



TM Forum on a Mission

Driving commercial industry initiatives
with Autonomous Networks

W. George Glass, CTO, TM Forum

The Missions are underpinned and supported by

ODA

+

Research

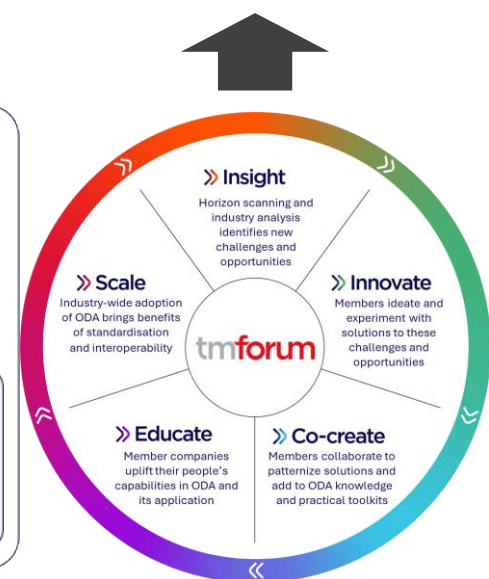
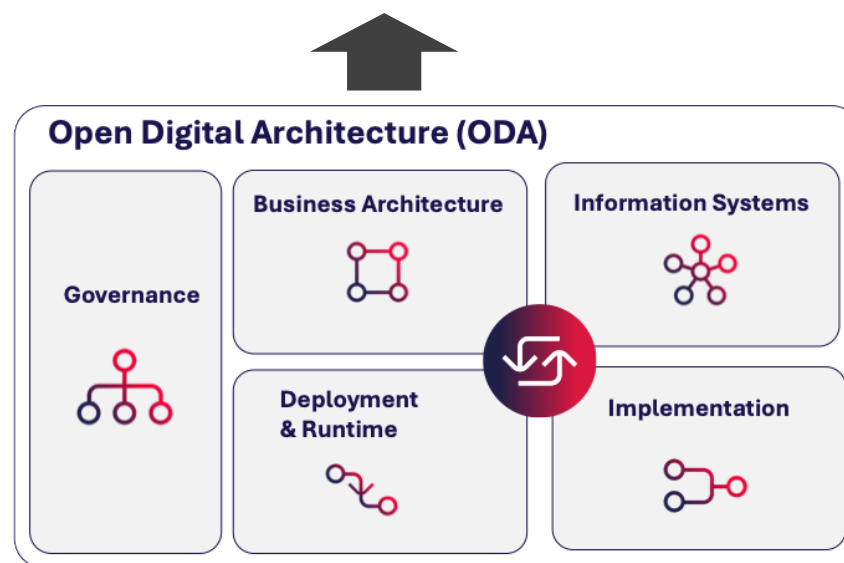
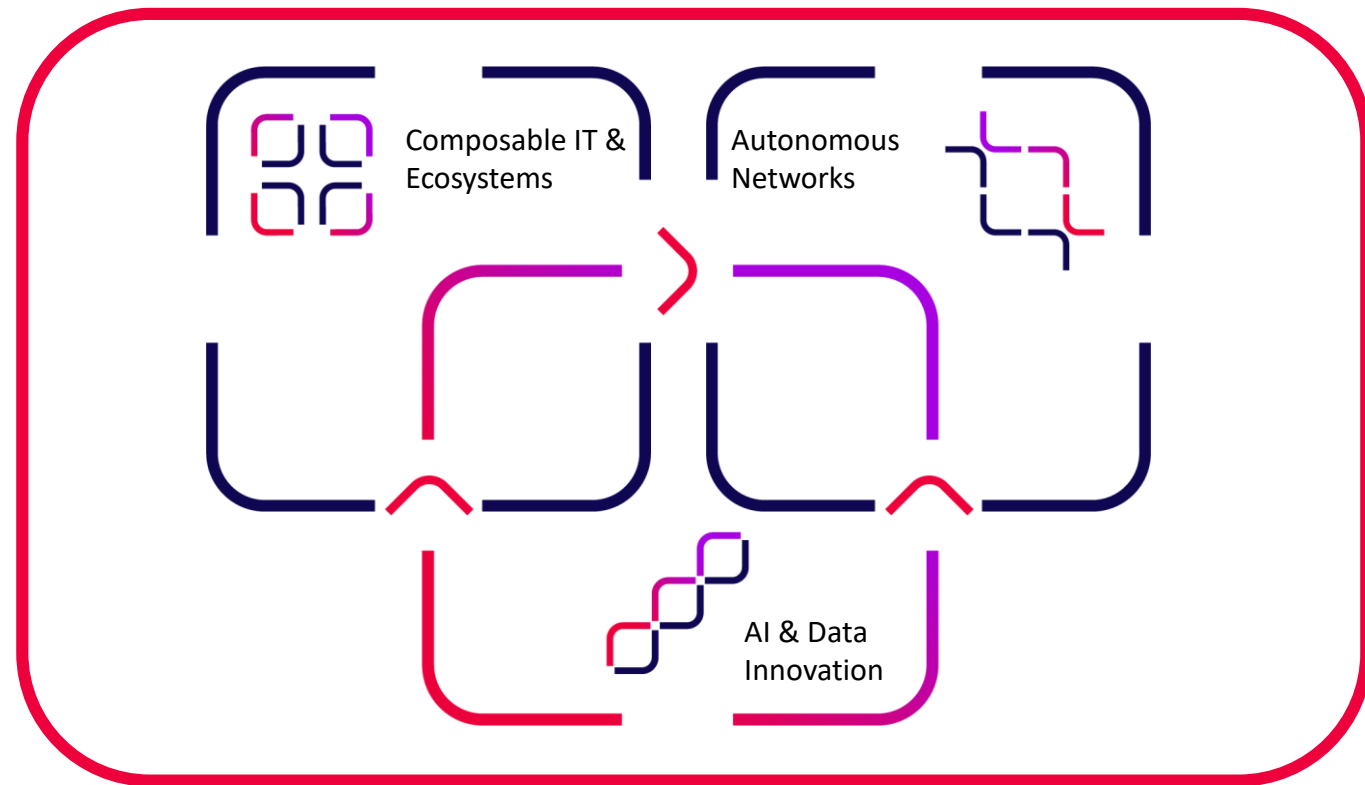
Catalysts

Innovation Hub

Collaboration projects

Education programs

Conformance certification

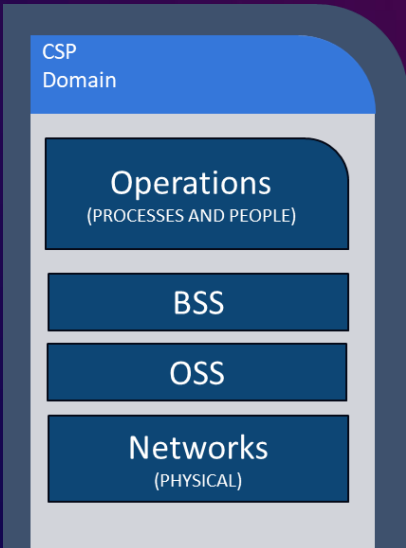


Transforming the Telecoms Industry with ODA

Aligned Vision

Traditional Telco Era

1980 - 2013

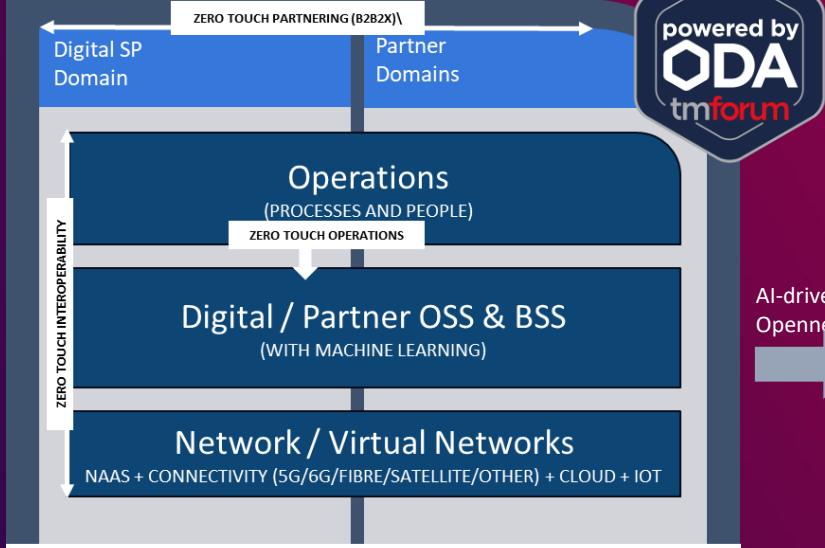


- ~ Single business model for Connectivity
- ~ Product centric people intensive processes
- ~ One or more tech stacks per product

Openness

Digital Telco Era

2014 - 2023

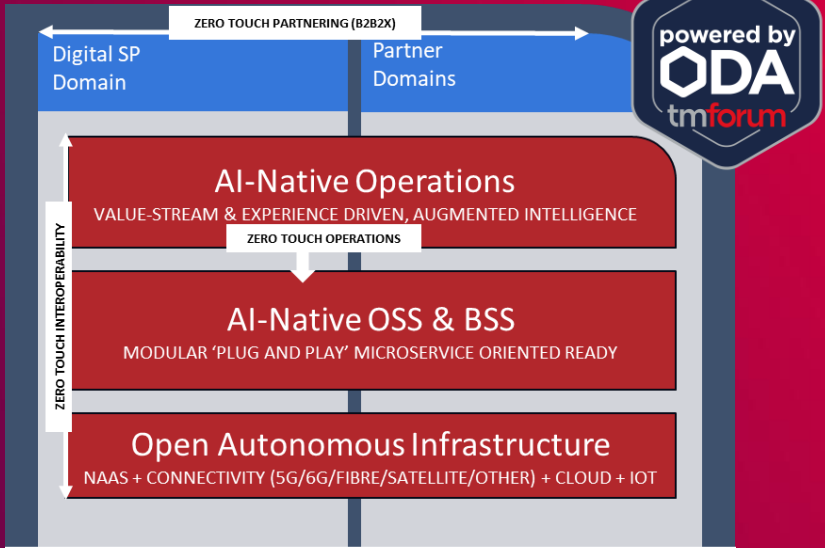


- ~ Connectivity + VAS business model
- ~ Basic automation of processes
- ~ Rationalized tech stack, cloud migrated

AI-driven Openness

AI-Native Telco Era

2024 - 2030+



- ~ Business-model and service agnostic
- ~ On-demand bundled services and capabilities
- ~ Defend and grow revenue

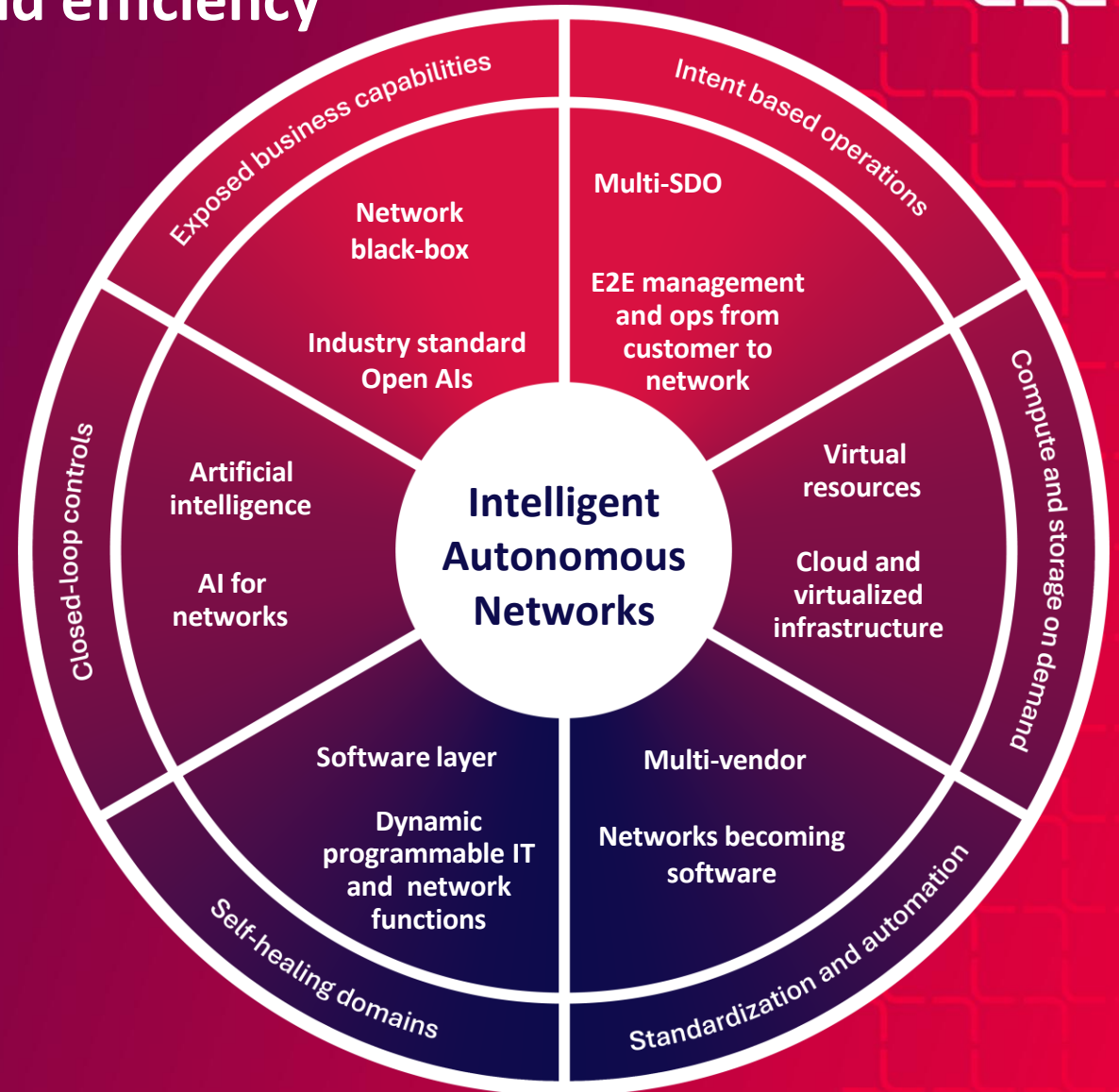
ODA is critical to unleashing growth, profitability and cutting-edge customer experience for the industry

Autonomous Networks

A Mission for network resilience, agility and efficiency

The Autonomous Networks Mission will unleash a step-change in customer experience, business velocity, profitability and new services by **unlocking the power** of seamless end-to-end autonomous operations

We will do this by accelerating industry-wide achievement of **Level 4+ Autonomous Network** operations and management by delivering an industry standard open architecture to enable self-healing, self-optimizing network domains, readying the network for end-to-end autonomous “Zero-X” operations



Big Ambitions to mature Autonomous Network Levels



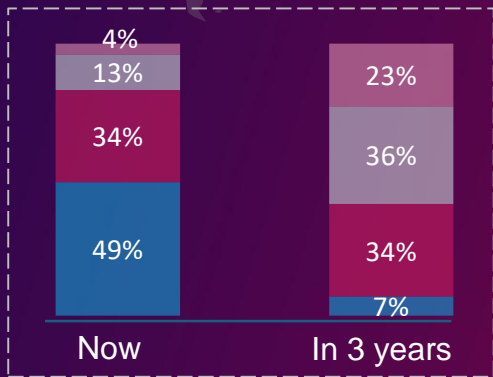
60+ leading partners signed AN Manifesto

Big Ambitions to reach L3/L4

91% of the TM Forum's member CSPs have a vision or ambitious strategy on network automation

60% CSPs expect to reach L3/4 in 3 years

14 leading CSPs state commitment for L4 between 2025-2027



Level 4
Level 3
Level 2
Level 1

*325 decision makers from 97 CSPs

Find out more on the Autonomous Networks Levels Assessment which helps CSPs position themselves and define a roadmap towards self-healing domains

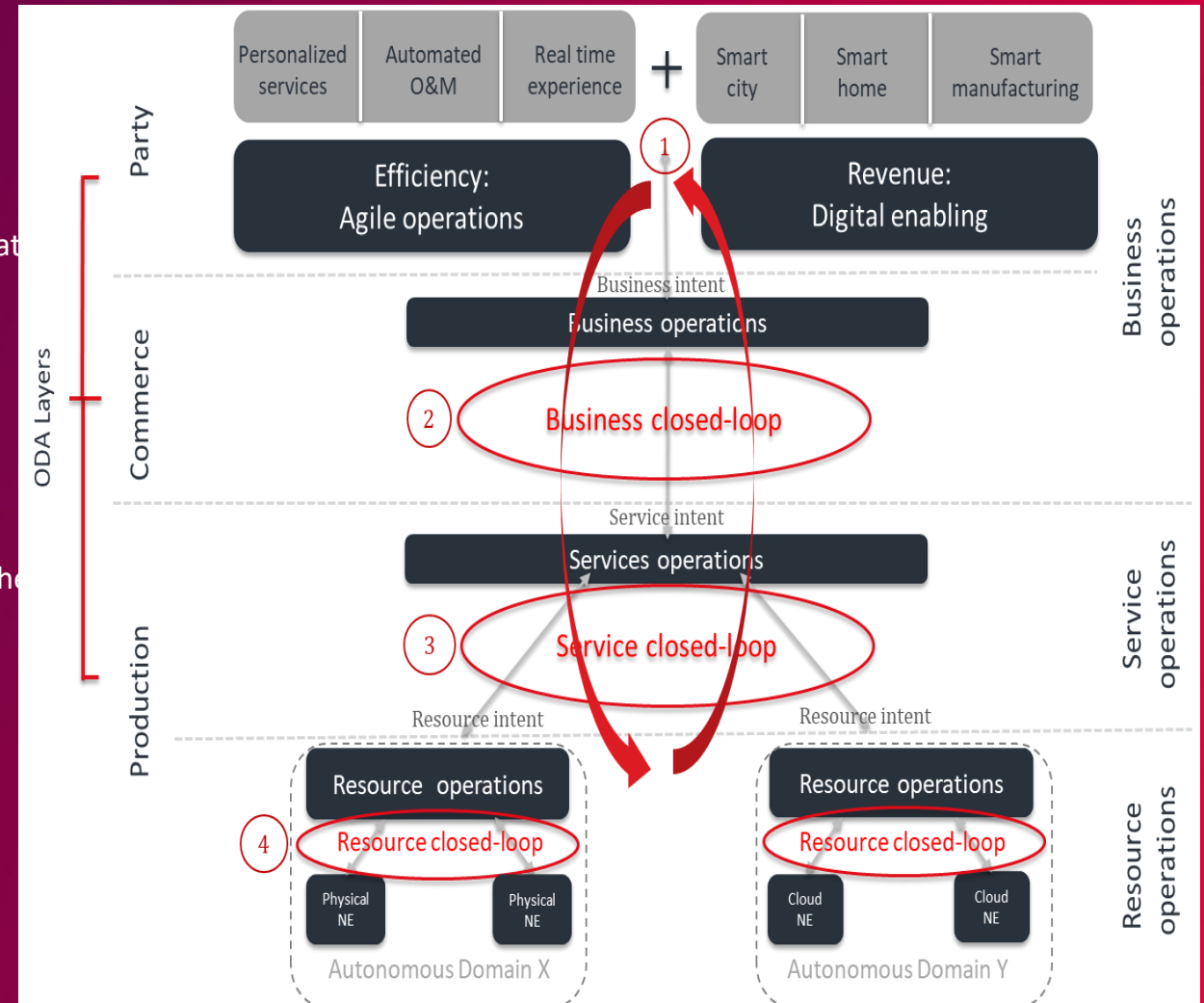
AN						
AN maturity levels Reference architecture Effectiveness indicators						
	L0	L1	L2	L3	L4	L5
	Manual O&M	Assisted O&M	Partial Autonomous Network	Conditional Autonomous Networks	Highly Autonomous Networks	Full Autonomous Networks
Execution	P	P/S	S	S	S	S
Awareness	P	P/S	P/S	S	S	S
Analysis	P	P	P/S	P/S	S	S
Decision	P	P	P	P/S	S	S
Intent/Experience	P	P	P	P	P/S	S
Applicability	N/A	Selected Scenarios				All Scenarios
P	People (manual)	S	System (autonomous)	P/S	Both: People assisting System	

ODA – Autonomous Networks

The revolution is happening now!

- We will develop the framework/blueprint/architecture for the management of tomorrow's network
- It requires:
 - Fragmentation of the networks into domains
 - Virtualization of the network functions within domains
 - Implementation of the network functions as software components that expose services
 - Encapsulation of the network function complexity within the relevant domains as a set of network services
 - Automation of network function repair within the domain
 - Exposure of the network's services from the domains using industry standard Open APIs
- It uses
 - Automated closed loop control **within** a domain (2) to (4)
 - Automated closed loop control of the network **across** all domains of the architecture (1)
 - AI, big data, cloudification and virtualization
- It delivers:
 - Simplification of the management of the network
 - Agile, flexible delivery of network services and resources
 - Self-optimizing networks
 - Self-healing networks
 - Intent based operations
 - An ecosystem that goes beyond the boundary of Telco and enables digital transformation across many industries

Layers and closed-loops of Autonomous Networks



Core Concepts - Logical Architecture to Functional Arch.

IG1230 v1.1
Autonomous Networks
Technical Architecture

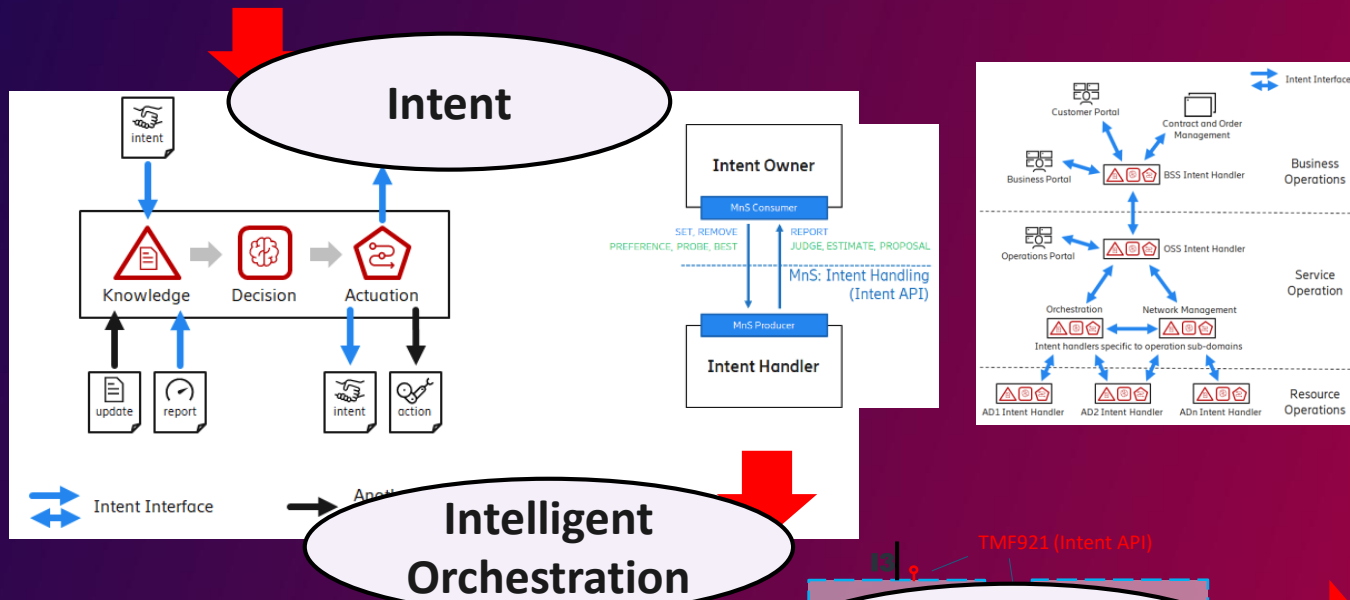


IG1252 v1.0
Autonomous Networks Levels
Evaluation Methodology

Autonomous Levels	L0: Manual Operation & Maintenance	L1: Assisted Operation & Maintenance	L2: Partial Autonomous Networks	L3: Conditional Autonomous Networks	L4: High Autonomous Networks	L5: Full Autonomous Networks
Execution	P	P/S				S
Awareness	P					S
Analysis	P					S
Decision	P					S
Intent/ Experience†	P					S
Applicability	N/A					All

P People (manual) S Systems (autonomous)

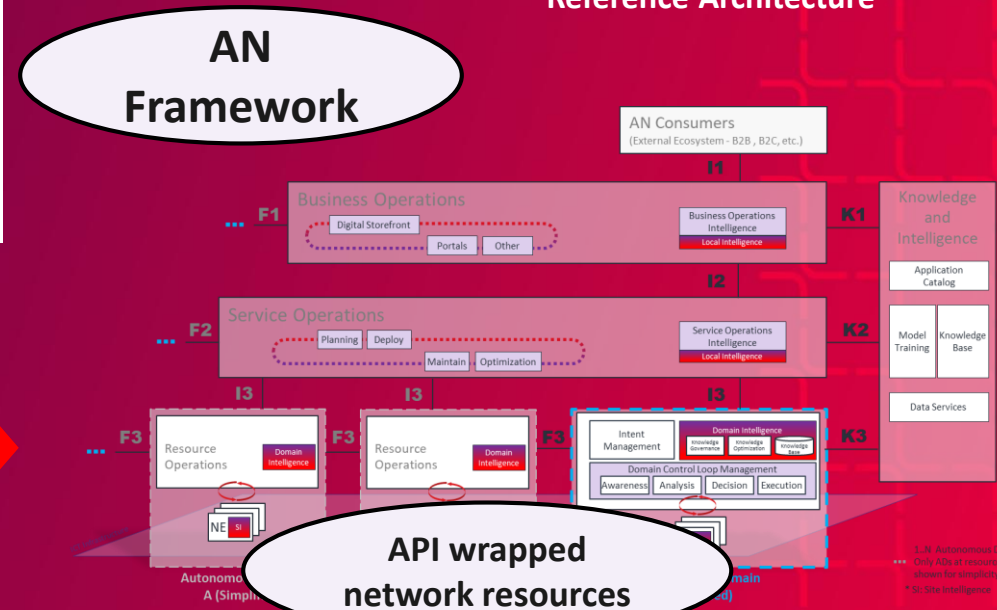
AN Level



IG1253 v1.0
Intent on Autonomous Networks

Autonomous Domain

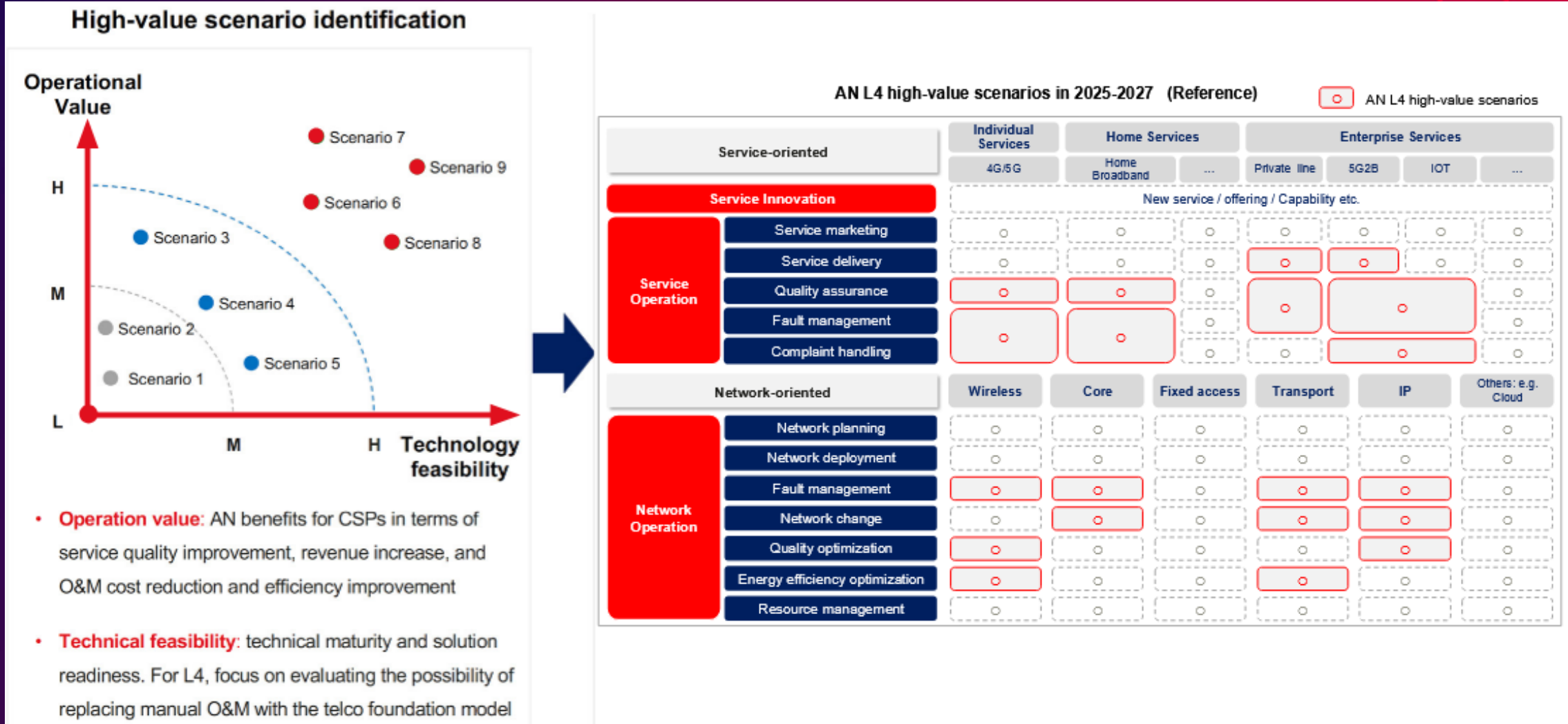
IG1251 v1.0
Autonomous Networks
Reference Architecture



API wrapped network resources

High-Value use cases prove the business value of ANL4

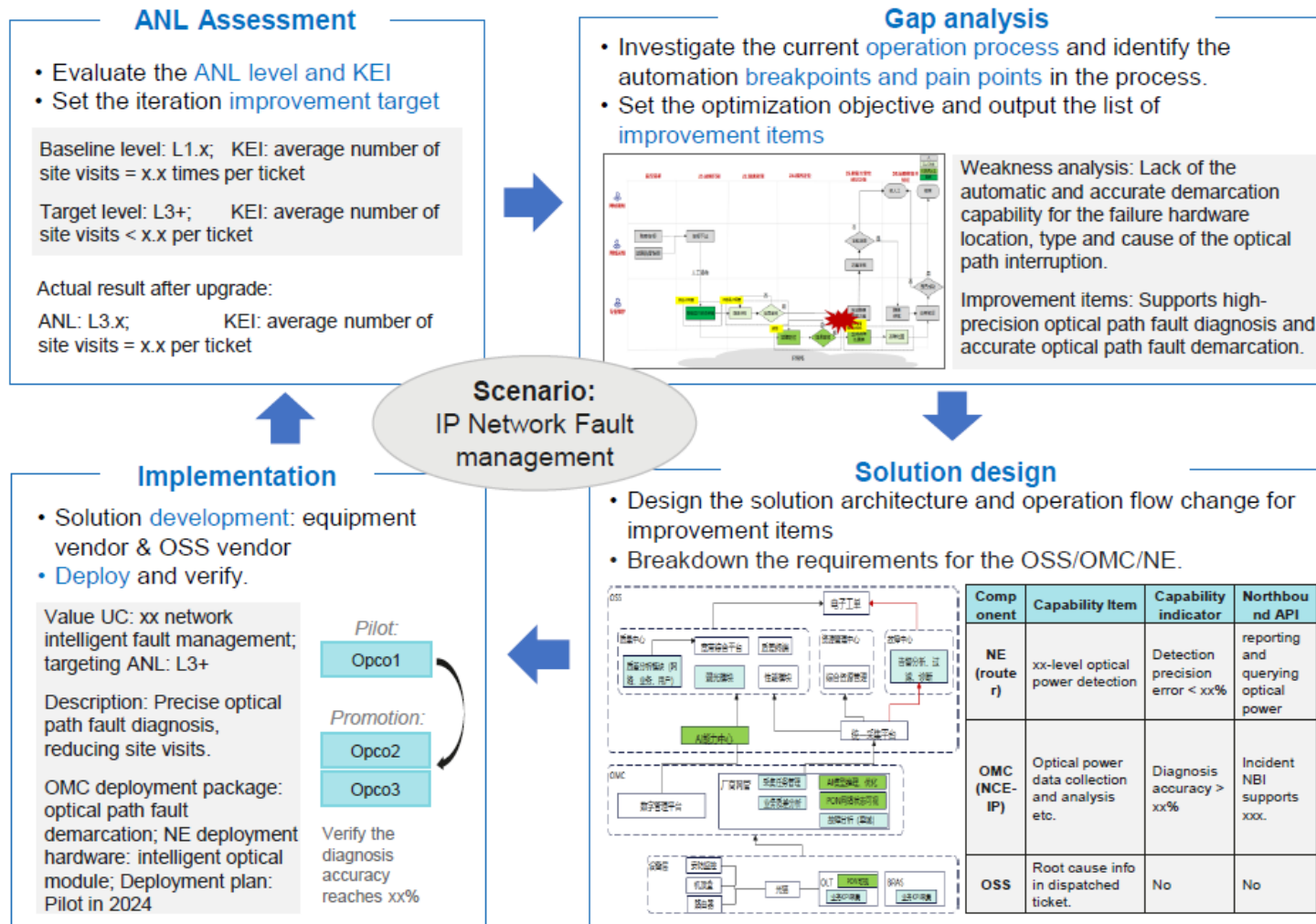
Members identified service/network areas with the biggest improvement opportunity



Target status design: Guidance for getting through AN journey



AN Journey collaboration case (with CSP-C)



L4 scenario target status design

AN SP	
3.1	Scenario Introduction
3.1.1	Scenario introduction
3.1.2	Sub-scenarios
3.2	Business Value Identification
3.2.1	Business values
3.2.2	Effectiveness Indicators
3.3	L4 Characters and Level Standards
3.3.1	Level Characters
3.3.2	Level Definitions
3.4	Target Architecture
AN Journey	
4.1	Scenario Assessment
4.1.1	Effectiveness assessment
4.1.2	AN level assessment
4.2	Gap Analysis
4.2.1	As-is workflow analysis
4.2.2	To-be workflow design
4.2.3	Capability indicators design
4.2.4	Transformation Items
4.2.5	High level requirements distribution
4.3	Solution Design
4.3.1	Scenario-level architecture design
4.3.2	Transformation Item design
4.3.3	System level requirements distribution
4.3.4	Interface requirements
4.3.5	Key technologies
4.4	Implementation
4.4.1	implementation roadmap
4.4.2	Partner introductions
Future Plans	

Two showcases that leverage HVS to demonstrate wider ANL4 capability



End-to-end 5G dynamic slice management

Fault Management across all technologies

AN L4 high-value scenarios in 2025-2027

		Service-oriented		Individual Services	Home Services	Enterprise Services			
		4G/5G	Home Broadband	...	Private line	5G2B	IOT	...	
Lifecycle	Operati on	Service marketing							
		Service delivery							
		Service assurance							
		Complaint handling							
Network	Plan	Network-oriented		Wireless	Core	Fixed access	Transpo rt	IP	Others: e.g. Cloud
		Network planning							
	Deployment	Network-oriented		Wireless	Core	Fixed access	Transpo rt	IP	Others: e.g. Cloud
		Network deployment							
	Mainten ance	Network-oriented		Wireless	Core	Fixed access	Transpo rt	IP	Others: e.g. Cloud
		Fault management							
	Optimiz ation	Network-oriented		Wireless	Core	Fixed access	Transpo rt	IP	Others: e.g. Cloud
		Quality optimization							
		Energy efficiency optimization							
		Resource management							

AN L4 high-value scenarios in 2025-2027

		Service-oriented		Individual Services	Home Services	Enterprise Services			
		4G/5G	Home Broadband	...	Private line	5G2B	IOT	...	
Lifecycle	Operati on	Service marketing							
		Service delivery							
		Service assurance							
		Complaint handling							
Network	Plan	Network-oriented		Wireless	Core	Fixed access	Transpo rt	IP	Others: e.g. Cloud
		Network planning							
	Deployment	Network-oriented		Wireless	Core	Fixed access	Transpo rt	IP	Others: e.g. Cloud
		Network deployment							
	Mainten ance	Network-oriented		Wireless	Core	Fixed access	Transpo rt	IP	Others: e.g. Cloud
		Fault management							
	Optimiz ation	Network-oriented		Wireless	Core	Fixed access	Transpo rt	IP	Others: e.g. Cloud
		Quality optimization							
		Energy efficiency optimization							
		Resource management							

Project proposals drafted to enable CTO/EM recruitment of members into the relevant IHPP

China Mobile's E2E Autonomous NOC (Dark NOC)

Build a Dark NOC (Network Operation Center) to enable end-to-end automatic intelligent O&M, simplifying operations with minimum or no manual interventions to improve quality, reduce costs, and increase efficiency.

Autonomous network (AN) level of the NOC rose from 3.2 to 4, according to self-assessment using TM Forum AN Levels assessment (ANL)

Challenges



- Insufficient end-to-end automation capabilities
- Strong human dependency of O&M processes



- Inadequate front end self-service capabilities
- Frequent interaction between front end and back end



- Low adoption of telecom GenAI/AI models
- Potentials of AI underutilized

Dark NOC

One-click close-loop

- Natural language understanding
- One-click automatic provisioning/change

Manual takeover on demand

- Unknown complex problem is automatically transfer to human expert.

AI Agents

Autonomous remote repair

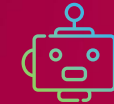
- Remote automatic troubleshooting
- Automatic Software/Configuration problem repair

Minimum site visits

- One ticket for one fault
- Minimum site visit for each ticket

Value

Efficiency and effectiveness



- Machine replacement of manual labor: 5,500 FTEs (Full Time Equivalent)
- Reduce MTTR (Mean Time To Resolution) by 30% in average



Customer responsiveness

- Timely service provisioning > 99%
- Timely complaint handling > 95%






Safety and quality

- Avoid human-induced failure
- Continuous improvement of customer satisfaction

Remarkable Results

- China Mobile started deploying Dark NOC in 2 of the largest subsidiaries in Oct 2023.
- China Mobile has achieved 5,500 FTEs machine replacement of manual labor by the end of 2024, with significant enhancement of O&M efficiency and customer experience.
- China Mobile is now replicating Dark NOC nationwide.



		 Digital Employees* (% of total staff)	 O&M Efficiency and Customer Experience Improvement	 Scale **
China Mobile Guangdong	IP Backhaul Fault Mgmt	<ul style="list-style-type: none"> • Back-end O&M: 30% • Field maintenance: 5% 	<ul style="list-style-type: none"> • 25% reduction in fault MTTR • 15% reduction in fault tickets • 0 or maximum 1 site visit per fault 	<ul style="list-style-type: none"> • Covered over 130,000 PTN/SPN NE in 13 Cities, serving 85 million 5G subscribers. • Digital employees have been used 150,000+ times, diagnosed 14,000+ work orders
	Home Broadband Complaint Handling	<ul style="list-style-type: none"> • back-end integrated operations: 25% • Field installation and maintenance: 6% 	<ul style="list-style-type: none"> • 50% reduction in complaint MTTR • Customer experience issue troubleshooting time reduction to < 10 minutes • Complaint ratio lowered by 30% 	<ul style="list-style-type: none"> • Serving 23 million home broadband subscribers • Copilots have been equipped with more than 9000 installation and maintenance engineers, and used 3,000-4,000 times daily
China Mobile Zhejiang	RAN Fault Mgmt	<ul style="list-style-type: none"> • Wireless O&M: 23% 	<ul style="list-style-type: none"> • 27% reduction in fault MTTR • 80% reduction in back-end support troubleshooting hours • 0 or maximum 1 site visit per fault 	<ul style="list-style-type: none"> • Covered 20,000 sites, 100,000 cells in the city of Hangzhou, serving 6.5 million 5G subscribers. • Digital employees help to close more than 8000 trouble tickets per month.
	Core Network Fault Mgmt / Complaint Handling	<ul style="list-style-type: none"> • Core Network O&M: 40% 	<ul style="list-style-type: none"> • 87% reduction in fault MTTR • 65% reduction in complaint MTTR • Complaint preemption ratio increased from 5% to 75%. 	<ul style="list-style-type: none"> • Covered all 11 cities in Zhejiang province, serving over 25 million 5G subscribers. • Digital employees have been used 60,000+ times, diagnosed 3,000 alarms, handled 2.6k+ complaint work orders

Note:

*The calculation of the number of digital employees is based on the saved labor hours comparing with manual operation.

** Subscriber numbers as of 2023, when the project started.

Thank you

W. George Glass

CTO, TM Forum

DD: +44 7885 746353

Email: wglass@tmforum.org

