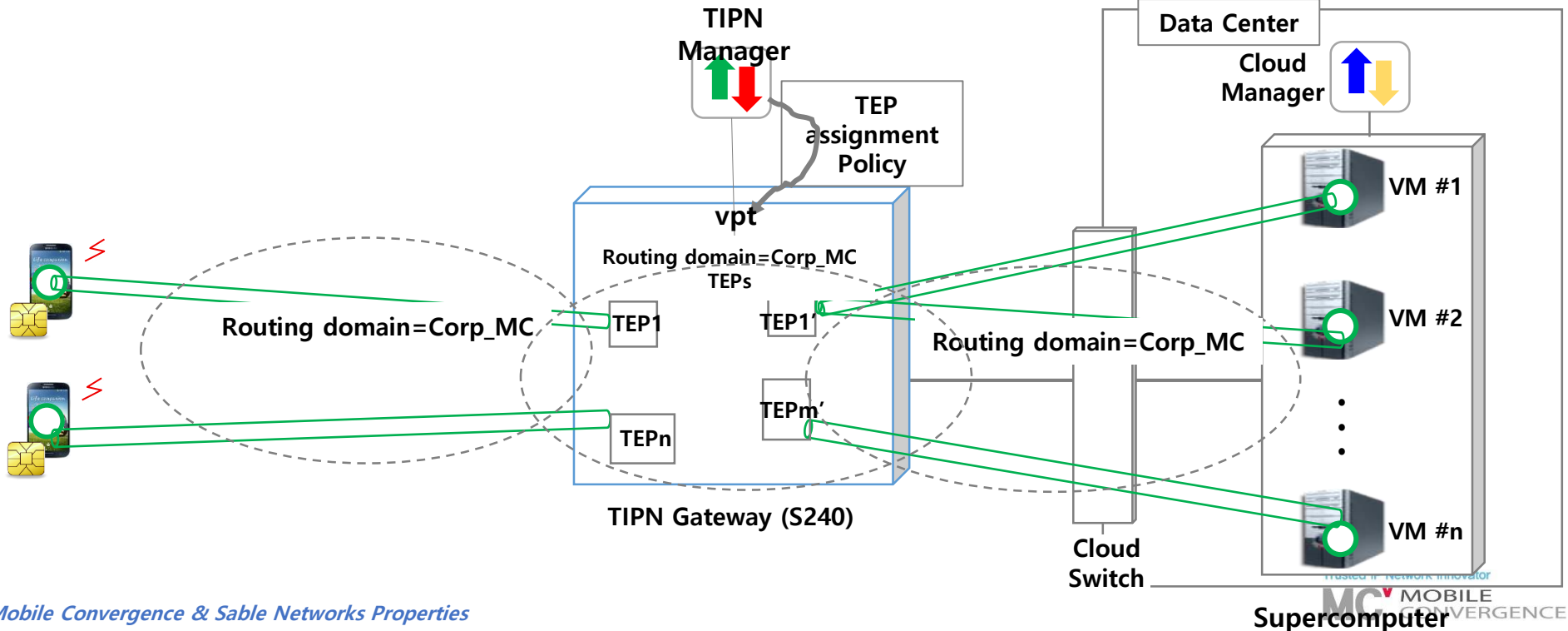


Supercomputer (VM) – Network VPN Management (10a')

Interworking Model : TIPN Agent per Smart Device ↔ TIPN Agent per VM

Single Routing Domain with multiple TEPs at GW

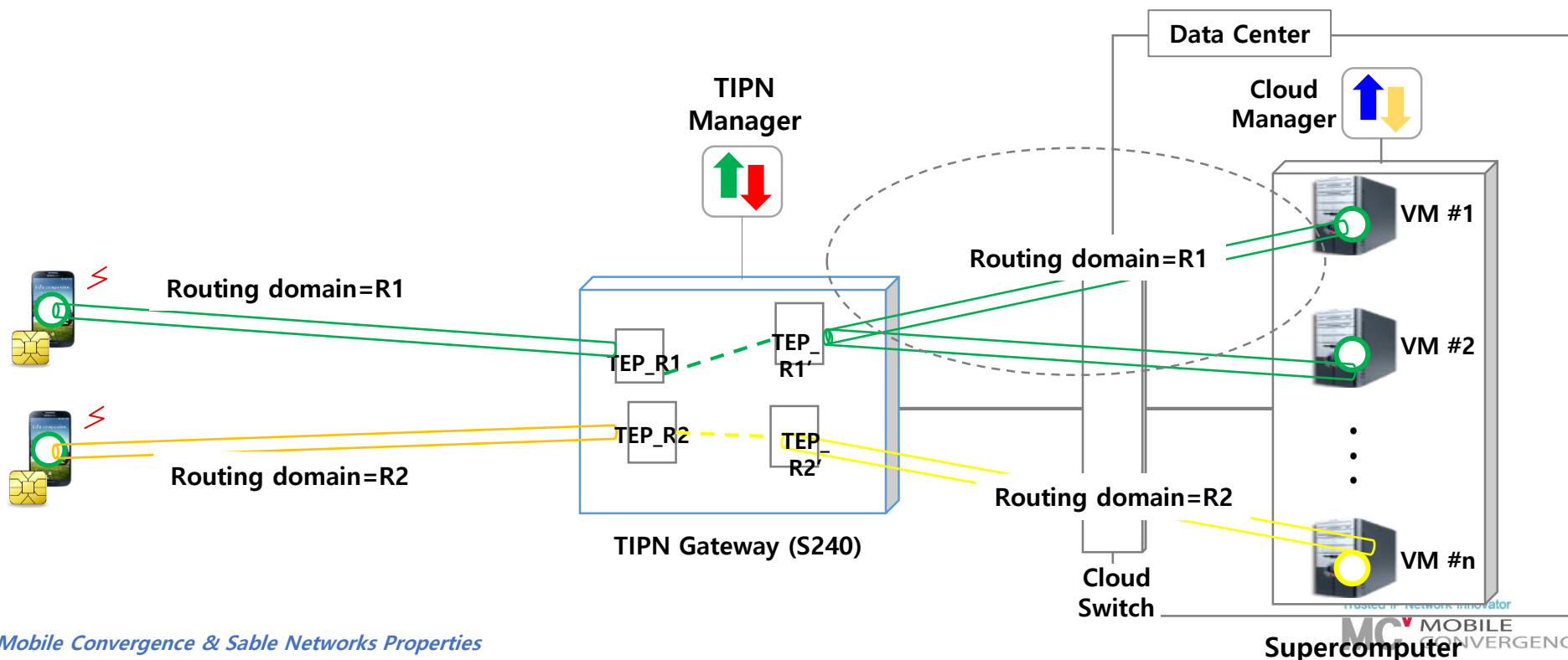
- Multiple TEPs can be used within a single Routing Domain
- TEP Assignment Policy distributed by TIM to GW's VPT. Possible policy options:
 - Device address range based TEP assignment
 - Server prefix based
 - Random
 - Load balancing across TEPs
 - Any other policy criteria
- GW VPT will use the TEP policy to assign a TEP from the many TEPs available in a routing domain



Supercomputer (VM) – Network VPN Management (10b)

Interworking Model : TIPN Agent per Smart Device ↔ TIPN Agent per VM

- Example 2 – Multiple Routing Domains = R1, R2 etc
 - SmartDevices terminate at GW using the TEP in specific Routing domain (i.e TEP_R1 in domain R1, TEP_R2 in domain R2).
 - TIPN tunnels are setup towards the VMs using TEP in it's routing domain (regardless of number of VMs in the specific routing domain).
 - Routing domain R1: Devices terminate using TEP_R1; Traffic to VMs #1 and #2 will use TEP_R1'
 - Routing domain R2: Devices terminate using TEP_R2; Traffic to VM #n will use TEP_R2'



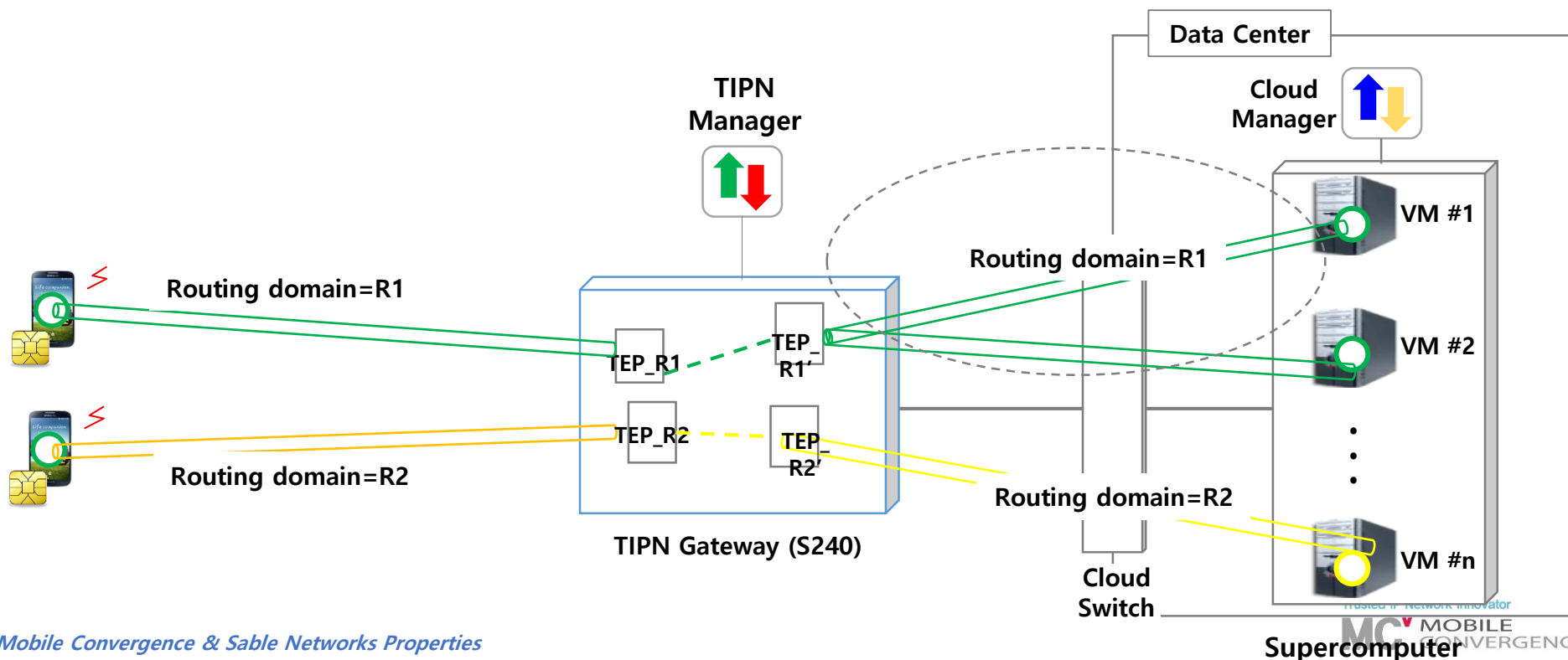
Supercomputer (VM) – Network VPN Management (10c)



Interworking Model : TIPN Agent per Smart Device ↔ TIPN Agent per VM

Summary

- Multiple devices or VMs can use the same TEP in the same Routing Domain (Optimizes GW performance with minimal configuration)
- Separate Routing domains need different TEPs



Supercomputer (VM) – Network VPN Management (10d)



Interworking Model : Cloud Manager ↔ TPN Manager

- Cloud Manager and TPN Manager Interworking
 - Routing domain information exchange between Cloud Manager and TPN Manager

