



Bridging the digital divide
with private LTE/5G for
communities

Powered by Nokia DAC/FastMile

NOKIA

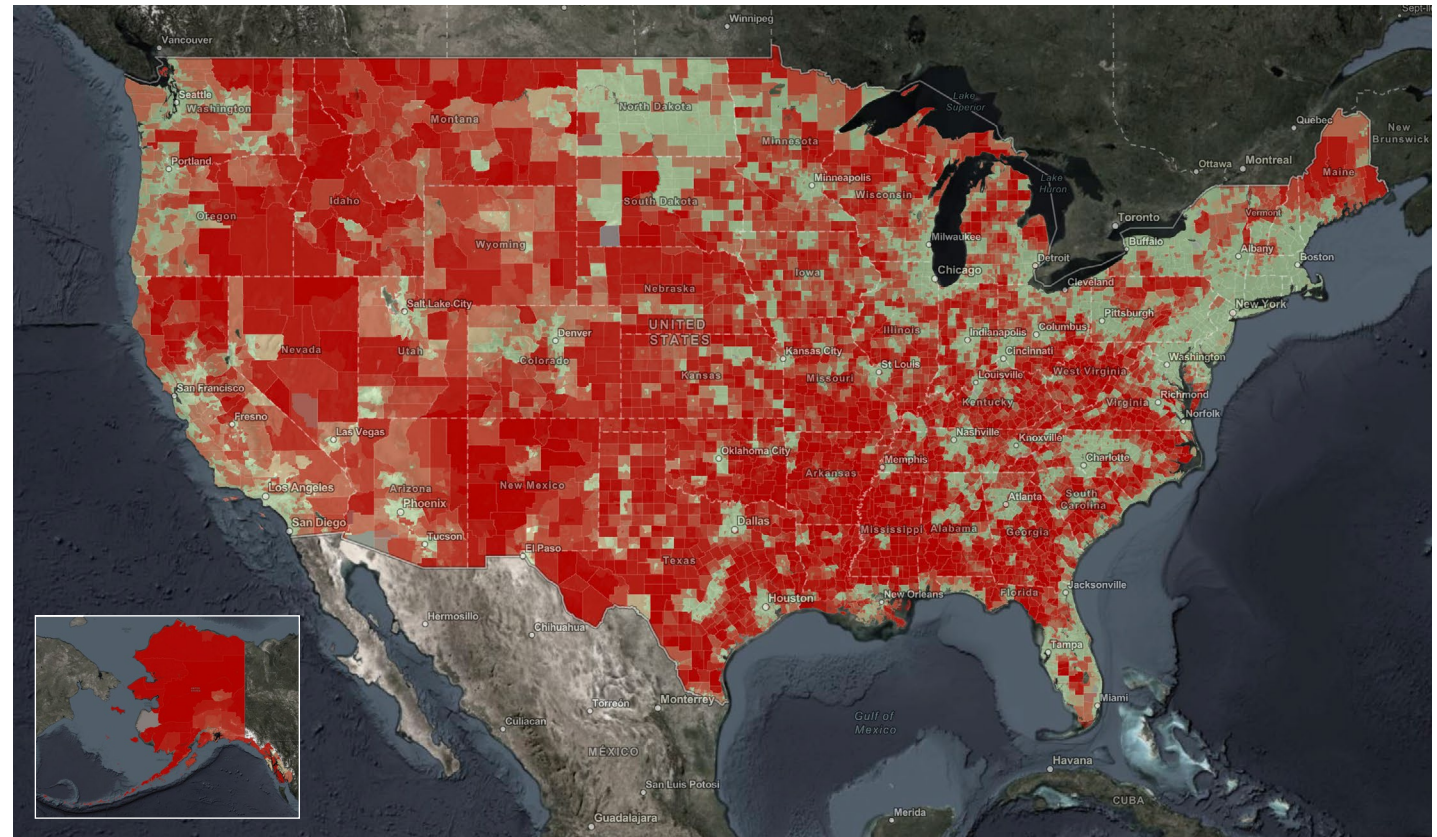
How big is the digital divide?

High-speed internet is the electricity of the 21st century. It brings growth, prosperity and better quality of life wherever it goes. Yet millions of Americans are still deprived of this utility so essential for prosperity. Estimates vary significantly on the magnitude of this challenge in the US, but Microsoft's survey from April 2019 indicates that as many as 162 million people do not use the internet at broadband speeds (25/3 Mbps).¹

According to the US Census Bureau, as many as 23 million households do not have a broadband internet subscription.² A 2017 US Congress Joint Economic Committee (JEC) report estimated nearly 12 million children do not live in homes with a broadband connection.³

While the digital divide is perceived to be a predominantly rural problem, significant disparities exist even in most of our cities, especially in poorer neighborhoods. The same JEC report concluded that less than half of households with incomes below \$20,000 have home broadband subscriptions.

NTIA - Indicators of Broadband Need (arcgis.com)



The Indicators of Broadband Need⁴ map was created by the United States Department of Commerce, National Telecommunications and Information Administration (NTIA). The map brings together several different datasets to show information on broadband availability within the United States. Layers in this map were created using data from the U.S. Census (the American Community Survey), Ookla Speedtest results, Measurement Lab (M-Lab) speed test results, Microsoft, the Federal Communications Commission (FCC), the Department of Education and internal NTIA data resources. All data is shown at one of three Census geographic levels: county, census tract, or census block.

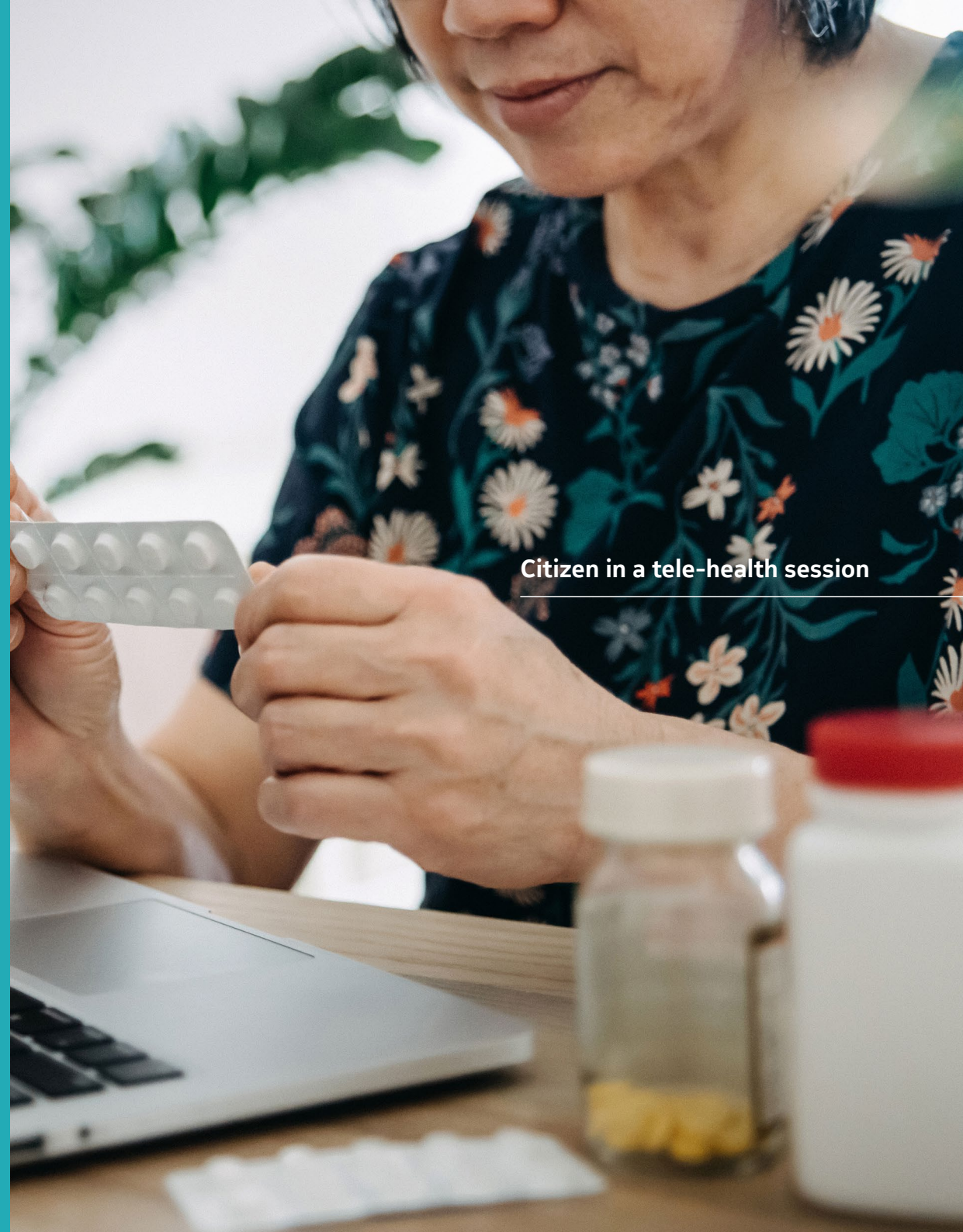
How has COVID-19 impacted the digital divide?

The current COVID-19 situation has exposed our digital divide as never before. Millions of students without internet access at home are facing difficulties attending classes and completing assignments online.

Every day we hear stories of families driving miles and spending hours in parking lots of restaurants or public Wi-Fi hotspots to give their students a chance to participate in distance learning.

With non-emergency medical care transitioning to tele-health, many people are suffering due to a lack of broadband internet at home.

While the pandemic has affected the lives of all, it has more profoundly impacted those without access to the internet. The unserved or underserved must go out of their homes for daily needs such as jobs, education, health care, or even grocery shopping—resulting in significantly higher exposure to the coronavirus.



Citizen in a tele-health session

How do we bridge the gap?

While there are several factors behind the digital divide, the most important adoption barriers can be summarized into three categories:

1. Access to broadband internet infrastructure
2. Affordability of devices and internet service
3. Awareness of the benefits of broadband internet.

Local governments can play a decisive role in overcoming these challenges by prioritizing broadband initiatives and collaborating with the private sector.

The CARES Act, Consolidated Appropriations Act and American Rescue Plan, have established over a combined \$600 billion Coronavirus Relief Funds to assist state, Local and Tribal governments to navigate the impact of the COVID-19 outbreak. Per the US Treasury guidance, permissible expenses include:

- Expenses to facilitate distance learning, including technological improvements in connection with school closings to enable compliance with COVID-19 precautions

- Expenses to improve telework capabilities for public employees to enable compliance with COVID-19 public health precautions.

The emergency funding also includes over \$200 billion for education, to prevent, prepare for, and respond to the coronavirus. These funds are broken down approximately as:

- \$190 billion Elementary and Secondary School Emergency Relief Fund (ESSER).
- \$76 billion Higher Education Emergency Relief Fund (HEERF).
- \$9 billion Governor's Emergency Education Relief Fund (GEER).

Awards to Governors may be used to provide emergency support through grants to local educational agencies (LEAs), institutions of higher education (IHEs), and other education-related entities that have been the most significantly impacted by coronavirus.

The Department of Education encourages States, LEAs and IHEs to invest GEER funds in technology infrastructure and professional development that will improve the capacity to provide high quality, accessible, distance education or remote learning.

Many households, especially in poorer neighborhoods and remote areas, just don't have the wireline or reliable cellular connection necessary for broadband internet at 25/3 Mbps, simply because the conditions for private communications service providers to profitably deliver it have not been met. But solutions exist to lower this barrier:

- As mentioned, government stimulus packages will allow partial financing of such projects
- There are innovative deployment models, such as the neutral host deployment model, whereby a single broadband network is deployed and operated by a wholesale operator. It can then re-sell the connections to telecommunication service providers, governments or businesses. This minimizes the CAPEX investment as only one broadband network is rolled out, lowering the break-even point of the project to make it financially viable

- The neutral host model can also be deployed through a public-private partnership, which further decreases the investment from local government
- The latest development of broadband wireless access technologies, with both 4.9G and 5G, provide reliable, high-speed internet access, with a lower cost of deployment than fiber for some semi-rural or rural areas.

To counter the problem of availability of IT devices, many local governments, school districts and non-profits have been working 24/7 to distribute free or subsidized laptops, tablets and hotspot devices to enable under-privileged students to take online classes. This is a necessary first step in addressing the homework gap.

How Nokia can help your community?

Nokia's Private LTE solution – Nokia DAC with FastMile CPE — can help your city, county and educational entities ensure students' access to online learning from the comfort and safety of their homes.

Further, the same solution will ensure business continuity for city services and improve the safety of public employees as they can work from home in compliance with COVID-19 public health precautions.

Student taking an online class from the comfort and safety of home



What is Nokia DAC?

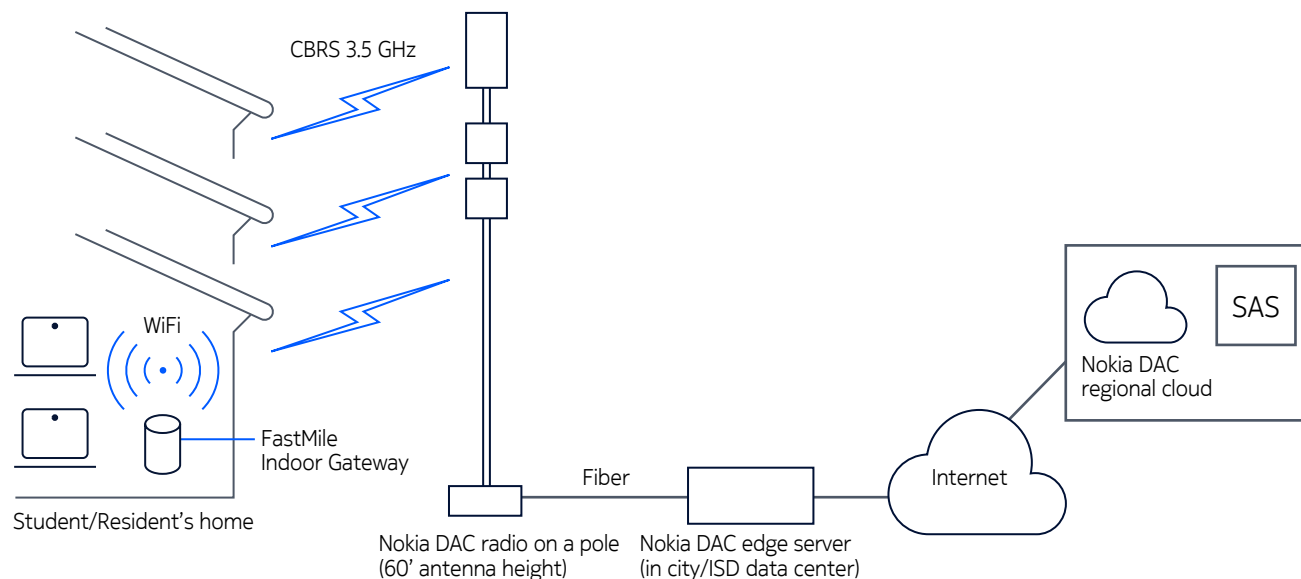
The Nokia Digital Automation Cloud (DAC) is an end-to-end digitalization platform for industrial grade private wireless connectivity and automation. It is a cost-effective, easy to deploy, industrial-grade private LTE solution that is software upgradeable to 5G. It combines the simplicity and affordability of Wi-Fi with the superior coverage, capacity, reliability, and security benefits of LTE – that's Nokia DAC. Your city can cost-effectively and expeditiously provide reliable broadband access to facilitate distance learning for students in unserved or underserved households. No costly, time-consuming digging up of trenches and cabling to extend broadband to homes. And you have full control and visibility of your network, users, devices and applications.

The Nokia DAC solution is comprised of two main building blocks:

- An edge server, which can be installed inside a city building—for instance, in the IT room—and must be connected to internet.
- An access point or radio, which can be installed on top of city-owned buildings, libraries, fire stations or light poles.

All that is then needed is a small CPE, such as the Nokia FastMile, installed at home to provide a Wi-Fi hotspot that the students or other residents can use with any standard laptop or tablet to access high-speed internet.

Nokia DAC/FastMile Private LTE solution for digital divide



Nokia DAC medium edge server



Nokia DAC radio





Nokia FastMile Indoor Gateway near the window

The Nokia FastMile Indoor Gateway addresses the majority of users. For homes that are far from the Nokia DAC radio, a compact Nokia FastMile outdoor receiver can be installed outside the student/resident home to boost the wireless signal quality.

How do the costs compare to the alternatives?

The costs of private LTE/5G solutions vary based on several factors, such as required speeds for internet access, number of households, coverage area and site infrastructure.

Historically the high cost of licensed spectrum has predominantly restricted the use of cellular technologies, such as LTE, to mobile operators. At the beginning of 2020, however, the FCC approved the use of CBRS (3.5 GHz) spectrum to be shared among different users, such as enterprises and cities. At least 80 MHz of this spectrum, known as Generally Available Authorized (GAA), is free of cost, which brings down a major entry barrier for the use of LTE.

The Nokia DAC scales down for small deployments and supports flexible pricing models, making it an attractive solution for cities and ISDs in addressing the digital divide for specific areas and neighborhoods.

With adequate household density, the Nokia DAC Private LTE solution presents a lower total cost of ownership (TCO) when compared with a fiber-based access alternative or even a carrier option based on MiFi/hotspot devices and monthly data packages.

It does entail higher upfront costs than a carrier option, due to the required investment in network infrastructure. But based on recurring savings from avoiding the cost of a monthly carrier subscription, this investment can break-even in the second year. Since a large portion of costs are related to site infrastructure, the use of local community sites, such as government buildings, schools, libraries, fire-stations and light poles can accelerate the break-even.



Radio on a light pole

What are the benefits of a private LTE/5G network?

The table below summarizes the pros and cons of a private LTE/5G network.

Nokia DAC Private LTE/5G for digital divide

Pros	Cons
<ul style="list-style-type: none"> • Fast connection speeds (25Mbps) • No data usage capping • Filtered access/content • Low monthly costs (\$5-10) • Full visibility and control • Carrier grade reliability • High level of security • Same network for unserved student/resident homes, government staff tele-working, IoT sensors and smart city applications • Monetization potential • Fast deployment 	<ul style="list-style-type: none"> • Upfront site construction costs • Spectrum costs (if paid spectrum)

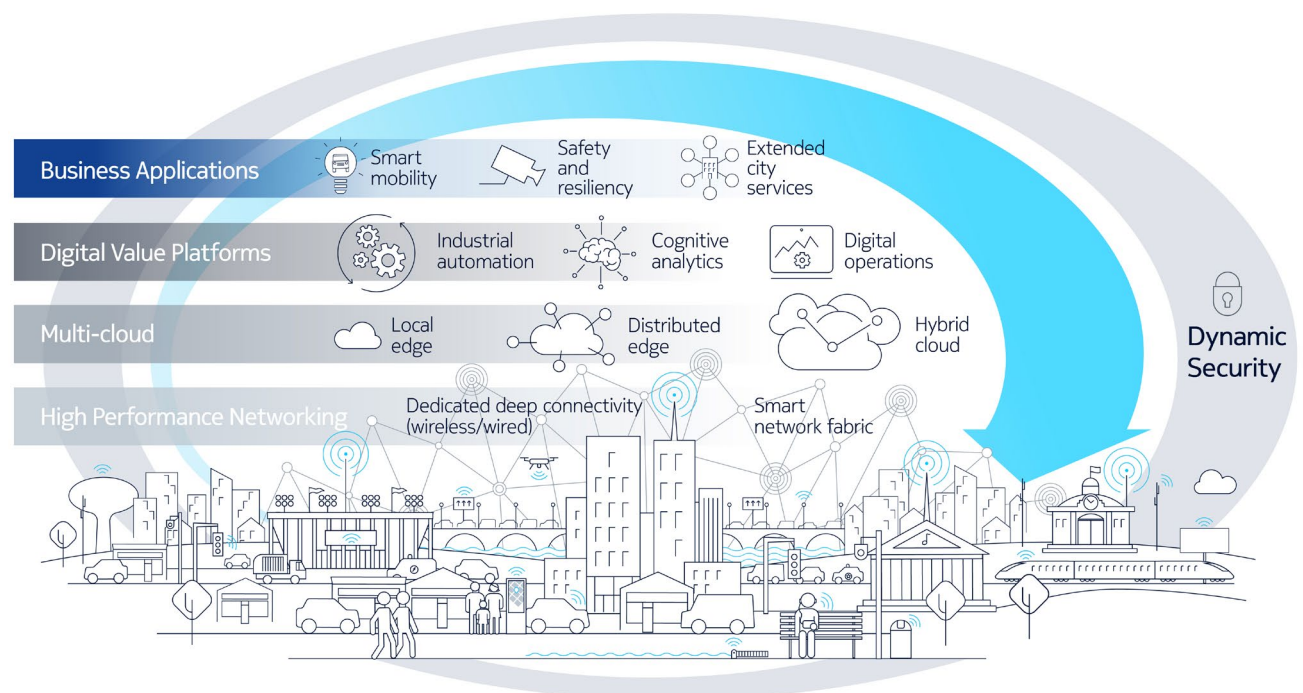
The same network deployed to meet the broadband needs of citizens can also be used by the city or county to provide its staff with telework capabilities in compliance with pandemic public health precautions.

In the future, the same Private LTE/5G network can be expanded to connect IoT sensors for

smart city applications, such as smart lighting, traffic management and smart meters.

The illustration below shows the Nokia Bell Labs Future X architecture for smart cities. This high performing dedicated network, based on fiber and private LTE/5G, is a city-wide platform for higher operational efficiency and improved citizen engagement.

The Nokia Bell Labs Future X architecture for smart cities



Why Nokia?

Chances are that you probably owned a Nokia cellphone at some point. If so, you may remember how easy it was to use and how hard it was to break! It's the same relentless focus on quality, performance, and ease of use that is behind Nokia's network infrastructure solutions. And Nokia Bell Labs, with its numerous innovations and nine Nobel Prizes over a span of 100 years, leads Nokia's Future X vision for Industry 4.0 and cutting-edge research into 6G and beyond.

Nokia has supplied over 400 LTE networks to mobile operators globally, which currently serve three out of four of the world's LTE subscribers. The same carrier-grade technology is behind Nokia's Private LTE solution being used by over 180 enterprise customers across multiple segments. With Nokia NDAC, you get the same carrier-grade reliability and performance through an easy to deploy and use, enterprise-friendly

solution. It comes as a pre-configured, complete package including spectrum, edge server and radio, devices, SIMs and applications. With this approach, a private LTE network can be set up in as little as 20 minutes!

Further, Nokia has a separate Enterprise business group to better serve the needs of our non-carrier customers including government and cities, utilities, transportation,

manufacturing, and webscale segments. You will benefit from dedicated attention and the focus of our passionate sales, solutions, and support personnel. Through our government and cities segment practice, we can assist you in your digital transformation journey and provide solutions to serve your specific needs.



Why consider Nokia as your partner for digital divide:

- **Industry Leader** in LTE/5G with over 400 LTE and 80 5G networks
- **#1 in Private LTE/5G** networks with more than 180 customers
- **Carrier-grade reliability and performance**
- **End-to-end solution** – network, spectrum, CPE, applications and services
- **Fast and easy to deploy and manage** – it's almost a plug-and-play wireless solution
- **Investment protection** – Nokia DAC is software upgradeable to 5G
- **Reduced upfront costs** – flexible pricing model scales down to one site
- **Your needs are prioritized** – dedicated government and cities team

Sources

1. <https://blogs.microsoft.com/on-the-issues/2019/04/08/its-time-for-a-new-approach-for-mapping-broadband-data-to-better-serve-americans/>
2. <https://www.census.gov/quickfacts/fact/table/US/PST045219>
3. https://www.jec.senate.gov/public/_cache/files/ff7b3d0b-bc00-4498-9f9d-3e56ef95088f/the-digital-divide-.pdf
4. <https://broadbandusa.maps.arcgis.com/apps/webappviewer/index.html?id=ba2dcd585f5e43cba41b7c1ebf2a43d0>

Act now

The COVID-19 pandemic has shown it is critical to find sustainable solutions for the homework gap and digital divide challenges that our under-privileged students and residents face. The Nokia team is looking forward to collaborating with you to help your community get access to broadband internet, which is so essential for education, growth and prosperity.



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At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering the future where networks meet cloud to realize the full potential of digital in every industry.

Through networks that sense, think and act, we work with our customers and partners to create the digital services and applications of the future.

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