
One Digital World

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Introduction

Advanced communication networks are changing the way people interact with data, technology, and one another. What was once a distant, singular transaction at a keyboard is now an immersive experience via smart interfaces and new capabilities. We are linked to and guided by input from thousands of connected devices—from mobile phones and telehealth wearables to sensors of every kind. As a hallmark of our digital world, data is created, shared, and analyzed widely, creating layers of input and insight, making our interconnected experience richer, tangible, and more valuable.

Through connectivity, better use of data, and a growing world of internet of things (IoT) technologies, industries, businesses, and communities are accelerating their digital future to become more resilient. Flexible communication networks underpin this revolution. Digital community systems, such as mobility networks, electric grids, and smart city systems, can endure disruption—from new market entrants and business models to global pandemics. With this flexibility, they can work in new ways to achieve their future state, be that more reliable, efficient, or citizen-centric.

Communications in our Digital World

Across industry, business, and community sectors, leaders are harnessing connectivity and data to work in new ways and build more reliable, efficient operations. They are operating from a widely accepted view that digitalization is the key to producing more with less—a growing priority across sectors. While going digital takes planning, the payoff comes quickly. When they hit the 40% digitization mark, leaders begin to secure large shares of the market.[1]

Communications are Critical Infrastructure

Resilient, reliable networks are vital in our digital world. Proof of this is playing out in our communities as the COVID-19 pandemic forces people into technology-centric classes, appointments, and workdays. Sixty-two percent of employed Americans are working from home during the crisis[2] and 29% of American schoolchildren completed schoolwork on a cellphone.[3] With this reliance

[1] McKinsey & Company. 2018. The Digital Utility: New Challenges, Capabilities, and Opportunities.

[2] Gallup. 2020. U.S. Workers Discovering Affinity for Remote Work. March 30-April 2 poll.

[3] Pew Research Center. 2020. 53% of Americans Say the Internet Has Been Essential During the COVID-19 Outbreak.

on connectivity, it is no surprise that 49% of Americans say that a major interruption to internet or cellphone service would be a very big problem.[4]

Surprisingly, about 42 million Americans do not have access to wired or fixed wireless broadband,[5] and COVID-19 is amplifying the digital divide. Without advanced communications networks, rural and underserved communities cannot connect to work or school, cannot operate a modern business, and do not have access to telehealth options or important digital public service announcements.

Roughly 63% of rural Americans have a broadband internet connection at home, up from 35% in 2007. Despite the progress, much of rural America still lacks the infrastructure to support high-speed internet, and those with access have slower service compared to nonrural areas.[6] The same holds true for lower-income Americans. About 29% of adults with household incomes below $30,000 do not own a smartphone, 44% do not have home broadband services, and 46% do not have a computer. By comparison, nearly all adults in households earning $100,000 or more annually own each of these technologies.[7]

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[4] Pew Research Center. 2020. Americans Turn to Technology During COVID-19 Outbreak, Say an Outage Would be a Problem.

[5] BroadbandNow. 2020. FCC Reports Broadband Unavailable to 21.3 Million Americans, BroadbandNow Study Indicates 42 Million Do Not Have Access.

[6] Pew Research Center. 2019. Digital Gap between Rural and Nonrural America Persists.

[7] Pew Research Center. 2019. Digital Divide Persists Even as Lower-Income Americans Make Gains in Tech Adoption.

Lack of connectivity leads to the "homework gap" where school-age children cannot complete schoolwork. The gap is more prominent in black, Hispanic, and lower-income households. About 17% of teens ages 13 to 17 said they are frequently unable to complete homework because they do not have reliable access to a computer or internet connection. About 12% of teens frequently use public Wi-Fi to do schoolwork because they do not have internet.[8]

COVID-19 will likely change the way communities deliver healthcare and education, with technology playing a central role. Clearly, communication networks are critical infrastructure and utterly crucial to advance healthcare, social mobility, economic equality, and quality of life in communities.

Because of COVID-19, traffic on AT&T's networks rose 27% between February 27 and March 27, 2020, and traffic on Verizon's wireless and fiber broadband service rose 22%. Company officials had never seen such a steep, swift surge, and they rushed to strengthen their mobile networks by adding cell sites, increasing the number of fiber connections, and upgrading the routing and switching technology to increase capacity.[9] The Federal Communication Commission (FCC) and several companies made emergency provisions, too. The FCC gave temporary authority to T-Mobile to use additional spectrum in the 600 MHz band to increase broadband service, and several companies like Comcast and Dish, made their spectrum available for broader use.[10]

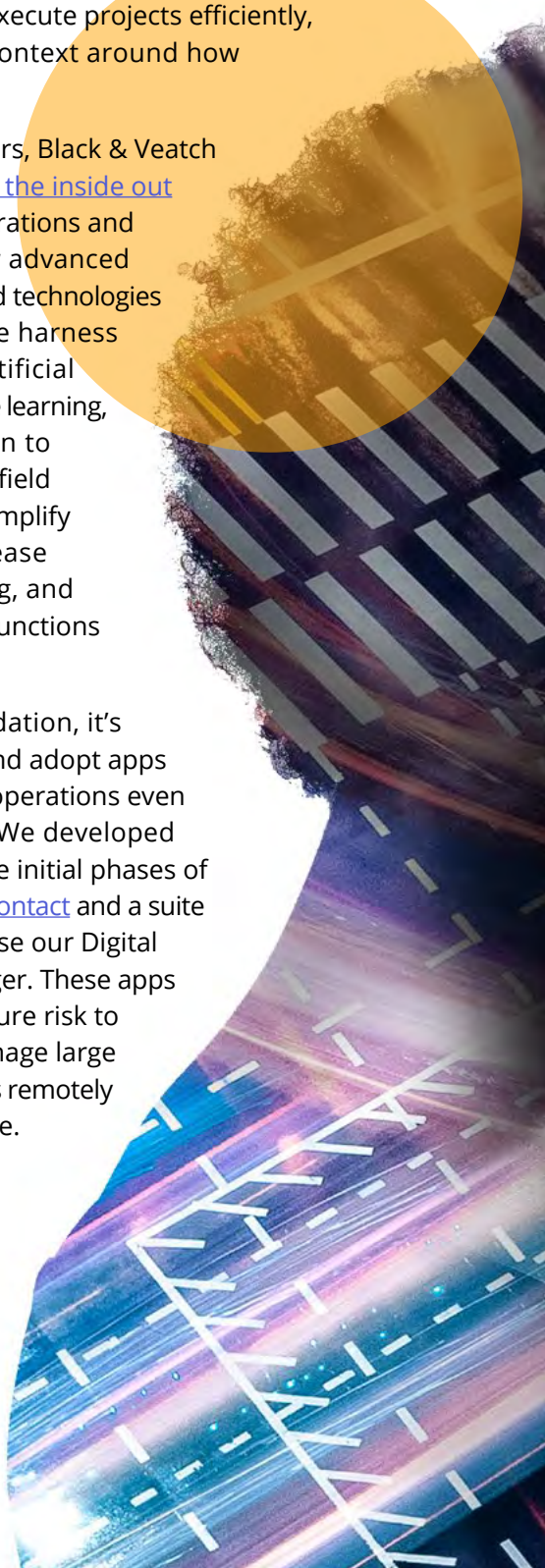
Despite initial slowdowns and outages when remote learning and working began, U.S. wireless and wireline communications have stabilized, even as populations continue to work and take classes from home. This is what resilient, converged networks are designed to do: flex to changing conditions and scale alongside need. Resilient networks start with our national wireless and wireline carriers. But, industries, businesses, and communities—such as school campuses, transportation agencies, hospitals, and utilities—need to modernize their critical network infrastructure to stay connected and productive even when our world stands still.

Advanced Networks Help Us Work in New Ways

As our networks evolve, workforces can modernize and leverage technology to work smarter, not harder. With a culture of innovation and a digital foundation, businesses will be ready to pivot towards new ideas that help them grow and profit. Several trends are reshaping how we work, but the most impactful trend is the onset of a more distributed office domain and workforce. COVID-19 has accelerated the remote workforce trend, where tools, information, people, and skillsets transcend geography. This emphasizes the need for digital tech to streamline and execute projects efficiently, and create a new context around how we work.

Over the last 10 years, Black & Veatch has innovated from the inside out to improve our operations and to understand how advanced communications and technologies help our clients. We harness digital tools like artificial intelligence, machine learning, and bot automation to organize dispersed field and office teams, simplify project tasks, increase information sharing, and excute back-office functions efficiently.

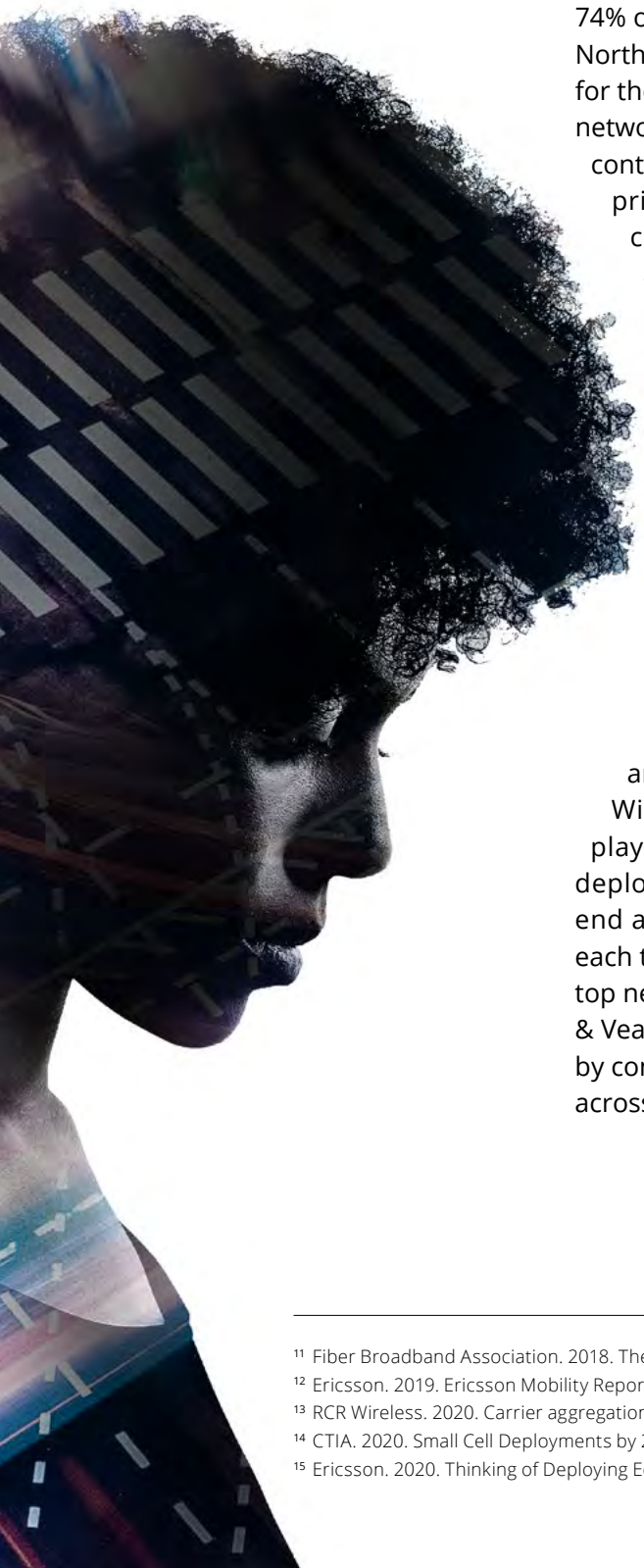
With a digital foundation, it's easier to develop and adopt apps that build resilient operations even during disruption. We developed new apps during the initial phases of COVID-19: BV Safe Contact and a suite of apps that compose our Digital Construction Manager. These apps help us track exposure risk to field crews and manage large construction projects remotely to keep workers safe.



[8] Pew Research Center. 2020. As Schools Close Due to The Coronavirus, Some U.S. Students Face a Digital 'Homework Gap'.

[9] New York Times. 2020. Surging Traffic Is Slowing Down Our Internet. March 26.

[10] Federal Communications Commission. 2020. FCC Provides T-Mobile Temporary Access to Additional Spectrum to Help Keep Americans Connected During Coronavirus Pandemic.



Accelerate the Digital Future

5G networks will support connected devices at a remarkable scale—2.5 million devices per square mile[11]—and 5G's gigabit speeds will reshape data and connectivity into innovation. As the 5G leader, the U.S. has already launched commercial 5G services for mobile and fixed wireless access, and Ericsson estimates that by 2025, 74% of mobile subscriptions in North America will be 5G.[12] But for the next decade, 4G and 5G networks will coexist. Carriers will continue to use 4G to provide primary connectivity for customers and deploy 5G at sites with greater traffic requirements. 4G and 5G will share resources and support each other for years to come,[13] which means industries can confidently modernize their existing 4G networks to support advanced technologies.

5G performance requires an advanced core network and efficient radio technologies, more spectrum bandwidth, and network densification. With several technologies in play, 5G network design and deployment requires an end-to-end approach to interconnect each technology seamlessly for top network performance. Black & Veatch is accelerating the future by constructing 5G network nodes across urban and rural communities.

While technology selection and construction vary among carriers, these five technologies are essential:

1. **Small Cells.** Traditional macro towers will be supplemented by a dense small cell network at the neighborhood level to provide a consistent network experience. Small cells in the U.S. will grow from 86,000 in 2018 to over 800,000 by 2026.[14] To support rapid deployment, Black & Veatch uses innovative apps to streamline the process and save 1-2 months of cycle time.
2. **Edge Computing.** Edge computing uses a distributed cloud network to process data-hungry apps at the source for better user experience and performance. Edge computing reduces load on backhaul networks and enables context awareness and data analytics capabilities to support mission-critical and low-latency apps. By 2023, 25% of 5G use-cases will depend on edge computing capabilities.[15]
3. **Edge Data Centers.** Instead of one central data center, 5G design may include numerous, smaller data centers distributed geographically to support edge computing. Edge data centers assist edge computing to support apps that demand substantial bandwidth, rapid response times, and low-latency.
4. **Fiber Optic Cable.** Fiber's expansive bandwidth supports small cell densification, edge computing, widespread connectivity, and fronthaul and backhaul from the edge to the core. Fiber is future-proof. Once fiber is in place, the 5G network can reach exponentially higher speeds with simple radio equipment additions.
5. **Macro Cells.** The macro layer provides the physical foundation for most wireless connectivity in the U.S., and more macro and small cell sites will be needed to support 5G use cases. Macro cells are typically located on tall towers or poles, making them ideal hosts for Massive Multiple Input Multiple Output (MIMO) antenna arrays and beamforming to send and receive more data on the same spectrum and find optimal signal routing.

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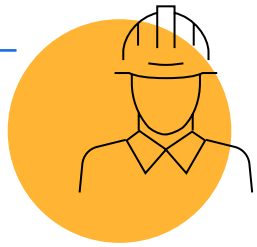
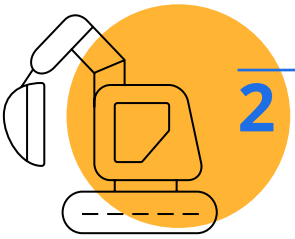
[11] Fiber Broadband Association. 2018. The Fiber Guide.
[12] Ericsson. 2019. Ericsson Mobility Report.
[13] RCR Wireless. 2020. Carrier aggregation is key to 4G and 5G coexistence: Ericsson
[14] CTIA. 2020. Small Cell Deployments by 2026.
[15] Ericsson. 2020. Thinking of Deploying Edge Computing? Here are Four Approaches.

Work in New, Innovative Ways with a Digital Foundation

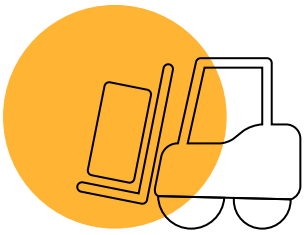
Since 2011, Black & Veatch has launched 35 innovations to advance our data networks, including machine learning analytics, drone data capture, and imagery-to-data solutions. Our digital foundation allows us to develop apps and tools to modernize our workforce. Digitalization allows us to work in new ways—data-driven, smarter, and more cohesively—to stay productive even during COVID-19 and create higher-value outcomes for our clients. Here are five of our digital tools:



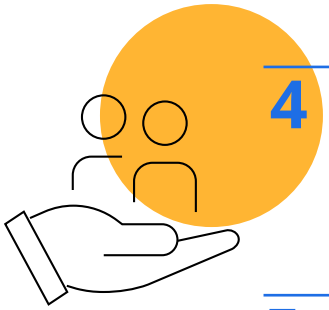
1 **Field Workforce Management Platform:** Customized system built for future innovation. Unifies the back office, front office, and field office systems for superior, real-time project control and time and cost savings. Uses intelligent routing to automate business functions. Supports digital construction management, which replicates field conditions for remote management.



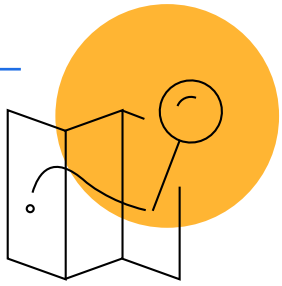
2 **Construction Start Dashboard:** Data-visualization tools communicate when sites are construction-ready. The dashboard is sharable with clients for quick status updates about forecasted dates, actualized dates, and other data about their sites. It is estimated that the dashboard will reduce the need for lengthy status meetings by 20-30%. Black & Veatch is piloting this tool with clients in California and Nevada.



3 **Materials Visibility Dashboard:** Tracks and monitors site material status in real-time. Guides material orders and schedules, which helps Construction Managers efficiently plan and schedule crews. Estimated to cut materials administrative time by 25%. Black & Veatch is piloting this tool with clients in California and Nevada.



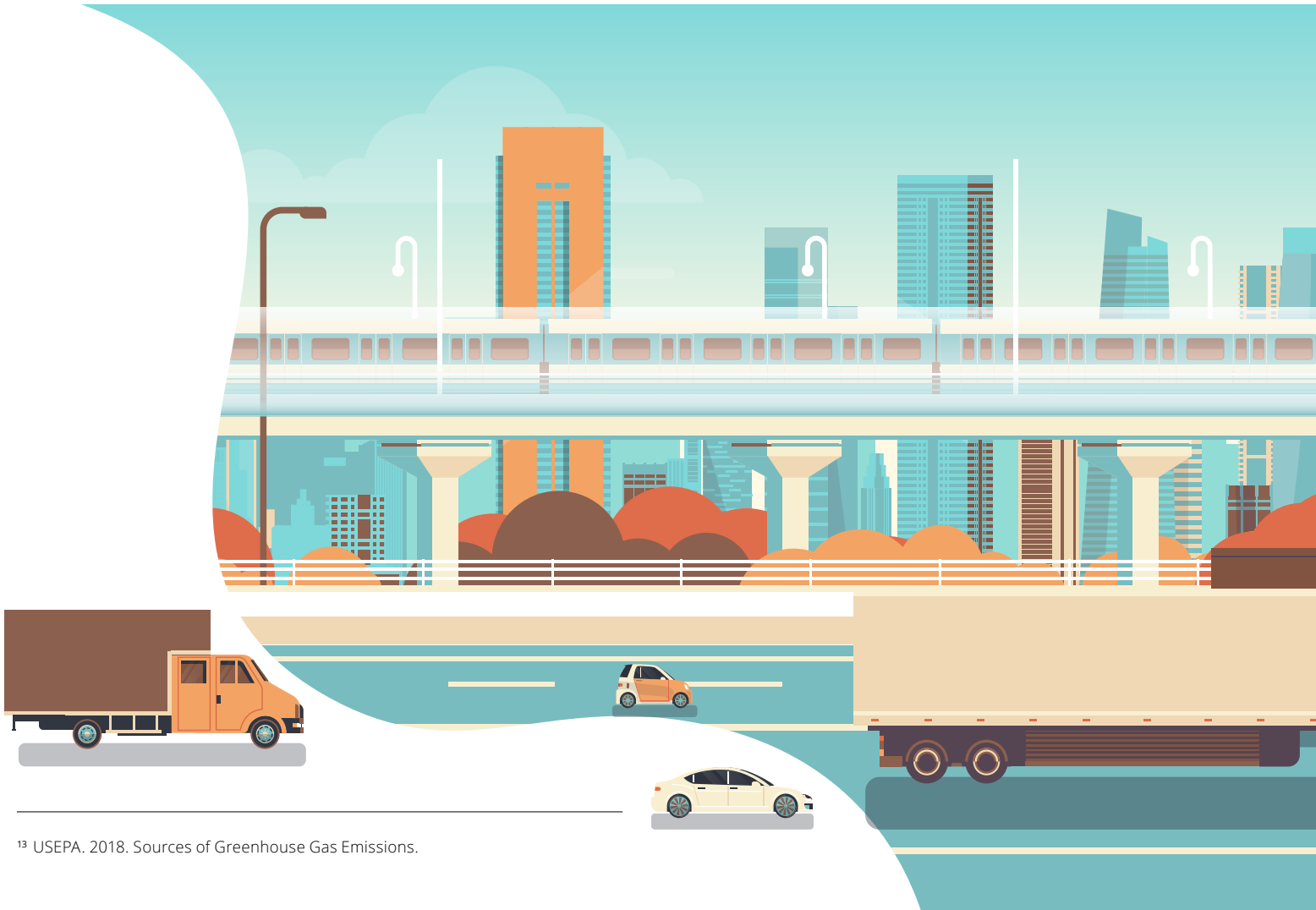
4 **BVSafe:** Mobile software that fast-tracks validation of craftsperson credentials in near-real time, slashing the risk of incidents. Paperless, time-stamped recordkeeping reduces administrative costs.



5 **BV Safe Contact:** Leverages connected data to merge COVID-19 data with mapped client project locations geospatially. Supports safer workplaces with digital social distancing wearables and mobile job safety apps that keep projects moving and workers safe. Contact tracing using advanced visualizations and analytics alerts employees of potential exposure, enabling them to quickly self-isolate and get treatment. Black & Veatch is using this tool on project sites across New York.

Safe, Sustainable Mobility in our Digital World

The transportation sector accounts for 28% of the total greenhouse gas emissions in the U.S.,[13] which is why sustainability is on the mind of every transportation planner. Transportation leaders are rethinking travel and transit to embrace our new digital mobility—one that centers on advanced communications, multi-modal travel, and data exchange. As they plan investments, leaders must balance the changing travel habits of consumers with overarching goals like reducing traffic snarls, increasing air quality and sustainability, moving goods more safely, and improving the day-to-day travels of citizens. Advanced communications support several emerging technologies that check all the boxes.



[13] USEPA. 2018. Sources of Greenhouse Gas Emissions.

Clean, High-Tech Mobility

On-demand ridesharing is a mobile revolution that continues to evolve. Car, bike, and scooter-sharing are now standard features of micro-transit and multi-modal transportation, but advanced communications are allowing traditional on-demand ride-sharing to go to the next level and beyond.

Consider the Hyperloop. Hyperloop is a point-to-point, high-speed surface transportation system that turns a 4-hour car trip into a direct 30-minute travel experience that is devoid of traffic, road noise, weather delays, and safety hazards. Hyperloop pods, which carry passengers and light freight, contain permanent magnets to repel a passive track that is contained within a low air pressure tube, which reduces friction. Linear motors glide the pod through the tube to its destination. Several countries across the globe, including the U.S., are constructing Hyperloop test pods and conducting feasibility studies with favorable results.

Hyperloop's speeds can reach 670 miles per hour, so advanced communications are critical to ensure system performance and safety. Digital communications enable the pod, physical infrastructure, and the control center to exchange location and speed data, which requires adequate bandwidth, data rate, and latency. A network of wired and wireless communications technologies is needed to meet these requirements.

In our interconnected digital world, when one industry innovates, several industries reap the benefits. This is particularly true with transportation, which influences energy and several community systems. Hyperloop's low-friction design uses minimal electricity to hit high speeds, and its energy efficiency is unparalleled by other types of mass transportation. With near-zero-emissions, Hyperloop will effectively shift passenger and freight travel from less-efficient modes, like internal combustion cars and trucks, to a more efficient travel/transport mode. Turning to more efficient modes is a primary sustainability strategy that can cut carbon emissions by 20%.[14]

[14] The Intergovernmental Panel on Climate Change. 2018. Global Warming of 1.5°C. Page 2-65.

Vehicle-to-Grid Connectivity

Our energy landscape is changing dramatically as EV adoption and renewables generation continues to grow. Estimates indicate that 3.6 million electric vehicles (EVs) (cars and light trucks) will be on U.S. roads by 2025,[15] and reach 22 million by 2030.[16] Multi-megawatt charging stations will result in terawatt-level power demand, which will increase as electrification expands as predicted into medium, heavy-duty, and autonomous vehicles, as well as into industrial, mining, buildings, agriculture, and other markets. These trends are sounding alarms among electric utilities because meeting this new load could mean immense capital expenditures for new generation, transmission, distribution, and storage infrastructure.

Concurrently, solar and wind energy are expected to rule generation in 2020, making up 76% of new U.S. generation and adding 42 gigawatts (GW) of zero-emission capacity. For the first time, renewable energy surpassed coal in U.S. electricity generation.[17] However, as more renewable energy is created, some states end up with a glut either because of meager demand or insufficient local transmission lines to carry electricity to places where it can be used. Often, states pay other states to take their excess.

These two dynamics—EV power demand and renewable energy—present an interesting contrast. Utilities could struggle to meet the power demand of large-scale electrification, and yet have too much renewable energy.

Vehicle-to-grid (V2G) connectivity may be part of the solution. V2G provides grid flexibility by being able to respond to changing grid and energy conditions. Using California EV projections for 2025, Lawrence Berkley National Laboratory found that EV managed charging (V1G) created 1GW of storage. However, adding even a limited number of vehicles with V2G capabilities increased storage to 5GW, which equates to $12.5-15.4 billion in stationary storage costs.[18] EVs with V2G capabilities could substantially reduce the need for new power plants and costly offloading of excess clean energy, which is a growing challenge in areas where solar and wind generation has increased. V2G uses EV batteries for mobile energy storage, and turns charging hubs into grid-regulating tools that help utilities integrate clean energy sources, augment available load, and balance performance like voltage, frequency, and ramp rate reduction.

Electric utilities and fleet managers are getting out in front of the electrification trends by constructing EV charging hubs and adopting EV fleets. Many are piloting V2G at the same time to capture grid value, revenue streams, and savings—one V2G eBus can generate $6,100 annually.[19] While grid stability and operational savings are motivating factors for V2G integration, utilities and fleet owners are also helping to meet state mandates for greenhouse gas emission reductions, renewables integration, and stationary storage.

San Diego Gas and Electric (SDG&E) will construct **300+ chargers for medium and heavy-duty vehicles** and equip **10 school buses with 25kW bi-directional chargers** to test how well they improve the utility's load factor and reduce local air pollution.[20]

[15] International Council on Clean Transportation. 2019. Quantifying the Electric Vehicle Charging Infrastructure Gap Across U.S. Markets.

[16] BloombergNEF. 2019. Electric Vehicle Outlook 2019.

[17] Forbes. 2020. Renewable Energy Prices Hit Record Lows: How can Utilities Benefit from Unstoppable Solar and Wind?

[18] Jonathan Coignard et al. 2018. Environ. Res. Lett. 13 054031.

[19] Clinton Global Initiative. 2018. V2G EV School Bus Working Group. Demonstration Project.

[20] Utility Dive. 2019. California OKs $100M SDG&E Commercial EV Charging Plan, Testing Electric Buses as Grid Assets.

As of 2018, the U.S. conducted 16 V2G pilot programs with the physical deployment of technologies,[21] and that number is growing to include school districts, cities, federal agencies, colleges, and businesses. This number may pick up as bidirectional vehicles, hardware, and software evolve and become mainstream. Right now, Nissan Leaf is the only EV available in the U.S. that is bidirectional-capable. But, as a sign of market progress, Fermata Energy's bidirectional EV charging system was recently certified to a new North American safety Standard, UL 9741.[22] As V2G expands, other forms of connectivity like vehicle-to-building (V2B), vehicle-to-home (V2H), and vehicle-to-everything (V2X) also gain speed.

In our digital world, V2G will rely on advanced communications to integrate essential hardware and software to help fleet owners optimize energy and vehicle use and seamlessly interface with utilities.

Digital communications support essential functions like advanced analytics and connectivity to understand charging needs and availability, optimize grid value, and evolve alongside our new mobility, which is becoming more connected, predictive, and proactive.

Smart Highway Connections

In many ways, roadway networks are mini-cities. They have their own citizens whose behaviors and needs are shaping new ways to get from Point A to Point B. They have departments that function better with enhanced data sharing. They have goals to build reliable operations, improve safety, and increase the quality of citizen experience. And like their city counterparts, transportation planners are going digital to build a flexible communications foundation that supports high-tech trends.

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[21] UK Power Networks and Innovate UK. 2018. V2G Global Roadtrip: Around the World in 50 Projects.

[22] UL. 2020. Fermata Energy Receives the First UL Certification for 'Vehicle-to-Grid' Electric Vehicle Charging System.

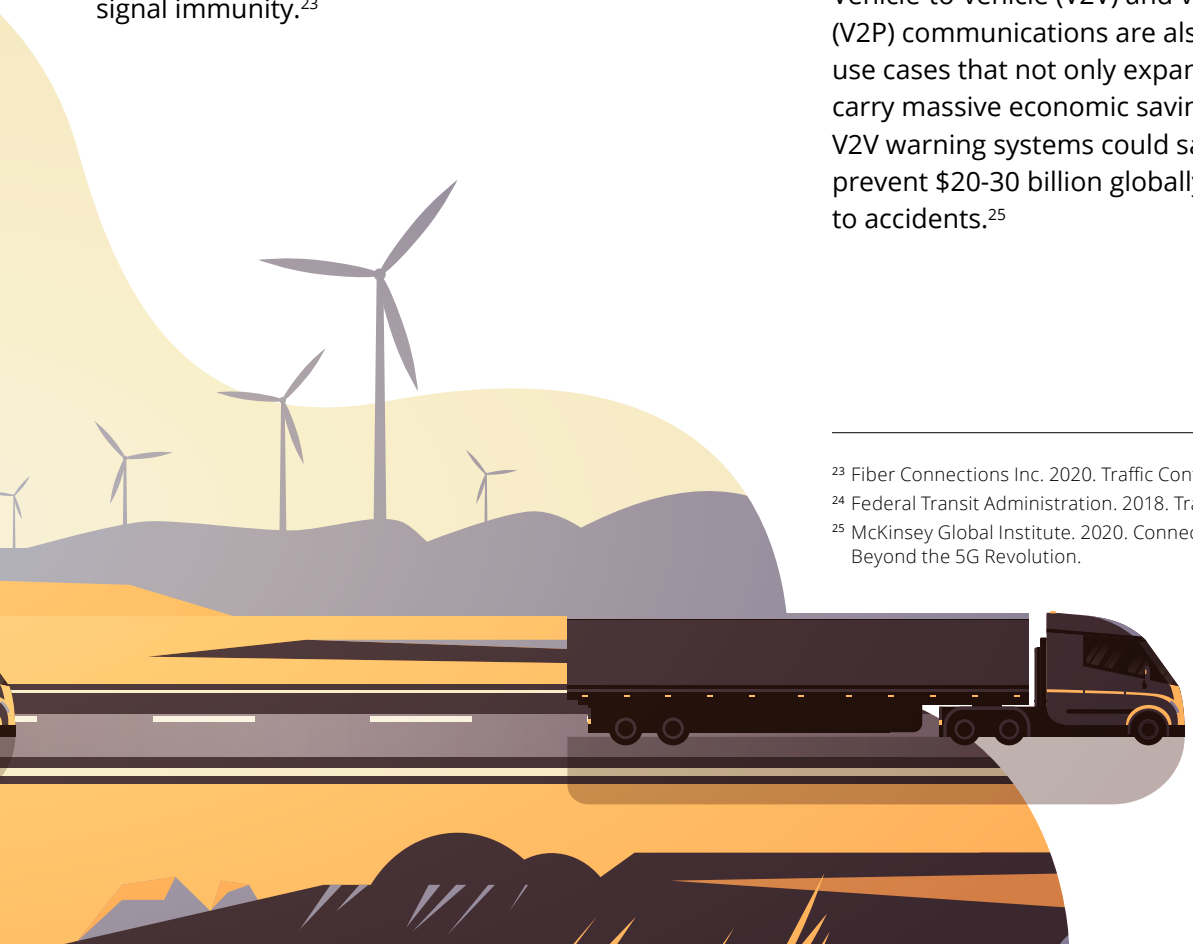
As they modernize, many transportation departments, like the Pennsylvania Turnpike Commission, are **over-building fiber to open leasing opportunities** and **generate new revenue streams.**

Increasingly, transportation planners are constructing intelligent transportation systems (ITS), which position data-driven functions as the centerpiece of modern travel and transport. ITS features such as All-Electronic Tolling (AET), variable message signs, real-time traffic updates, video surveillance, and future innovations like connected vehicles require upgraded networks to provide the necessary bandwidth and data rates. Fiber is especially important in transportation, because the distance between data collection points and processing points can be many miles apart. Fiber delivers greater bandwidth, longer transmission distances, and more signal immunity.[23]

Transportation networks and their nearby communities can align goals and create multi-modal systems that link smart travel options from the highway to the neighborhood. Communities can develop on-demand ride-sourcing and bike-sharing, in addition to hyperloop, autonomous shuttles, eBus, train, or walking routes. As a valuable outgrowth of transit centers, transit-oriented development is springing up to revitalize neighborhoods, increase ridership, and provide access to walkable, mixed-use development.[24] To evolve connected mobility, communities will need to develop tech-enabled innovations—interactive reservations, smart parking, vehicle routing, app-based payments, EV car charging and sharing, and vehicle arrival tracking—that make use of integrated communication and energy networks, V2X connections, and data gathering.

As 5G networks evolve, they will work in concert with fiber networks, Dedicated Short-Range Communications (DSRC), satellites, and low-power wide-area networks (LPWA) to enable new forms of vehicle and transportation connectivity. Vehicle-to-infrastructure communications will use two-way signals between cars and digitized roads, bridges, and tolls outfitted with sensors, antennae, and routers. These connected data points will help transportation planners manage traffic in real-time, and help drivers understand safety, mobility, or environment-related conditions along their route.

Vehicle-to-vehicle (V2V) and vehicle-to-pedestrian (V2P) communications are also evolving connectivity use cases that not only expand our digital world but carry massive economic savings. Estimates show that V2V warning systems could save numerous lives and prevent $20-30 billion globally in vehicle repairs related to accidents.[25]



[23] Fiber Connections Inc. 2020. Traffic Control Issues.

[24] Federal Transit Administration. 2018. Transit-Oriented Development.

[25] McKinsey Global Institute. 2020. Connected World. An Evolution in Connectivity Beyond the 5G Revolution.

Connectivity is King

Our digital world relies on advanced communications to create interconnection between vehicles and everything around them. 5G, dense fiber networks, and wireless communications will seamlessly connect related systems for safer, more sustainable travel, and flexible, responsive energy and community systems. As we evolve, there will be no such thing as static infrastructure—roads, cars, and infrastructure will integrate into the environment and operate with situational awareness.



Vehicle-to-Grid:

- EV mobile energy storage helps integrate clean energy sources.
- Promotes grid flexibility and balances voltage, frequency, and ramp rate reduction.
- As we evolve, smart highways will collect energy through photovoltaic collectors, which will be stored and used to power streetlights and digital highway signs.

Vehicle-to-Building:

- Shifts power from stored EV batteries to buildings.
- Uses cheaper, stored energy during more expensive high-demand periods.

Vehicle-to-Home

- EVs charge at night and use that electricity during the day when power is more expensive.
- Leverages batteries as back-up power supply for emergencies.

Vehicle-to-Network

- IoT sensors monitor car maintenance status and notify owners of needed repairs.
- Over-the-air software updates to connected cars.




Vehicle-to-Vehicle

- Short-range connectivity that allows cars to talk to each other.
- Warning systems prevent accidents.

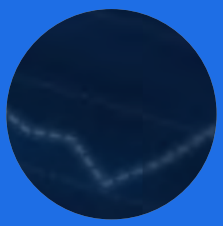
Vehicle-to-Infrastructure

- Vehicles connect to roads, bridges, traffic lights and tolls for two-way signals.
- Provides real-time traffic management, driver route optimization, and informs road usage.
- As we evolve, roads will use sensors to monitor roadside parking and identify littering.

Vehicle-to-Pedestrian

- Smartphones connect with travel systems to inform optimal travel routes.
- Connected cars “see” pedestrian via smartphone or other wearable device for increased safety.





Data-Driven Electricity in our Digital World

As communities focus on sustainability, distributed energy resources (DERs) get a lot of attention, but residential solar and electrification are really turning heads.

As these two markets take off, utilities are digitalizing their distribution grid to leverage smart devices such as sensors that enable automation. This allows utilities to gain greater control over DERs and to navigate what is becoming a highly diverse and sometimes volatile energy environment.

While COVID-19 dampened residential solar growth in 2020, customer-owned rooftop solar had a record year in 2019, and the market continues to expand across states while costs continue to fall.[26] Communities continue to shift to cleaner energy sources, but their use results in voltage swings that the utility needs to monitor and control in order to stay within mandated limits.

At the same time, electrification is creating massive power demand that is largely unpredictable. About 3.6 million EVs (cars and light trucks) will be on U.S. roads by 2025.[27] To support large-scale electrification, the U.S. needs to construct 9.6 million charge ports by 2030, composed of a mix of Level 2 and DC Fast chargers.[28] As medium and heavy-duty vehicles and fleets become electrified, utilities will experience the impact of simultaneous charging, corridor-charging hubs, and large charging depots—all with charging requirements of 5MW, 10MW or more. This is problematic considering that simultaneous charging of 60,000 100 kWh EV batteries with a 5-minute charge time would equate to an instantaneous demand of 70 gigawatts.[29] The power demand of EV charging will only increase as electrification expands as predicted into autonomous vehicles, transit, drones, aircraft, marine vehicles, buildings, agriculture, and beyond.

When electrification, rooftop solar, and other DERs scale to this degree, significant ripple effects will occur across the distribution grid due to intermittency and load balancing.[30] To prepare, utilities are digitalizing their distribution grid, deploying smart devices, and viewing data as a vital resource. Utilities that modernize their distribution grid use data to make assets more reliable because they can anticipate, detect, and resolve problems faster.[31] As an indication that electric utilities are embracing data-driven operations, the U.S sales of distribution automation market

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[26] Solar Energy Industries Association. 2020. Solar Industry Research Data.

[27] International Council on Clean Transportation. 2019. Quantifying the Electric Vehicle Charging Infrastructure Gap Across U.S. Markets.

[28] IEI/EEI. 2018. Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030.

[29] Wood MacKenzie. 2017. The Rise of the Electric Car: How Will it Impact Oil, Power and Metals?

[30] Navigant 2018. Energy Cloud 4.0. Capturing Business Value Through Disruptive Energy Platforms.

[31] McKinsey & Company. 2018. The Digital Utility: New Challenges, Capabilities, and Opportunities.

size is expected to grow from an estimated value of $12.4 billion in 2020 to $17.7 billion by 2025[32] and smart meter deployments are estimated at $39 billion in 2019.[33]

These operational leaps are made possible by a converged communications network with a core internet protocol (IP) and multi-protocol label switching (MPLS) network and a flexible, scalable wireless field area network (FAN). An IP-MPLS-FAN network reduces network congestion and gives utilities speed, visibility, and control at the edge of the distribution system where it's most needed. It also enables a utility to fully realize the potential of their digitalized distribution grid and smart technologies, helping them achieve a sustainable future, regardless of disruptions. A modernized IP network, purpose-built for a digital distribution grid, offers a reliable and scalable architecture to host automation, smart sensors, and emerging technologies like synchrophasors for situational awareness and control. With a digital foundation, utilities can develop apps to get ahead of DER and the new load and generation they introduce.

A digital distribution grid helps meet modern day challenges because it is:

- **Visible:** Utilities know what's happening across the electric continuum. Digital tech identifies and resolves issues earlier, improving overall quality of service.
- **Optimized:** Monitoring, control, and automation technologies optimize the full potential of new load and generation resources.
- **Holistic:** The grid operates as a seamless, integrated system of systems, interconnected by an advanced communications network.
- **Flexible**: Networks can easily adapt to a disruptive marketplace and allows utilities to integrate DERs beneficially.
- **Safe:** Monitoring diverse conditions enables personnel to be alerted before a fire or other dangerous event occurs, keeping workers and the public safe while also protecting equipment.
- **Secure:** Digital platforms are designed to establish cybersecurity protections and standards across the distribution grid, which means security is embedded within apps and interconnected devices to protect data and ensure privacy as data is transferred across the system.

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[32] PR Newswire. 2020. Distribution Automation Market Worth $17.7 Billion by 2025 — Exclusive Report by MarketsandMarkets™.

[33] The Edison Foundation. 2019. Electric Company Smart Meter Deployments: Foundation for a Smart Grid (2019 Update).

Grid Modernization Values

Utilities that transform operations and systems with digital technologies capture big values by streamlining systems, boosting performance, and conducting maintenance at the right time. As a bonus, they enable improved communication with customers, 45% of whom want a digital interface. Here's what a utility may gain by transforming to a digital grid.

25% **reduced operating expenses** translate to lower revenue requirements or greater profits.

20-40% **increase in performance** related to safety, reliability, customer satisfaction, and regulatory compliance.

5-10% **profit boost** by making advanced analytics a core capability to find and resolve problems insightfully.

10-20% **reduction in asset-management costs** by using advanced analytics to power predictive maintenance offers

Source McKinsey & Company. 2018. The Digital Utility: New Challenges, Capabilities, and Opportunities.

Conclusion

Our digital world is fast-evolving, and it won't be long before success is measured by how well an industry or community system applies digital innovation. To thrive in our digital world, leaders need to start by planning and deploying advanced communication networks. From here, they can restructure operations from an interconnected, digital perspective and work in new ways to do more with less. The trophies of transformation include resilient and reliable operations that are agile in the face of disruption.

Technology integrators, such as Black & Veatch, have a holistic vision of communications networks and digital technologies, and how they transform each sector—from transportation and energy to communities of every kind. Black & Veatch is a leader in converged, intelligent networks, with expertise in communications infrastructure, sustainable mobility, connected communities, grid modernization, and emerging technologies. Accelerate your digital future with Black & Veatch.

Digital technology deployment is accelerating. Our eBook series **fast-tracks** industry **transformation.**

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