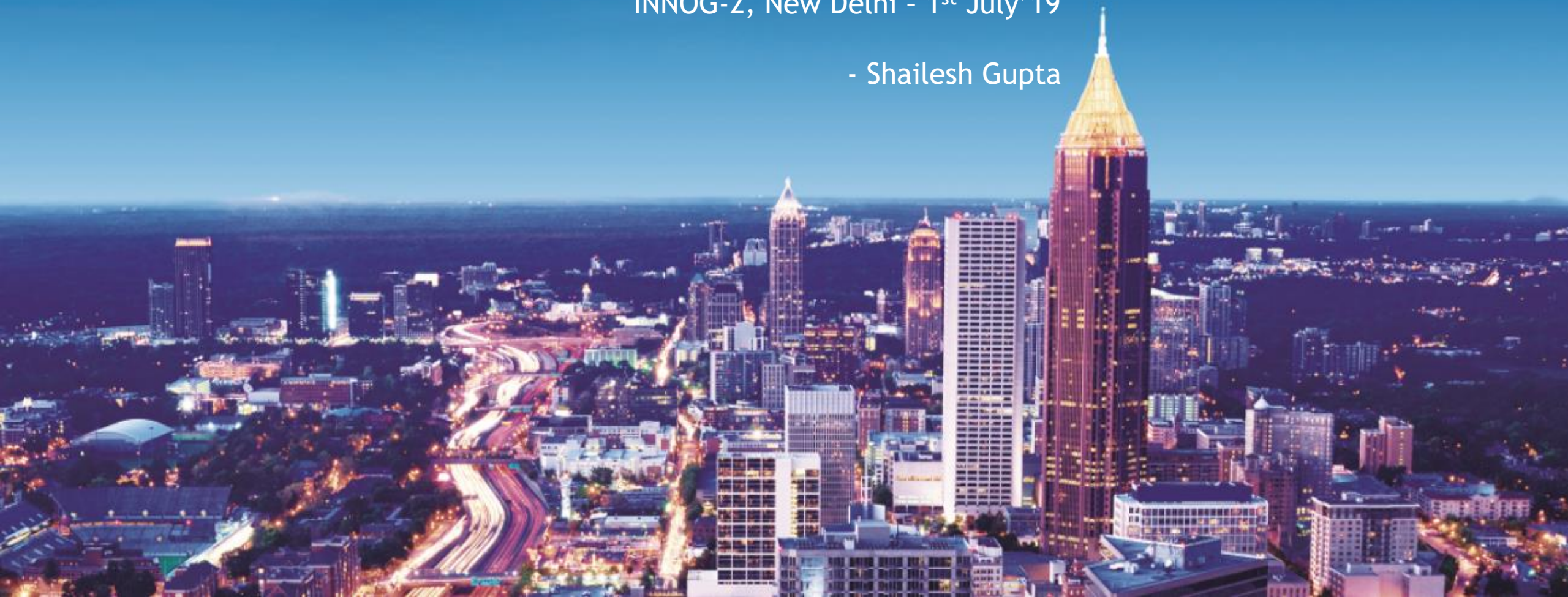


“Journey of 64K to 21T”

INNOG-2, New Delhi - 1st July'19

- Shailesh Gupta



- ✓ Internet Penetration in India/ World
- ✓ Who we are ? - T1 ISP/ Digital Infrastructure Provider
- ✓ Global T1 IP Backbone - How it differs from T2/National Providers ?
- ✓ International Cable Diversity
- ✓ Tools & Systems - Tata Communications Automation Journey
- ✓ DDOS Detection & Mitigation : Clean Pipe Solution
- ✓ SDWAN Use Cases
- ✓ IOT Use Case
- ✓ Q & A

2018 INTERNET PENETRATION IN INDIA



ultraxart.com

BASED ON THE DATA AVAILABLE BY INTERNET AND MOBILE ASSOCIATION OF INDIA (IAMAI)

INDIA



TOTAL POPULATION
1.3 BILLION

RURAL - URBAN

RURAL

67.5%

890 Millions

21% Internet Users
187 Million

URBAN

32.5%

430 Millions

66% Internet Users
291 Million

OVERALL

1.32 billion

35% Internet Users
500 Million

Country or area	Internet users ^[8] ^[Note 1]	Rank	Percentage ^[9]	Rank
 China	721,434,547 ^[10] ^[11]	1	52.2%	82
 India	462,124,989 ^[12]	2	34.8%	126
 United States	286,942,362	3	88.22%	15
 Brazil	120,111,118	4	60.1%	67
 Japan	115,111,595	5	89.8%	13
 Russia	102,258,256 ^[13]	6	71.3%	46
 Nigeria	86,219,965 ^[14]	7	46.1%	95
 Germany	71,016,244	8	88%	16
 Bangladesh	63,354,000 ^[15] ^[16]	9	39.20%	112
 Mexico	62,954,584	10	50.84%	85

A global business group with products and services in over 150 countries



More than 151 years experience

Over 695,000 employees



Group revenue of \$100bn with 60% generated outside India



A global leader in several sectors (including IT, banking, healthcare and manufacturing)



TATA CHEMICALS



TATA COMMUNICATIONS



TATA CONSULTANCY SERVICES



TATA MOTORS



TATA POWER

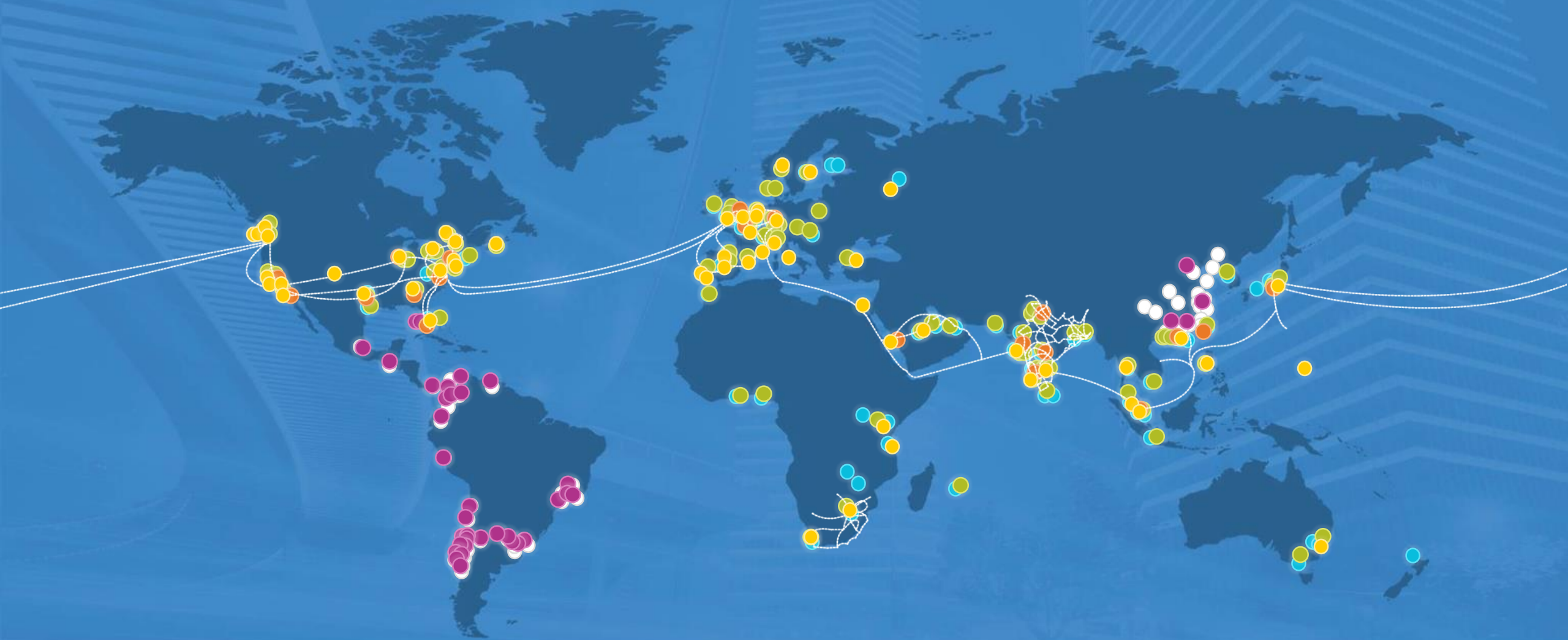


TATA STEEL



TATA GLOBAL BEVERAGES





MPLS PoP



Partner MPLS PoP



Ethernet PoP



Partner Ethernet PoP



CDN PoP



IP PoP

--- TGN Cable

**NETWORK
CONNECTIVITY**

CLOUD AND DATA
CENTRE SOLUTIONS

UNIFIED COMMUNICATIONS
AND COLLABORATION

MANAGED
SECURITY

MEDIA AND
ENTERTAINMENT

SERVICE

CONTINUES INVESTMENT ON IP BACKBONE TO ADDRESS RAPID INTERNET GROWTH

Global IP footprint: >20Tbps of IP backbone capacity

North America
6,100G+

Trans
Atlantic
670G+

Europe
7,800G+

Europe-India
860G+

India-Asia
820G+

Trans-Pacific
500G+

Middle-East
& Africa
1,000G+

India
900G+

Asia-Pacific
2,200G+

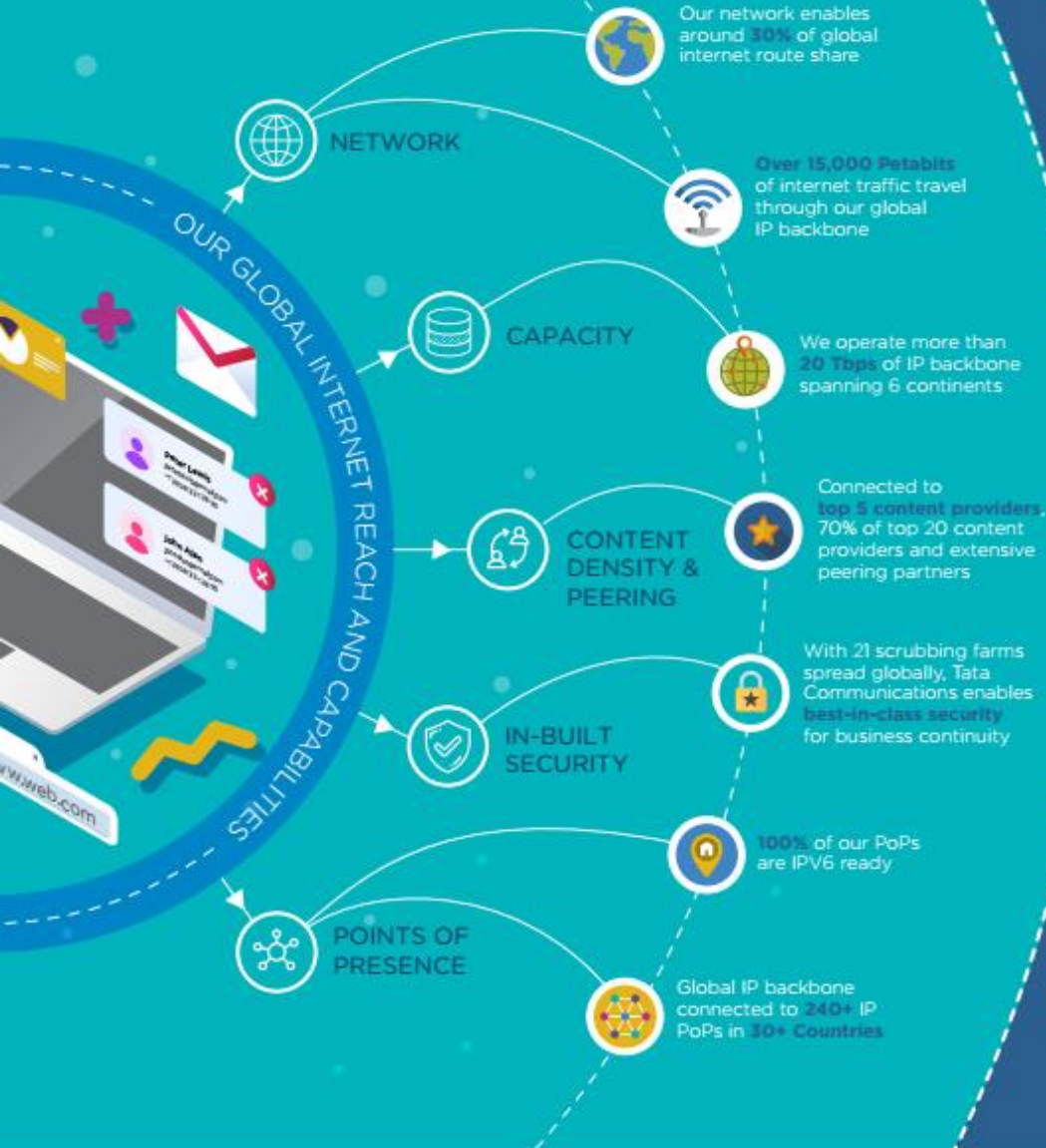
Key Highlight:

- Operate >21 Tbps of IP backbone spanning Six Continents
- Own and operate first round the globe subsea cable network
- Global IP network supporting over 60B wholesale voice minutes globally
- Highly resilient and fully redundant network architecture

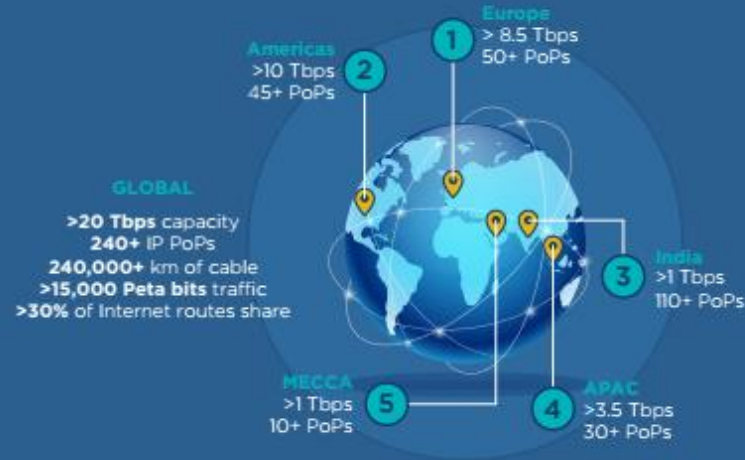


GLOBAL IP BACKBONE CAPABILITIES

TATA COMMUNICATIONS



STRONG PRESENCE ACROSS 6 CONTINENTS



AWARDS AND RECOGNITION



BENEFITS OF TATA COMMUNICATIONS IP TRANSIT

- FLEXIBLE AND SCALABLE
- REDUNDANT & RESILIENT NETWORK
- DENSE IP FOOTPRINT
- SHORTEST POSSIBLE PATH & MINIMAL LATENCY
- SHORTER TURN-UP TIMES & QUICK UPGRADES

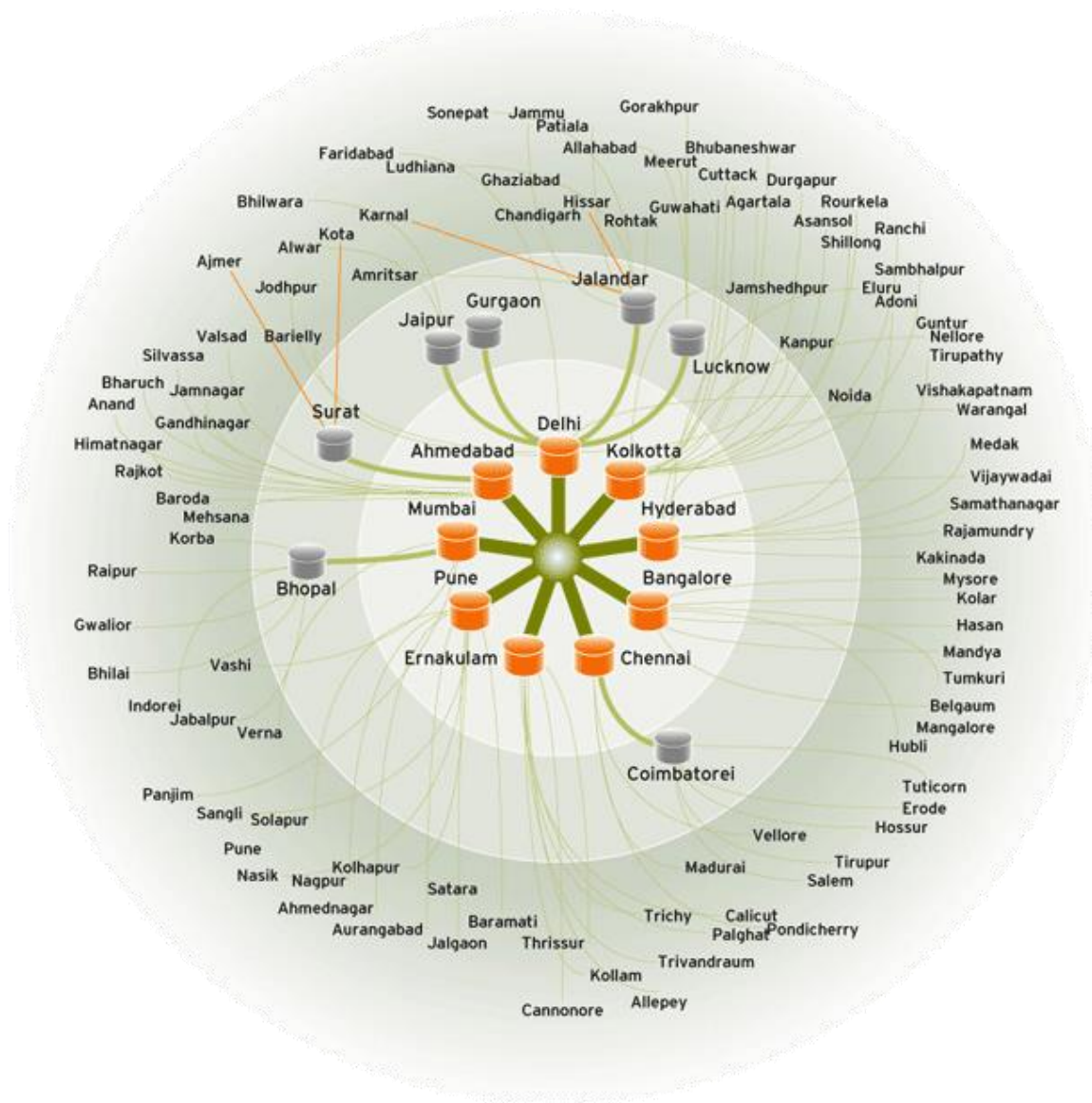
CUSTOMER SEGMENTS: BALANCED MIX OF CUSTOMERS IN DIFFERENT REGIONS



*Source : Gartner, Magic Quadrant for Network Services, Global, Neil Rickard et al, 13 February 2017.

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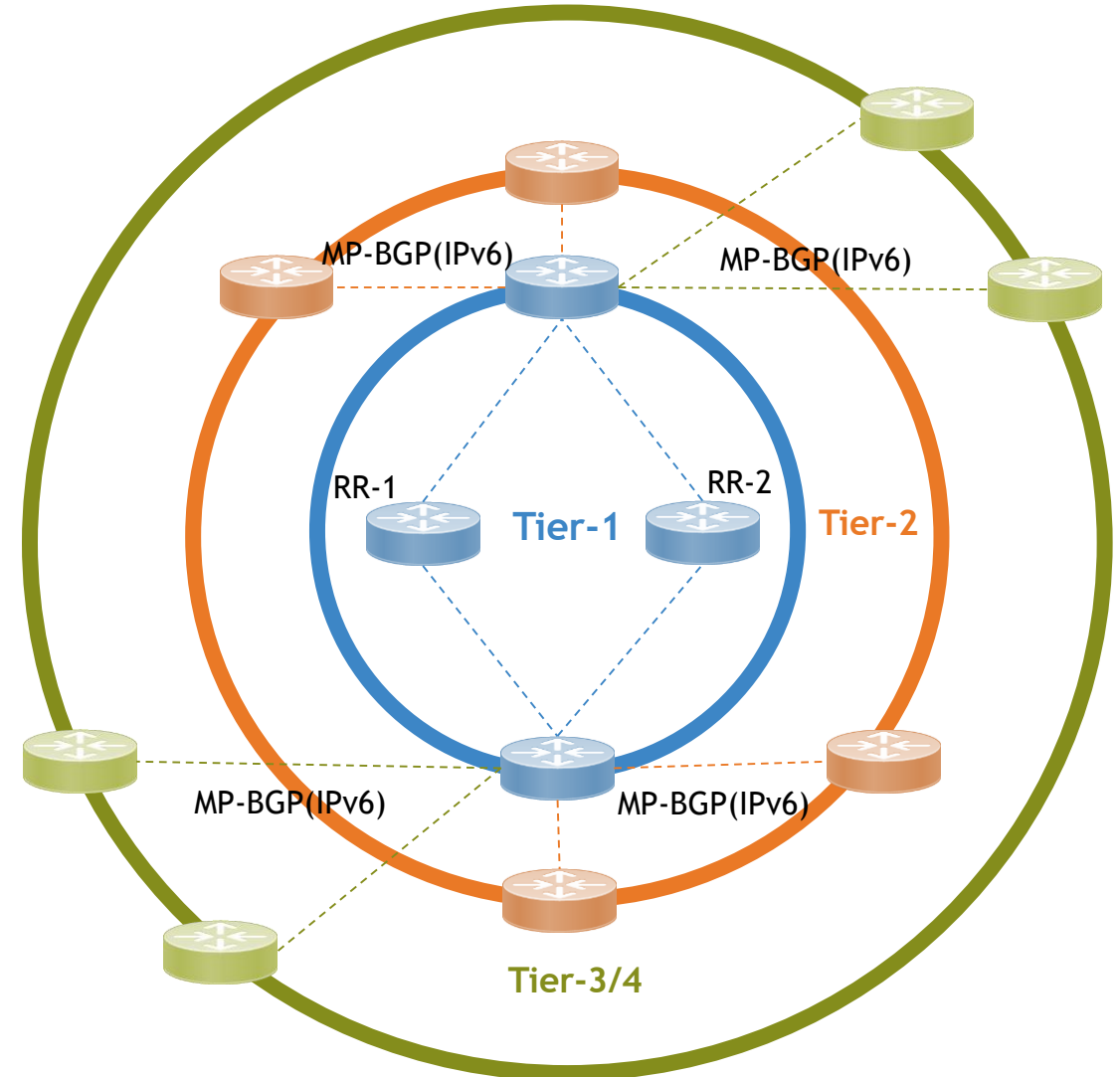
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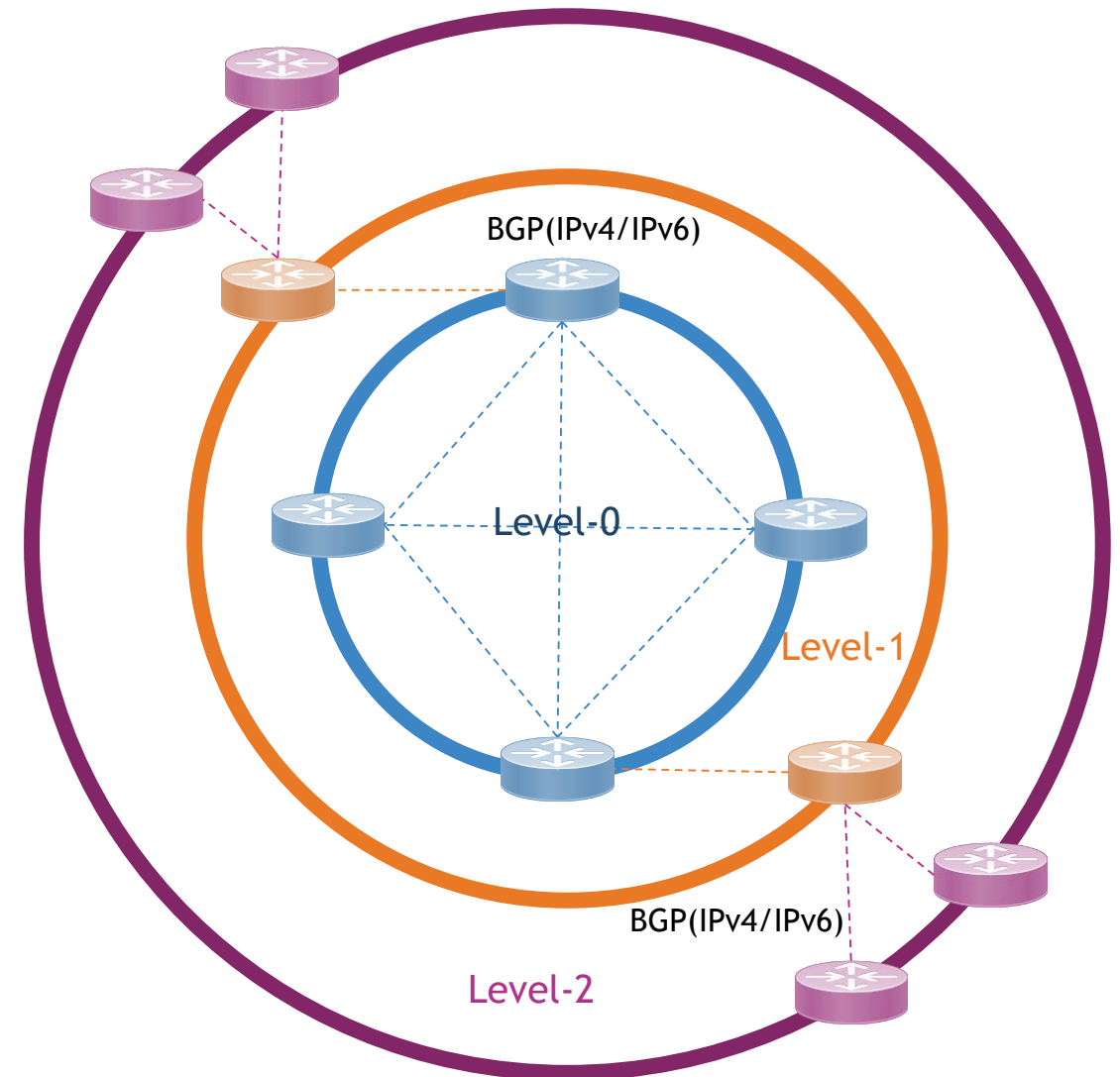
- | Device role | Make/Model |
|-------------|-----------------------|
| Core | Nokia/7750 SR-12 |
| Edge | Nokia/7750 SR-12/7/A8 |

PMS	CACTI
FMS	Monolith
TT System	Service Now

- 6PE and hierarchical architecture
- Tier-1 PoP meshed with route-reflector(RR) for IPv4/IPv6
- Tier-2/3/4 PoP connect to nearest Tier-1 PoP
- Tier-1 router act as regional RR
- Full internet routing table (IPv4/IPv6) available on de-converge/ internet PE
- Default route on MPLS/converged PE



- Dual stack (IPv4/IPv6) with hierarchical architecture
- Level-0 between continent (NA,EU and APAC and ROW)
- Level -1 within in any given region (Europe/APAC/NA)
- Level-2 within City/PoP
- Full routing table (IPv4/IPv6) available on every router

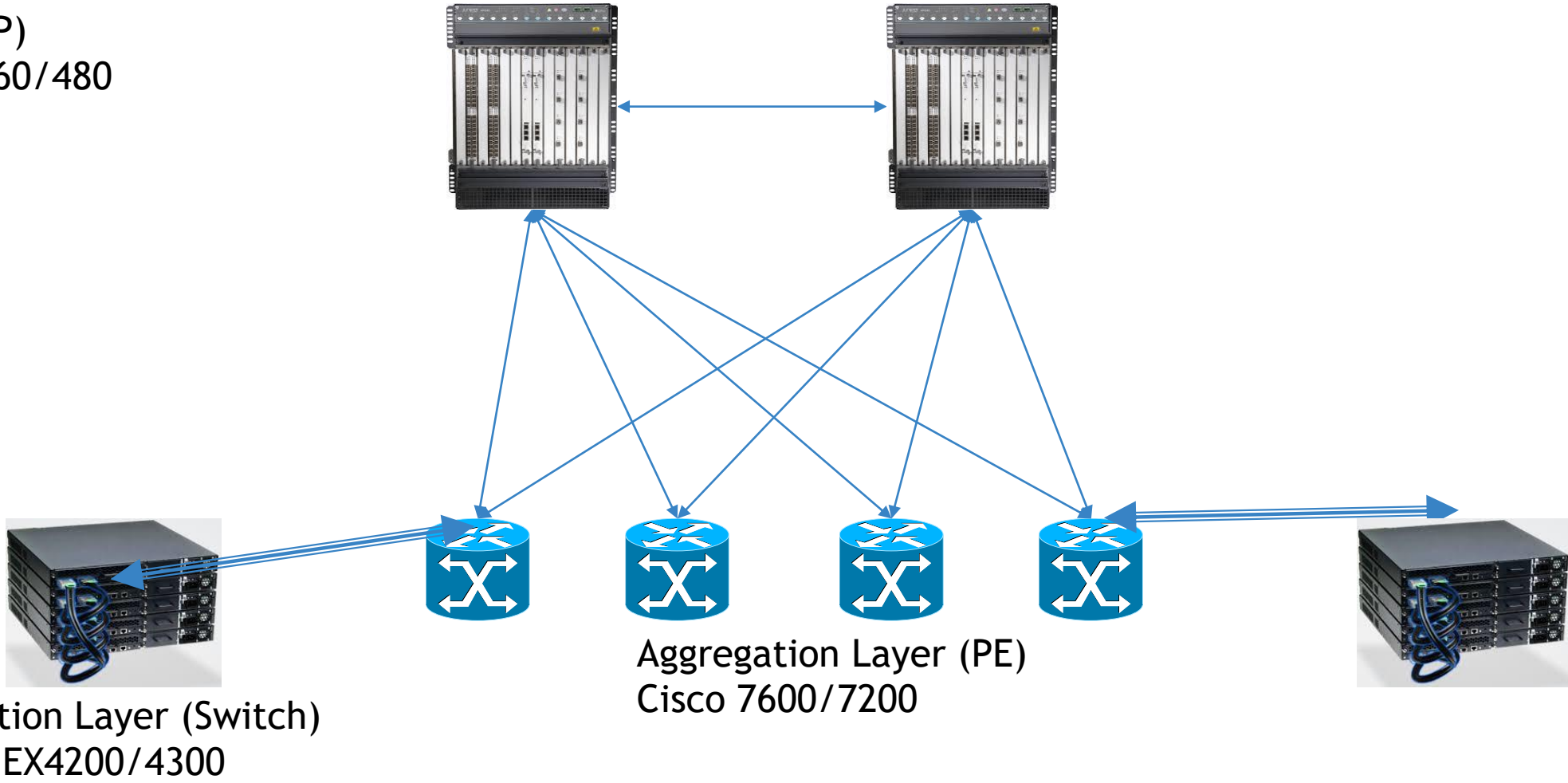


ILL NETWORK ARCHITECTURE AT T1 NODE



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CORE Layer (P)
Juniper MX-960/480

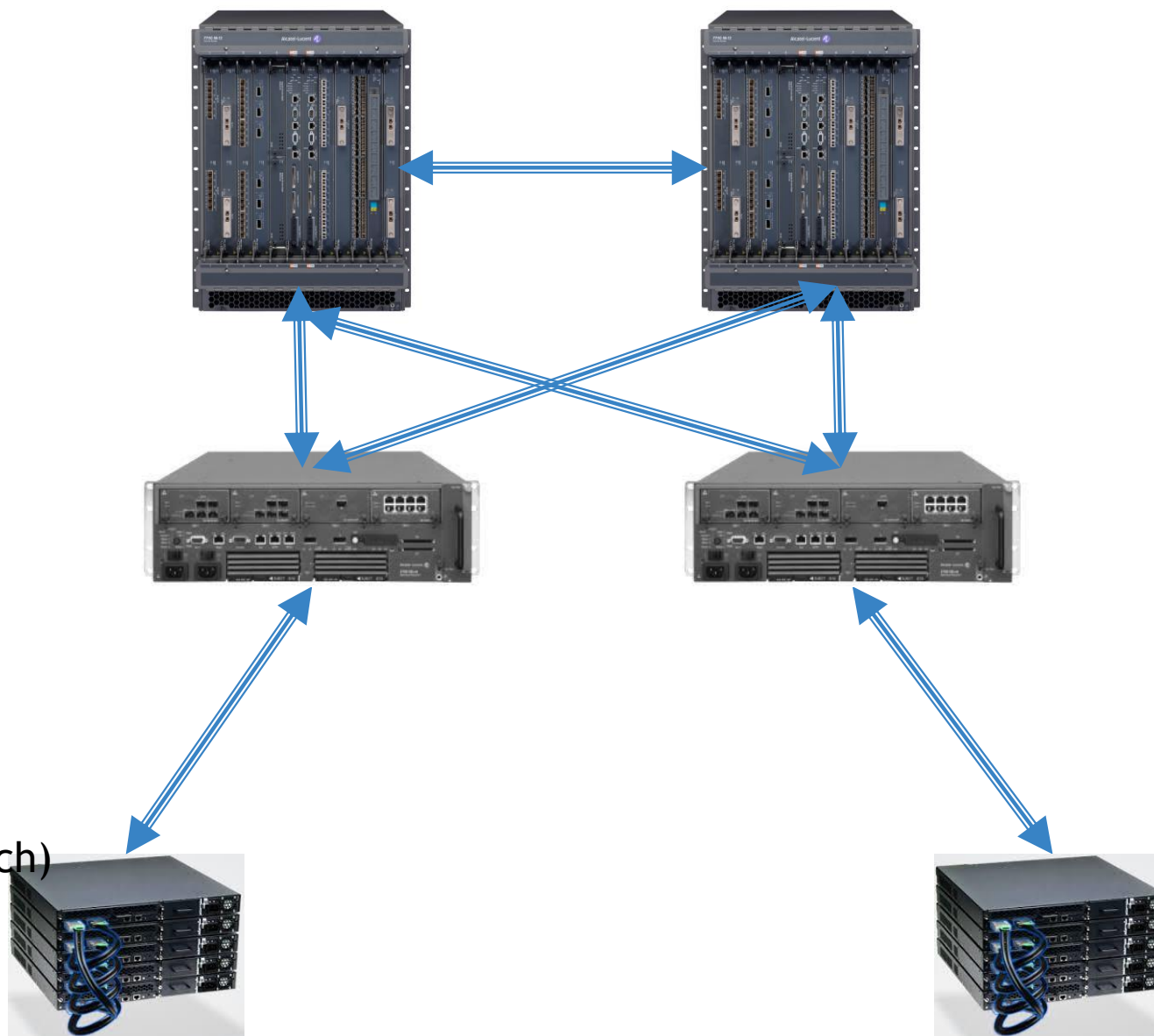


GVPN NETWORK ARCHITECTURE AT T1 NODE

CORE Layer (P)
NOKIA 7750 SRC7

Aggregation Layer (PE)
NOKIA 7750 SRC12

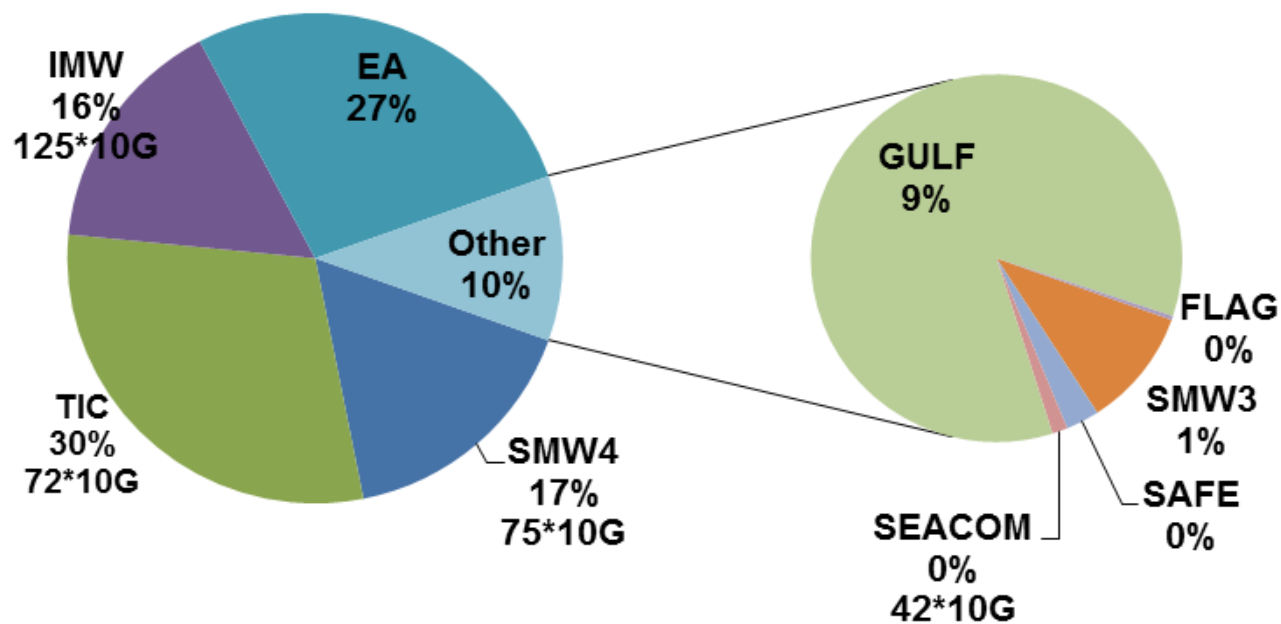
Distribution Layer (Switch)
Juniper EX4200
Huawei S5300



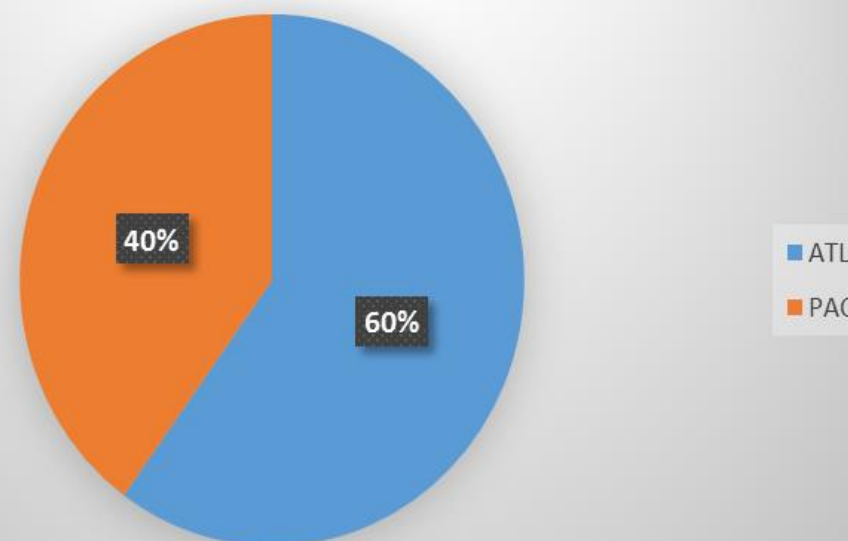
INTERNATIONAL CABLE DIVERSITY

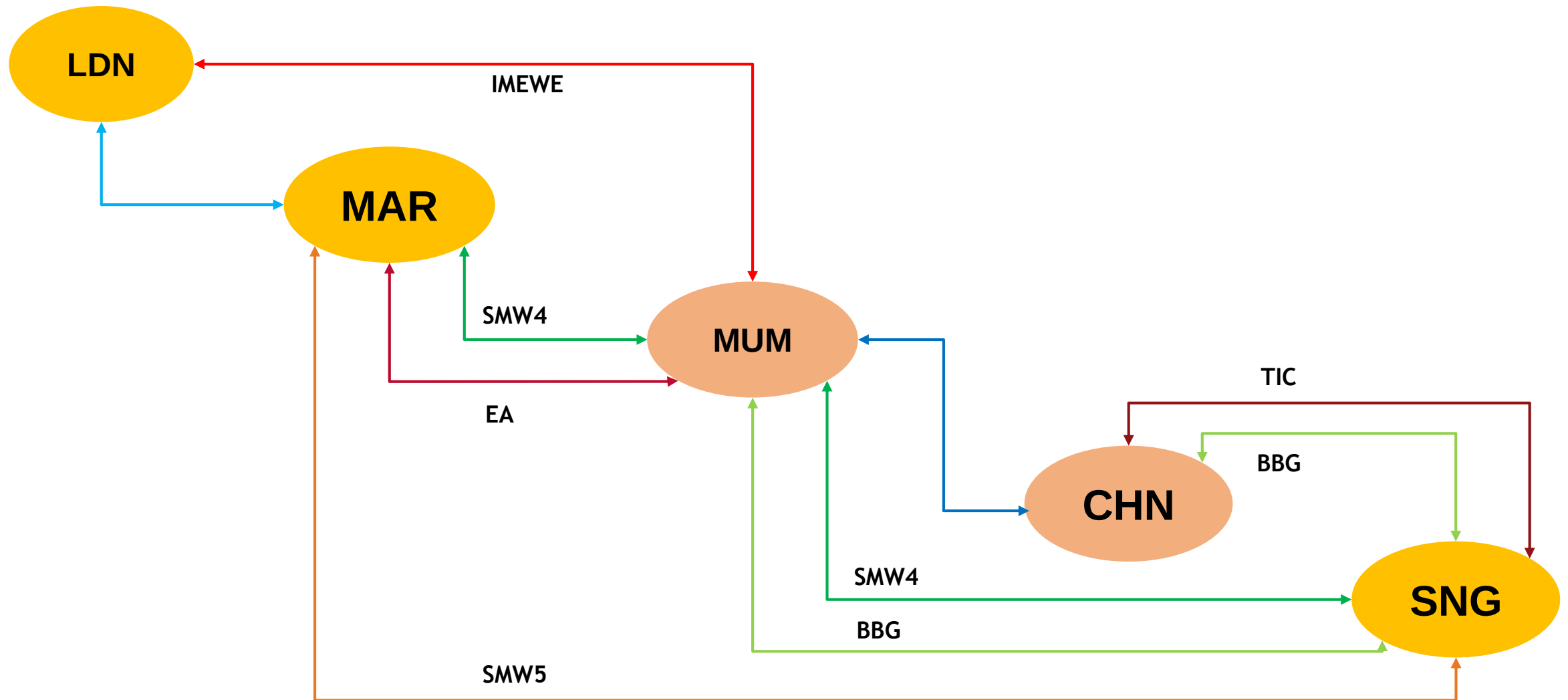


Cable Wise Traffic- India terminating



ATL vs PAC distribution

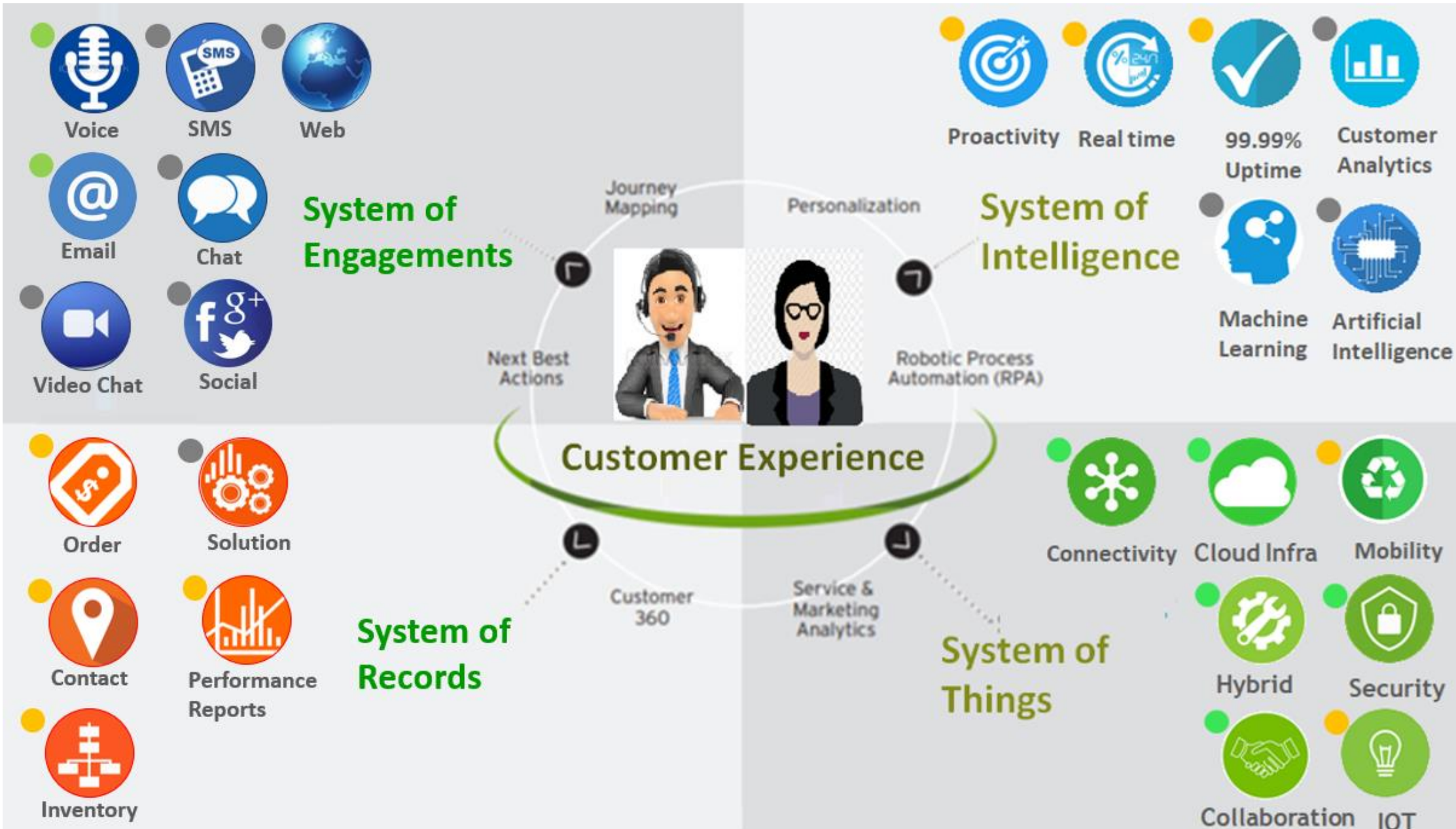




TOOLS & SYSTEMS - AUTOMATION JOURNEY



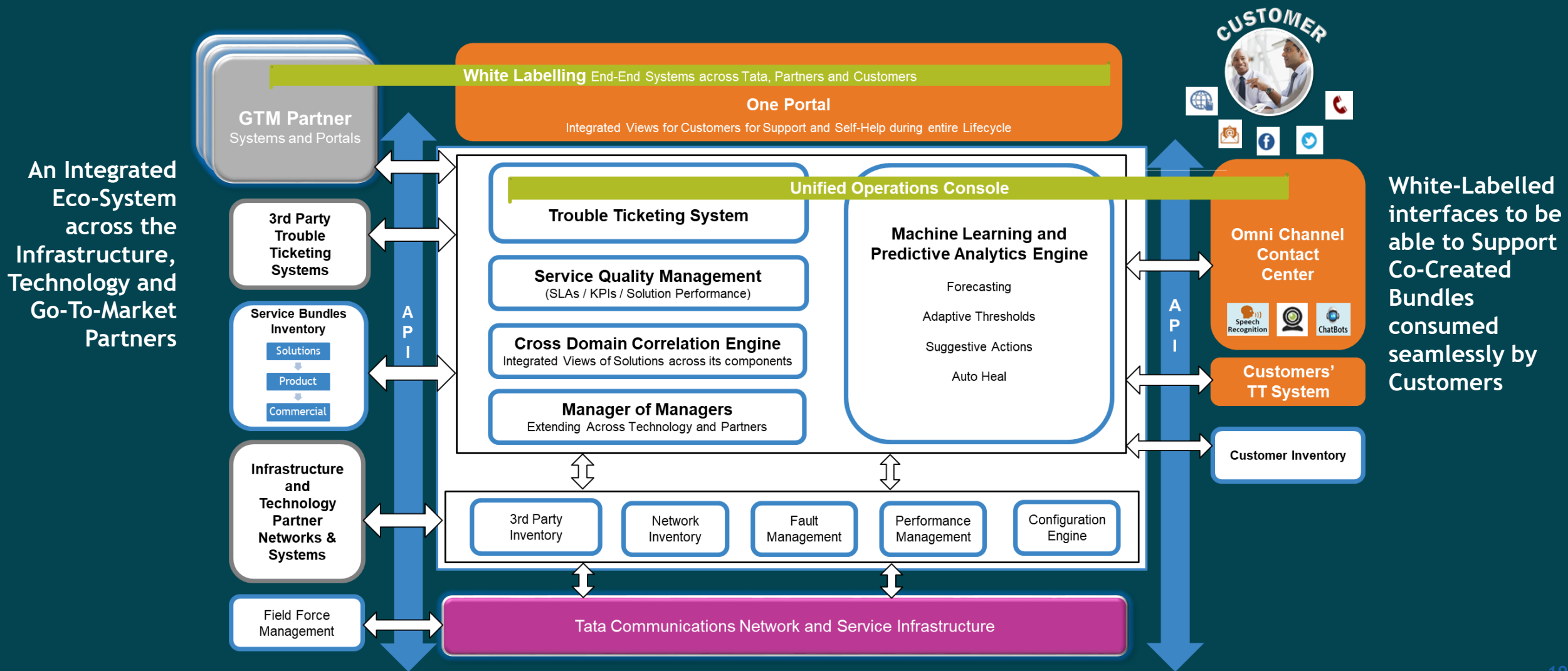
CUSTOMER 360 JOURNEY



LEGEND

- No capability
- Need Improvement
- In Use

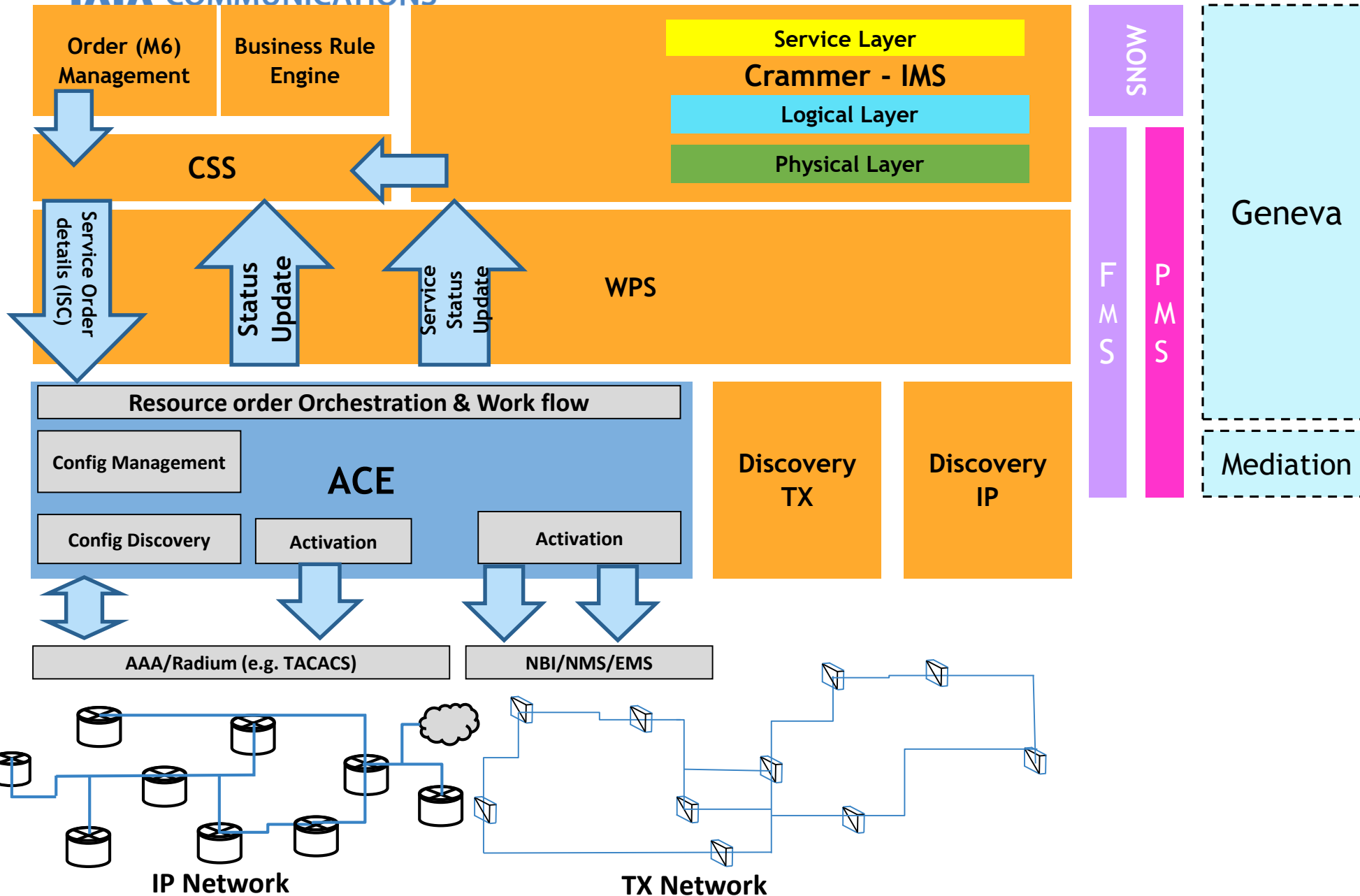
INTELLIGENT DIGITAL SYSTEMS



High level Architecture - ACE Implementation



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1. Netprovision (NetP) is the activation tool for L1,L2 and L3 services
2. CSS - Configuration workflow+ UI for ACE services. Built on IBM BPM 8.01 platform.
3. Talend (MDM) - backend tool of CSS used for storing service inventory instances
4. POS, Cramer and upstream systems provide data to construct the service inventory instance.
5. Integration is through the ESB layer.
6. Note: WPS/BPM is responsible for orchestrating the entire configuration workflow and integrating with the activation tool to send configuration requests.

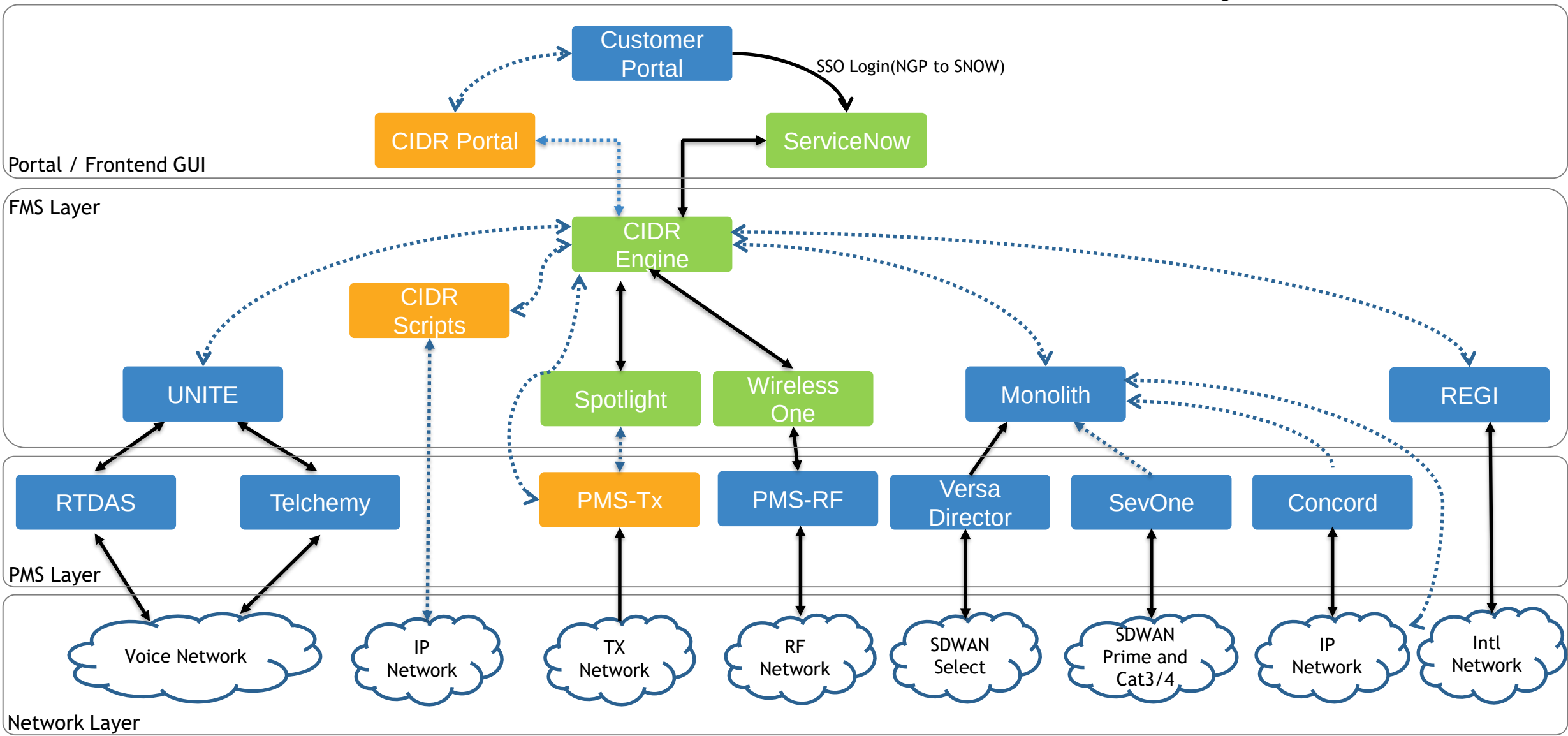
Cross-Domain Integrated Diagnosis and Resolution : Architecture



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- Tool available & Integrated with CIDR
- Tool available but not Integrated with CIDR

- Feature to be developed
- Integration completed
- Integration to be done

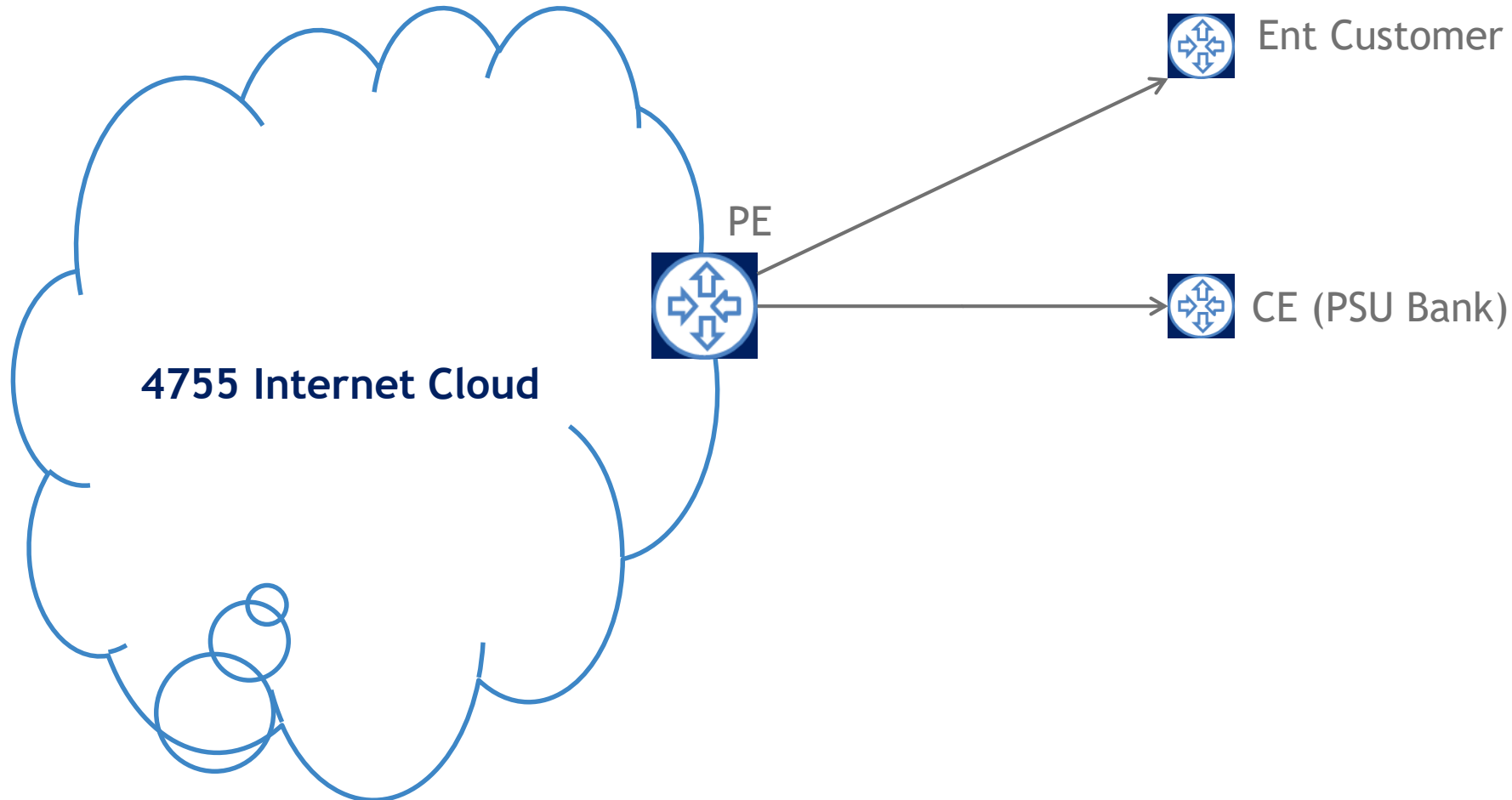




DDOS DETECTION & MITIGATION

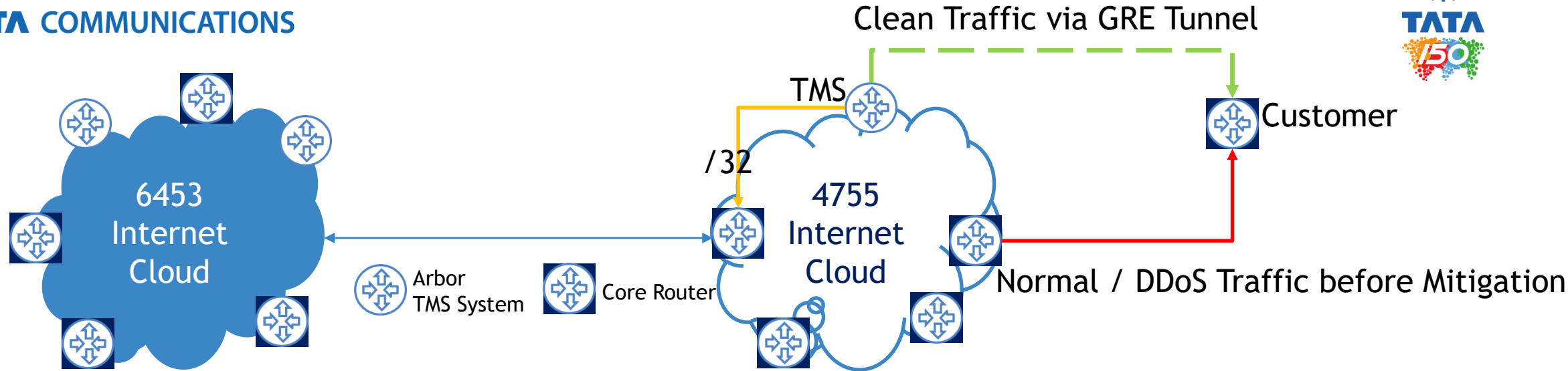
DDOS CASE STUDY - ATTACK ON INDIAN PSU BANK CHOKED BB (RANSOMWARE)

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DDOS DETECTION & MITIGATION - CLEAN PIPE

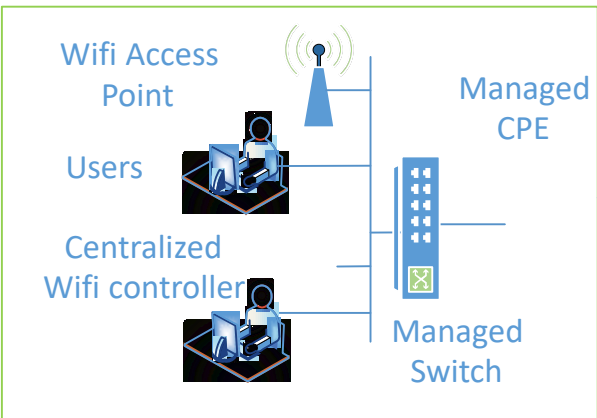
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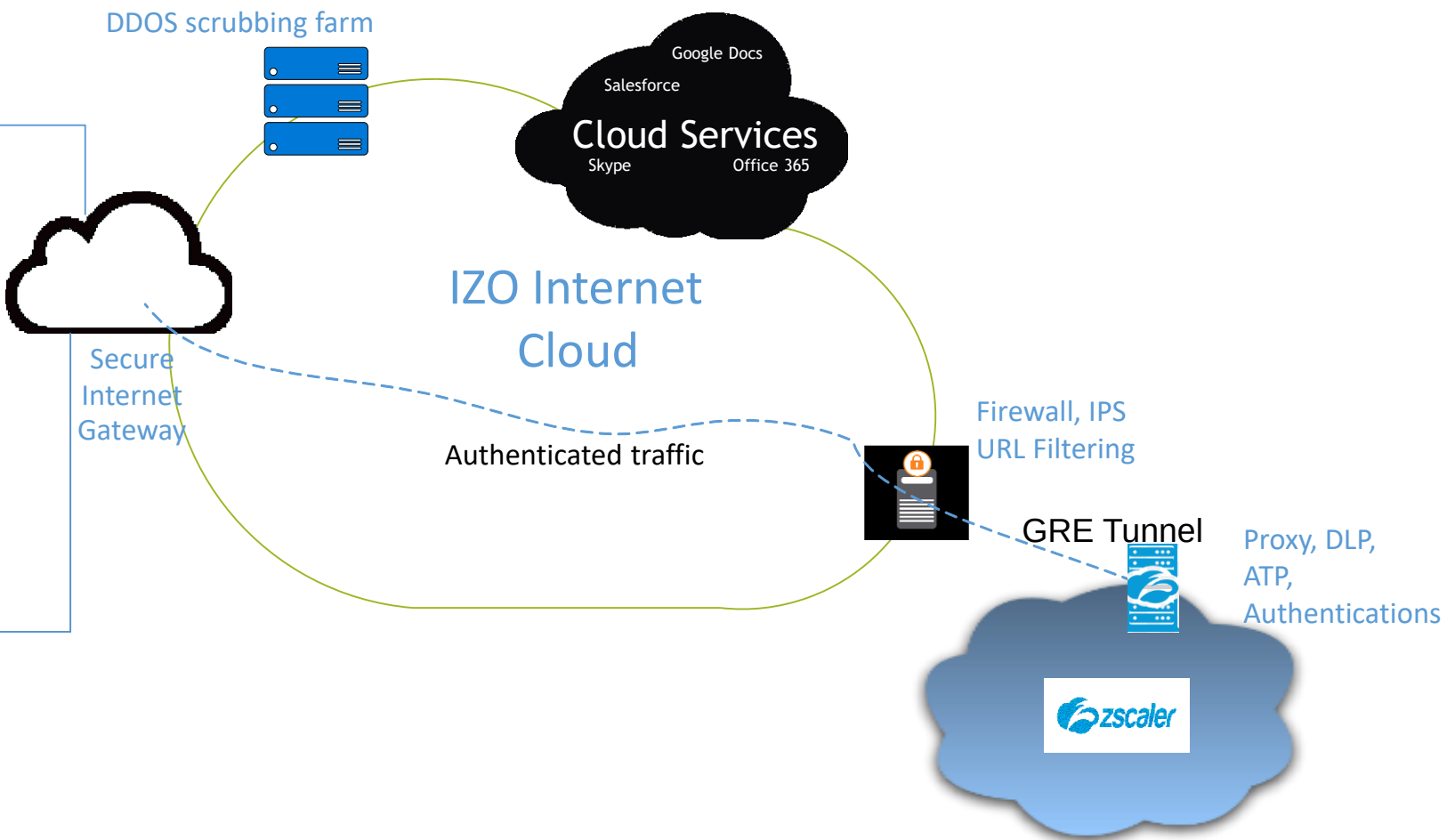
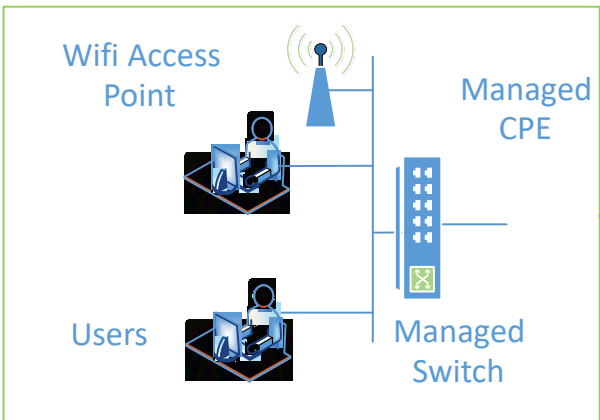
- ✓ NTP Amplification attacks are block-holed using Filter in the juniper routers at perimeter level.
- ✓ Customer initiated block-holing using communities
- ✓ Detection and mitigation using Arbor
- ✓ 13 Mitigation system are deployed in the network
 - Paid service, Managed Objectives created for subscribed customers
 - Enabled detection for TCL (4755) owned IP's, IPNOC block-holes reactively
 - Customer owned IP's to be detected.

Option-1 : Detect & Block-holed by default for TCL owned IPs
Option-2 : Detect & Mitigate : Clean Pipe : Paid Service

Location 1



Location n



SDWAN

Gartner predicts that by 2018, more than 40% of WAN edge infrastructure refresh initiatives will be based on vCPE or SD-WAN appliances versus traditional routers (up from less than 2% today).*

IDC estimates that worldwide SD-WAN infrastructure and services revenues will see a compound annual growth rate (CAGR) of 69.6% and reach \$8.05 billion in 2021.**

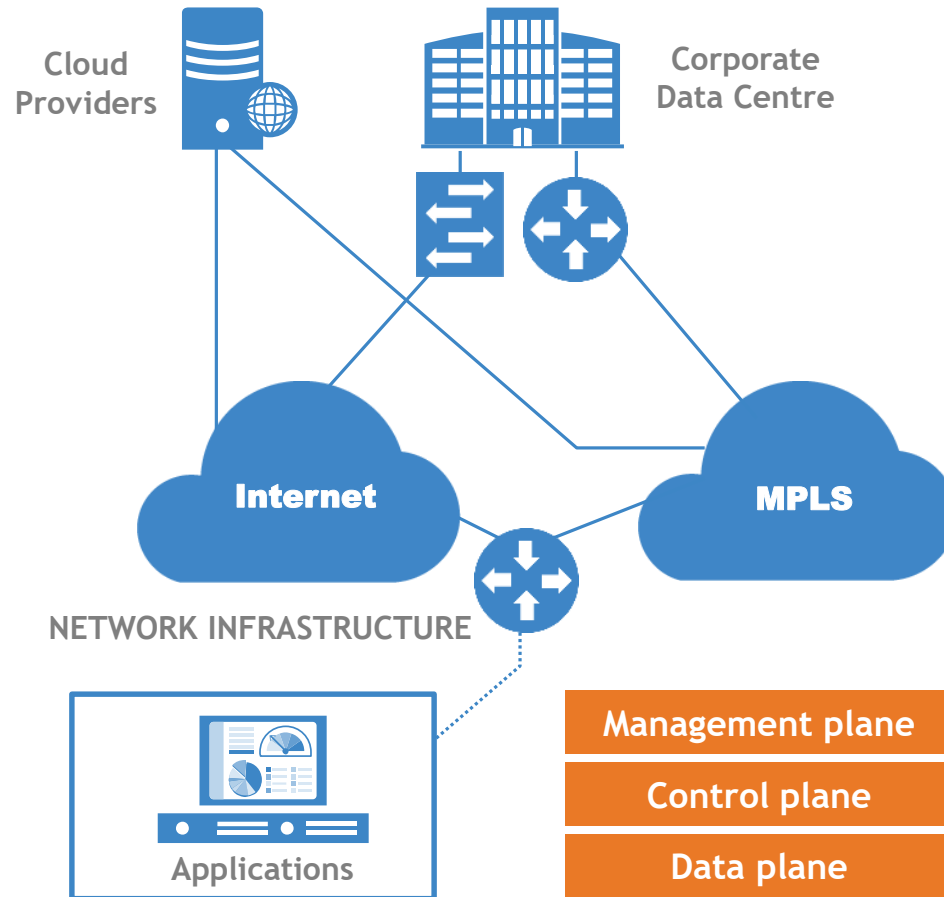
* Gartner: Market Guide for WAN Edge Infrastructure, March 2017

** IDC: Press Release FRAMINGHAM, Mass., July 27, 2017

IS SDWAN THE PATH TO A CLOUD-READY WAN?

What is SDWAN?

- Secure traffic path
- Usage of public and private WANs
- Zero touch install
- Application-aware routing
- Centralised policy manager
- Application traffic reporting and Analytics
- Network technology agnostic



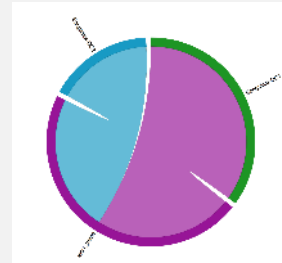
Objectives

- Centralised policy management control
- Fully utilised private and public WAN links
- Intelligent application steering
- Reduced deployment cycles and cost (MACD)

ONLINE VISUALISATION ANALYTICS AND BUSINESS INTELLIGENCE



AUTOMATED TUNNEL CREATION AND TRAFFIC LOAD MANAGEMENT

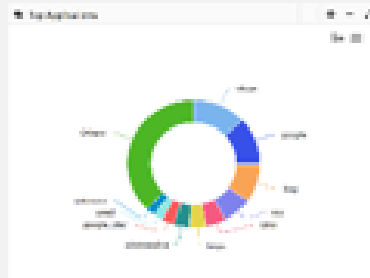


CENTRALISED CONFIGURATION, POLICY MANAGEMENT



A screenshot of a central configuration and policy management interface. It shows a complex web-based dashboard with multiple tabs and sections for managing network policies, configurations, and monitoring. The interface is densely packed with information, including tables and various control elements.

VPN SEGMENTATION AND APPLICATION AWARE ROUTING



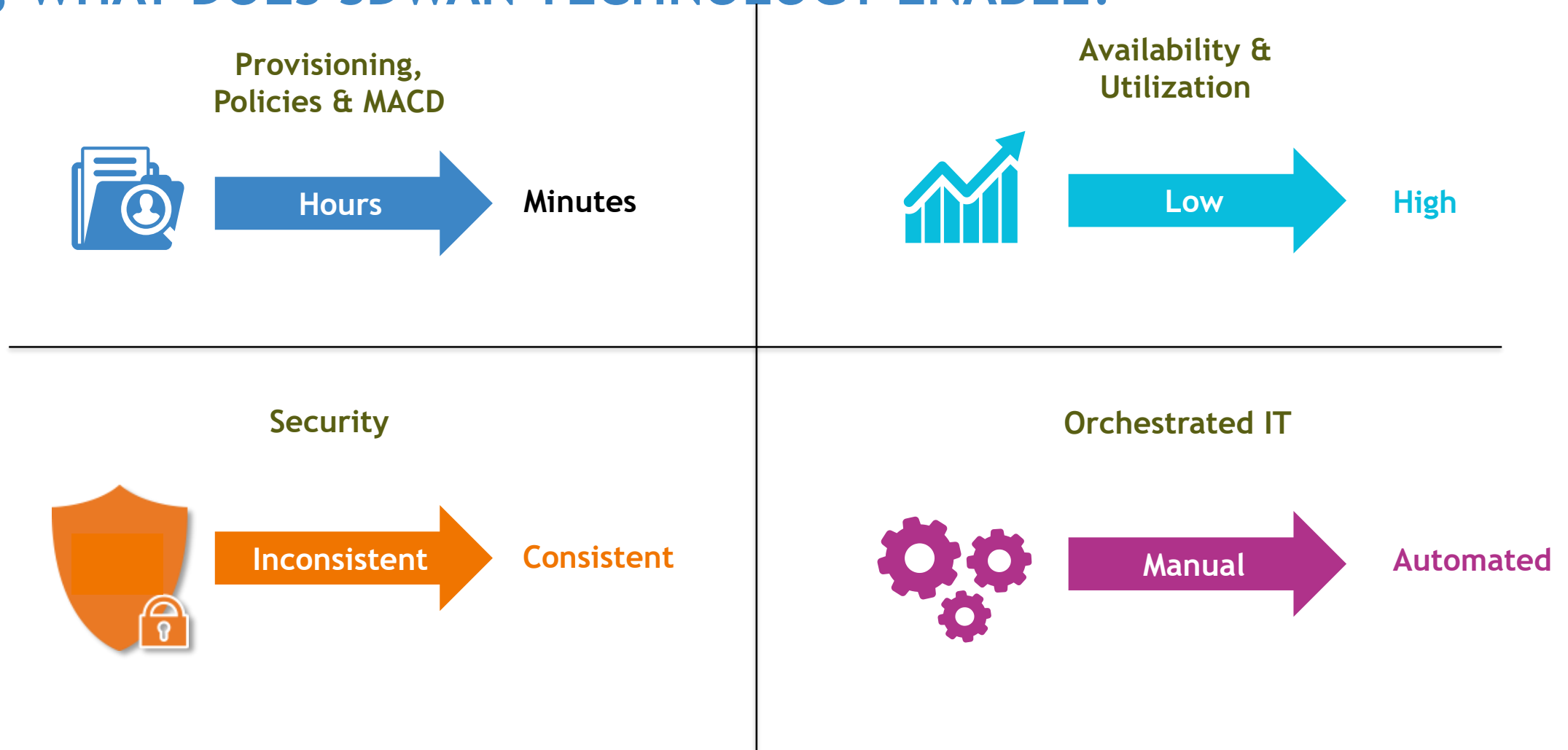
SELF-SERVICE PORTAL AND INSTANT POLICY ENFORCEMENT

Sites		SDWAN policy		App QoS policy		
App QoS profile		App QoS rules				
Name	Applications	URL Categories	Source address	Destination address	QoS profile	
Test2	Google_PLAY				QoS profile1	

NETWORK PLANNING, DESIGN AND ANALYSIS



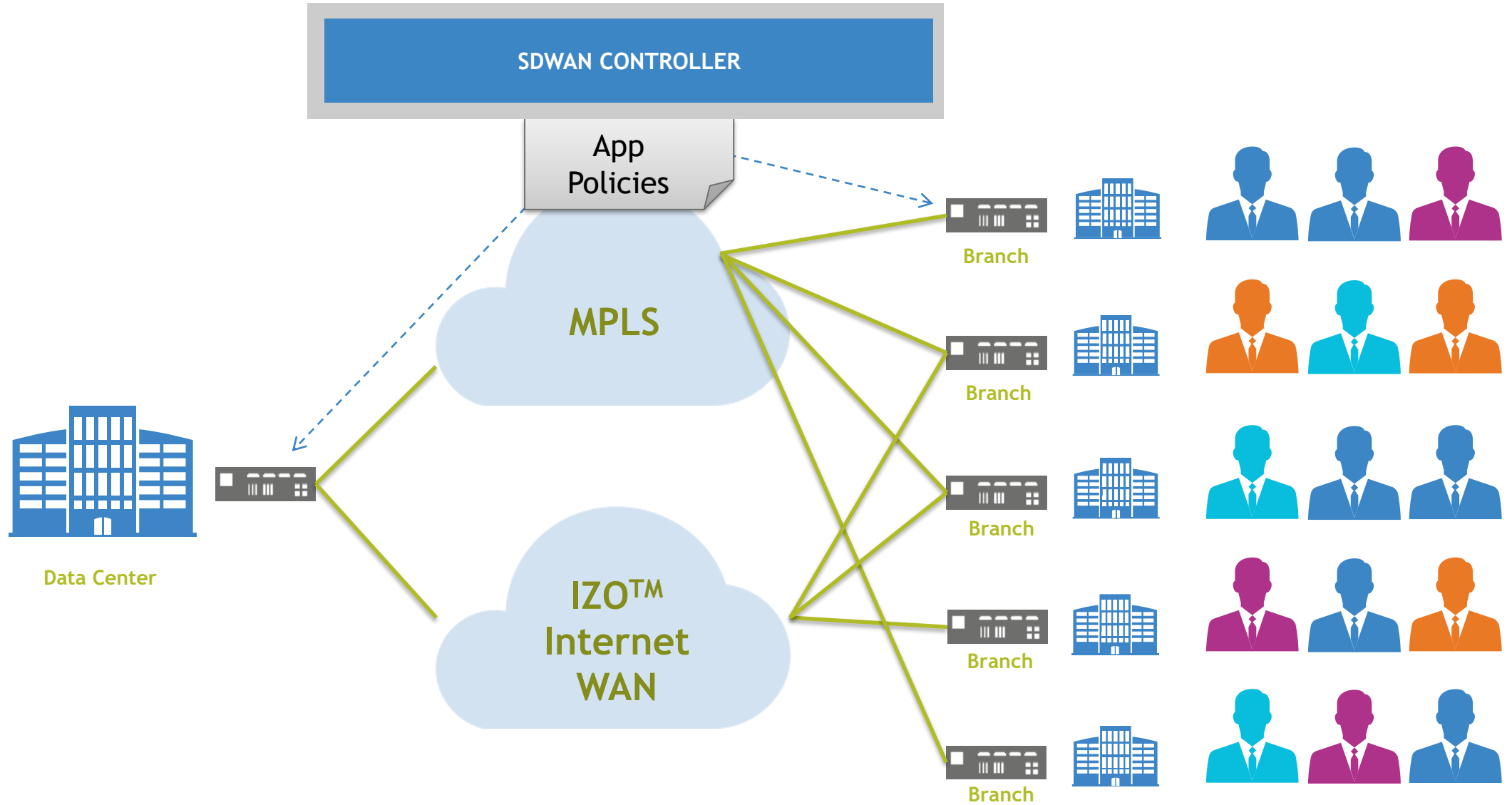
SO, WHAT DOES SDWAN TECHNOLOGY ENABLE?



USE CASE FOR SDWAN

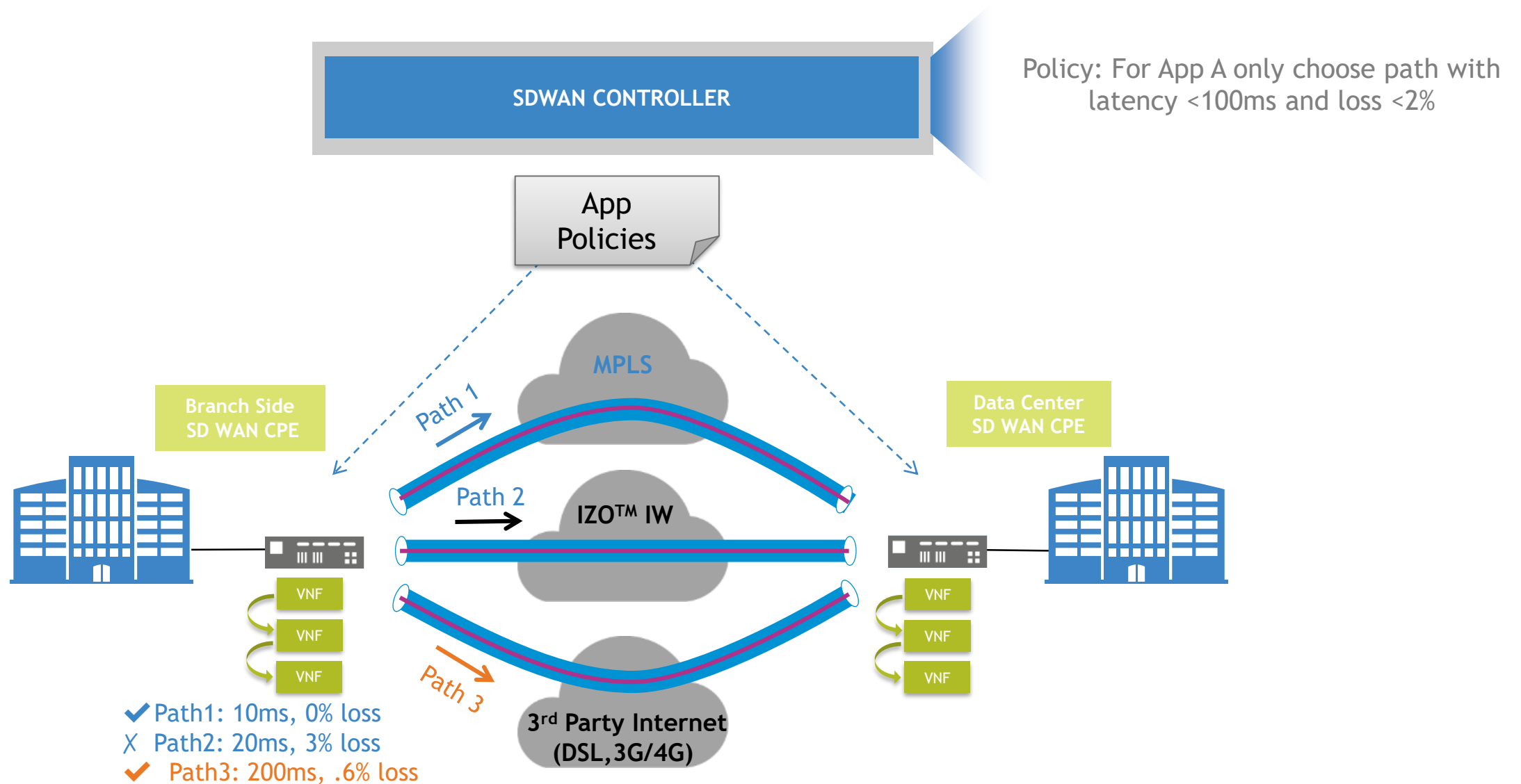
Complex application & SEGMENTATION MANAGEMENT

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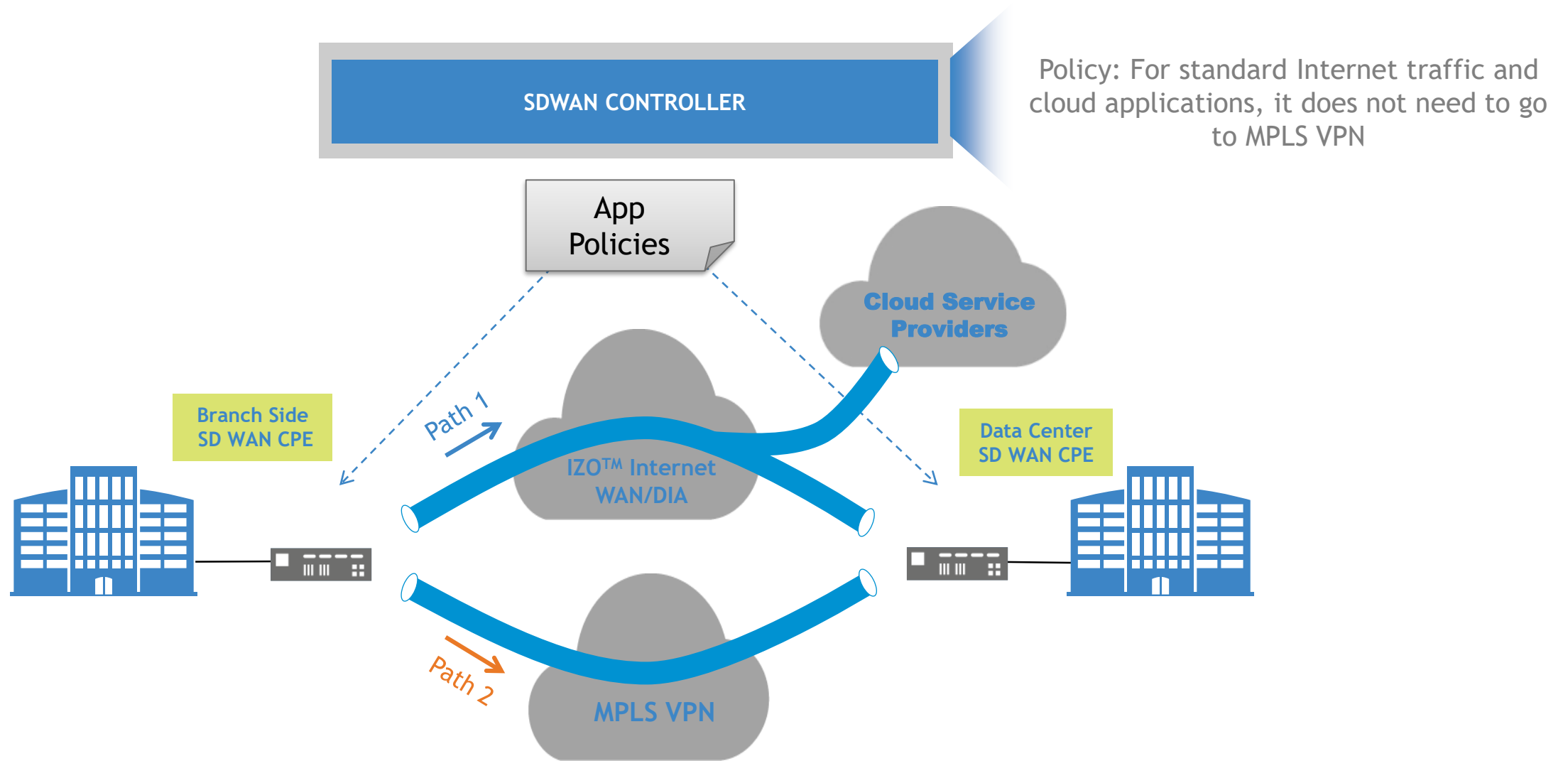
USE CASE FOR SDWAN Flexible branch networking

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USE CASE FOR SDWAN Access to cloud service providers or breakout to internet

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IOT USE CASE - CONNECTED WORKFORCE



CONNECTED ID CARD

An ID card that helps organizations improve employee wellbeing. The features are fully customisable to the specific needs and guidelines of the organization.

The solution runs on Tata Communications' robust LPWAN IoT network, platform and application suite



WELLNESS FEATURES



SOS Button

Employees can send an SoS signal to supervisor in case of an emergency



Audio alarm

The ID generates audio alarm to employee if they reach a hazardous/restricted location



Tracking

Organization can track employee location, enabling automatic attendance, hazard warning etc.



Supervisor Alerts

Receive instant alerts if employees enter restricted or hazardous zones



Enterprise grade managed service
- service delivery and assurance



Configurable Application



Analytics engine

- Reduce emergency incidents and ensure safety

Complete data control and end-to-end enterprise-grade service with solution lifecycle support with KPIs.

- Long lasting battery on devices.
- Long range Indoor/outdoor coverage.



Solution Components	
Safety tracker (“ID Card”)	A Smart device capable of detecting the various beacons, collecting beacon information, sending uplink and alerts via LoRaWAN and receiving messages.
LoRaWAN	Creation of LoRaWAN network infrastructure to ensure reliable functioning of the solution for sending location messages, alarms to the supervisor. Integration of LoRa Network with IoT platform to provide a robust back-end for the system.
BLE Beacon	• BLE beacons would be used to create various zones in the plant area. • BLE Beacon: Demarking and indicating to the Device that the worker is in the plant. A specific zone based on map will be indicated. • Safe Zone: Demarking normal working zones within the plant • Hazardous Zone: Demarking the hazardous area within the Plant
Application	Development of worker tracking application which enables the complete functionality of the solution



Magic Quadrant
for Network Services,
Global 2018



Best Customer Experience
First Time Winner



- Enterprise Telecom Service Provider of the Year—Large Enterprise Segment (Fourth year in a row)
- Enterprise Data Service Provider of the Year (Tenth year in a row)
- IoT New Product/Service Innovation Award (Second year in a row)
- SDWAN (Software-defined WAN) New Product/Service Innovation Award (First time winner, new award category)
- Third Party Managed Hybrid Cloud Provider of the Year (First time winner)
- Conferencing Service Provider of the Year



About Shailesh Gupta

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Shailesh Gupta has graduated in Computer Science & Engineering and acquired Post Graduate Diploma in Operations Management. He has wide experience of 30 Years cutting across IT, Telecom, OEM, ISP/ Managed Service Provider.

Shailesh is presently working as **Vice President & heading Global Service Operations at Tata Communications Limited**. He is Leadership Forum member. Shailesh is **RSSAC Caucus member of ICANN & IPAdmin** of Tata Communications for APNIC, RIPE, ARIN, AFRINIC & LACNIC. Shailesh is also member of **Govt of India Security Council Working Group**.

He held various positions in VSNL/ Tata Communications since 1998. He has played key role in integration of TISL, Dishnet, Direct Internet, Teleglobe. He has been part of Internet Re-launch, MPLS roll out, MMDS/ Wi-Max deployment. Shailesh has led various automation projects like Auto Config Engine (ACE), Proactive Monitoring of IP, Tx & Voice Services. He has set up Global Premium support desk for Top-324 customers of Tata Communications. Shailesh is leading various initiatives to enhance NPS of Tata Communications to 70+.

During his 5 Years tenure as **Scientist- SD** with **National Informatics Center (NICNET), Govt of India**, Shailesh has contributed in multiple projects like General Election, RBI, PIB, UP Government Treasuries etc.

During his 4 Years tenure as **Senior Support Engineer** with **ICL (International Computers Limited), UK** Shailesh has worked on Mainframe S-39, Miniframe & successfully completed projects for IIT, SCB, LIC, SBI, Grindlays etc.

THANK YOU

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