Strengthening connections today, while building for tomorrow.

Wireless broadband, small cells and 5G
Our Georgia communities are increasingly turning to wireless networks and mobile technology to operate smarter and more efficiently.

Georgians are rapidly abandoning landlines in favor of mobile phones making reliable wireless connectivity at home an important consideration for home buyers and renters.

- >50% of Georgia households have moved away from landlines and are wireless-only.
- The average North American home had 14.7 connected devices in Q2 2016.
- 67% of Americans moving to a new community rank reliable wireless as more of a must-have than good schools (65%) and affordable housing (60%).

The Way Georgia Communicates is Changing...

Georgians are increasingly turning to wireless networks and mobile technology

From 2000-2016, Georgia has seen:

- 292% increase in wireless phone subscribers¹
- 5,440% increase in broadband subscribers²
- 68% decrease in switched access lines³
- 18% increase in population⁴

Growth of Wireless-Only Households in Georgia¹:

1 CDC National Health Statistics Wireless Substitution Reports

1 FCC Local Competition Report May 2001 (as of 12/31/00), Table 9; FCC Voice Telephone Services Report February 2018 (as of 12/31/16), Supplemental Table 1.
² FCC High-Speed Services for Internet Access: Status as of December 2000 (Table 7); FCC Internet Access Service Report February 2018 (as of 12/31/16) *Connections/lines over 200 Kbps.
³ FCC Local Competition Report May 2001 (as of 12/31/00), FCC Voice Telephone Services Report April 2017 (as of 06/30/16), Supplemental Table 1.
⁴ U.S. Census Bureau Quick Facts 2016 (July 1) Estimate Nevada; U.S. Census Bureau Nevada 2000.
What the demand looks like on AT&T’s network

Data usage on AT&T’s network has increased more than 360,000% since 2007

Wireless Usage MB

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Why Small Cells?

• Support rapid increases in data usage and mobile applications;

• Handle the growing number of new connected devices in marketplace;

• Prepare our network for the next generation of technologies and services – like 5G, AirGig, the Internet of Things and smart cities; and,

• Position Georgia as a leader in connectivity and help ensure the state has the 21st century infrastructure needed to remain the #1 state to do business.
The footprint, or service area, of a site is determined by height and frequency band.

**Macrocell (4G LTE)**
The common form factor for wireless communication. Higher height and lower frequencies used result in the larger service area.

**Current Small Cell (4G LTE)**
Uses the same frequencies as macrocells, in addition to utilizing unlicensed spectrum. Due to lower height, footprint is smaller. Increases capacity or coverage in target areas.

**Future Small Cell (5G)**
Very high frequencies enabled by future 5G technology result in smaller footprint, but can be used in future 5G in order to meet the exponential increased capacity demand. These frequencies are not used for wireless service today.

- Heights and service areas are approximations
- Small cell sites supplement vs. replace macrocell sites
Illustration: Leveraging Common Infrastructure to Implement Small Cells
Examples of Small Cells deployed in our communities
Cell sites are often supporting various generations of wireless technology. As new generations of technology are deployed, customers migrate over to the newer technology over time requiring their continued support. These cell sites help provide you with the fast network coverage you’ve come to expect from AT&T.

- **GPRS** Theoretical Peak: 48 Kbps
- **EDGE** Theoretical Peak: 237 Kbps
- **UMTS** Theoretical Peak: 384 Kbps
- **HSDPA** Theoretical Peak: 3.6 Mbps
- **HSPA 7.2** Theoretical Peak: 7.2 Mbps
- **HSPA+** Theoretical Peak: 21.6 Mbps (est)
- **LTE** Theoretical Peak: 73 Mbps (est)
- **LTE+** Theoretical Peak: 450 Mbps (est)
- **5G** Theoretical Peak: 10 Gbps (est)

**Can Deliver 4G Speeds with Enhanced Backhaul**

- Consistent with worldwide global standards for GSM device
- Lets you use your device globally

**Timeline:**
- **2005**
- **2011**
- **2015**
## AT&T’s Leadership Roles in Delivering the Value of 5G to Transportation: *at a glance*

| **17.8M** Connected Cars on AT&T Network |
| **25** Major Global Auto and Truck Brands |
| **2.7M** Connected Fleet Vehicles |
| **Global Solutions in 200+ Countries and Territories** |

### Driving Innovation

- **Global Alliances** – 5GAA, NGMN, ITSA, GSMA, Auto ISAC, TSR
- **Exclusive Carrier for the American Center for Mobility**
- **AT&T Drive Studio – Development and Research Center**

* as of 3Q2017
But Where is That Intersection of 5G and Automotive?

- Software and Firmware Over-the-Air (SOTA/FOTA)
- "Remote" Driving + Vehicle Assist
- HD Mapping + Vehicle Navigation and Path Planning
- Augmented + Virtual Reality Entertainment Services
Mobility speeds – faster...faster...faster.

- Ongoing advancements in wireless technology are crucial pieces of the economic development puzzle.
- Accenture estimates the telecom operators are expected to invest about $275 billion in infrastructure over the next 7 years, creating up to 3 million jobs.
- **500 new construction jobs** will be created each year over the estimated 7 year buildout.
- **120,000 new jobs** will be created each year over the first 7 years of deployment.

In Georgia cities, Smart City technology and 5G investments are expected to have the following economic impact:

<table>
<thead>
<tr>
<th>City</th>
<th>Population</th>
<th>Jobs</th>
<th>GDP Growth</th>
<th>Network Investment</th>
<th>Smart Grid &amp; Transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlanta</td>
<td>456,002</td>
<td>1,256</td>
<td>$694M</td>
<td>$375M</td>
<td>$263.21M</td>
</tr>
<tr>
<td>Albany</td>
<td>73,801</td>
<td>689</td>
<td>$112M</td>
<td>$61M</td>
<td>$42.6M</td>
</tr>
<tr>
<td>Athens</td>
<td>123,371</td>
<td>1,152</td>
<td>$188M</td>
<td>$101M</td>
<td>$71.21M</td>
</tr>
<tr>
<td>Blue Ridge</td>
<td>1,391</td>
<td>13</td>
<td>$2M</td>
<td>$1M</td>
<td>$0.42M</td>
</tr>
<tr>
<td>Valdosta</td>
<td>56,474</td>
<td>527</td>
<td>$86M</td>
<td>$46M</td>
<td>$32.6M</td>
</tr>
<tr>
<td>Macon-Bibb</td>
<td>152,555</td>
<td>1,424</td>
<td>$232M</td>
<td>$125M</td>
<td>$88.06M</td>
</tr>
<tr>
<td>Augusta</td>
<td>197,081</td>
<td>1,840</td>
<td>$300M</td>
<td>$162M</td>
<td>$113.76M</td>
</tr>
<tr>
<td>Columbus</td>
<td>197,485</td>
<td>1,843</td>
<td>$301M</td>
<td>$162M</td>
<td>$113.99M</td>
</tr>
<tr>
<td>Rome</td>
<td>36,407</td>
<td>340</td>
<td>$55M</td>
<td>$30M</td>
<td>$10.88M</td>
</tr>
<tr>
<td>Savannah</td>
<td>146,763</td>
<td>1,370</td>
<td>$223M</td>
<td>$121M</td>
<td>$84.71M</td>
</tr>
<tr>
<td>Dublin</td>
<td>16,104</td>
<td>150</td>
<td>$25M</td>
<td>$13M</td>
<td>$4.81M</td>
</tr>
<tr>
<td>Snellville</td>
<td>19,738</td>
<td>184</td>
<td>$30M</td>
<td>$16M</td>
<td>$5.9M</td>
</tr>
</tbody>
</table>

SOURCE: “How 5G Can Help Municipalities Become Vibrant Smart Cities,” Accenture Strategy, Jan 12, 2017. These estimates are based on expected benefits for the United States from next generation wireless networks and some smart city technologies. They are based on per capita application of the estimated national benefits to individual cities (e.g., the number of construction jobs are national averages assigned on a per-capita basis), and may vary depending on the individual city.
What is a Smart City?

The integration of technology with a strategic approach to sustainability, cost reduction, citizen well-being and economic development.

Source: International Electrotechnical Commission, 2014
AT&T in Georgia

More than 4 million strand-miles of fiber-optics in Georgia.

Approximately 1,250 upgrades made in 2017, including 30 new cell sites, addition of wireless and wired network capacity and new broadband network connections in Georgia.

1,168
Wi-Fi hotspots in Georgia as of March 2018.

99.7%
of Georgia covered by the AT&T mobile broadband network as of January 2018.

More than 17,400employees working in Georgia as of June 2018.

More than 5 billion invested in our Georgia wired and wireless networks during 2014 – 2016.