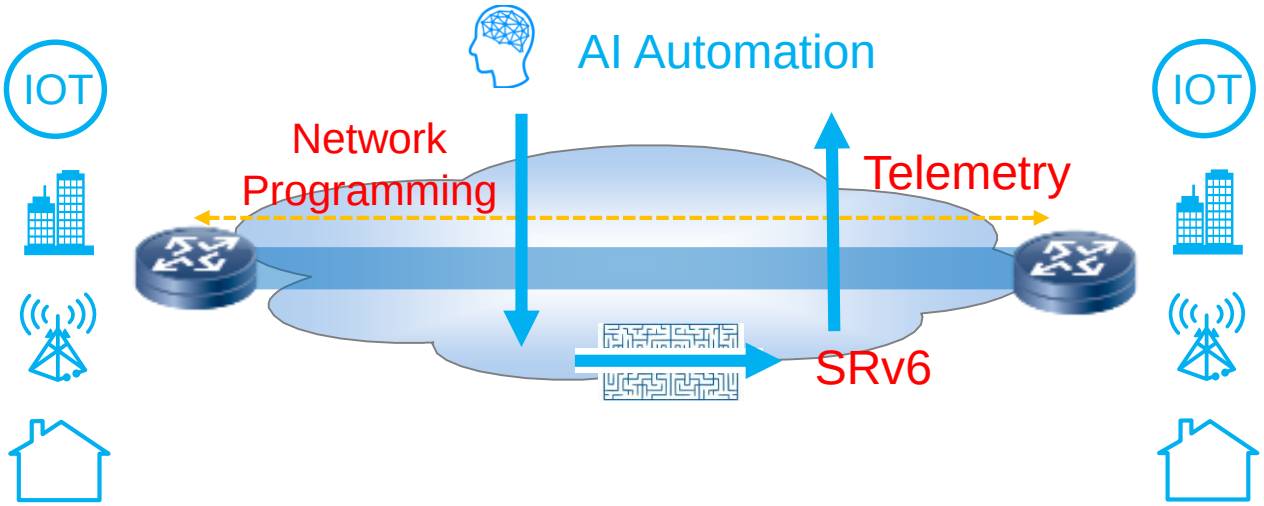
IP Innovation and Standards (Network Intelligence/Telemetry)

Intent Driven Network for Future: Intelligence & Simplicity

Intelligent Network Operation: Release human potential



Simplify Network Architecture: Expand various service

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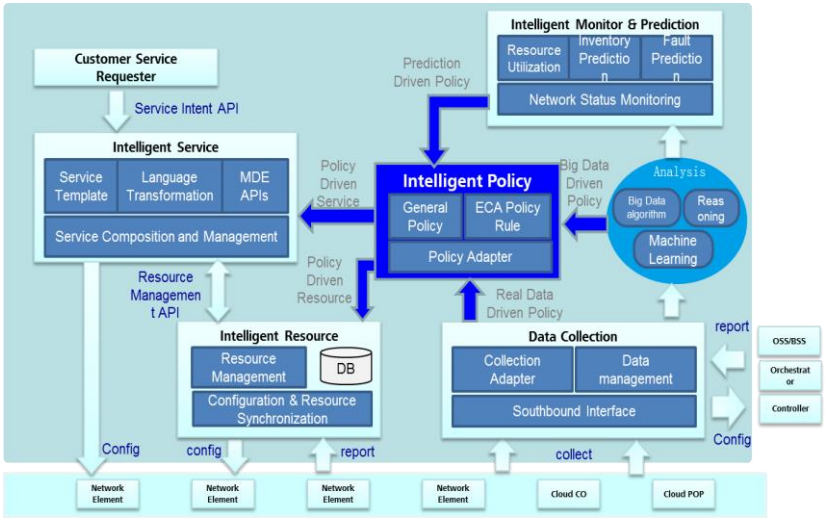
Network AI Architecture/Requirements Definition in ETSI ENI



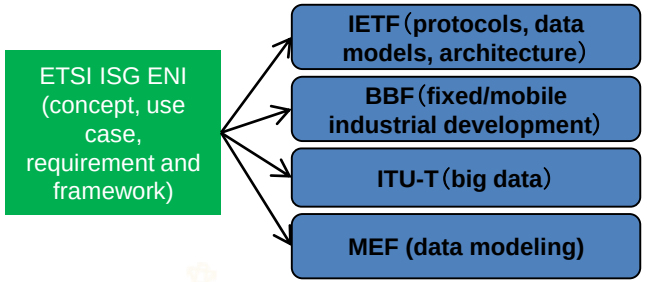
Intelligent management and control architecture for: Service – Strategy - Data analyzing/Prediction –Resource Consolidation

- Intent-based abstracted service interface, policy interface, simplified OAM operations
- Centralized resource management/distribution interface for improved resource utilization and better storage consistency
- Policy-driven service deployment and resource allocation, with reduced manual intervention
- Data-driven real-time service and resource adjustments to network policies

Combined with network big data analyzing/ monitoring/ prediction, drive network policy to adjust the service and resource, and evolve from “Network Automation” to “Network Intelligence”

ETSI ENI – The Industry's First Network Intelligence Standards Group led by Huawei was Established in 2017

1. ENI, as the home of intelligent network standards, working together with other standardization organizations
2. Recognize Huawei leadership and guide the industry in ENI from the following perspectives: use case and requirement, top-level architecture design of intelligent OAM, IETF SDN NBI and data modelling standardization, telemetry enabling technique standardization, network planning mechanism and so on



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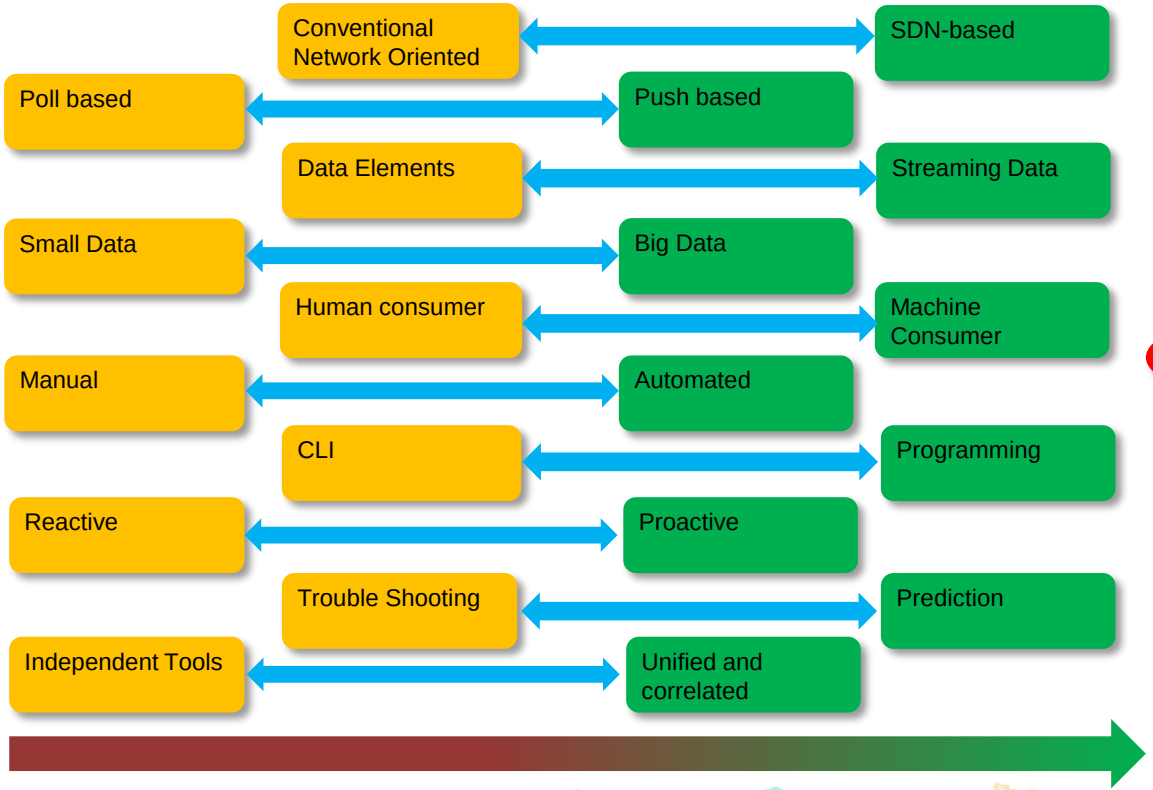
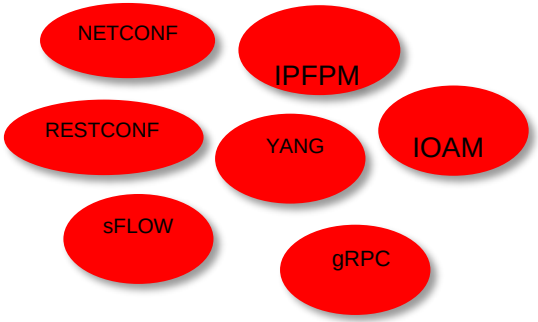
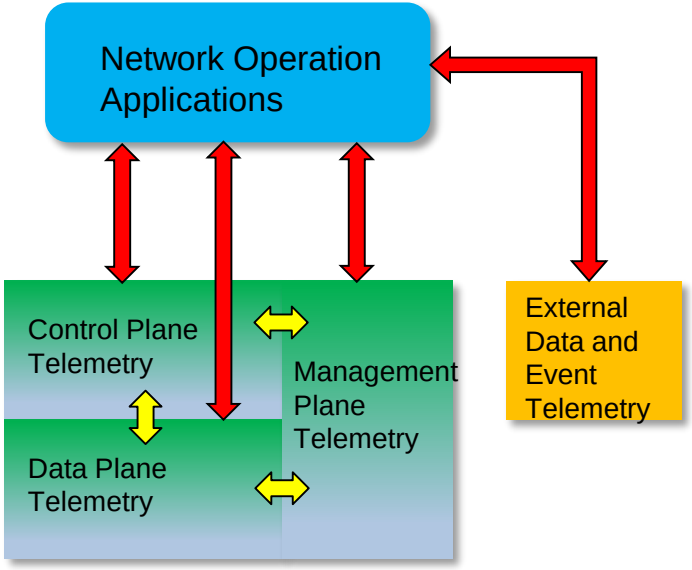
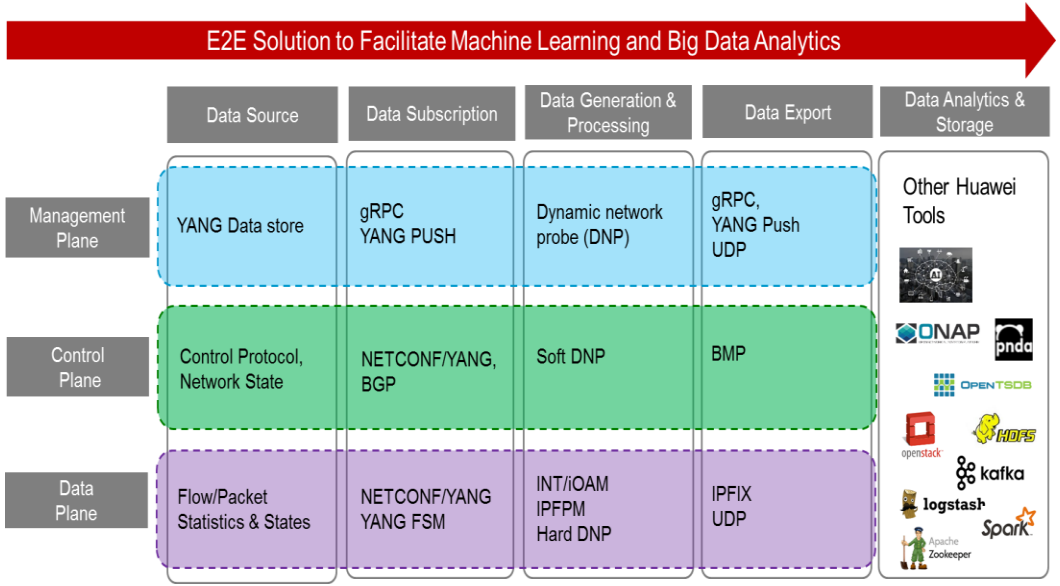
Conventional Network OAM vs. Network Telemetry





Network Telemetry Framework (NTF)





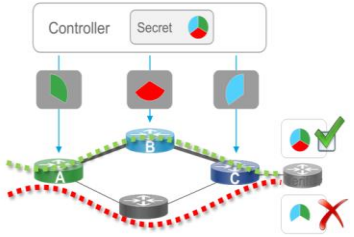
Toward a Network Telemetry Framework (https://tools.ietf.org/html/draft-song-ntf-01) was presented for the first time in IETF 101 London

Updates for IETF 102:

- New co-authors: Giuseppe Fioccola (Telecom Italia), Zhenqiang Li (China Mobile), Pedro Martinez-Julia (NICT), Laurent Ciavaglia (Nokia) and Aijun Wang (China Telecom)
- Clearer definition and characteristics summary of network telemetry for distinguishing from conventional OAM.
- New content for Control Plane Telemetry: identify the requirements and challenges in details. BMP extensions are identified as NMP (Network monitoring Protocol)
- New content for Data Plane Telemetry: 1) Technique Classification: Active/Passive, In-Band/Out-of-Band, E2E/In-Network, Flow-Path-Node; 2) IPFPM alternately mark

Date Plane Telemetry: iOAM/iFIT

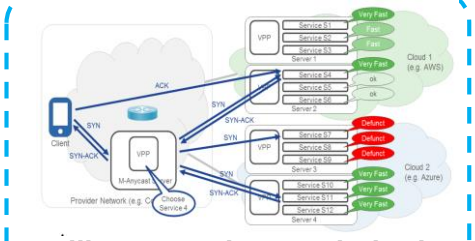
Usecases



Path Verification

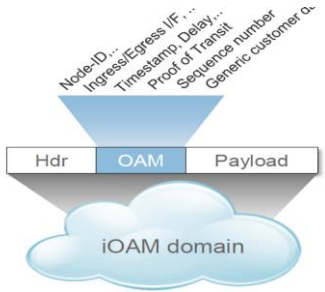
SLA Compliance

Root Cause Analysis

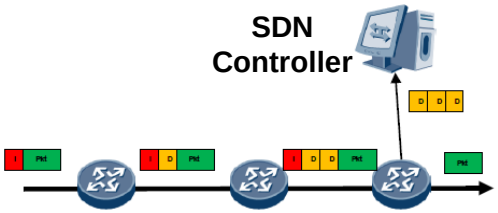


Intelligent Service Load Sharing

Solutions



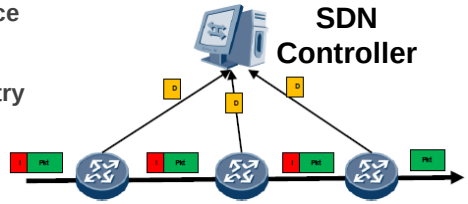
iOAM (In-Situ OAM)



Challenges

- Legacy Network Device
- Forwarding Performance
- Huge Traffic Export
- E2E Data Plant Telemetry

iFIT (In-Flow Info Telemetry)



Drafts

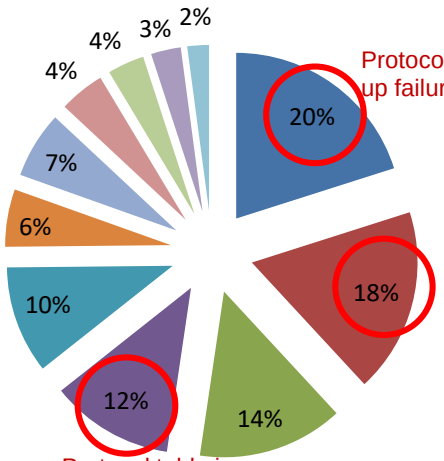
Area	Topic	Draft
iOAM	Data Fields for In-situ OAM	draft-ietf-ippm-ioam-data-00
	In-situ OAM Data Validation Option	draft-song-ippm-ioam-data-validation-option
	In-situ OAM Data Type Extension	draft-song-ippm-ioam-data-extension
	Segmented iOAM	draft-song-ippm-segment-ioam
	YANG Model	draft-zhou-ippm-ioam-yang

Area	Topic	Draft
Encap	SRv6	draft-ali-spring-srv6-pm
		draft-li-spring-passive-pm-for-srv6-np
	MPLS	draft-song-mpls-extension-header
	IPv4 & Ethernet	In Research
	Tunnel Mode	draft-song-ippm-ioam-tunnel-mod

Control Plane Telemetry: Network Monitoring Protocol (NMP)

Usecases: Protocol Troubleshooting

2016 Network Failure Cause Analysis



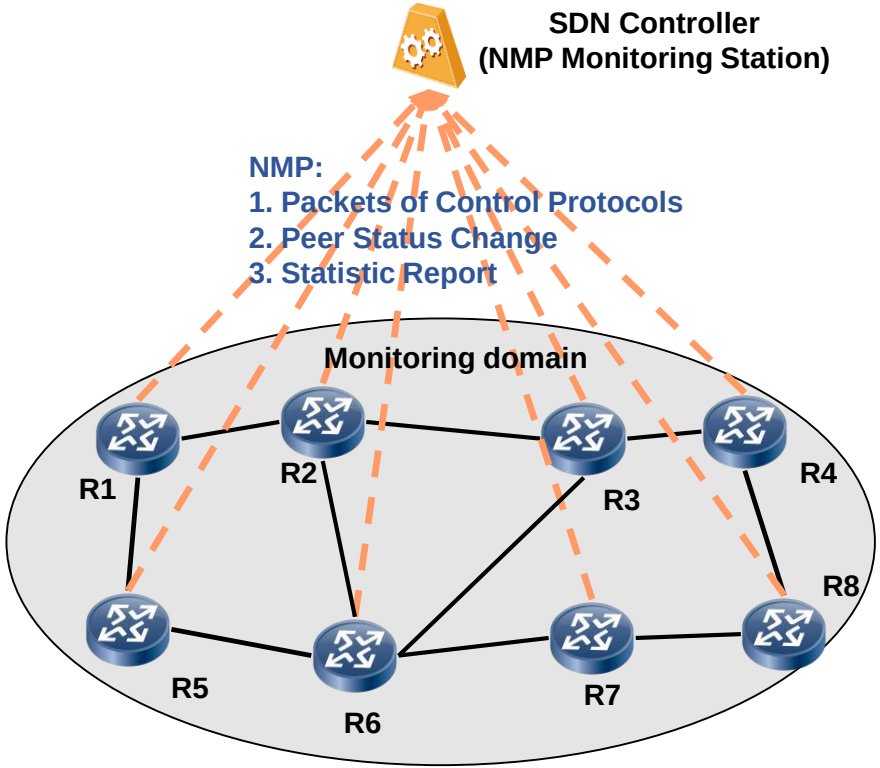
Protocol neighbor set up failure

Protocol neighbor damping

Protocol table issue

Based on typical network failures statistics, control protocol issues take up 48%.

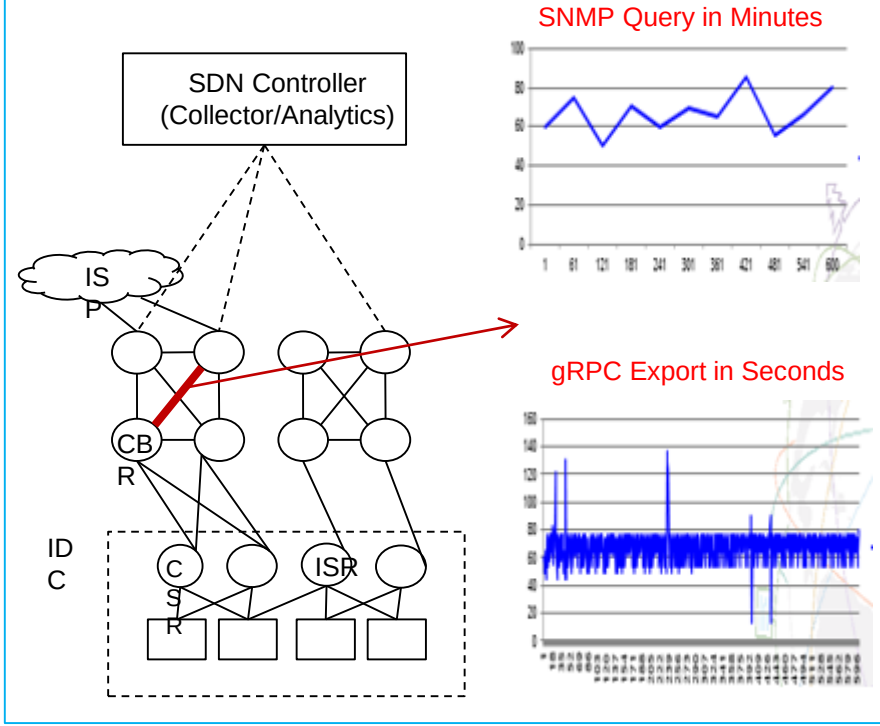
- Existing troubleshooting methods
  - Time-consuming (hours)
  - Labor-consuming
  - Data acquisition difficult
  - Require OAM experience for operators
- Typical issues, like route flapping, hard to localize



Network Monitoring Protocol (https://tools.ietf.org/html/draft-gu-network-monitoring-protocol-00) was presented for the first time in IETF 102

Management Plane Telemetry: gRPC/Netconf/YANG

Usecases: Micro-Burst Detection



Solutions/Drafts is becoming stable and mature.
Challenges: Google OpenConfig vs. IETF; Huge YANG Models

Category	Drafts	Status
Base Feature	**Custom Subscription to Event Streams** draft-ietf-netconf-subscribed-notifications	Close to Publish
	YANG Datastore Subscription draft-ietf-netconf-yang-push	Close to Publish
Transport	**NETCONF Support for Event Notifications** draft-ietf-netconf-netconf-event-notifications	WG draft
	RESTCONF and HTTP Transport for Event Notifications draft-ietf-netconf-restconf-notif	Close to Publish
	Notification Message Headers and Bundles draft-ietf-netconf-notification-messages	WG draft
Distributed Data Collection	**UDP based Publication Channel for Streaming Telemetry** draft-ietf-netconf-udp-pub-channel	WG draft
	Subscription to Multiple Stream Originators draft-zhou-netconf-multi-stream-originators	Individual draft

Dynamic Network Probe: Pre-process and Flexible Deployment

Issue 1: Telemetry will produce tons of raw data, which is not wise to export without preprocess

- Chip/NP: I/O Bandwidth
- Network Interface: Bandwidth which may impact user traffic
- Collector: CPU, Memory, Network

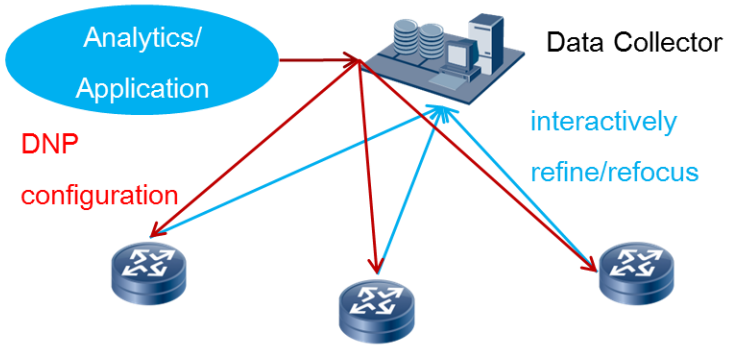
Issue 2: More pre-process functions are required to be flexibly defined for various application

- Passing through the threshold
- Actions
- More stateful operations

DNP: the pre-process function that can be dynamically defined and loaded into network

- Include software and hardware probes
- Could be used on management plane, control plane and the data plane.

Application Driven Telemetry

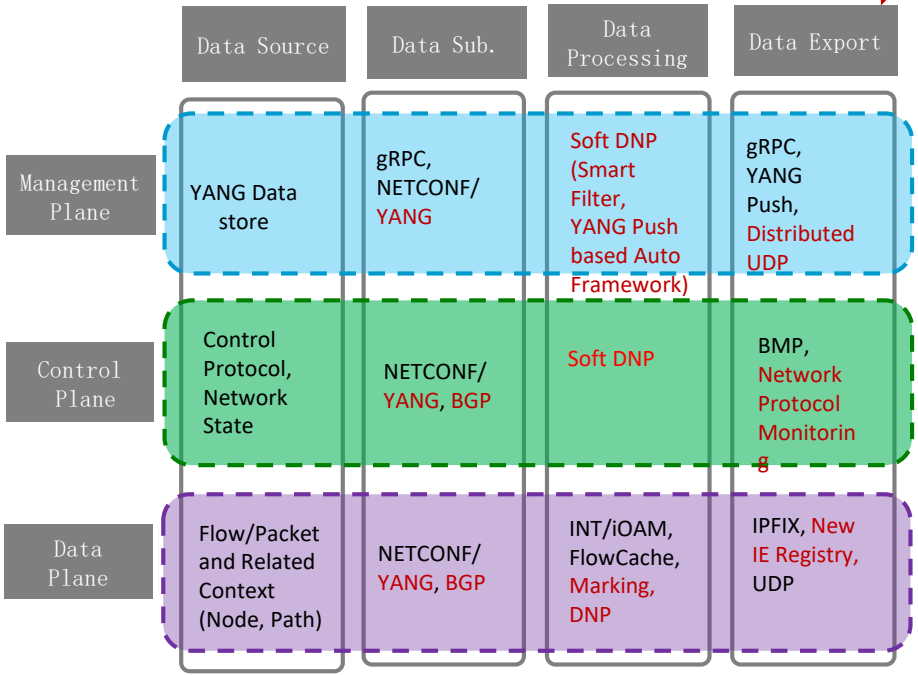


draft-clemm-netconf-push-smart-filters

Huawei Telemetry Research and Standard Planning

① Key Standardization Points

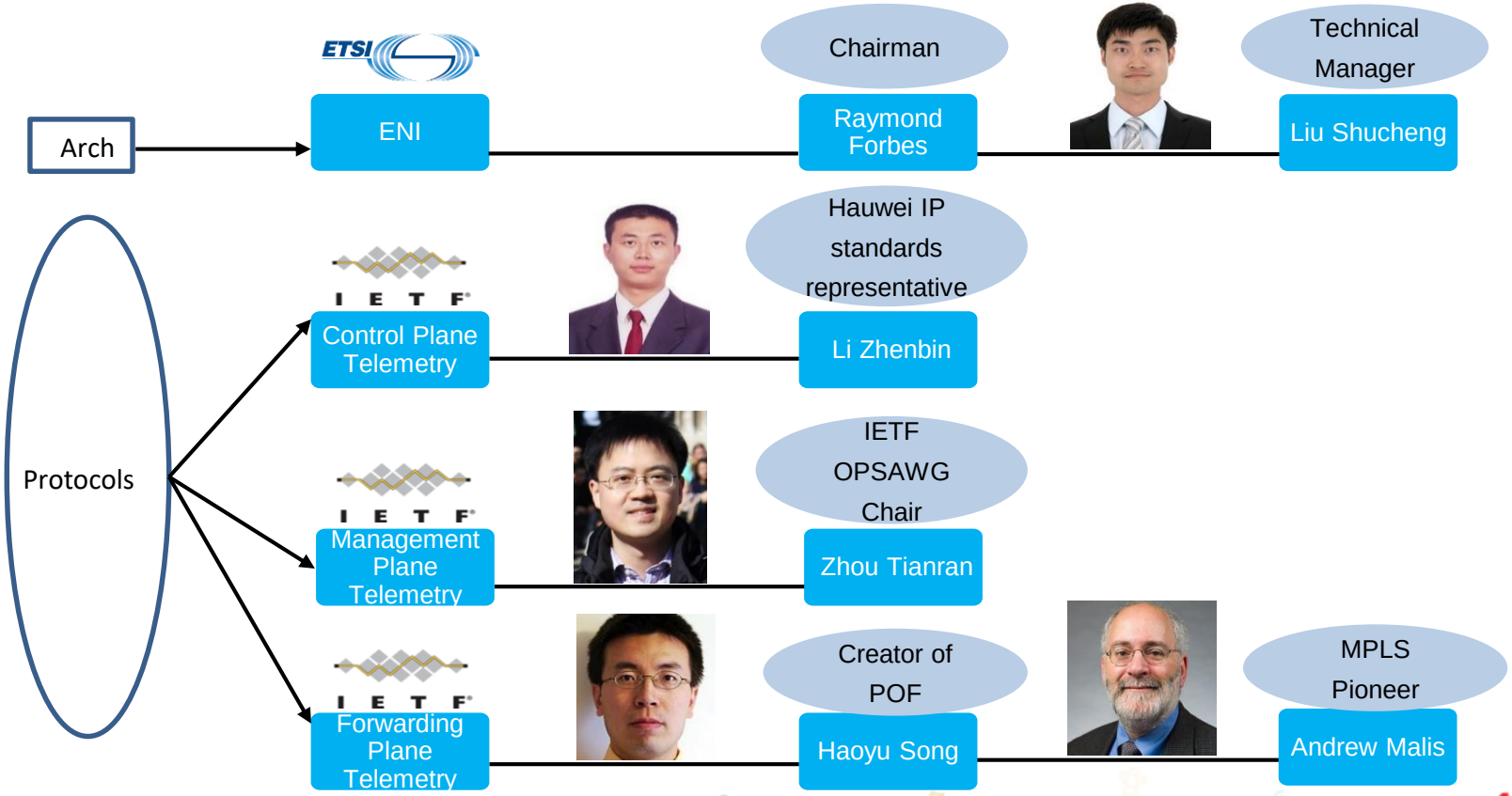
End to End Solution to Facilitate AL, ML, and Big Data Analytics



② Standardization Objectives

Topic	Objective
NTF	Build the Telemetry standard brand, and lead the industry development, by the complete Telemetry solution: NTF
Data export	Ensure Huawei's continuous leadership in the data export solution
IOAM	Build the most suitable IOAM solution for operators
DNP	Spread DNP concept in the industry

Huawei Master Key Positions in E2E Network Intelligence Solution



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From Traditional Networks to SDN During

Past 10 Years What Have We Got?

Different opinions

OpenFlow interface, Centralized control

Decoupling hardware and software

Open source controller

Separation of Traffic and control

NFV Network Functions Virtualization

Reach an agreement

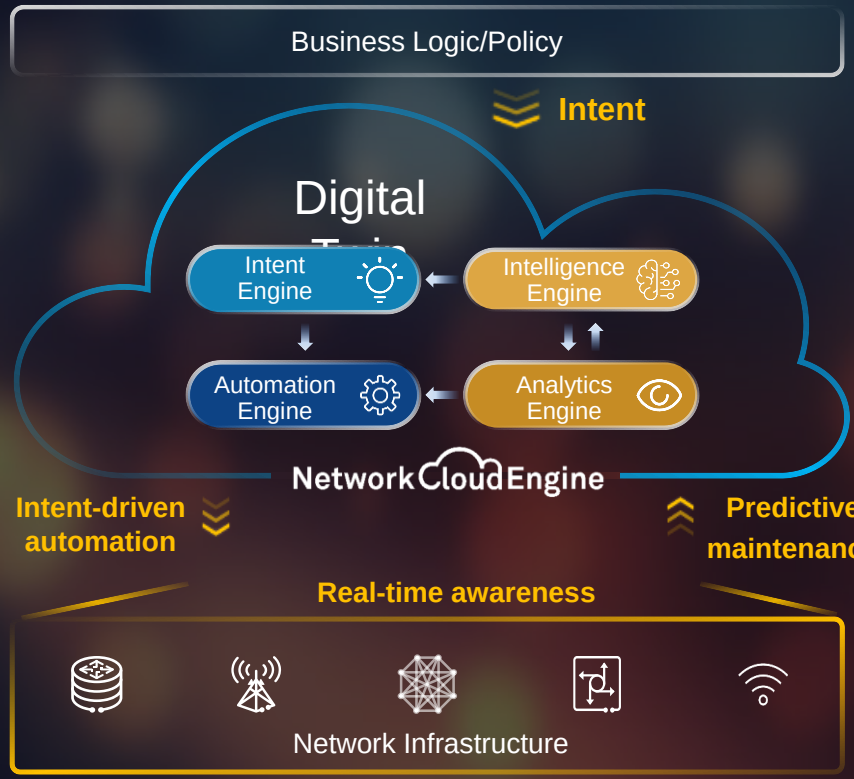
Network Automation

Ask not What SDN Technologies Is, Ask What SDN Can Do

IDN Bridges Business Intent and Networks

IDN
Intent-Driven Network

- Network-centric
- Fragmented
- Reactive
- Skill-dependent



- User-centric
- Closed-loop
- Predictive
- AI/Automation

Use Case 1: Huawei Intent-Driven Network @ Campus

Invisible user experience

Difficult experience guarantee

+ IDN

Multi-dimensional Visualization

Real-time visibility of per-user, per-app VIP experience

90%+ typical faults predicted, avoiding user complaints

Troubleshooting in minutes based on traceable data

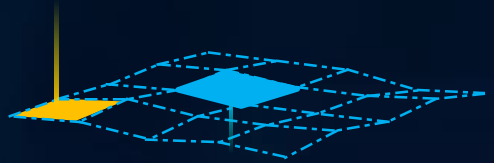
Use Case 2: Huawei Intent-Driven Network @ Home Broadband

Operator X in China

30M+ work orders yearly

x

50 RMB / home visit



Uncertain Network Behavior

Average churn rate: **15% ~ 20%**

Huawei's Innovation in Beijing China

Operator Y in Beijing: 30K work orders / months

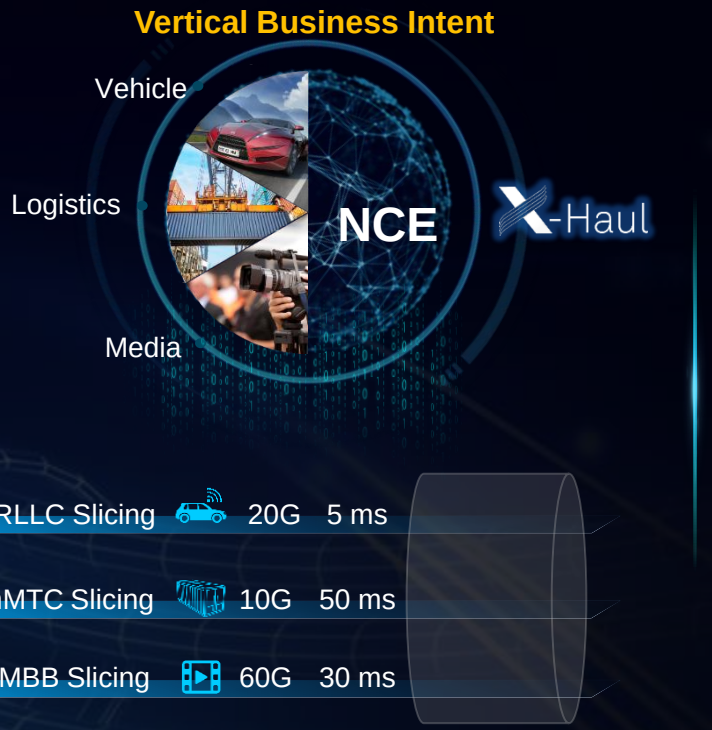
Targets:

0 User Complaint
Detect issue before complaint

0 Work Order
Solve problems in advance

Lower Churn Rate
Proactive experience optimization & assurance

Use Case 3 : Huawei Intent-Driven Network @ 5G Transport



Intelligence

Intent-driven transport slicing automation

Per slice traffic prediction and self-optimization

Simplicity

Unified SR/EVPN for 4G/5G seamless networking

IP, microwave & optical E2E automatic provisioning

Ultra-broadband

25G/50G/100G smooth migration using FlexE

5G microwave up to 20Gbps

Security

Network level security (IPsec/MACsec)

Tenant level resource isolation (FlexE)

THANK YOU

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