Cloud-Network Convergence in China Telecom

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Motivation

Cloud and network are deployed and managed separately in China Telecom before 2016, therefore:

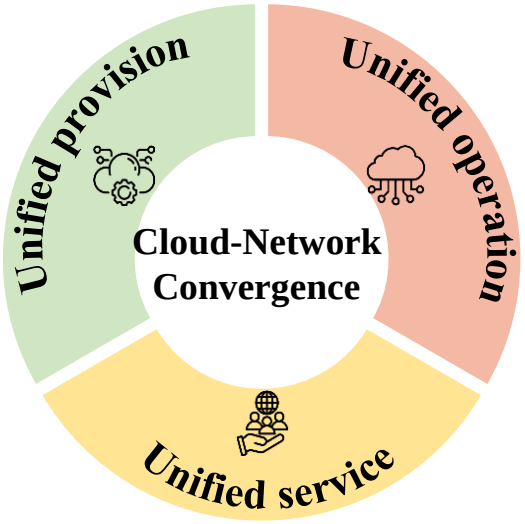
- **Cloud services can't be accessed easily due to the non-standardized interfaces between cloud & network**
- **Hard to provide integrated cloud & network services due to the separation of cloud & network**
- **Low efficiency of operation and management due to the separation of cloud & network**
- **Hard to expand Telecom Cloud services due to the coupling of network & services**
- **Limited flexibility in service development and deployment due to the non-cloudified service anchor**

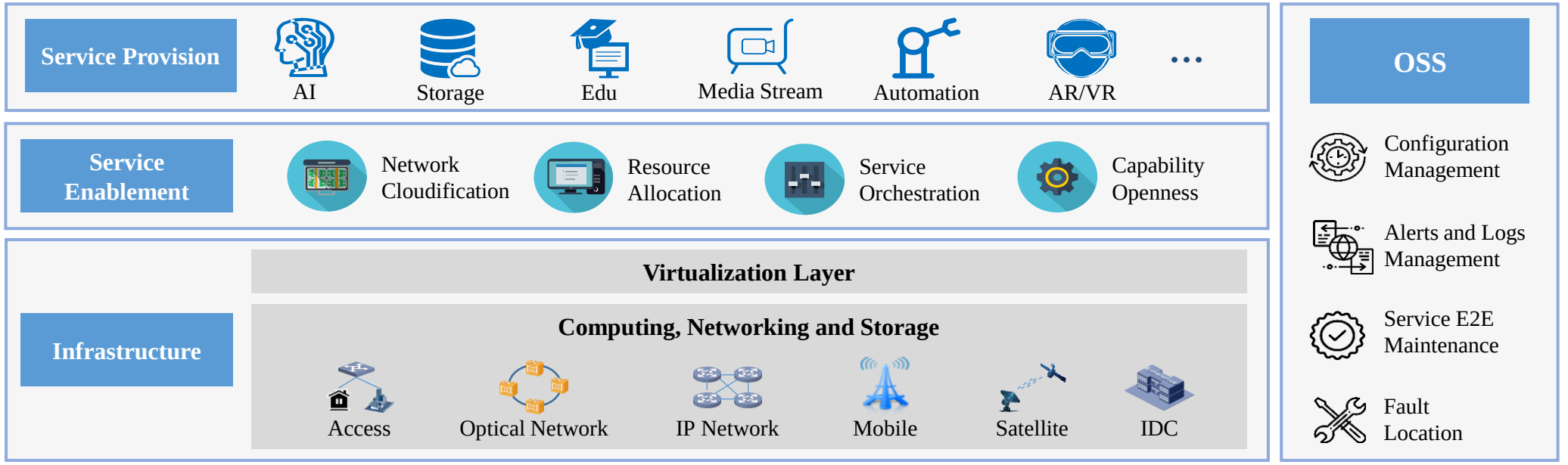
Build cloud-network converged infrastructure to meet the increasingly serveice requirement...

Cloud-Network Convergence Strategy of China Telecom

- **Building cloud-network converged infrastructure to offer diverse, customized, reliable services to various customers**

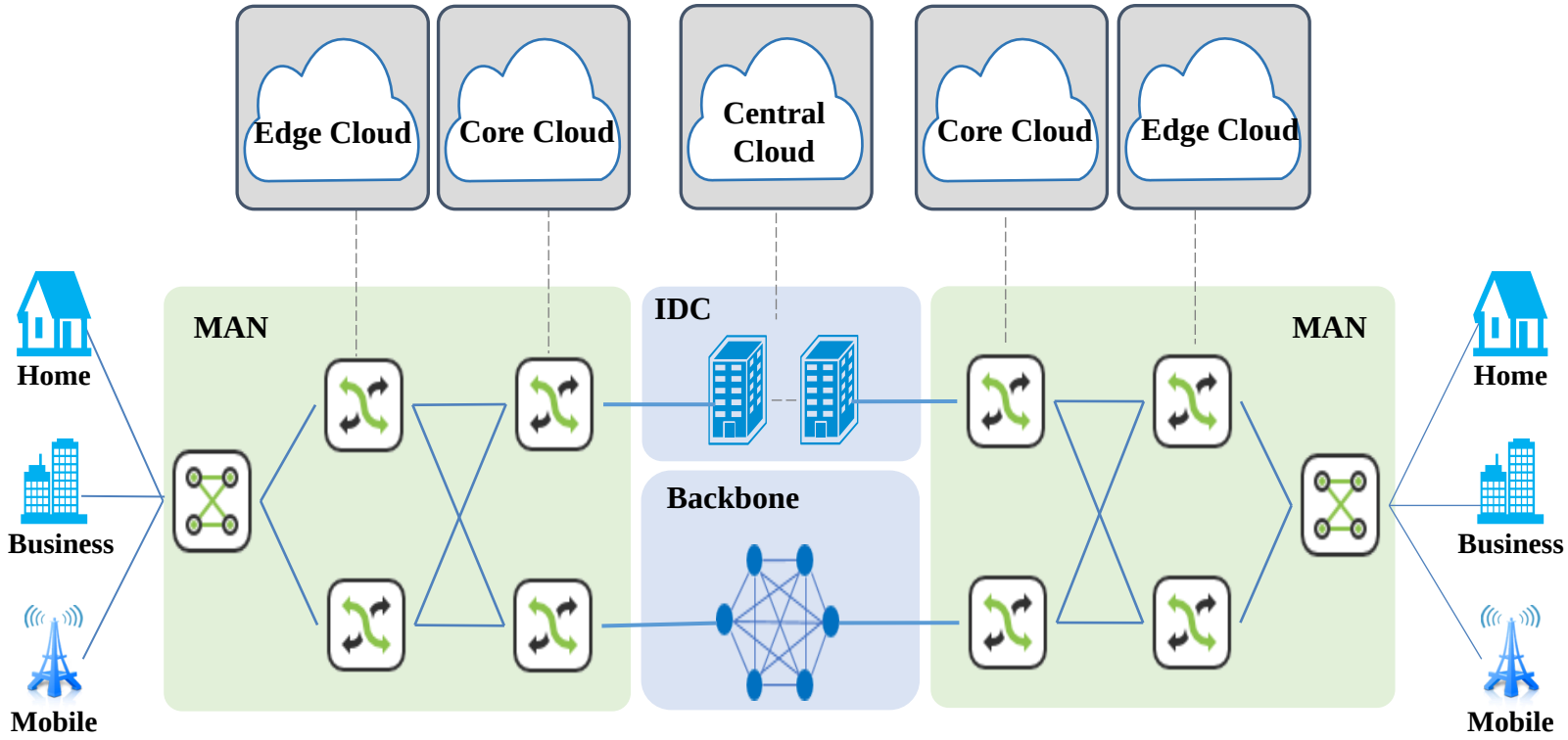
  - Unified abstraction and encapsulation of cloud & network resources
  - Unified scheduling and orchestration of cloud & network resources
  - Unified operation and management of cloud & network resources
  - Unified end-to-end monitoring and maintenance of cloud & network services
  - Unified deployment and delivery of cloud & network services
  - Unified portal for providing cloud & network services





Status Quo of Network, Cloud and Services

- **IP Network: connection for clouds and services**
  - Contains IP MAN, IP Backbone, and IDC
- **Telecom Cloud: cloud services based on virtualized infrastructure**
  - Deployed in central cloud, core cloud, and edge cloud
- **Diversified services**
  - 2H: HSI, IPTV, VoIP…
  - 2B: dedicated network, cloud access…
  - 2C: 4G, 5G…

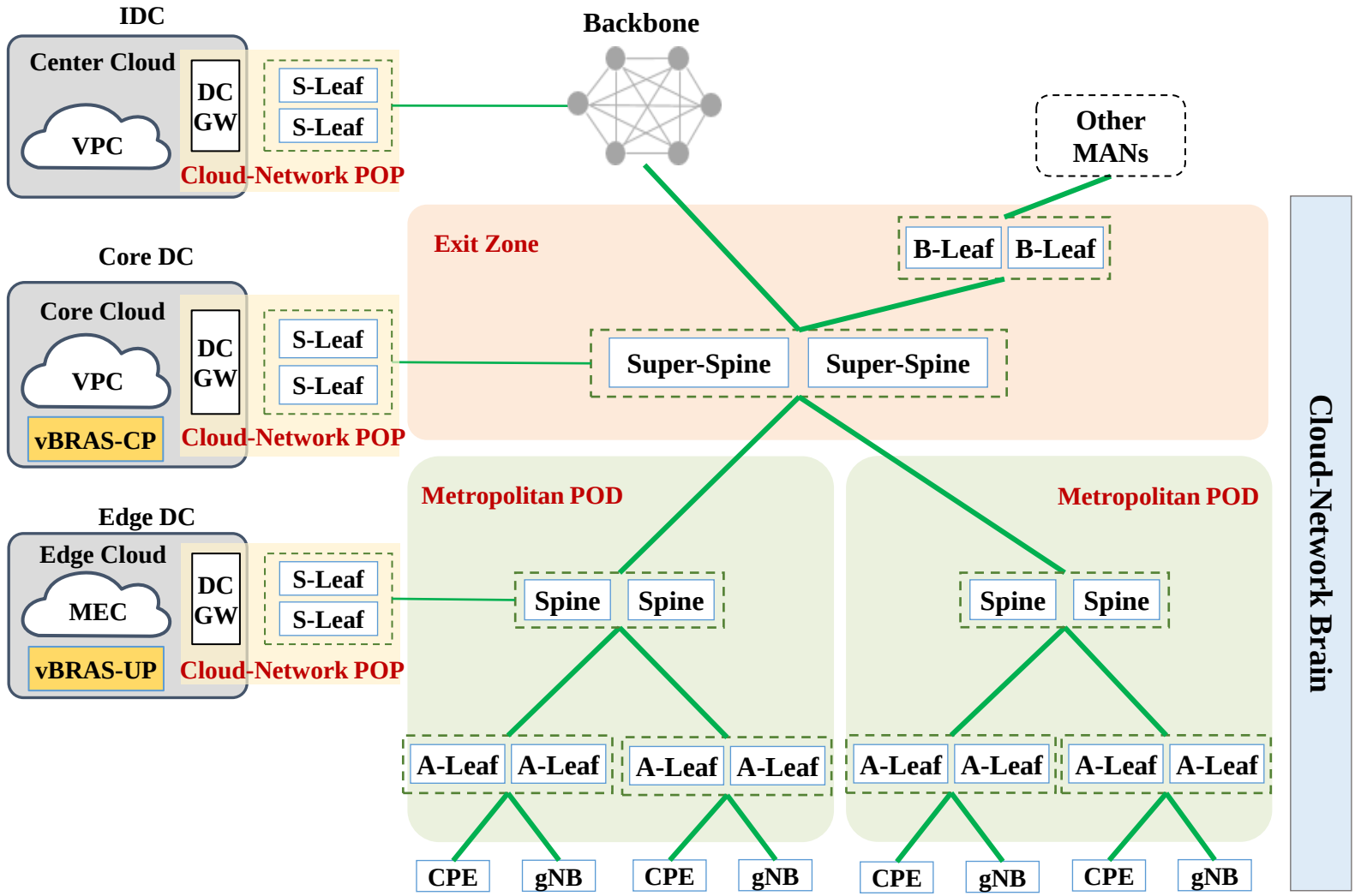


All services are based on Telecom Clouds

All Telecom Clouds are based on IP network

Overview of Cloudified IP MAN

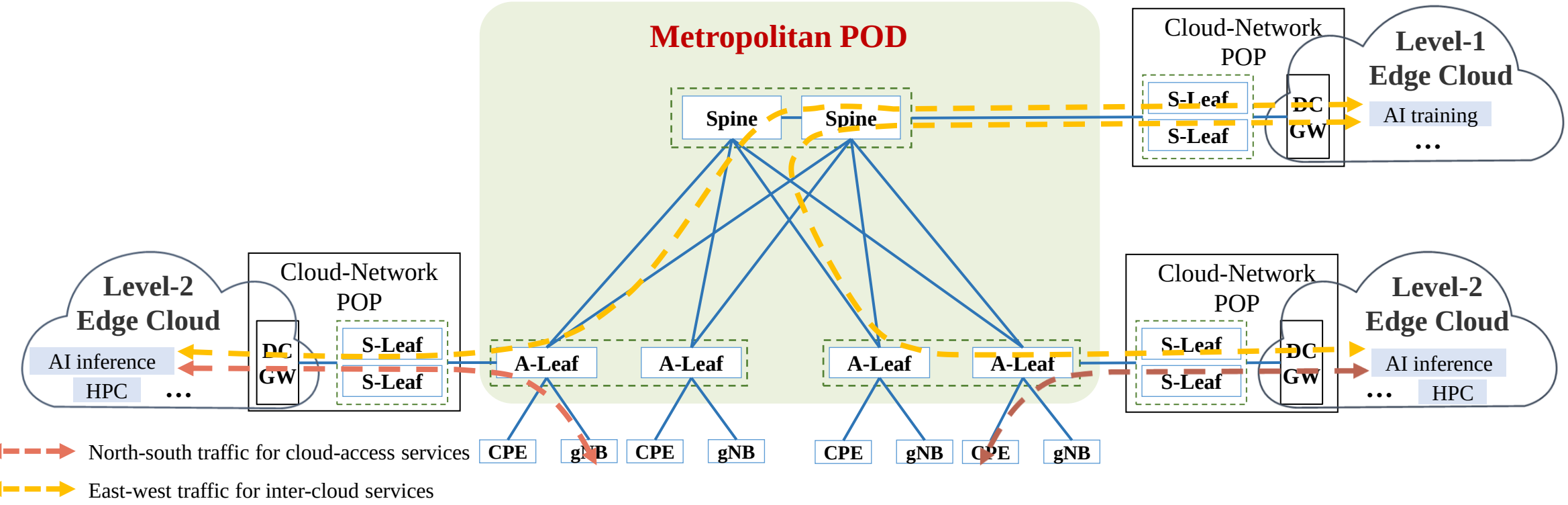
- **"Building Blocks" Architecture: easy to expand & flexible to deploy**
  - Contains Metropolitan POD, Cloud-Network POP, and Exit Zone
- **Network and Service Decoupling: services not affected by network**
  - **Overlay service:** SRv6/EVPN-based (unified protocol stack)
  - **Underlay network:** enhanced network capabilities, e.g. nested slices, iOAM
- **Network Element Cloudifying: agile deployment & enriched VAS**
  - Mainly focus on service anchor cloudification



*Till now, Cloudified IP MAN has over **120 million** fixed and mobile subscribers access, and **1000+** cloud resource pools connected*

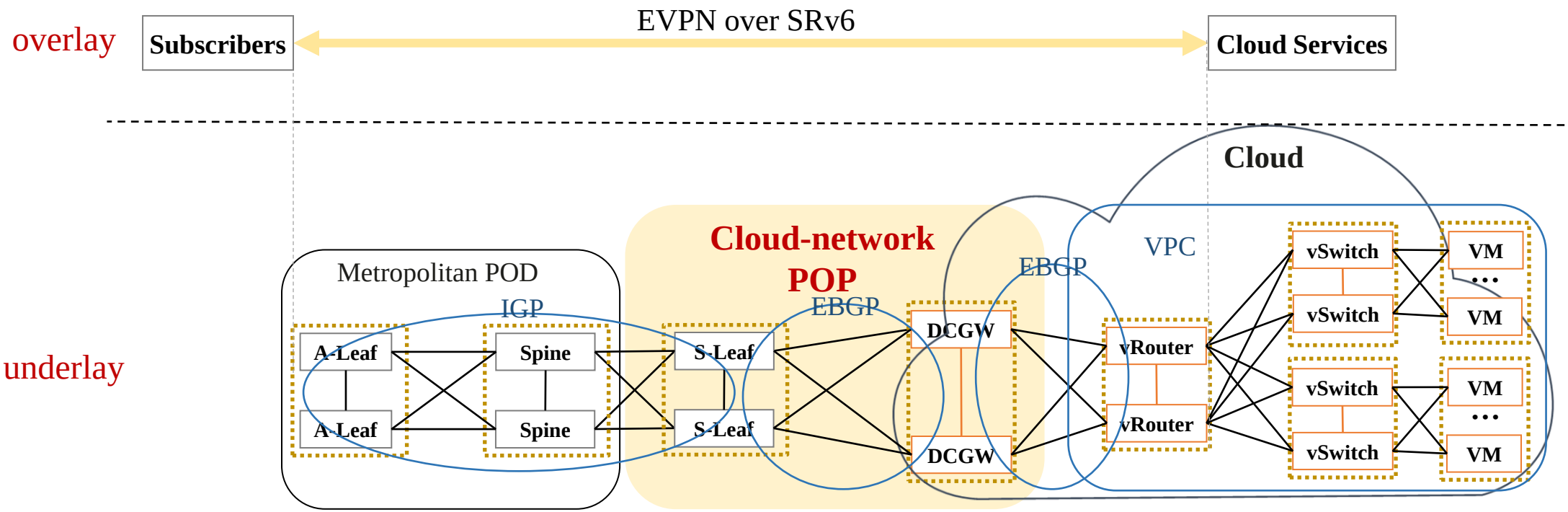
Key Components of Cloudified IP MAN: Metropolitan POD

- **Based on Spine-Leaf architecture, enabling elastic network scaling and rapid traffic steering**
  - **Easy to scale:** Spine/Leaf can scale in/out per service demands w/o impacting network or services
  - **Full-mesh:** Agilely steering the north-south and east-west traffic from clouds and subscribers
  - Metropolitan POD can expand network capacity and enhance device capability to satisfy the increasing demands of AI/HPC services in the future



Key Components of Cloudified IP MAN: Cloud-Network POP

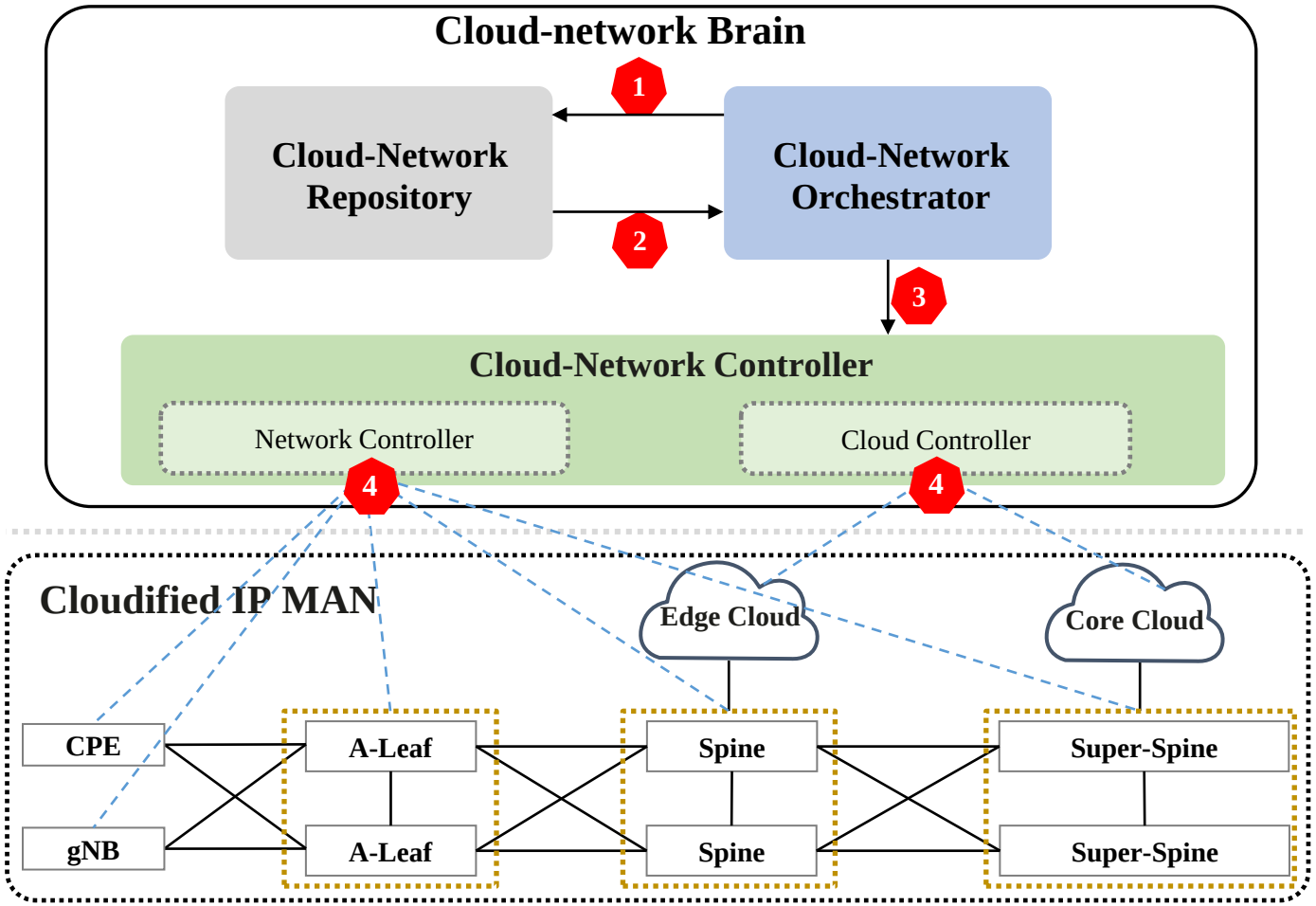
- **Plug-and-Play, enabling fast and standardized cloud-network integration**
  - **Pre-deployed infrastructure:** connecting S-Leaf and DCGW within the Cloud-Network POP and allocating link bandwidth according to service demands
  - **Dynamic-deployed channel:** dynamic configuring SRv6/EVPN between subscribers & services to enable rapid cloud service provision



Unified Cloud-Network Scheduling

- **Integrating the management of cloud-network to optimize resource allocation and enhance scalability**

1. If triggered, Orchestrator queries Repository for cloud and network resources
2. Repository allocates physical resources (devices, ports, etc.) and logical resources (VLANs, slices, etc.) for services
3. Orchestrator assigns configuration tasks to Cloud and Network Controllers based on allocated resources
4. Controllers issue configurations to cloud and network respectively



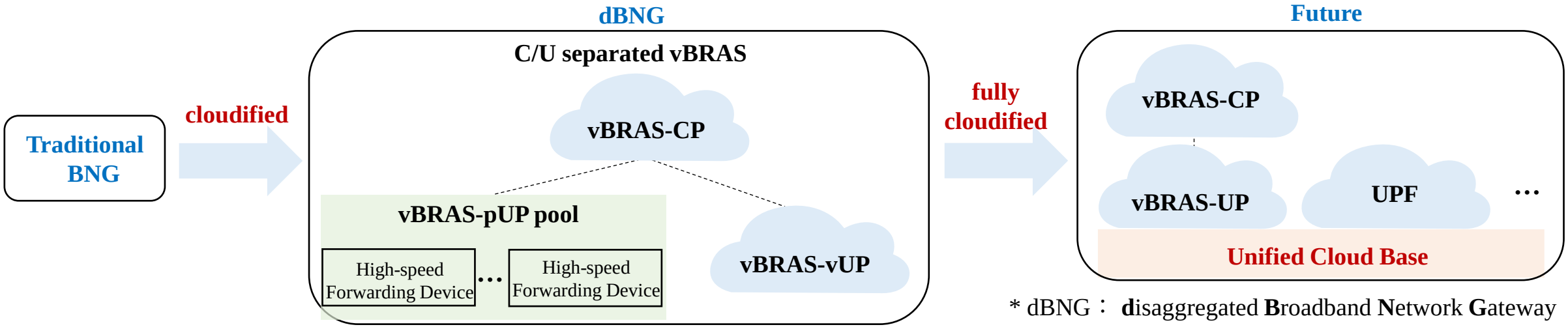
Service Anchor Cloudification

- **At first stage, mainly focusing on fixed broadband service anchor cloudification (C/U Separated vBRAS) to improve resource utilization and management efficiency**
  - **vBRAS-CP (Control Plane device): fully cloudified**
    - ✓ Intensive management of user sessions, addresses, and other resources
  - **vBRAS-vUP (virtualized User Plane device): fully cloudified**
    - ✓ Carrying IPoE-based service (e.g. VoIP) to improve resource utilization
  - **vBRAS-pUP (physical User Plane device):** high-speed forwarding device
    - ✓ Efficiently forwarding the high-traffic services (e.g. HSI, IPTV)

Service Anchor Cloudification provides a platform for flexible service development and deployment

*Till now, Cloudified C/U separated vBRAS accesses over **40 million** HSI subscribers*

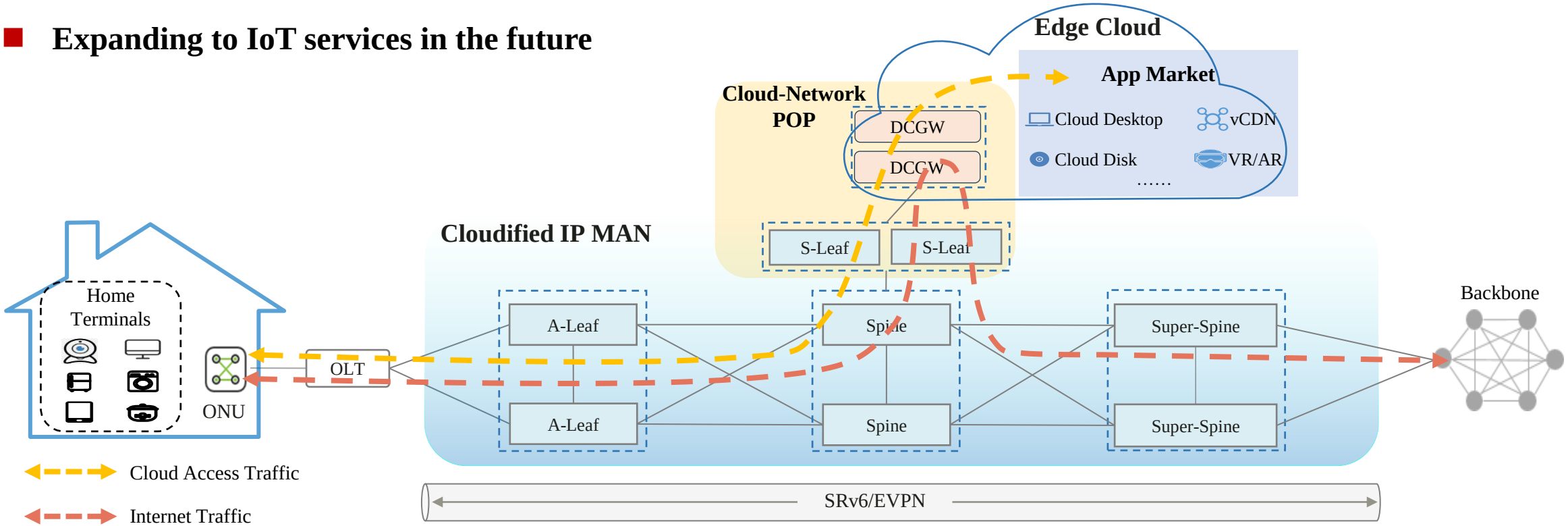
- **In the future, building Unified Cloud Base for fixed and mobile services**
  - Cloudified UPF & Cloudified BRAS in the same framework



* dBNG： **d**isaggregated **B**roadband **N**etwork **G**ateway

Case 1: Smart Edge Cloud Service

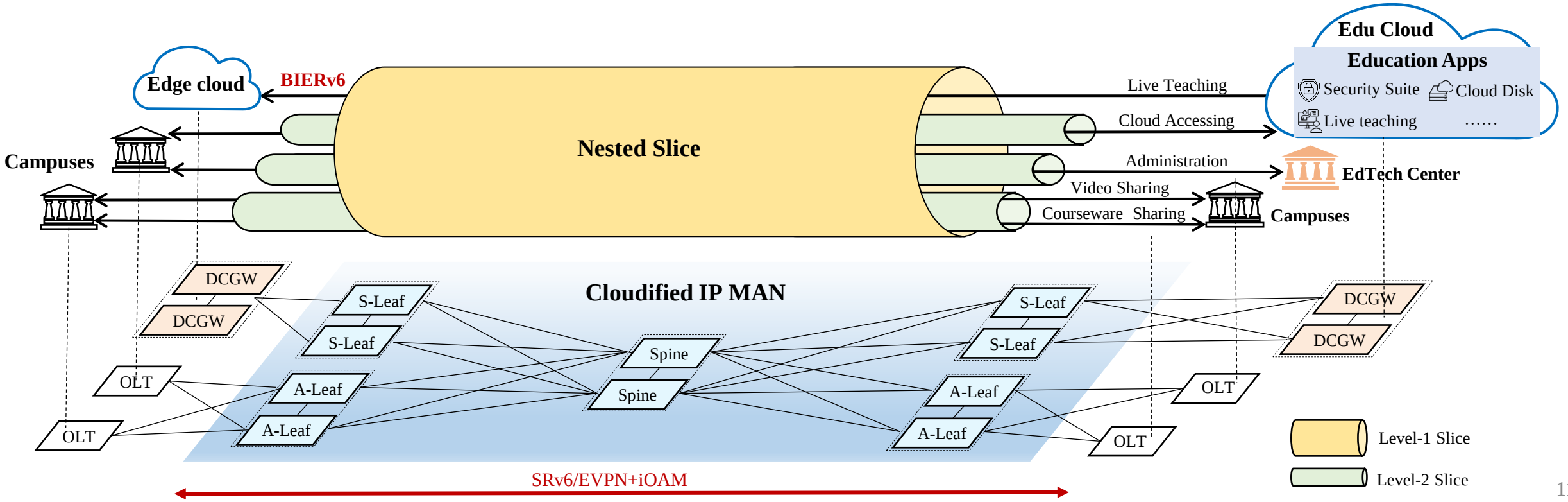
- **Migrating home VAS into cloud w/o altering CPE and networking mode**
  - Establishing fast connections between homes and edge cloud based on Cloudified IP MAN
  - Providing agile and diverse cloud services based on sunk edge cloud
  - Migrating certain functions of CPE (e.g. DHCP, NAT) into cloud to construct intranet between home and cloud services
- **Expanding to IoT services in the future**



Case 2: Dedicated Network for Education Sector

Building high-quality education dedicated network based on Cloudified IP MAN

- Flexibly connecting sites and clouds based on SRv6/EVPN
- Providing customized channels for cloud/cloud connection and cloud/customer connection based on nested slices
- Deploying efficient multicast service among cloud/cloud and cloud/customer based on BIERv6
- Enabling visualized management for cloud-network services based on iOAM



Takeaway

- **Cloud-network convergence is successful in China Telecom, will keep pushing it forward**
- **Cloudified IP MAN will play a more and more important role in Cloud-network convergence**
- **Service anchor cloudification provides a platform for flexible service development and deployment**
- **Next Steps**
  - Building Unified Cloud Base for fixed and mobile services
    - Non-cloudified vBRAS-pUP limits the flexibility of service development and deployment
  - Accelerating the process of standardizing resource interfaces
    - Incomplete standardization of resource interfaces hinders unified service provision and management
  - Expanding smart edge cloud service to IoT
  - .....

There is a long way to go, let's push it forward together

Questions and Feedback are Welcome

Thanks!