

Advances in Industrial PON

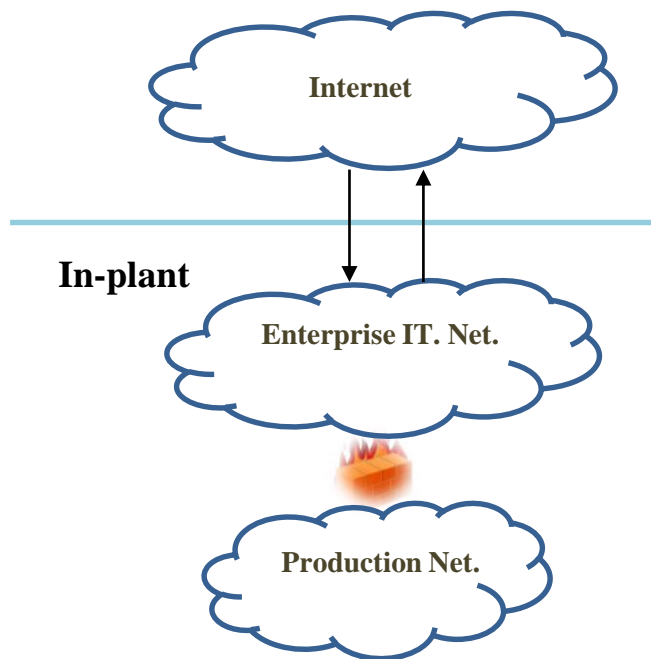
Dr. Jiang Ming

China Telecom

A decorative graphic in the bottom-left corner consisting of overlapping, flowing, semi-transparent bands in shades of yellow, orange, and red, creating a sense of movement and depth.

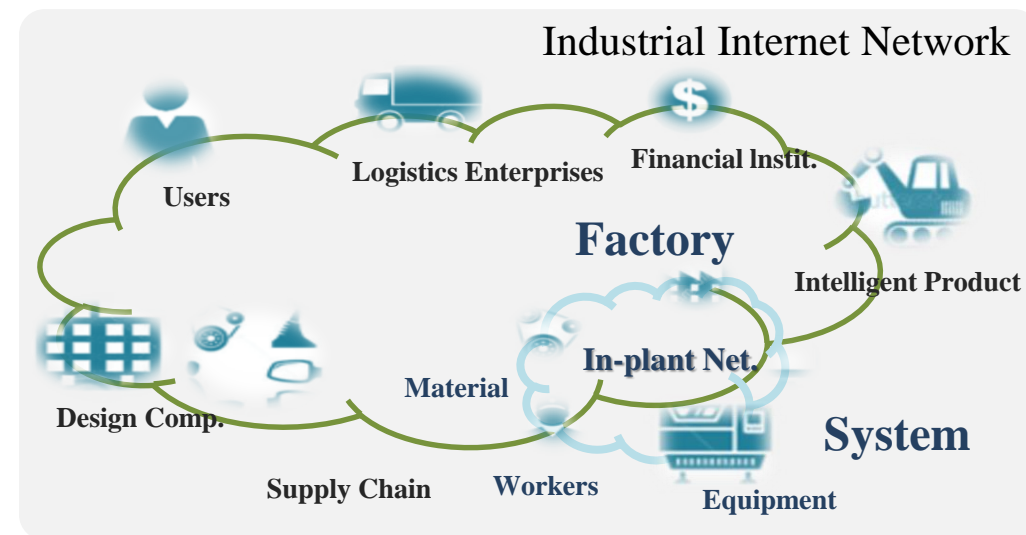
Motivation For Industrial PON

Traditional Factory



- Isolated Networks
- Inefficient Network
- Deeply Customized
- Information Silos

Smart Factory



- All in one network
- Real-time data acquisition
- Cloud-based capabilities
- Safety & Robustness

PON

IT & OT Convergence

Industrial PON – Enhanced Solution for Intra-Factory Network



- Breaks the barriers among many sub-networks inside the factory
 - better efficiency and quality
 - intelligent management and manufacturing
 - cost efficiency

Industrial PON

- Massively deployed in operator network,
- long standing and proven
- cost-effective

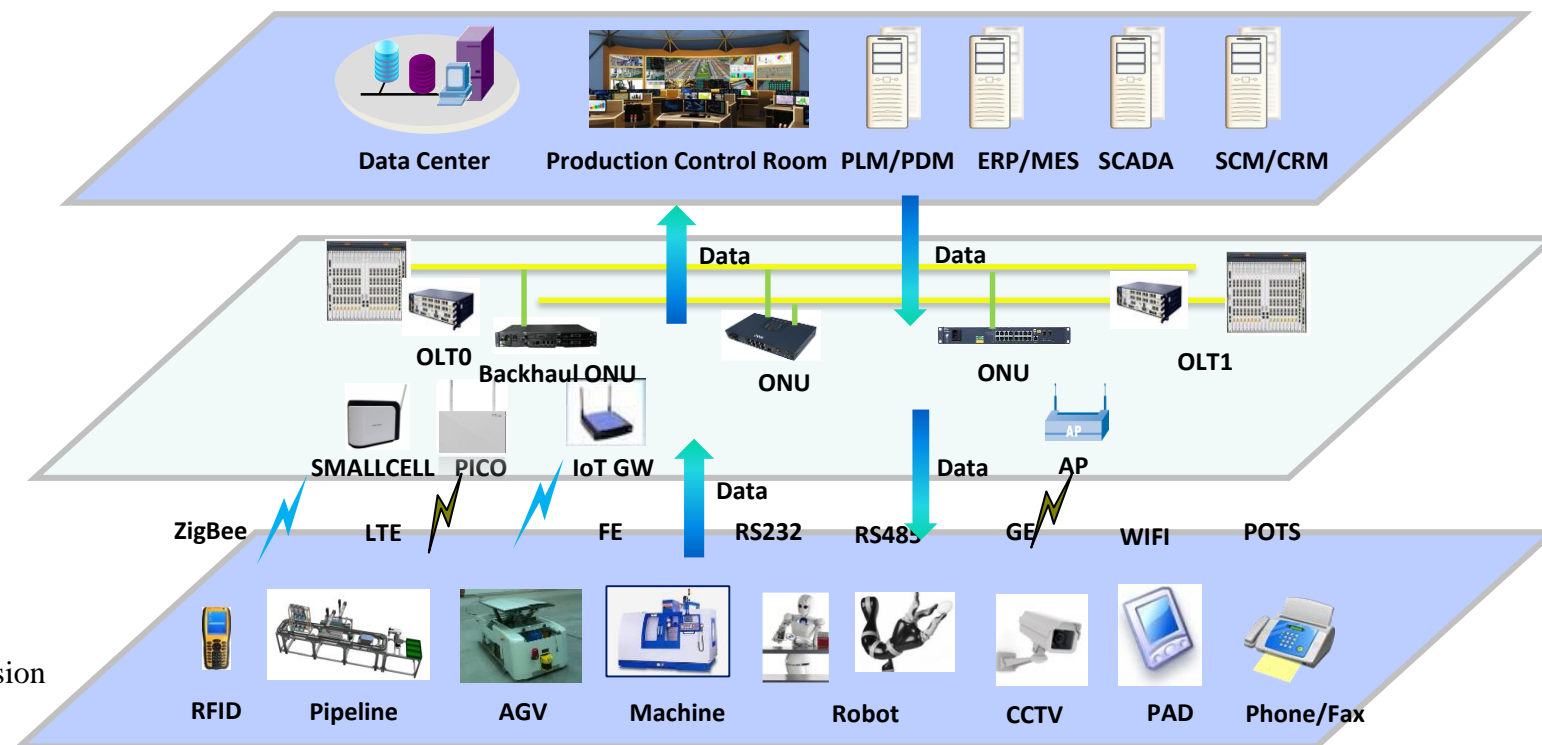
Mature

- Stable fibre connection
- Abundant security algorithms
- Standardized protection mechanisms

High reliability

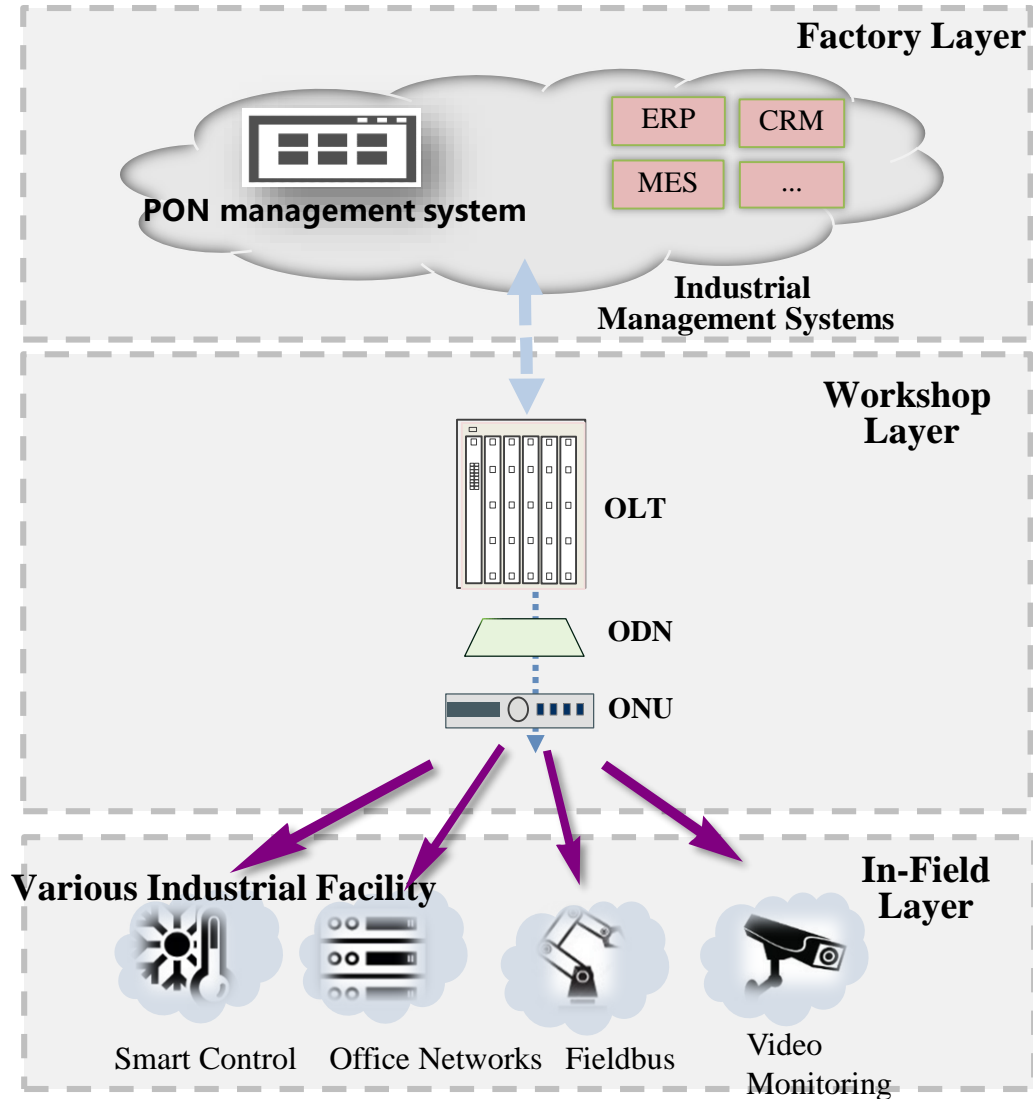
- Latency control
- Edge computing
- Industrial data acquisition interface and protocol conversion
- SDN evolution

Innovation



PON based industrial network solution overview

Architecture and Major Characteristics



Control and Management

Intelligent operation

Open API

Self-service

Monitoring

OLT

Edge computing

Encryption

Network slicing

Network resilience

ONU

Protocol conversion

Environment adaption

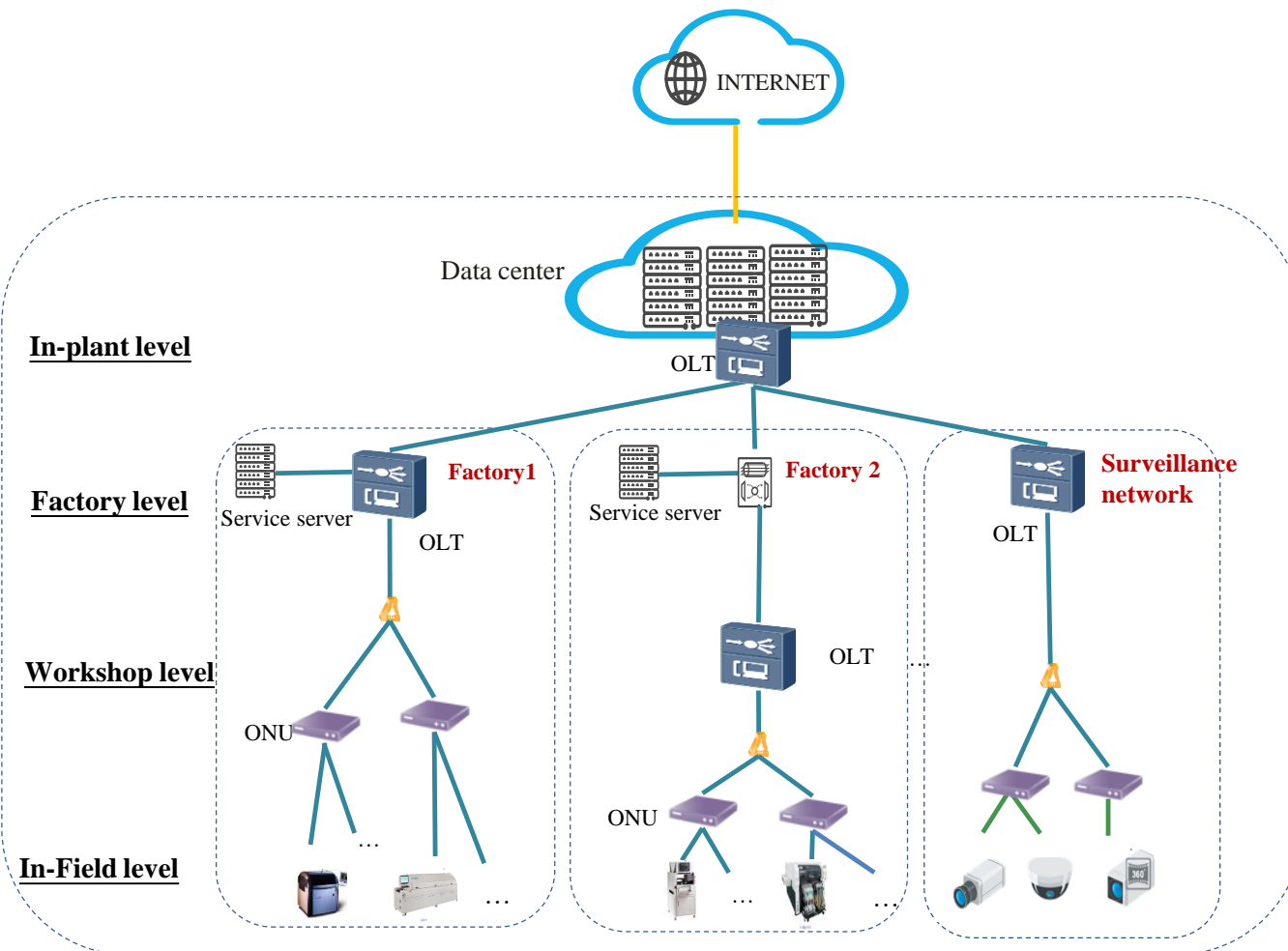
Industrial Phy. interfaces

E2E System

Deterministic experience

Security

Robustness



◆ In-plant level

◆ Workshop level

◆ Factory level

◆ In-Field level

Latency Control

- Latency can be well controlled and adaptive

Network Slicing

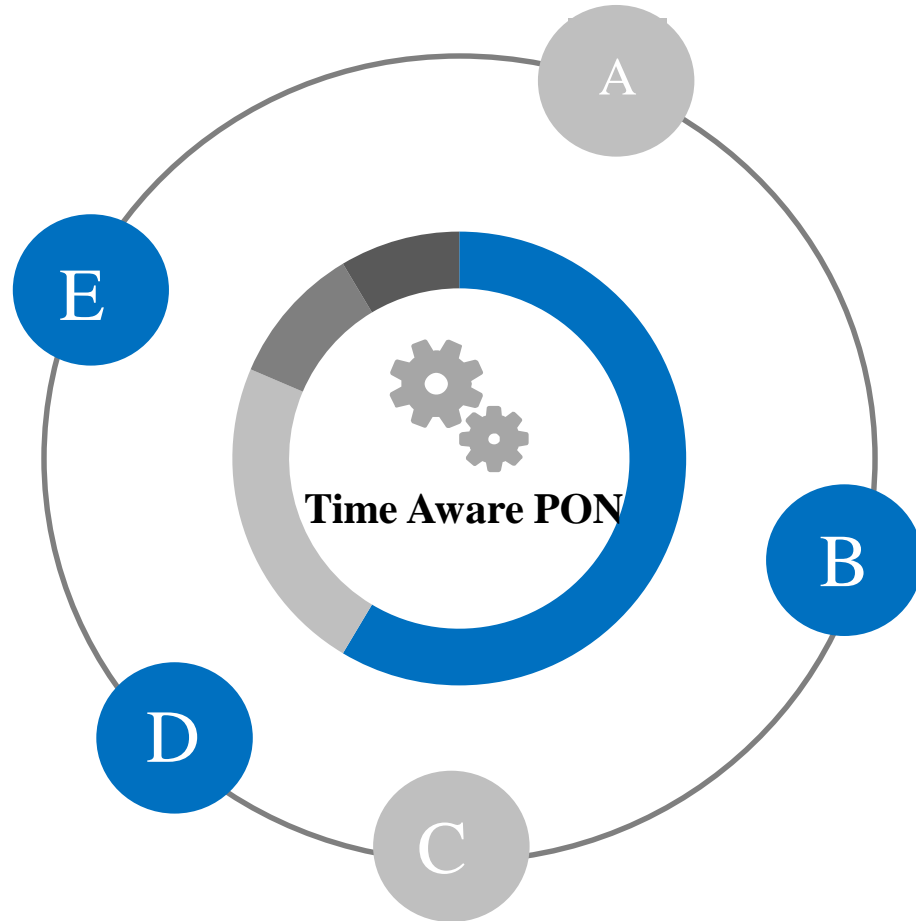
- Realize low-cost all-in-one multi-service-carrying PON system, simplifying the factory network

Network Resilience

- High network resilience and availability with standardized and multiple protection mechanisms

Intelligent Operation

- Network can be much smarter given SDN and AI new technologies



A Shapping and HQos mechanisms to optimize latency inside the OLT/ONU equipment

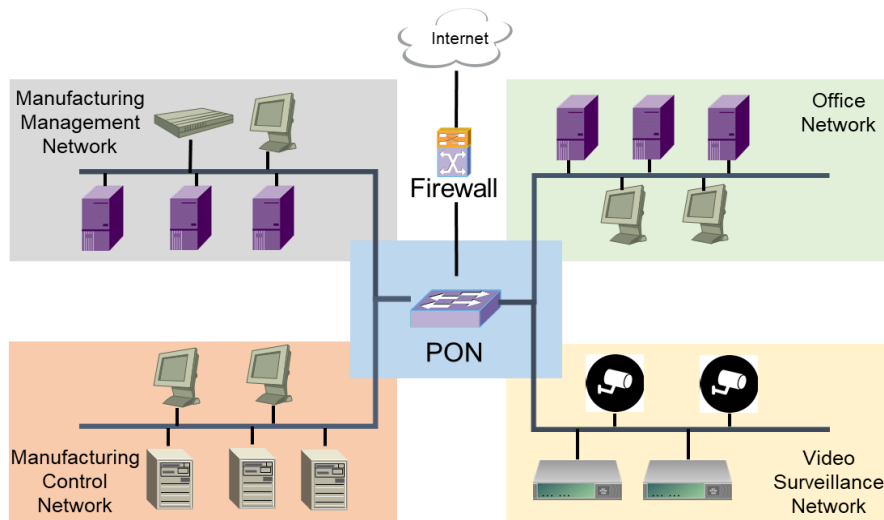
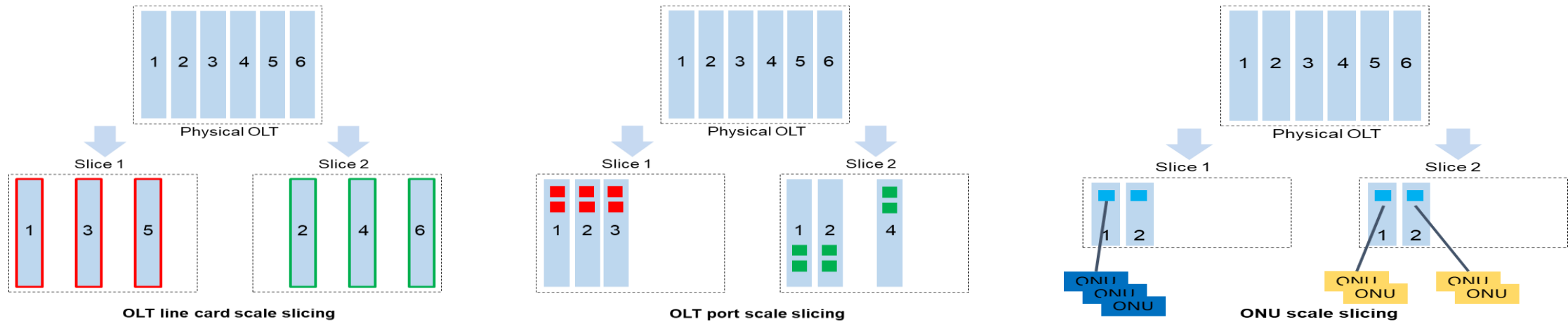
B Service-PON linkage mechanism, including CO-DBA, Adaptive SLA template

C Quiet window optimizing mechanisms, including Shutting down, DAW, Adaptive window opening

D Uplink scheduling optimizing, including Shortened DBA cycle, Multiple burst per 125us TC frame

E Time Synchronization, 802.1as for EPON, Native sync built in ITU-T PON TC, 1588v2

Flexible PON slicing granularity, including PON line card, OLT port, ONU, supporting independent management



A useful scheme to guarantee the service experience

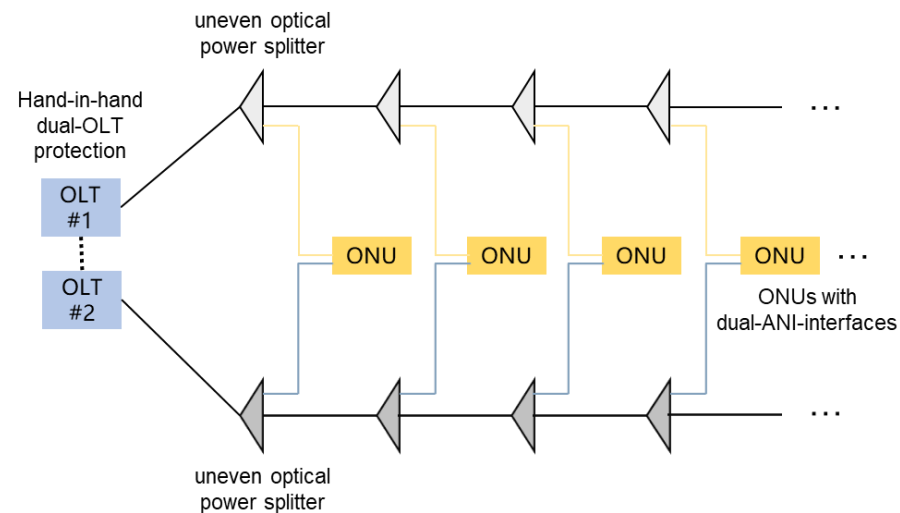
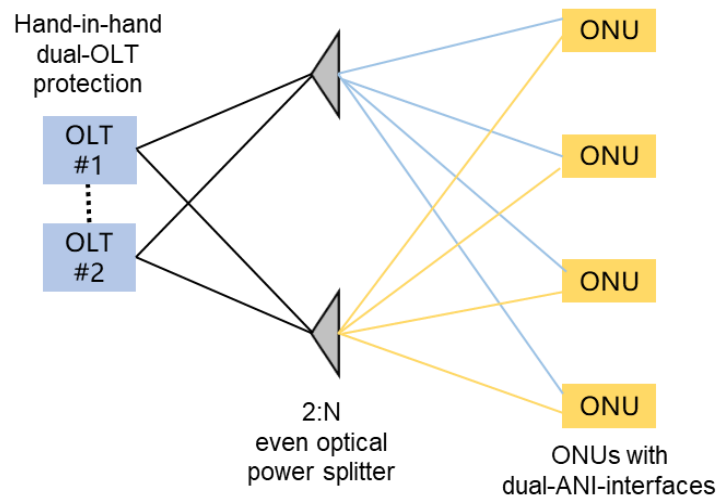
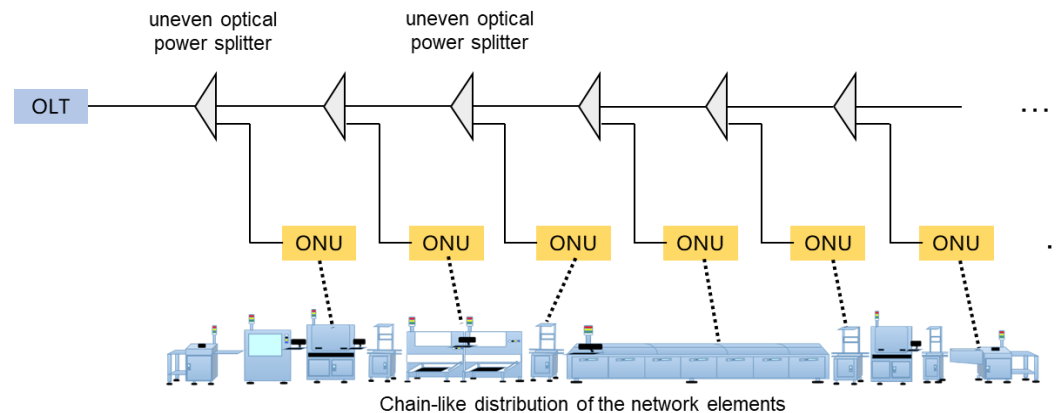
- carry multiple sub-networks within the factory with less physical OLTs
- keep each sub-network isolated on the service, security and management aspects

- **ODN network**

- Tree and chain topologies
- Even and uneven optical power splitter

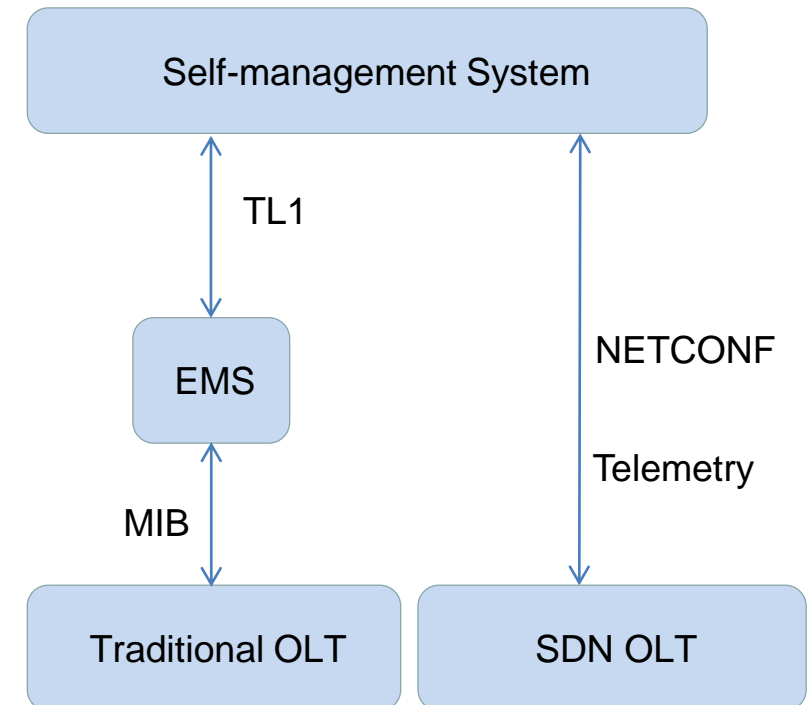
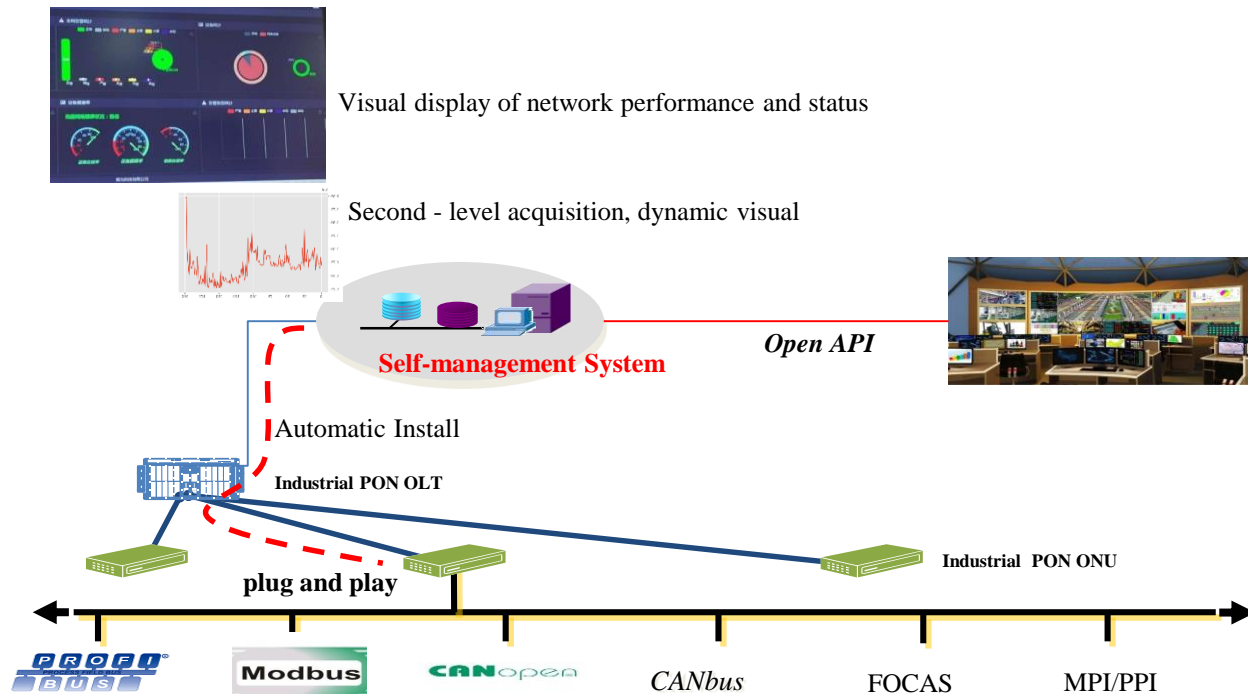
- **Enhanced protection scheme**

- Type A ~D
- Hand-in-hand protection

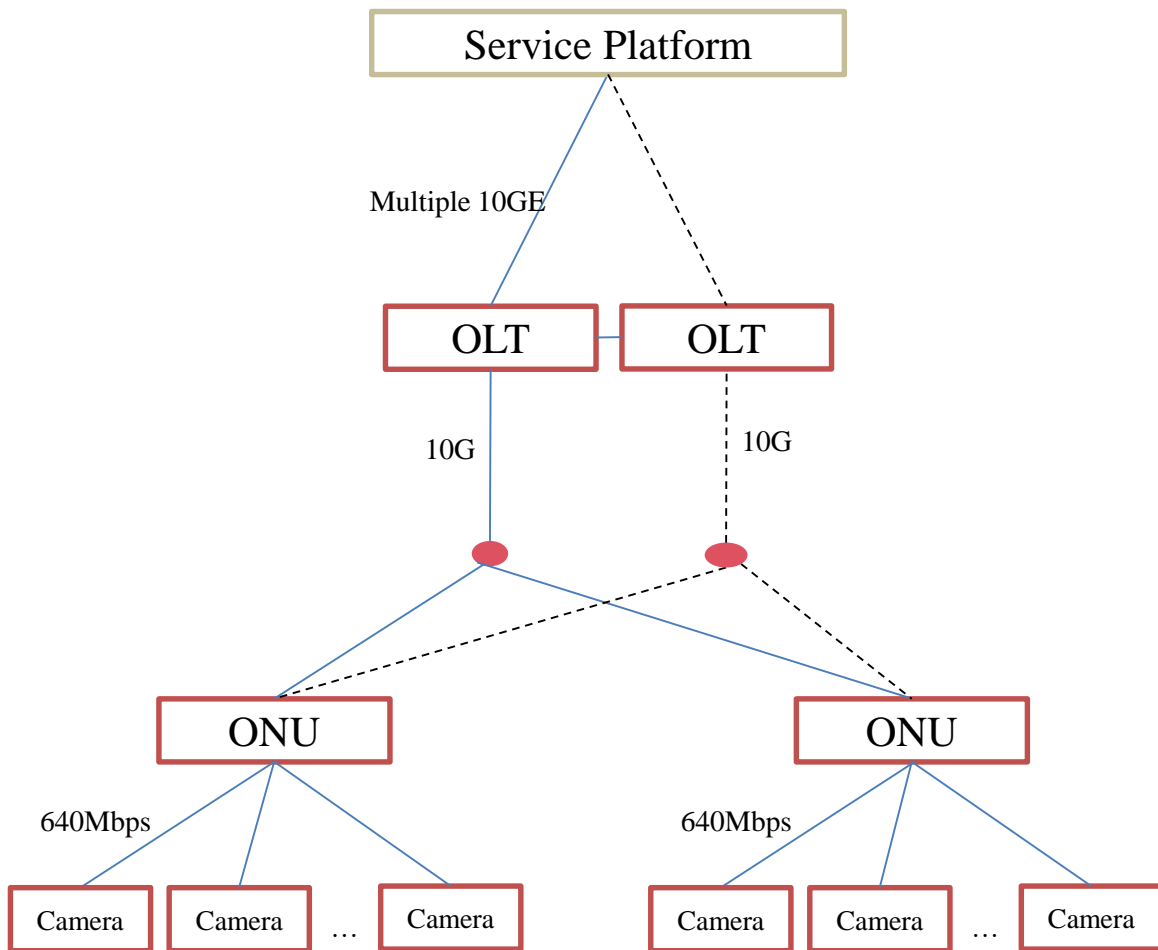


Self-management System, SDN based, intelligent and easy to use, open and extensible

- Linkage of Industrial PON network and factory management
- Self-management, self-operation and self-service
- Open north interface to enterprise's factory management system



Use case 1: Video Service Transmission



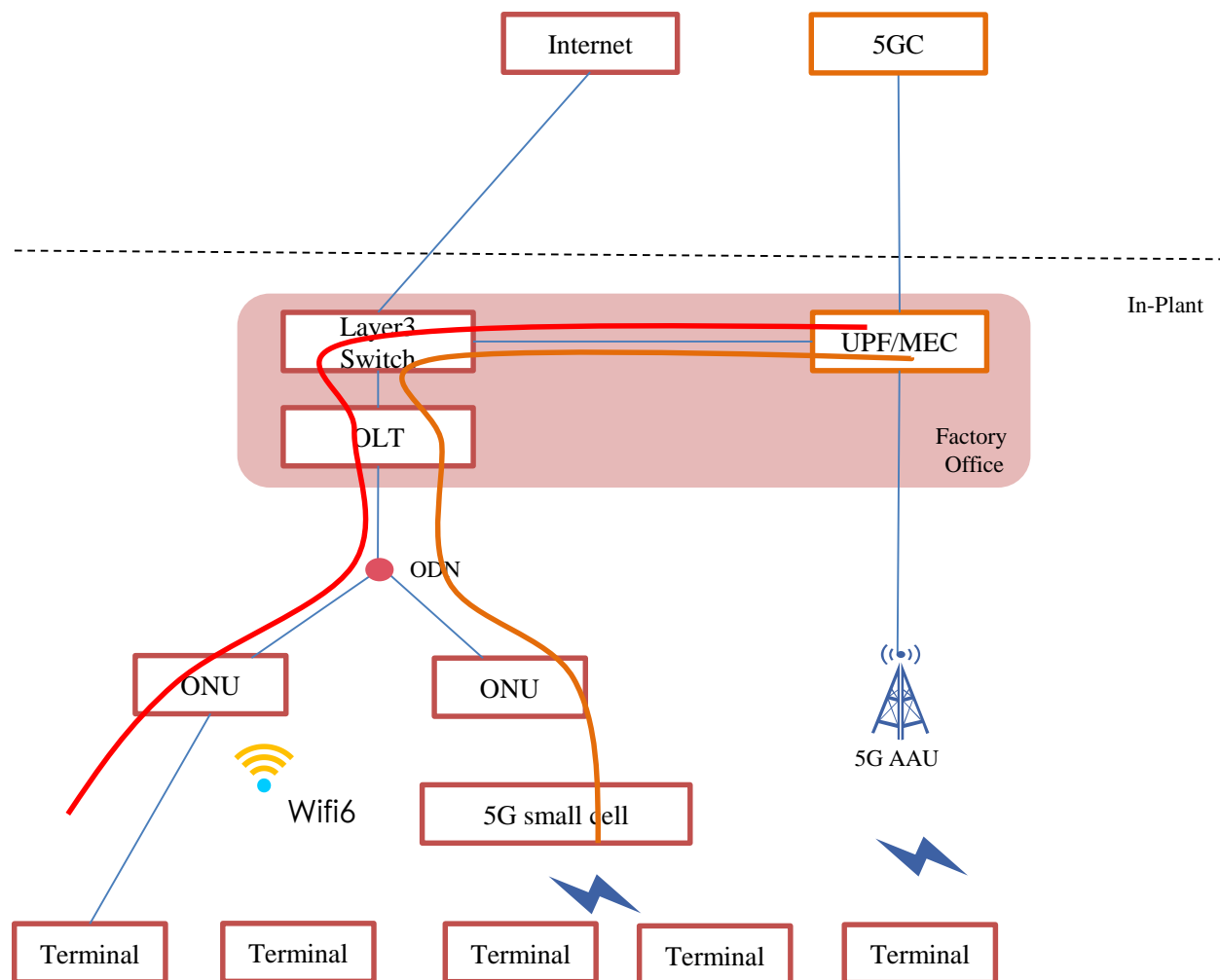
Service requirements:

- High Load Traffic in the upstream and high concurrency ratio
- Multiple industrial cameras per production line
- Nearly 640Mbps upstream bandwidth for one camera

Solution:

- Symmetric 10G-EPON
- Type-D protection
- Large capacity and high density OLT

Use case 2: Dual Gigabit industry Network



Service requirements:

- wireless and wireline Network can be covered in manufacture, office and dormitory areas.
- Sub network: surveillance and factory management network, office network, etc.

Solution:

- Industrial PON + 5G
- PON network deployed in the whole area: Wifi/5G backhaul and wireline
- Network Slicing: OLT port scale

Industrial PON is booming

Good practices achieved by China Telecom

*Welcome cooperation with partners in the communication, industry
and academia ...*



Thank you !