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Agenda

• Changing telecom landscape
• Impact on
  ▪ Operator & Tower companies
  ▪ Regulatory landscape
• Opportunities
• Bharti Infratel 2.0
## Changing telecom landscape

<table>
<thead>
<tr>
<th>Year</th>
<th>1G</th>
<th>2G</th>
<th>3G</th>
<th>4G</th>
<th>5G</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>900 MHz, 1800 MHz</td>
<td>900 MHz, 2100 MHz</td>
<td>850MHz, 1800 MHz, 2300MHz</td>
<td>&lt;1 GHz, 1-6 GHz, &gt;6 GHz</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>64 kbps</td>
<td>2 Mbps</td>
<td>200 Mbps</td>
<td>&gt;1 Gbps</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>500 -1000 ms</td>
<td>50 - 200 ms</td>
<td>25 – 100 ms</td>
<td>&lt;= 1 ms</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With M2M and IoT, the number of devices continue to increase.
Trends

• Voice to data demand
• Increasing data speeds
• Technology cycle shrinking
• Band to ‘Bandwidth’ for higher speeds
• Bandwidth only in higher bands; i.e. need higher frequencies
• Better user experience necessitates lower latency demands
• Favorable regulatory environment for Infrastructure
Impact

• Uniform high speeds require site densification
• Higher frequency signals travel lesser distances
• Fiber a necessity to backhaul
• Capex requirements going up and hence sharing is imperative
• Service differentiation would be the key
User speed reduces with distance from site

Site densification needed to give uniform speeds for applications
More sites required for coverage on higher frequency

<table>
<thead>
<tr>
<th>Base frequency band</th>
<th>New frequency band</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>900 MHz</td>
</tr>
<tr>
<td>900 MHz</td>
<td>1.0x</td>
</tr>
<tr>
<td>1800 MHz</td>
<td></td>
</tr>
<tr>
<td>2100 MHz</td>
<td></td>
</tr>
<tr>
<td>2300 MHz</td>
<td></td>
</tr>
<tr>
<td>2600 MHz</td>
<td></td>
</tr>
</tbody>
</table>

Source: Analysys Mason
High backhaul capacity needs call for Fiber

Drivers for fiber
- Microwave capacity limitations
- Low latency demands
- Losses due to large distances
- Poor wireline availability
- More data is consumed indoors

<table>
<thead>
<tr>
<th>Backhaul Capacity per BTS</th>
<th>2G</th>
<th>2 – 4 Mbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G</td>
<td>12 – 30 Mbps</td>
<td></td>
</tr>
<tr>
<td>4G</td>
<td>30 – 120 Mbps</td>
<td></td>
</tr>
<tr>
<td>5G</td>
<td>&gt; 1 Gbps</td>
<td></td>
</tr>
</tbody>
</table>

% Fiberized Networks
- China ~85%
- US ~80%
- Global ~50%
- India ~25%

Increasing investment by operators

### Spectrum

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(Rs bn)</td>
<td>1,063</td>
<td>94</td>
<td>672</td>
<td>1,099</td>
<td>658</td>
<td>3,585</td>
</tr>
<tr>
<td>(USD bn)</td>
<td>15.9</td>
<td>1.4</td>
<td>10.1</td>
<td>16.4</td>
<td>9.8</td>
<td>53.7</td>
</tr>
</tbody>
</table>

### Non-Spectrum *

<table>
<thead>
<tr>
<th>Capital investment</th>
<th>FY15</th>
<th>FY16</th>
<th>FY17</th>
<th>FY18</th>
<th>FY19 (H1 annualized)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Rs. Bn)</td>
<td>219</td>
<td>280</td>
<td>296</td>
<td>337</td>
<td>372</td>
</tr>
<tr>
<td>(USD Bn)</td>
<td>3.3</td>
<td>4.2</td>
<td>4.5</td>
<td>5.1</td>
<td>5.6</td>
</tr>
</tbody>
</table>


Sharing is imperative
Growth trends with 4G launch

With increasing penetration of 4G and implementation of 5G, a bigger leap is expected

Source: TRAI reports
Consolidation in operator landscape…

Larger and stronger operators to take on data led opportunities
Operator consolidation impact on Bharti Infratel

Churn since Q1 FY17 in consolidated Bharti Infratel

Source: Company filings

Worst behind us, industry impact significantly higher
Leading to consolidation in tower market

Key Players

OpCo owned towers

Other players

Changing landscape as we head towards more independent tower companies
Changing regulatory landscape
Vision

India’s transition to a digitally empowered economy and society by fulfilling ICT needs of citizens and enterprises by establishment of a ubiquitous, resilient and affordable Digital Communications Infrastructure and Services.

Missions

- **Connect India**: Creating Robust Digital Communications Infrastructure
- **Propel India**: Enabling Next Generation Technologies and Services through Investments, Innovation and IPR generation
- **Secure India**: Ensuring Sovereignty, Safety and Security of Digital Communications

Strategic Objectives (to be accomplished by 2022)

1. Provisioning of Broadband for All
2. Creating 4 Million additional jobs in the Digital Communications sector
3. Enhancing the contribution of the Digital Communications sector to 8% of India’s GDP from ~ 6% in 2017
4. Propelling India to the Top 50 Nations in the ICT Development Index of ITU from 134 in 2017
5. Enhancing India’s contribution to Global Value Chains
6. Ensuring Digital Sovereignty

Progressive, forward looking policy with Infrastructure focus

Source: National Digital Communications Policy 2018
Impact on tower companies

Key takeaways

- Cabling (IBS) for buildings compulsory through NBC
- 60% towers fiberization
- Accelerated rollout of fiber in government premises
- Common service ducts alongside roads / highways
- Incentives and exemptions for tower construction
- Ease in rollout of fiber
- Incentivizing clean energy for sites
- Scope enhancement of IP1s to include active infrastructure

Government realizing the importance of Neutral Hosts; paving way for NetCo

Source: National Digital Communications Policy 2018
Opportunities
Multipler effect on data consumption

Growth in voice usage

Growth in data usage

Capacity = No. of users \times Usage per user

Data, unlike voice, is not limited by number of subscribers or usage
Mobile subscriptions forecast

3.5 Bn 4G subscriptions against <2Bn 4G subscriptions as envisaged in 2014

4G technology adoption exceeded expectations by over 2X

Source: Ericsson Mobility Report November 2018 and 2014
Different kinds of sites

**Improve macro**
More spectrum, Multi Carrier, MIMO, Advanced Antennas, etc

**Densify**
Additional Macro

**Add “Small Cell”**
Macro + "Small Cells"

- Higher data rates
- Higher capacity
- Very high data rates
- Very high capacity
How densification will play out

- Improve
- Densify
- Add

Area traffic density

- Dense urban
- Urban
- Suburban
- Rural

Improve
Densify
Add
Working towards a service differentiation

Existing sites

- airtel: 180k
- vodafone idea: 200k
- jio: > 220k

Would have to catch up / rationalize

Market growth will be led by macro densification and small cells

Source: Company fillings, Street estimates, News reports
New type of opportunities will emerge

Current opportunities
› Macro densification
› In-building solutions (IBS)
› Smartly placed “small cells”

Adjacent opportunities
› Wi-Fi complementing 3GPP access
› Fiber backhaul for high capacity BTS Sites
› BTS hotels / Outdoor DAS
› Managed Services
› NetCo
› Data Center

Number of Sites will increase; but new type of sites will start to emerge
Bharti Infratel 2.0
Company Strategy

Promote Passive Infrastructure Sharing

- Organic Growth and Acquisition Opportunities
- Capitalize on opportunities of Data growth, Digital India, Smart Cities Initiatives of Government

Achieving Cost Efficiencies Across Tower Portfolios

Increasing Revenue and Capital Productivity
Investment Thesis

- Largest Indian Towerco with over 1.9x Sharing Factor
- Demonstrated Operational and Financial Performance
- Insulated from Major Concerns - $-Re, Leverage, Import Dependence
- Operator Agnostic Way to Benefit from Data Growth
- Experienced Management Team
- Regulatory Environment Favorable
- High Standards of Corporate Governance
Bhopal Smart City: Architecture

Energy saving from LED lighting

Monetisation:
- Revenue from mobile service providers
- Wi-Fi
- Fibre
- Advertisement

City owned secure data processing & management system at Command Centre

Use of Free frequency/3G/4G/Fibre

Great showcase to demonstrate the model and capability

<table>
<thead>
<tr>
<th>Item</th>
<th>Deployed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Pole</td>
<td>150</td>
</tr>
<tr>
<td>LED Lights</td>
<td>21000</td>
</tr>
<tr>
<td>WiFi Hotspot</td>
<td>100</td>
</tr>
<tr>
<td>CCTV</td>
<td>100</td>
</tr>
<tr>
<td>OFC</td>
<td>200 Km</td>
</tr>
<tr>
<td>Sensors</td>
<td>50</td>
</tr>
<tr>
<td>Mobile App</td>
<td>1</td>
</tr>
<tr>
<td>Command and control center</td>
<td>1</td>
</tr>
<tr>
<td>Smart Billboard</td>
<td>150</td>
</tr>
</tbody>
</table>
Smart City expertise

- Setting up of infrastructure which will include poles, micro sites and fiberized backhaul
- PPP long term contracts
- Shared ICT infrastructure is the key enabler of the smart city
Opportunities for Infratel

• Existing areas of business
  ▪ Maximizing organic business
  ▪ Small Cell
  ▪ In Building Solutions

• New areas
  ▪ Fiber sharing
  ▪ Wi-Fi
  ▪ Smart cities
  ▪ BTS Hotel
  ▪ Managed services

• Selectively evaluate inorganic growth

5G will bring opportunities for NetCo and Data Center
Thank you

8th January 2019
## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>3GPP</td>
<td>3rd Generation Partnership Project</td>
</tr>
<tr>
<td>Bn</td>
<td>Billion</td>
</tr>
<tr>
<td>BTS</td>
<td>Base Transceiver System</td>
</tr>
<tr>
<td>CCTV</td>
<td>Closed Circuit Television</td>
</tr>
<tr>
<td>DAS</td>
<td>Distributed Antenna System</td>
</tr>
<tr>
<td>FY</td>
<td>Fiscal Year</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>IBS</td>
<td>In-Building Solutions</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communication Technology</td>
</tr>
<tr>
<td>IoT</td>
<td>Internet of Things</td>
</tr>
<tr>
<td>ITU</td>
<td></td>
</tr>
<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
</tr>
<tr>
<td>MHz / GHz</td>
<td>Mega / Giga Hertz</td>
</tr>
<tr>
<td>MB / GB</td>
<td>Megabyte / Gigabyte</td>
</tr>
</tbody>
</table>
## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIMO</td>
<td>Multiple Input Multiple Output</td>
</tr>
<tr>
<td>MoU</td>
<td>Minutes of Usage</td>
</tr>
<tr>
<td>Ms</td>
<td>Milliseconds</td>
</tr>
<tr>
<td>M2M</td>
<td>Machine to Machine</td>
</tr>
<tr>
<td>NDCP</td>
<td>National Digital Communications Policy</td>
</tr>
<tr>
<td>NetCo</td>
<td>Network Company</td>
</tr>
<tr>
<td>OFC</td>
<td>Optical Fiber Cable</td>
</tr>
<tr>
<td>Rs / Re</td>
<td>Rupees</td>
</tr>
<tr>
<td>Towerco</td>
<td>Tower Company</td>
</tr>
<tr>
<td>USD</td>
<td>United States Dollar</td>
</tr>
<tr>
<td>Wi-Fi</td>
<td>Wireless Fidelity</td>
</tr>
</tbody>
</table>