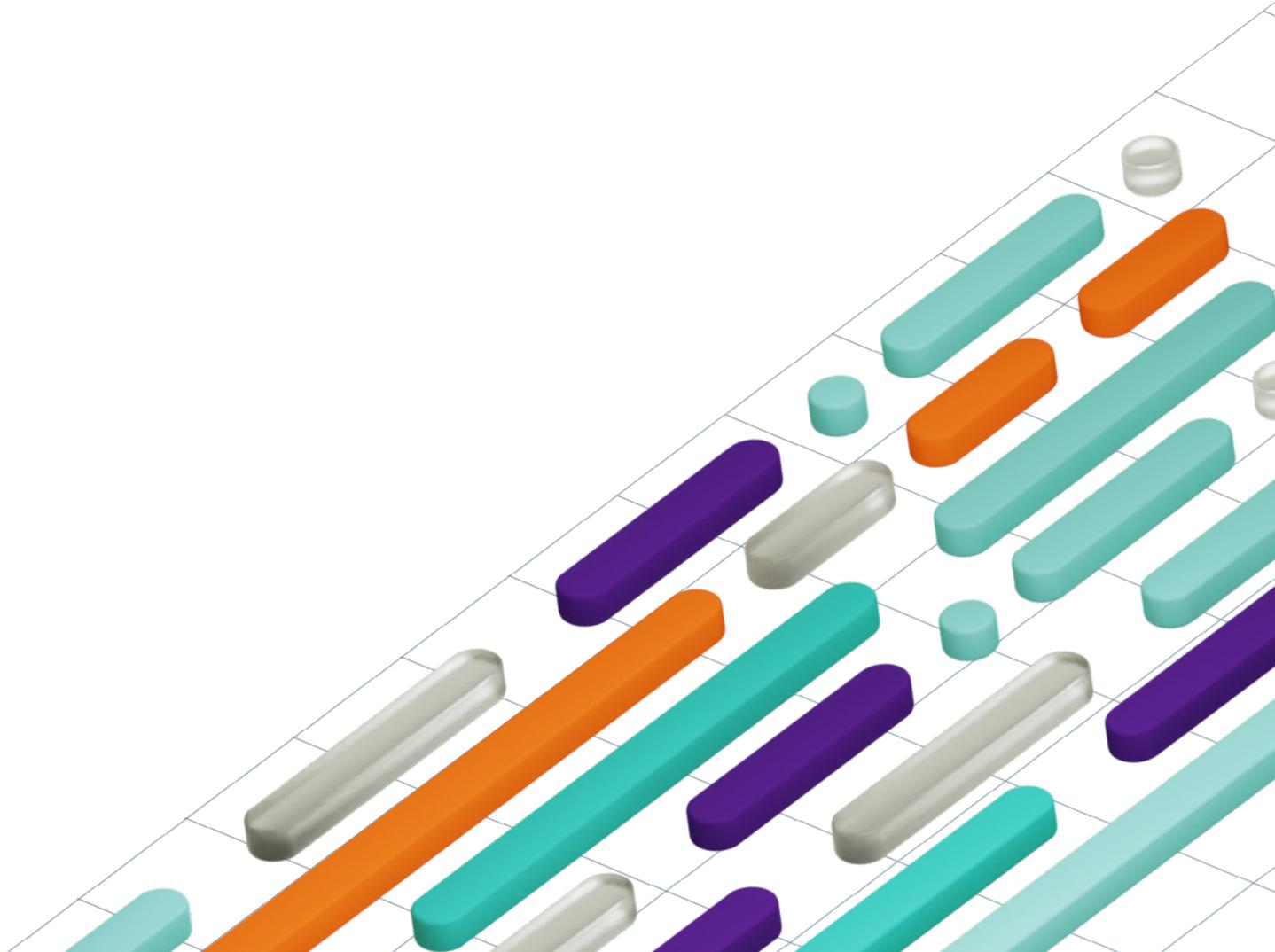




The 4G Decade

Quantifying the Benefits



Quantifying 4G's Benefits

Today—perhaps more than ever—the impact and importance of America’s world-leading 4G wireless networks is clear. U.S. 4G leadership created jobs for millions of Americans, drove remarkable economic growth, and enabled entirely new industries. Wireless speeds are up, prices are down, and consumers receive tremendous value from these 4G networks. Now as we enter the 5G era, the next generation of wireless networks will unleash even greater consumer benefits and create a 5G economy that will help the U.S. grow and maintain its position as the world’s innovation leader.

As we stand at the beginning of this 5G-powered decade, it’s important to reflect on how significantly 4G shaped our country’s economy and our lives over the past ten years. Wireless was a fundamentally different experience in 2010 when 4G was first introduced.

Today, we are accustomed to widespread, high-speed mobile 4G networks powering a diverse array of apps, services, and content available through remarkably powerful smartphones.

But it was gradual, step-by-step improvements in capacity, speeds, and coverage over the last decade that built the resilient 4G platform we rely on today.

As we look to our 5G future, it is important to realize that the 4G decade is not a story of overnight success. The U.S.’s 4G leadership and the benefits that resulted from it required years of diligent preparation, investment, and innovation from America’s wireless industry—along with smart policies and regulatory frameworks.

4G Economic Highlight

The U.S. wireless industry GDP grew

253%

to \$690.5B

If it were a country, America’s wireless industry would be the world’s **21st largest economy.**

The U.S. 4G chapter began well before there were even 4G networks, with spectrum auctions and infrastructure buildouts. Investment dollar by investment dollar, cell site by cell site, America's wireless providers built something entirely new—high-speed mobile broadband, practically everywhere.

Consumers, forward-thinking industries, and tech innovators responded, adopting 4G devices, leveraging this remarkable new platform, and investing in the technologies and services that rode on top of these wireless networks.

From the engineers who developed the first smartphone models and the companies that

created the world's dominant smartphone operating systems to our widely available and value-generating 4G networks and the U.S.-born app economy these networks support, the U.S. wireless industry built, over a decade, a dynamic and competitive platform fueled by ingenuity and commitment.

With the first nationwide 5G networks available today—ahead of schedule—it's important to remember that over the next decade, as 5G transforms how we work, live, and play, the impacts of the next generation of wireless will play out in a similar fashion—and on a similar timeline.

4G Economic Highlight

The U.S. wireless industry enabled
20.4M
U.S. jobs

That's one of every six jobs—**up 440%** since the beginning of the decade—making wireless the largest job contributor across all industries.

2

4G Accelerates GDP Growth

4G wireless providers' work to steadily increase their coverage, capacity, and customer base meant that wireless networks became the decade's core platform for technology innovation and economic growth.

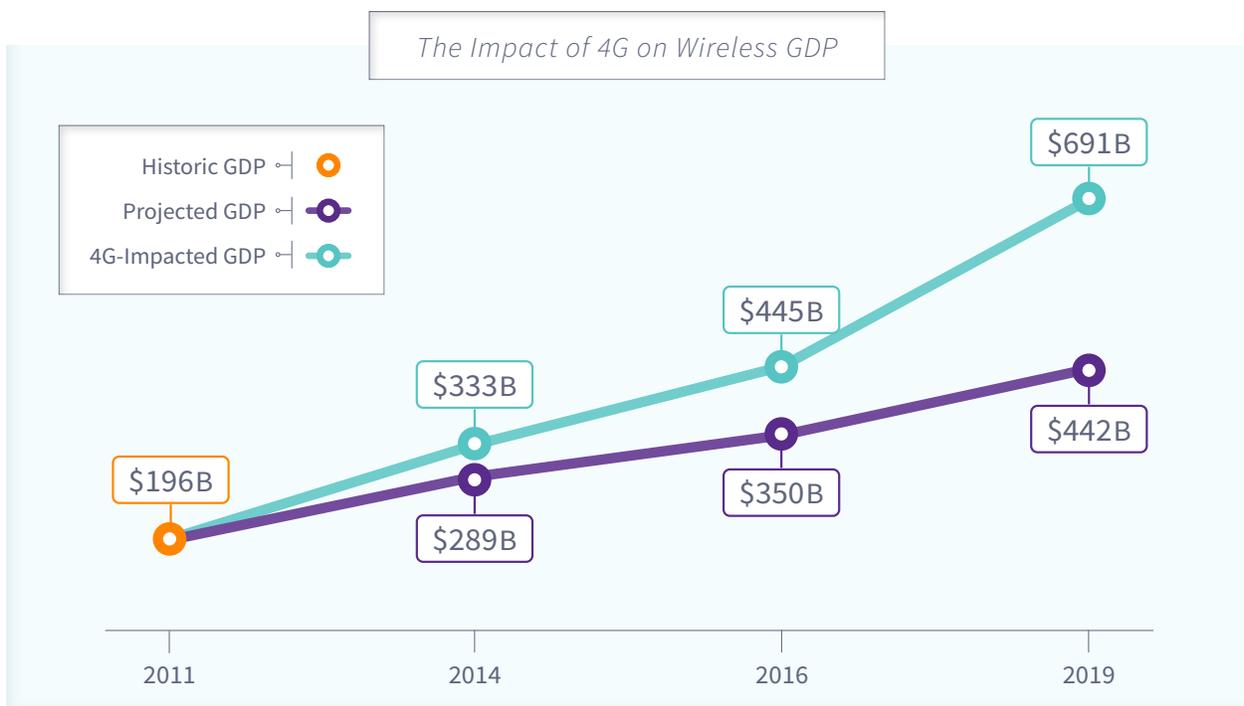
In 2011, the wireless industry and the companies it powers contributed \$195.5 billion to GDP. Based on historical 3G trends, the industry's GDP contribution was projected to grow by 126%, to \$441.8 billion by 2019. In reality, 4G blew past all expectations. The industry's contribution grew to a staggering \$690.5 billion in 2019, \$248.7 billion more than projected. This expansion reflects the monumental impact of America's 4G leadership and the American-designed mobile devices, mobile advertising, apps and content created.



Thanks to 4G, U.S.
GDP grew

\$248.7B

more than projected



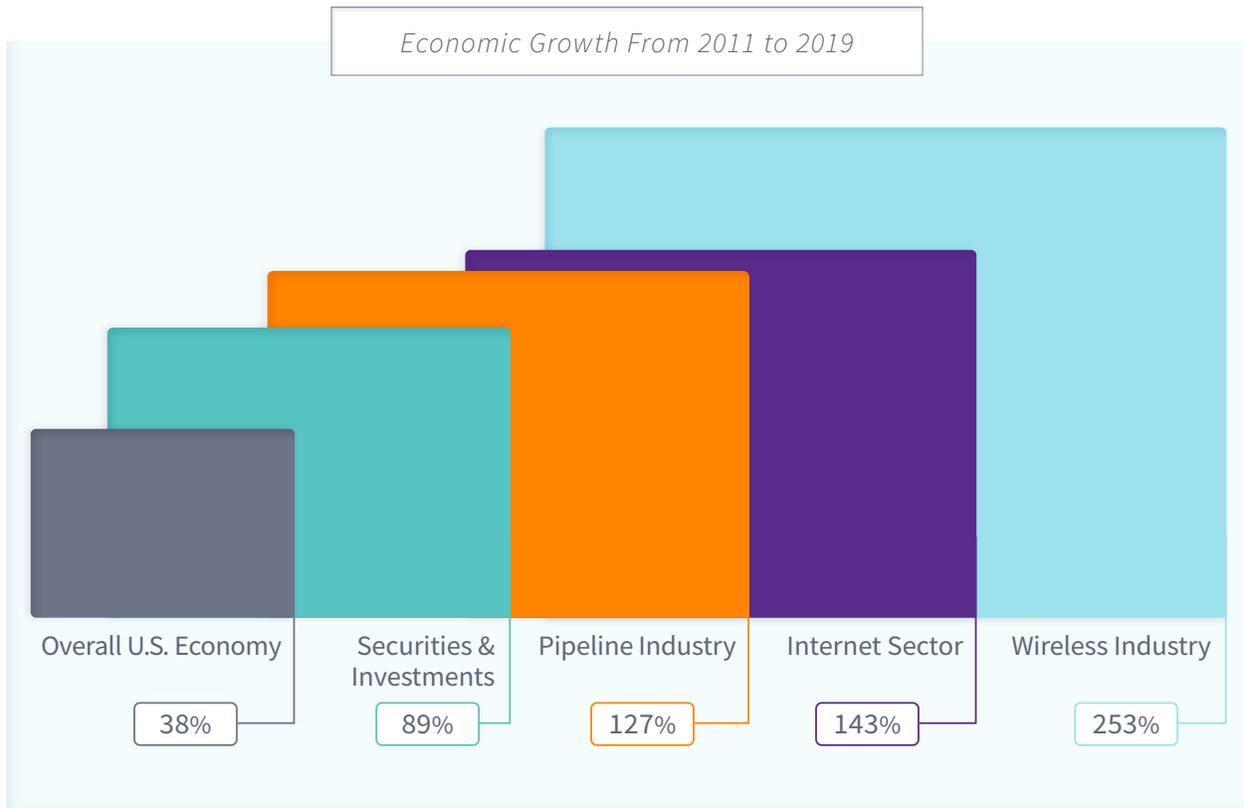
During the same timeframe, overall U.S. GDP increased from \$15.542 trillion to \$21.427 trillion, an increase of \$5.885 trillion. This means that nearly 10% of the GDP increase of the entire U.S. economy during the decade was due to the wireless industry.

Not only was the wireless industry's success a factor in the economy's growth, but from 2011 to 2019, the wireless industry's direct share of the U.S. economy more than doubled—increasing from 1.3% of the U.S. economy to 3.2%. Over the 2011 to 2019 timeframe, the U.S. economy grew by 38% while the wireless sector grew by 253%.



10%

of the increase in U.S. GDP during the 4G decade was due to the wireless industry



4G Spurs Job Creation

The wireless industry's buildout of robust and accessible 4G networks and the tech sector's investment in building the products of the future on those networks drove job creation in the 4G decade.

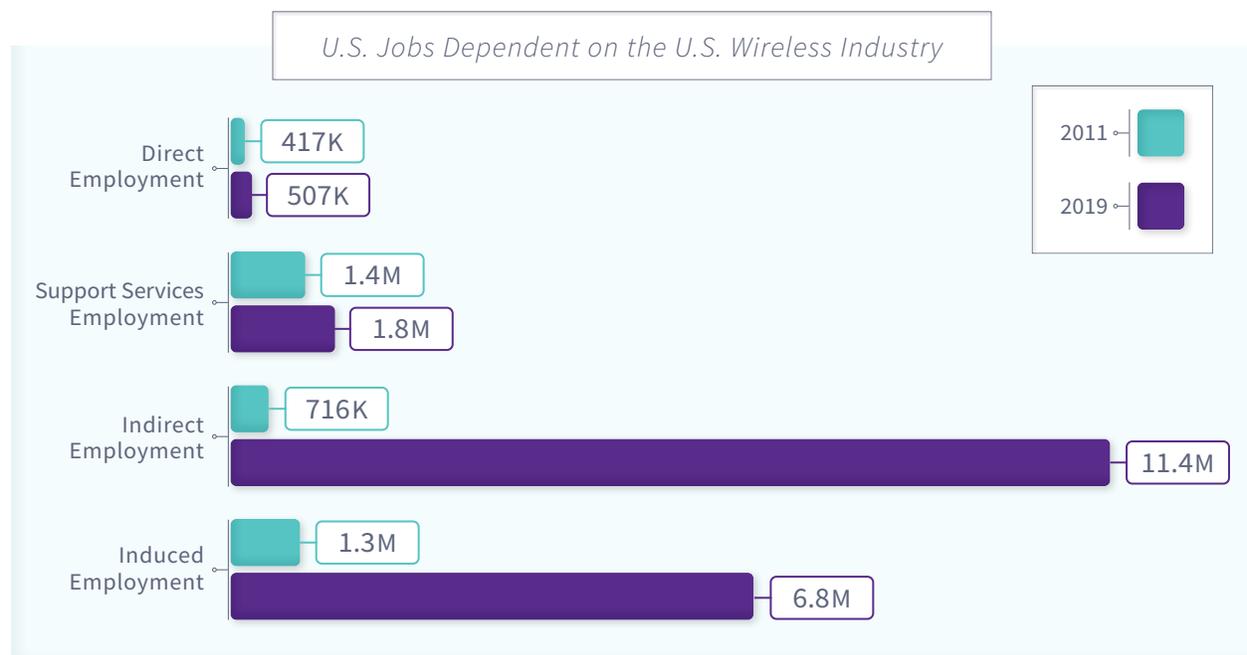
In 2011, 3.7 million jobs were connected to the wireless industry, or 2.4% of the 153.1 million people employed at the time. By June 2019, 20.4 million jobs depended on the wireless industry, or one in every six people employed.

The wireless industry and the sectors it critically enables added 16.7 million new jobs during the 4G decade. Direct employment increased from 417,339 to 507,096, wireless support-service jobs increased from almost 1.4 million to 1.8 million, and the number of jobs that were indirectly reliant on the wireless industry increased from 716,000 to 11.4 million.



1 in 6

jobs depended on the wireless industry by 2019



Of the 11.4 million, 8.7 million people participate in the on-demand economy, a new sector built completely on the sophistication of smartphones, and increased capacity, availability, and adoption of 4G networks. The rest come from the other industries in the wireless ecosphere, such as the mobile device hardware, mobile advertising, app development, and content industries.

Even putting aside the on-demand economy with its 8.7 million jobs and 4.4 million induced jobs, the wireless industry still grew by 3.6 million jobs, more than a third of the entire job growth of the U.S. economy between 2011 and 2019.



More than 1/3

of U.S. job growth
between 2011 and 2019
was due to wireless
industry growth



DIRECT JOBS are positions that work directly for the employers and provide services that directly impact a customer's experience.

SUPPORT JOBS in the wireless industry range from contractors acquiring the permits for new cell sites to programmers creating the newest wireless apps.

INDIRECT JOBS rely on the wireless industry—everything from grocery stores, retailers, builders, contractors, etc.

Finally, when these directly and indirectly generated incomes are spent and re-spent on a variety of items in the broader economy (e.g., food, clothing, entertainment), it gives rise to **INDUCED EMPLOYMENT** effects.

4

Investment Climbs During 4G Era

As each generation of wireless has been built to reach more Americans and offer consumers more data capacity and security, providers have increased their network investment.

Between 1983, when cellphones became available to the public, and 1995, the start of the 2G era, wireless capital investment totaled \$18.9 billion. During the 2G era, capital investment jumped considerably to \$108.0 billion. Investments in the 3G era grew to \$183.1 billion between 2003 and 2010.

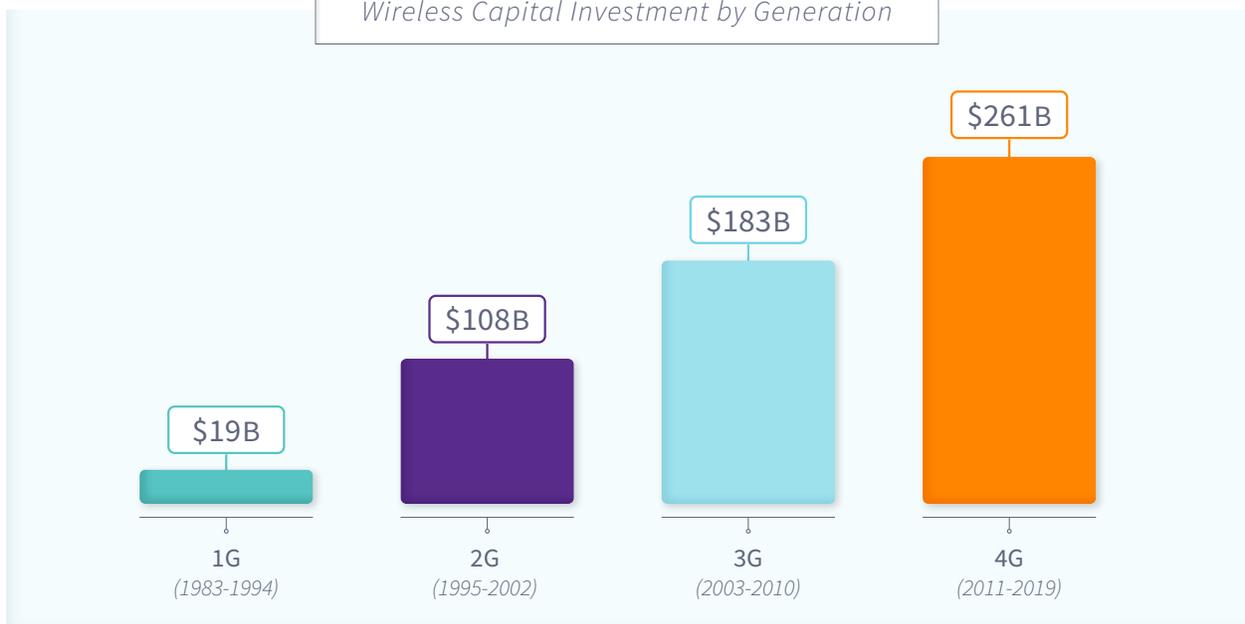
And in the 4G era, these investments in network equipment, cell sites, software, and other network needs grew to a total of \$261.0 billion—a 43% increase from the decade prior. Customers saw the value of these investments as 4G networks evolved and spread to communities across the country, bringing with them a much more dynamic wireless experience than any generation before.



43%

more was invested in wireless capital during the 4G era than the decade prior

Wireless Capital Investment by Generation



5 4G Spectrum Generates New Jobs

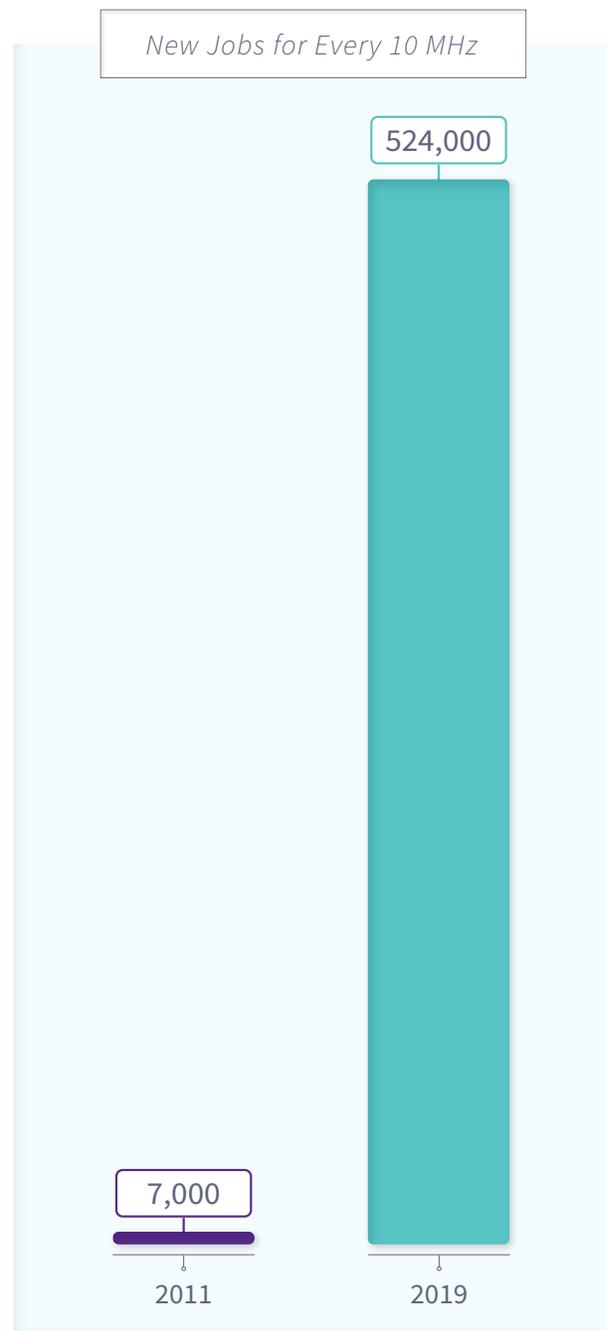
In 2011, at the dawn of the 4G era, Recon Analytics' report, "The Wireless Industry: The Essential Growth Engine of U.S. Economic Growth," demonstrated that every 10 MHz of additional licensed low-band spectrum created at least 7,000 jobs.

Now looking back at the 4G decade, we find that the job growth created by the increase in available licensed spectrum—thanks in large part due to the AWS-3 (2015) and broadcast incentive (2017) auctions—is significantly higher. Including the on-demand economy, every 10 MHz of low-band spectrum auctioned to the wireless industry created more than 524,000 new jobs (158,000 for the core industry alone) new jobs. This means the number of jobs created by freeing up spectrum for wireless networks increased over 75x during the 4G era.



524,000

new jobs created by every 10 MHz of low-band spectrum auctioned to the wireless industry



4G Produces Faster Speeds

During the 4G decade, download speeds increased 31x from 1.3 Mbits/second to 41 Mbits/second, as the wireless industry invested in spectrum, infrastructure, and new technologies to improve efficiencies. These faster speeds drove mobile innovation and other consumer benefits.

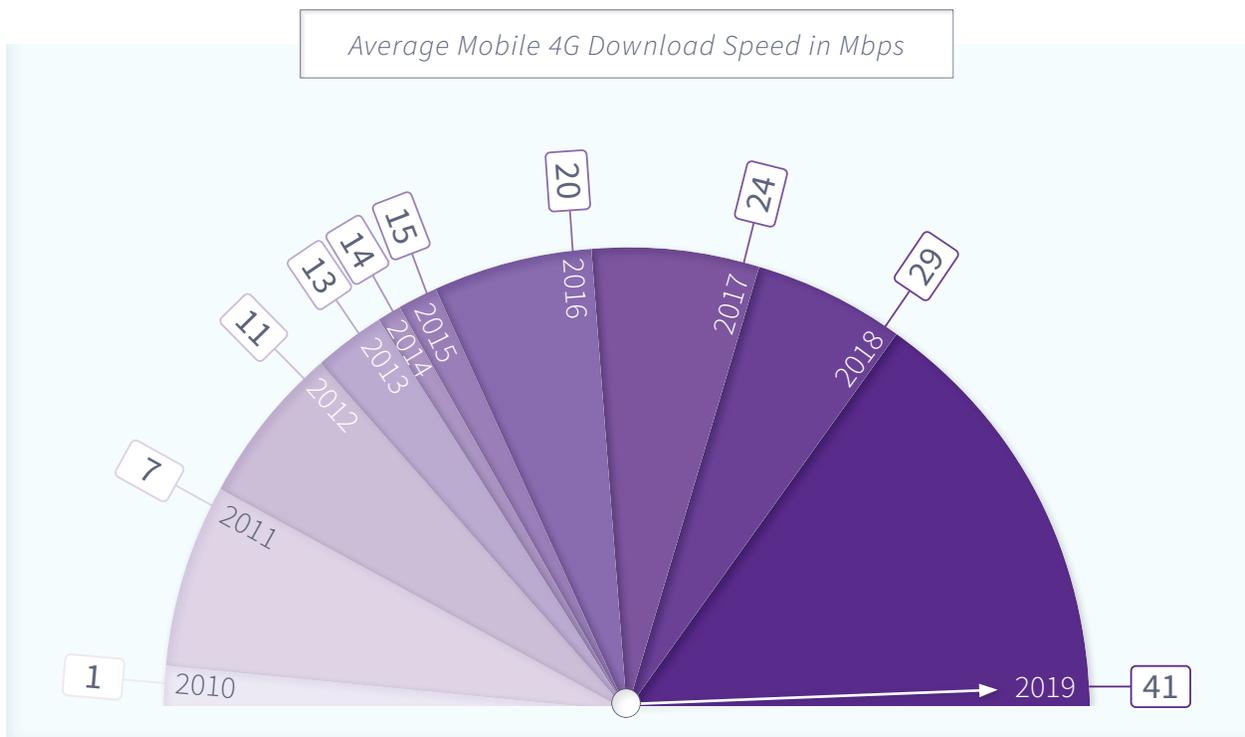
Speeds increased over time as the mobile network operators purchased new spectrum, added cell sites, and deployed new technologies like MIMO, which allows multiple antennas on the same cell site to send and receive data—dramatically increasing the amount of information that can be transmitted at any given time.

These ever-increasing speeds meant customers could use their phone in new ways—streaming video content, engaging with ridesharing apps, live-mapping driving routes, and managing smart home products, to name a few.



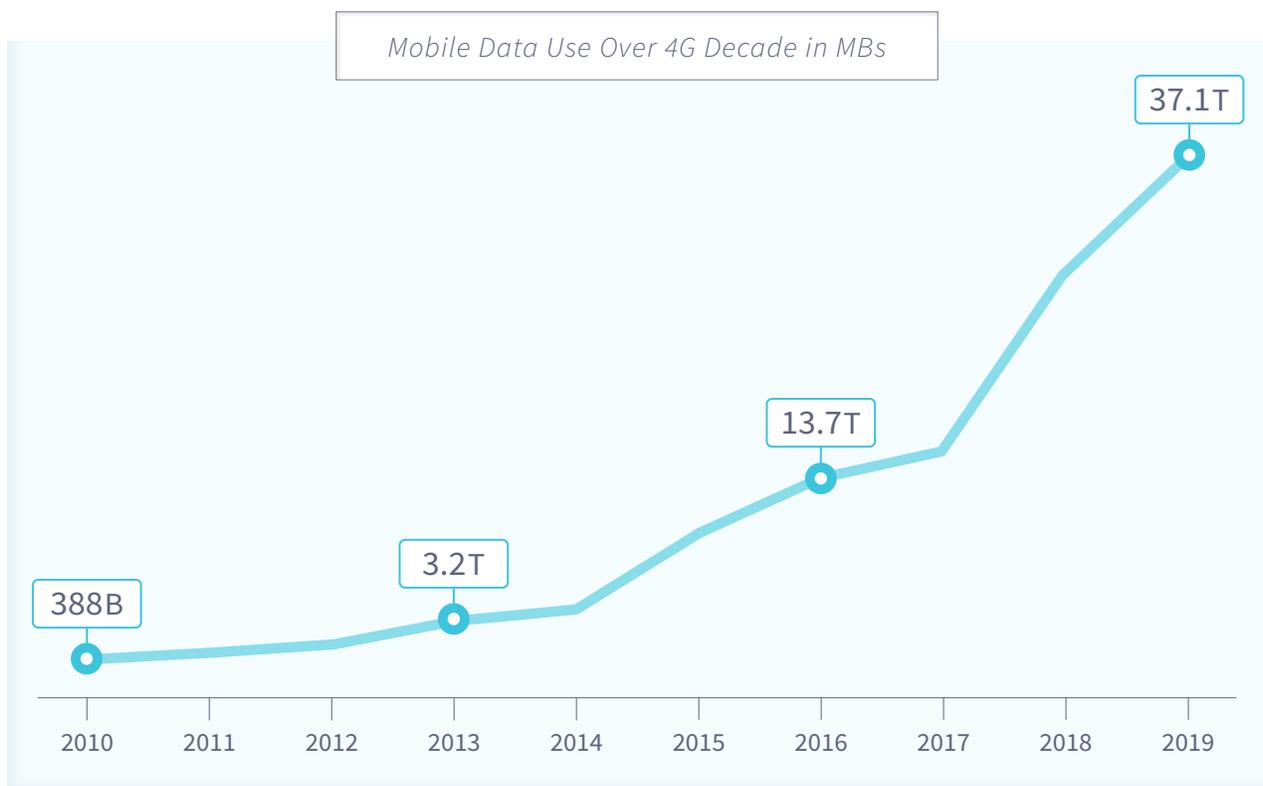
31x

increase in
download speeds
during the 4G era



Data Use Skyrockets During 4G Era

In 2010, Americans consumed a total of 388 billion MBs. In 2018, fueled by 4G's increased speeds and capacity, American consumers used a record 28.58 trillion MBs of mobile data, up more than 73 times the volume of traffic in 2010, according to CTIA's 2018 Annual Survey. In 2019, Americans used more than 37 trillion megabytes of data—96 times the amount consumed in 2010.



**28
hrs**

is the time it takes the average 2019 smartphone user to consume 360 MB of data (*the amount used per month in 2011*)

3G networks introduced us to initial apps and the idea of wireless data, but as 4G's capabilities grew, they unlocked the significant potential of apps and mobile broadband data, making them a staple of our wireless experience and exponentially increasing Americans' mobile traffic. In 2011, every smartphone used an average of 360 MB of data per month. Just eight years later, our devices used more than 25 times more data. The average smartphone consumer used 9.2 GB per month in 2019.



96x

more data consumed
by Americans in 2019
than 2010

Average Amount of Data Smartphone Users Consume Monthly in GBs



Consumers Save Over 4G Decade

The U.S. 4G decade also made a material difference to consumers' wallets, with the costs of wireless plans decreasing significantly.

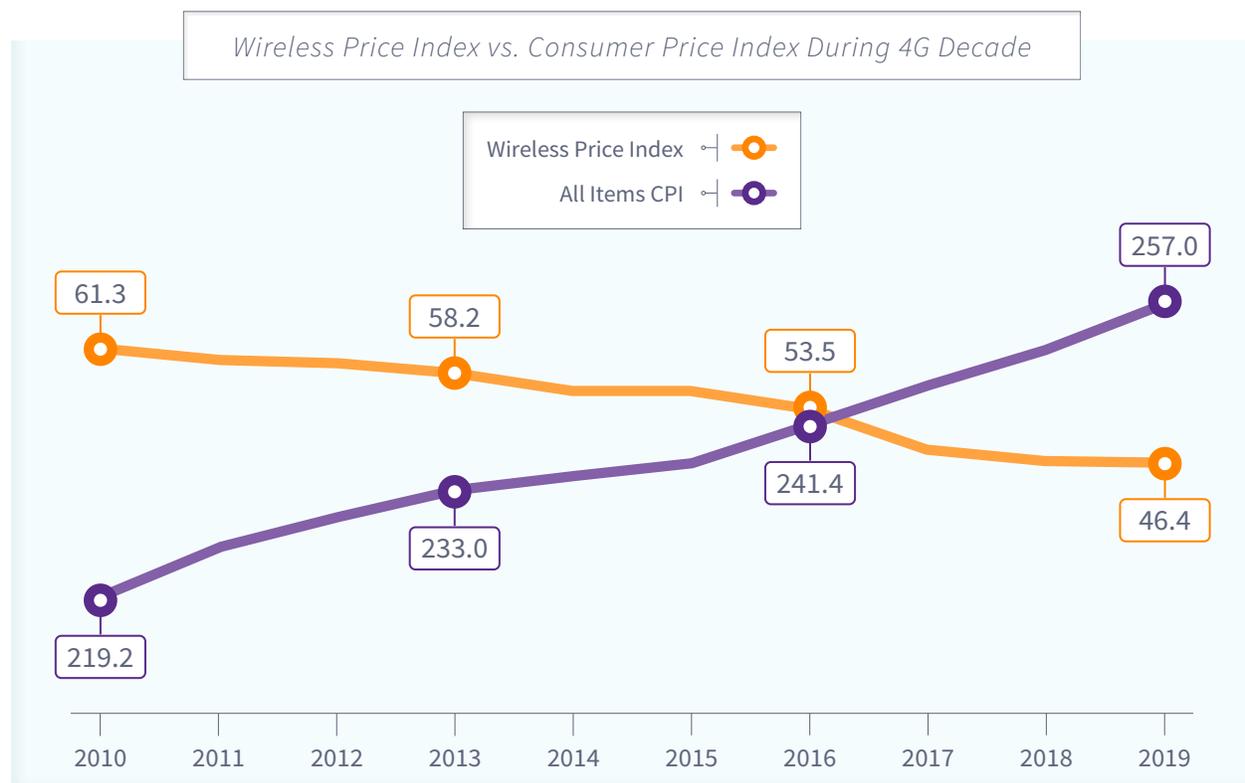
In 2010, a personal unlimited voice, text, and data plan cost an average of \$113.87 for one line, on a subscriber-weighted basis. Nine years later, the same plans cost \$64.95, a decline of 43%. Adjusting for inflation, the decline in cost is even higher at 52%.

That means that in 2019, a single line subscriber saved \$576.60 a year compared to 2010 prices—totaling a grand savings for Americans of more than \$130 billion per year.

The savings consumers realized over the course of the decade can also be seen by looking at the impact of the wireless industry on the Consumer Price Index. The Wireless Price Index fell by 24% in the 4G decade, exerting downward pressure on the Consumer Price Index.

At one point in 2017, this pressure meant the average price for a set of core consumer goods fell for the first time in seven years, with the price of wireless service falling so dramatically that it drove nearly half of that decline.

Wireless Price Index vs. Consumer Price Index During 4G Decade



In addition, the effective price consumers pay per MB decreased significantly. In 2011, the effective price per MB was \$0.20. By the end of 2019, the price came down to half a cent, a 98% decrease from what it was when wireless providers were initially deploying 4G networks.

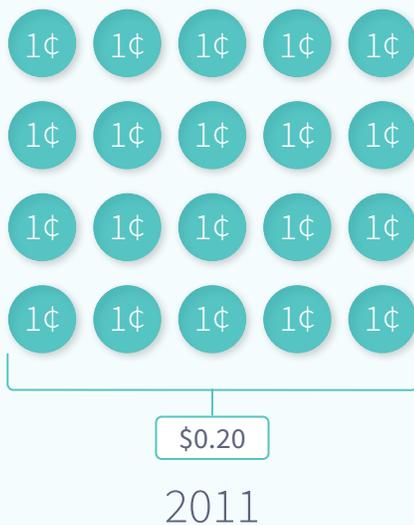
These lower prices and the high value offered by wireless connectivity via more data, faster speeds, and expanded services has led more low-income Americans and communities of color to choose mobile wireless service as their means of staying connected. Nearly all (95%) individuals making less than \$30,000 a year have a cellphone, and 25% of Hispanic adults and 23% of African-American adults were “smartphone-only” internet users (Pew Research Center).



\$130B

saved per year by
Americans compared to
2010 subscriber prices

Decrease in Price per MB



Conclusion

4G's launch in 2010 and every investment, spectrum auction, and innovation that followed built a mobile broadband experience that transformed the way Americans live and work. Looking back at the 4G decade, it's clear that this transformation had a powerful impact on the U.S. economy as well—supporting 20 million jobs, driving nearly \$700 billion in economic contribution and saving consumers billions annually. As we kick off the 5G decade and take our first steps into an era that holds more economic, social, and innovative promise than any generation before it, the 4G story provides a benchmark for how to evaluate our progress, a model for how to sustain our global wireless leadership, and a foundation on which to build a flourishing 5G economy.

About the Research



Recon Analytics is a research and consulting firm for the telecom, media, and technology industry. We clear the clutter, help focus executives and policymakers on what is actually happening in the marketplace and what really matters, and make a positive impact on business and policy decisions.



CTIA represents the U.S. wireless communications industry. From carriers and equipment manufacturers to mobile app developers and content creators, we bring together a dynamic group of companies that enable consumers to lead a 21st Century connected life.