“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
INTERNET PENETRATION IN INDIA

2018

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

URBAN
32.5%
430 Millions

OVERALL

21% Internet Users
187 Million

66% Internet Users
291 Million

1.32 billion

35% Internet Users
500 Million
<table>
<thead>
<tr>
<th>Country or area</th>
<th>Internet users</th>
<th>Rank</th>
<th>Percentage</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>721,434,547</td>
<td>1</td>
<td>52.2%</td>
<td>82</td>
</tr>
<tr>
<td>India</td>
<td>462,124,989</td>
<td>2</td>
<td>34.8%</td>
<td>126</td>
</tr>
<tr>
<td>United States</td>
<td>286,942,362</td>
<td>3</td>
<td>88.22%</td>
<td>15</td>
</tr>
<tr>
<td>Brazil</td>
<td>120,111,118</td>
<td>4</td>
<td>60.1%</td>
<td>67</td>
</tr>
<tr>
<td>Japan</td>
<td>115,111,595</td>
<td>5</td>
<td>89.8%</td>
<td>13</td>
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<tr>
<td>Russia</td>
<td>102,258,256</td>
<td>6</td>
<td>71.3%</td>
<td>46</td>
</tr>
<tr>
<td>Nigeria</td>
<td>86,219,965</td>
<td>7</td>
<td>46.1%</td>
<td>95</td>
</tr>
<tr>
<td>Germany</td>
<td>71,016,244</td>
<td>8</td>
<td>88%</td>
<td>16</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>63,354,000</td>
<td>9</td>
<td>39.20%</td>
<td>112</td>
</tr>
<tr>
<td>Mexico</td>
<td>62,954,584</td>
<td>10</td>
<td>50.84%</td>
<td>85</td>
</tr>
</tbody>
</table>
WE ARE PART OF THE TATA GROUP

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)
CONTINUES INVESTMENT ON IP BACKBONE TO ADDRESS RAPID INTERNET GROWTH

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

Our network enables around 60% of global internet traffic through our global IP backbone.

We operate more than 20 Tbps of IP backbone spanning 6 continents.

Connected to 70% of top 20 content providers and extensive peering partners.

With 21 scrubbing farms spread globally, Tata Communications enables content distribution for business continuity.

100% of our PoPs are PPI-Ready for business continuity.

Global IP backbone connected to 240+ IP POPs in 150+ countries.

STRONG PRESENCE ACROSS 6 CONTINENTS

Over 15,000 Petabytes of internet traffic travel through our global IP backbone.

>20 Tbps capacity
240+ IP PoPs
240,000+ km of Cable
>16,000 Peta bits traffic
>30% of Internet routes share

GLOBAL

>8.5 Tbps
45+ PoPs

America

>10 Tbps
45+ PoPs

Europe

>8.5 Tbps
50+ PoPs

Asia Pacific

>3.5 Tbps
30+ PoPs

MEGACITIES

>1 Tbps
10+ PoPs

In-Built Security

Points of Presence

Capacity

Content Density & Peering

Our awards and recognitions:

Ranked amongst Top 5 Tier-1 (transit-free) IP Service provider globally.

A true global Tier-1 ISP in the Americas with extensive reach to 97% of the world’s GDP.

Gartner is the top-rated CSP for Network Services, Global for 5th consecutive year.

AWARDS AND RECOGNITION

CUSTOMER SEGMENTS:

BALANCED MIX OF CUSTOMERS IN DIFFERENT REGIONS

Enterprises

Cloud Service Providers

Content Providers

Mobile Operators

ISPs

OTTs

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

*Source: Gartner, Magic Quadrant for Network Services, Global, Tallulah Bick of, 11 February 2022.*

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• 115 Pops across India.
• 3-tier Hierarchical topology for better management.
• 9 Tier 1 pops
• 250 Metro E pops
• 23 Tier 2 pops
• 83 Tier 3 pops

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
CORE Layer (P)
Juniper MX-960/480

Distribution Layer (Switch)
Juniper EX4200/4300

Aggregation Layer (PE)
Cisco 7600/7200
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

- IMW: 16% (125*10G)
- EA: 27%
- Other: 10%
- TIC: 30% (72*10G)
- SMW4: 17% (75*10G)
- GULF: 9%

ATL vs PAC distribution

- ATL: 60%
- PAC: 40%
TOOLS & SYSTEMS - AUTOMATION JOURNEY
CUSTOMER 360 JOURNEY

System of Engagements

System of Intelligence

Customer Experience

System of Records

System of Things

LEGEND
- No capability
- Need Improvement
- In Use
INTELLIGENT DIGITAL SYSTEMS

Generating Business Value for Customer
Leveraging Information Systems for Digital interactions

Taking the Journey of Customer transactions from Proactive to Predictive to Anticipatory

Implement Workflow Automation and integration with Field and Partners
Improve Depth of Monitoring Capabilities on New Services
Leveraging Analytics and AI on Customer Interactions
Cross Domain Service Impact Correlation
Integrated SLA and KPI Management
Deploy Omnichannel Touchpoints including Social Media platforms integration

An Integrated Eco-System across the Infrastructure, Technology and Go-To-Market Partners

White Labelling: End-to-End Systems across Tata, Partners, and Customers

Unified Operations Console

Machine Learning and Predictive Analytics Engine
- Forecasting
- Adaptive Thresholds
- Suggestive Actions
- Auto Heal

Manager of Managers
Extending Across Technology and Partners

3rd Party Inventory
Network Inventory
Fault Management
Performance Management
Configuration Engine

Tata Communications Network and Service Infrastructure

Omni Channel Contact Center

API

Customers’ TT System

White-Labelled interfaces to be able to Support Co-Created Bundles consumed seamlessly by Customers

White Labelling: End-to-End Systems across Tata, Partners, and Customers

One Portal
Integrated Views for Customers for Support and Self-help during entire Lifecycle

3rd Party Trouble Ticketing Systems
Service Bundles Inventory
Service Baskets

Infrastructure and Technology Partner Networks & Systems
Field Force Management

API

Customer Inventory

“TO-BE” FRAMEWORK
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

- **ServiceNow**
- **Customer Portal**
- **CIDR Portal**
- **CIDR Engine**
- **SSO Login (NGP to SNOW)**
- **Portal / Frontend GUI**

**FMS Layer**
- **UNITE**
- **CIDR Scripts**
- **Spotlight**
- **Wireless One**
- **Monolith**

**PMS Layer**
- **RTDAS**
- **Telchemy**
- **PMS-Tx**
- **PMS-RF**
- **Versa Director**
- **SevOne**
- **Concord**

**Network Layer**
- **Voice Network**
- **IP Network**
- **TX Network**
- **RF Network**
- **SDWAN Select**
- **SDWAN Prime and Cat3/4**
- **IP Network**
- **Intl Network**

Legend:
- Green: Tool available & Integrated with CIDR
- Blue: Tool available but not Integrated with CIDR
- Orange: Feature to be developed
- Black: Integration completed
- Grey: Integration to be done
DDOS CASE STUDY - ATTACK ON INDIAN PSU BANK CHOKED BB (RANSOMWARE)

4755 Internet Cloud

PE

Ent Customer

CE (PSU Bank)
✓ 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
CLEAN INTERNET SOLUTION

Location 1

- Wifi Access Point
- Users
- Centralized Wifi controller
- Managed CPE
- Managed Switch

DDOS scrubbing farm

- Secure Internet Gateway
- Authenticated traffic

IZO Internet Cloud

Cloud Services
- Google Docs
- Salesforce
- Skype
- Office 365

Authenticated traffic

GRE Tunnel

- Proxy, DLP, ATP, Authentications

Location n

- Wifi Access Point
- Users
- Managed CPE
- Managed Switch
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
**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)

**Is SDWAN the Path to a Cloud-Ready WAN?**

![Diagram illustrating network infrastructure, cloud providers, corporate data centre, and management plane, control plane, data plane relationships.](image-url)
EMPOWERING CUSTOMERS - BUILD, AUTOMATE, SCALE, SECURE AND VISUALISE THEIR NETWORK

ONLINE VISUALISATION ANALYTICS AND BUSINESS INTELLIGENCE

AUTOMATED TUNNEL CREATION AND TRAFFIC LOAD MANAGEMENT

CENTRALISED CONFIGURATION, POLICY MANAGEMENT

VPN SEGMENTATION AND APPLICATION AWARE ROUTING

SELF-SERVICE PORTAL AND INSTANT POLICY ENFORCEMENT

NETWORK PLANNING, DESIGN AND ANALYSIS
SO, WHAT DOES SDWAN TECHNOLOGY ENABLE?

- **Provisioning, Policies & MACD**
  - Hours: Manual, Inconsistent
  - Minutes: Automated, Consistent

- **Availability & Utilization**
  - Low: Manual
  - High: Automated

- **Security**
  - Inconsistent
  - Consistent

- **Orchestrated IT**
  - Manual
  - Automated
USE CASE FOR SDWAN

Complex application & SEGMENTATION MANAGEMENT

SDWAN CONTROLLER

App Policies

MPLS

IZOTM

Internet WAN

Data Center

Branch

Branch

Branch

Branch

CRM

EMAIL

R&D

HRMS

SAP

SFDC
Policy: For App A only choose path with latency <100ms and loss <2%.
USE CASE FOR SDWAN

Access to cloud service providers or breakout to internet

Policy: For standard Internet traffic and cloud applications, it does not need to go to MPLS VPN.
**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

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SOS Button</strong></td>
<td>Employees can send an SoS signal to supervisor in case of an emergency.</td>
</tr>
<tr>
<td><strong>Audio alarm</strong></td>
<td>The ID generates audio alarm to employee if they reach a hazardous/restricted location.</td>
</tr>
</tbody>
</table>

### LOCATION FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tracking</strong></td>
<td>Organization can track employee location, enabling automatic attendance, hazard warning etc.</td>
</tr>
<tr>
<td><strong>Supervisor Alerts</strong></td>
<td>Receive instant alerts if employees enter restricted or hazardous zones.</td>
</tr>
</tbody>
</table>

### MANAGED SERVICES

- 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.
## OVERVIEW OF THE SYSTEM REQUIREMENTS

### Solution Components

<table>
<thead>
<tr>
<th>Solution Components</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety tracker (“ID Card”)</td>
<td>A Smart device capable of detecting the various beacons, collecting beacon information, sending uplink and alerts via LoRaWAN and receiving messages.</td>
</tr>
<tr>
<td>LoRaWAN</td>
<td>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.</td>
</tr>
</tbody>
</table>
| 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 |
ANALYST AWARDS

Gartner

Magic Quadrant for Network Services, Global 2018

MEF AWARDS 2018
Wholesale Service Provider APAC

Frost & Sullivan

2018 BEST PRACTICES AWARD

- 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

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.

Email: shailesh.gupta@tatacommunications.com  Mobile : +91 9223276162/ +91 7208076162
THANK YOU

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