IMPLEMENTING THE NECP WEBINARS

5G IS HERE: HOW WILL THIS IMPACT EMERGENCY COMMUNICATIONS?

DECEMBER 9, 2020

Agenda

- Webinar Overview and Objectives
- National Emergency Communications Plan (NECP) and SAFECOM Nationwide Survey (SNS): Technology
- 5G Capabilities and CISA 5G Strategy
- Resources and Actions
- Question and Answer Session

Webinar Objectives

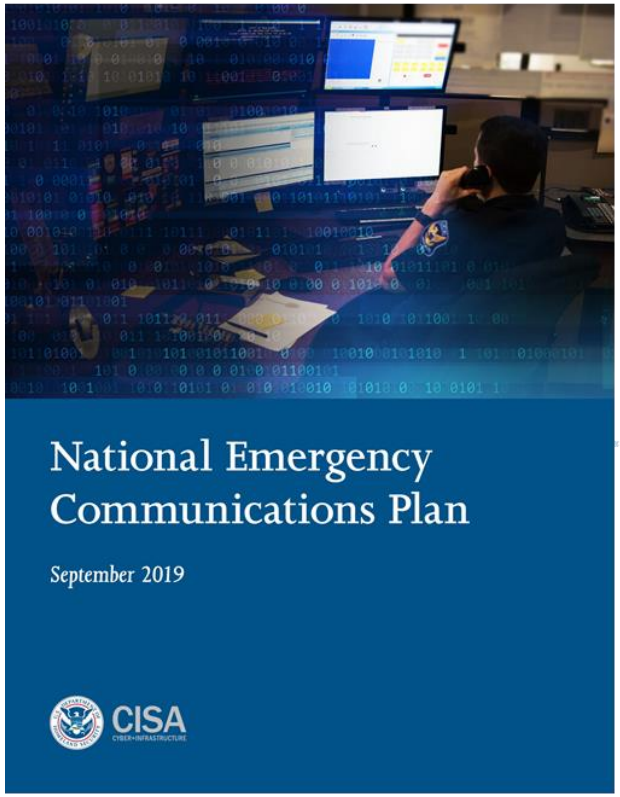
- Discuss technologies currently in use and gaps/challenges that affect ability to communicate
- Use the NECP to plan for the integration of emerging technologies
- Gain an understanding of 5G capabilities and impacts on public safety communications
- Learn about the *CISA 5G Strategy*

Presenters

Eric Runnels
Cybersecurity and Infrastructure Security Agency

Serena Reynolds
CISA National Risk Management Center

National Emergency Communications Plan



- Mandated by Title XVIII of the Homeland Security Act of 2002, the NECP was first published in 2008, and its latest update was published in 2019
- The NECP is the Nation's strategic plan to strengthen and enhance emergency communications capabilities
- The Plan is designed to provide guidance to those that plan for, coordinate, maintain, invest in, and use communications to support public safety operations
- It helps stakeholders enhance and update the policies, governance structures, planning, and protocols that enable responders to communicate and share information under all circumstances
- The NECP navigates the complex mission of maintaining and improving emergency communications while also integrating new technologies and capabilities for emergency responders

NECP Goals

NECP Vision: To enable the Nation's emergency response community to communicate and share information securely across communications technologies in real time, including all levels of government, jurisdictions, disciplines, organizations, and citizens impacted by any threats or hazards event

Goal 1: Governance and Leadership

Develop and maintain effective emergency communications governance and leadership across the Emergency Communications Ecosystem

Goal 2: Planning and Procedures

Develop and update comprehensive emergency communications plans and procedures that address the evolution of risks, capabilities, and technologies across the Emergency Communications Ecosystem

Goal 3: Training, Exercises, and Evaluation

Develop and deliver training, exercise, and evaluation programs that enhance knowledge and target gaps in all available emergency communications technologies

Goal 4: Communications Coordination

Improve effective coordination of available operable and interoperable public safety communications capabilities for incidents and planned events

Goal 5: Technology and Infrastructure

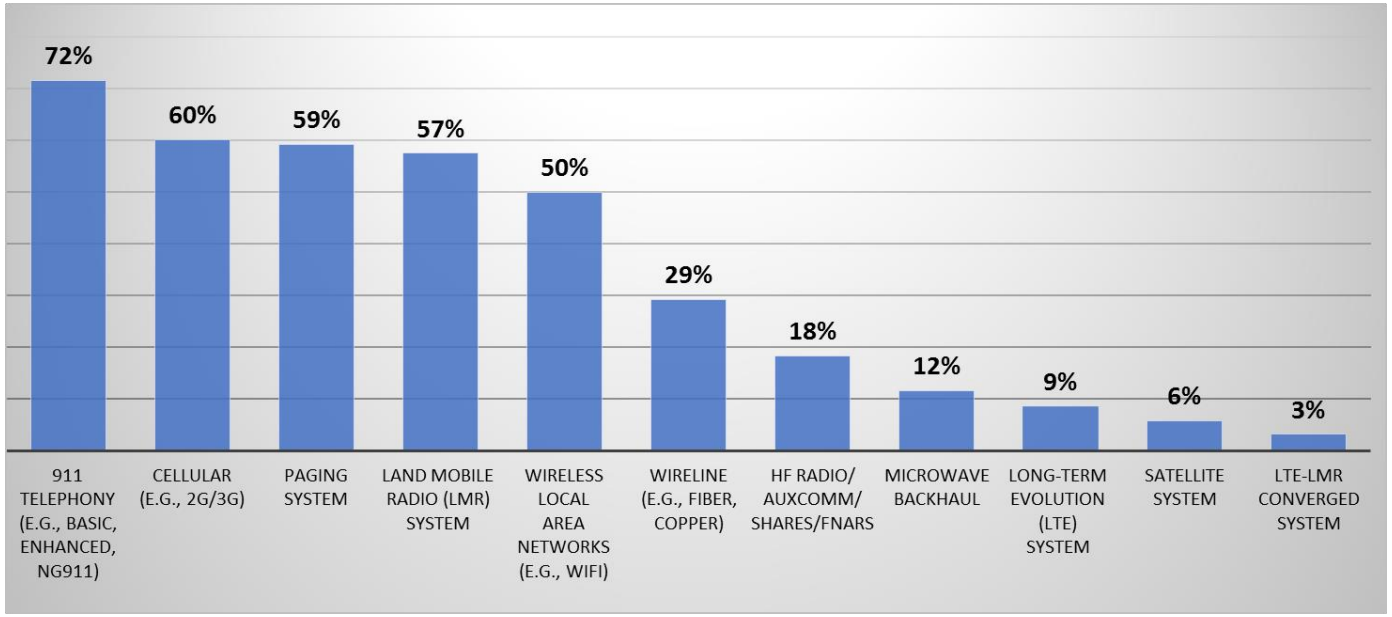
Improve lifecycle management of the systems and equipment that enable emergency responders and public safety officials to share information efficiently and securely

Goal 6: Cybersecurity

Strengthen the cybersecurity posture of the Emergency Communications Ecosystem

Technology Evolution Overview

- New and emerging technologies offer advanced capabilities to enhance command, control, and situational awareness
- No single technological solution can address all emergency communications challenges
- Integration of new technologies require regulatory, compliance, and/or legal support



- ***60% of public safety organizations use a cellular system; and***
- ***9% use a Long-Term Evolution (LTE) system***

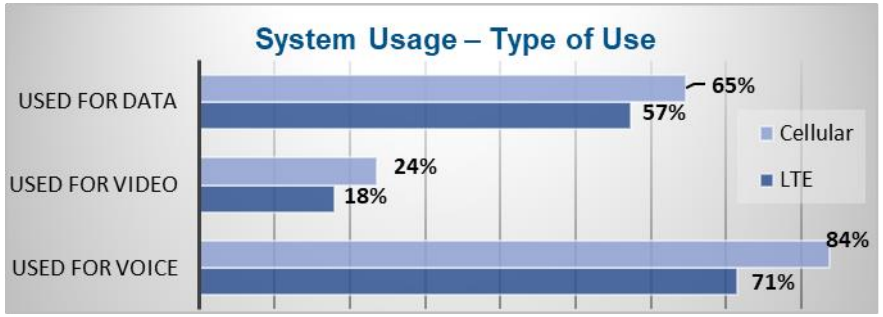
- Governance, standard operating procedures, use, training, and exercises programs must evolve as well
- The SNS findings reflected the need to address technology lifecycle planning, especially for emerging technologies like 5G—the fifth-generation technology standard for cellular networks

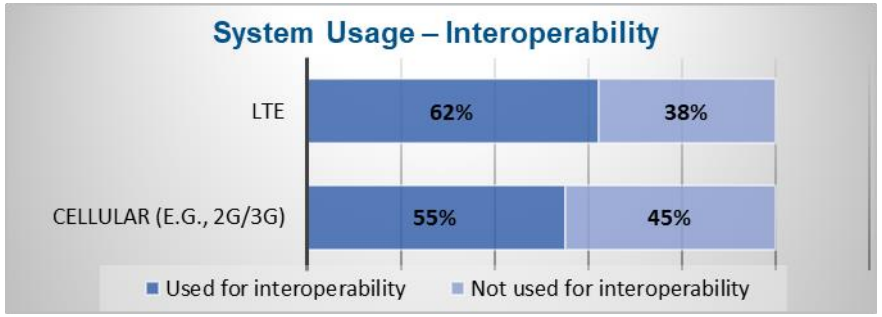
SAFECOM Nationwide Survey (SNS)

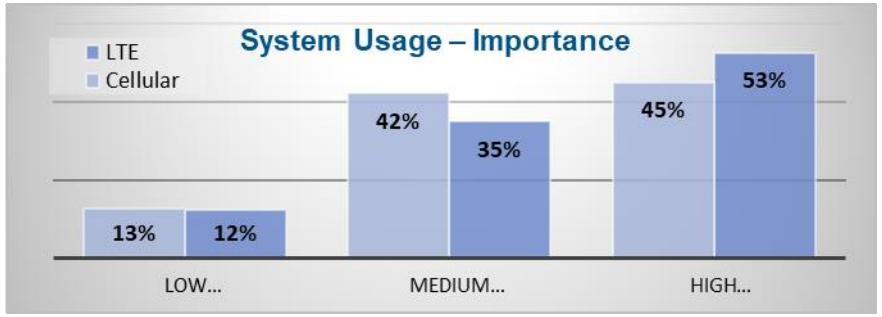
- The SNS is a data collection initiative that supported the content and recommendations of the NECP
- The SNS consisted of 38 questions that span the 5 elements of the *SAFECOM Interoperability Continuum*, plus a security element that accounted for cybersecurity
- Findings from the SNS gauge the status of the Nation's emergency communications capabilities and helped inform the NECP's goals, objectives, and success indicators

SNS: Technology Use

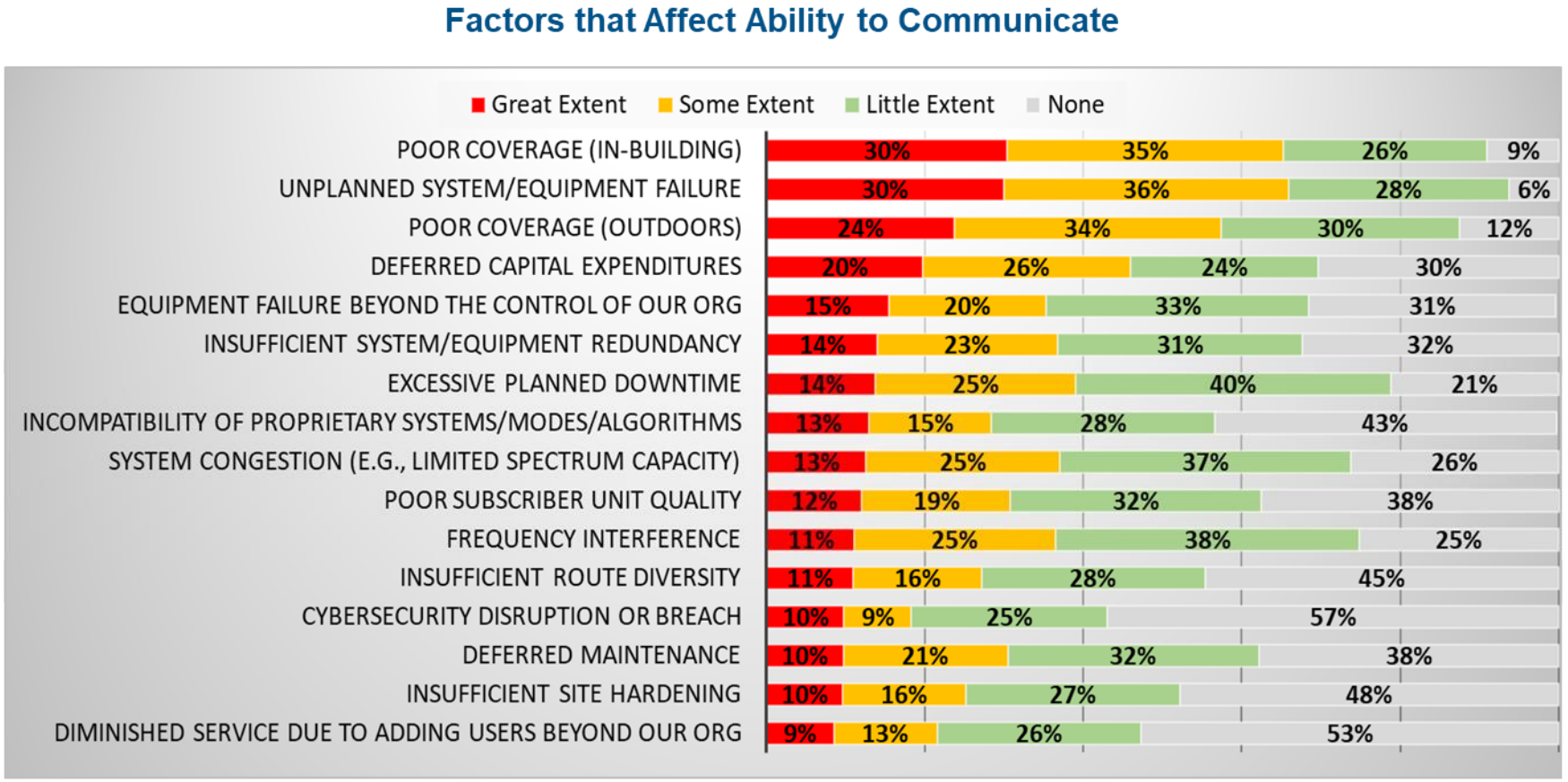
- Of those using cellular and Long-Term Evolution (LTE) networks, more public safety organizations are using them for voice services than data services
- Over half of respondents indicated that the cellular and LTE systems they use is provided through a commercial, subscription-based service
- Over 55% of respondents indicated that they use cellular and LTE systems for interoperability
- Almost two-thirds say their cellular and LTE systems support day-to-day situations without intervention
- Over 45% of organizations indicate their cellular and LTE systems are highly vital for mission function







SNS: Technology



Most respondents (91%) report poor **in-building** coverage impacting their ability to communicate, and 88% report poor **outdoor** coverage impacting their ability to communicate

Eric Runnels
December 9, 2020

NECP Success Indicators: Technology

Goal 5 - Improve lifecycle management of the systems and equipment that enable emergency responders and public safety officials to share information efficiently and securely

- Support public safety requirements that drive research, development, testing, and evaluation of emergency communications technology
- Ensure communications and information sharing systems meet public safety's mission-critical needs
- Support data interoperability through the development of effective and sustainable information sharing and data exchange standards, policies, and procedures

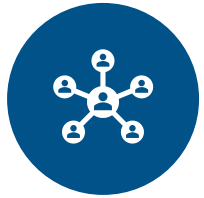
NECP Success Indicators: Support Areas

Governance & Leadership

- Governance bodies include information management, network infrastructure, and cybersecurity representatives
- Governance bodies identify and address legislative and regulatory issues associated with emerging technology

Training, Exercises, and Evaluation

- Implement tools and trainings to address emerging technology impacts
- Include injects in exercises to test communications systems and personnel including emerging technology



Communications Coordination

- Establish sufficient testing and usage observations of all operable and interoperable primary, secondary, and backup communications systems

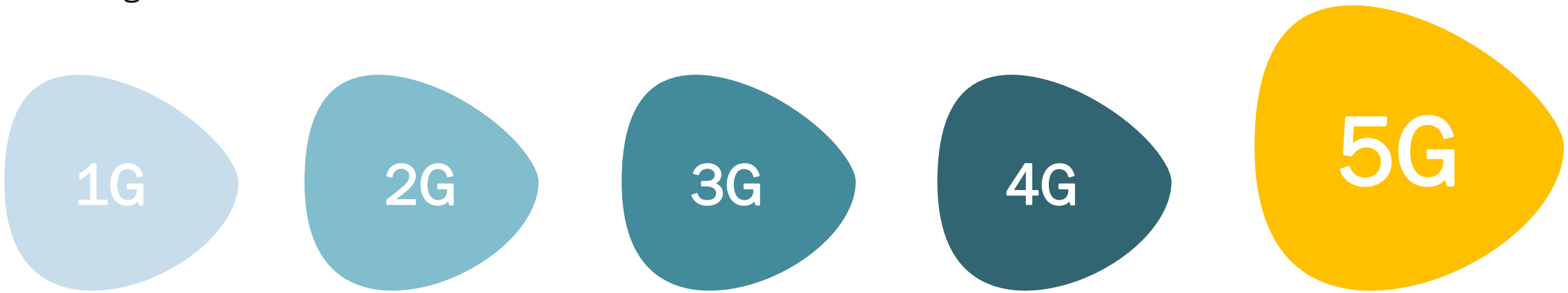
Technology & Infrastructure

- Foster an open, innovative, and standards-based commercial marketplace for solutions development to ensure requirements are addressed in emerging standards
- Cultivate sustained engagement between federal research, development, testing, and evaluation programs and public safety organizations to address resiliency, interoperability, and other challenges

The Promise and Reality of 5G

5G OVERVIEW

5G is the next generation of wireless networks. Building upon exiting 4G Long-Term Evolution (LTE), 5G brings new capabilities that will transform the digital landscape and serve as a catalyst for innovation, new markets, and economic growth around the world.



FIRST GENERATION

1G delivered analog voice

SECOND GENERATION

2G introduced digital voice (e.g., Code Division Multiple Access [CDMA])

THIRD GENERATION

3G brought mobile data (e.g., CDMA 2000)

FOURTH GENERATION

4G LTE ushered in the era of mobile broadband

FIFTH GENERATION

5G delivers the age of smart devices, connecting virtually everyone and everything through machines, objects, and devices

THE PROMISE OF 5G

5G networks and future communications technologies will introduce a vast array of new connections, capabilities, and services. Compared to 4G, 5G will bring:

100X Network Capacity

5G promises greater traffic capacity, allowing for millions of devices to be connected on the same network within a small area.

10X Decrease in Latency

Data response times will be as low as 1 millisecond, providing endless possibilities from remote surgeries to self driving cars.

100X Faster Download Speeds

While a 3GB movie would take 40 minutes to download on 4G, it will take only 35 seconds on a 5G network.

3X Spectrum Efficiency

5G will operate on three different spectrum bands, low, mid, and high-band, to enhance capabilities and coverage.

[1]https://www.visualcapitalist.com/5g-next-generation-mobile-connectivity/

HOW IS 5G DIFFERENT?

5G improves upon previous generations of telecommunications technology in its use cases, spectrum usage, and infrastructure deployments:

Diverse Use Cases

Enhanced Mobile Broadband (eMBB)

Ultra Reliable Low Latency Communication (URLLC)
(i.e., Mission-Critical Services)

Massive Machine-Type Communication (mMTC)
(i.e., Massive Internet of Things [IoT])

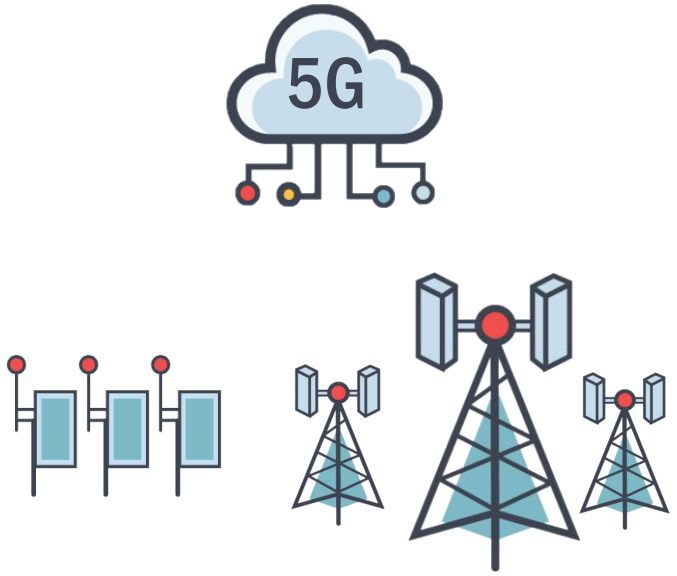
Diverse Spectrum

mmWave
High-band
Above 24 GHz

Sub-6 GHz
Mid-band
1 GHz – 6 GHz

Sub-GHz
Low-band
Below 1 GHz

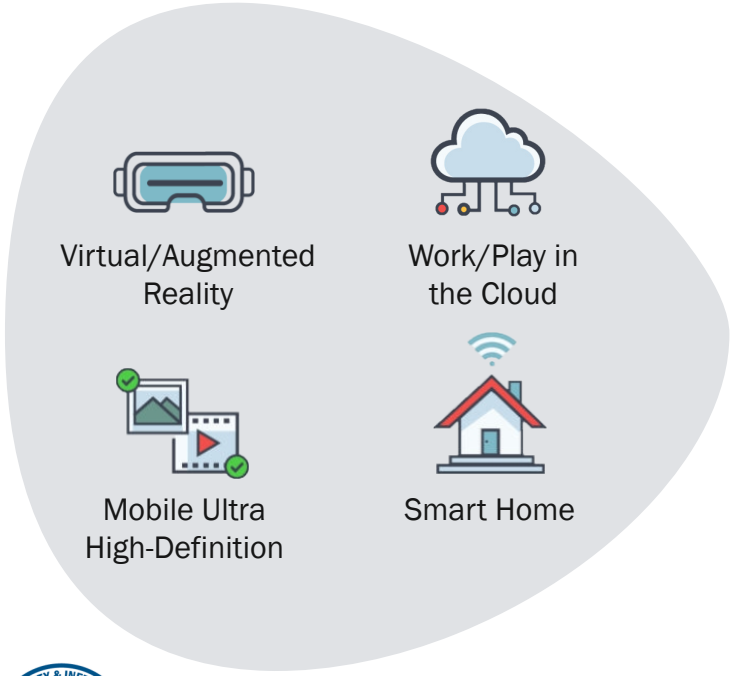
Diverse Deployments



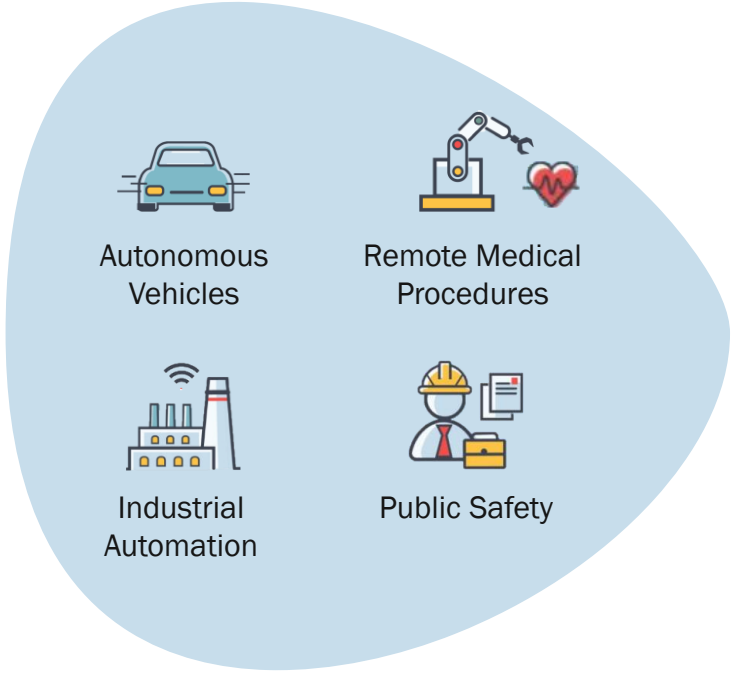
USE CASES

As identified by 3GPP, the leading global telecommunications standards development body, initial 5G applications will be organized by use case type, which are defined by their unique characteristics and services they facilitate:

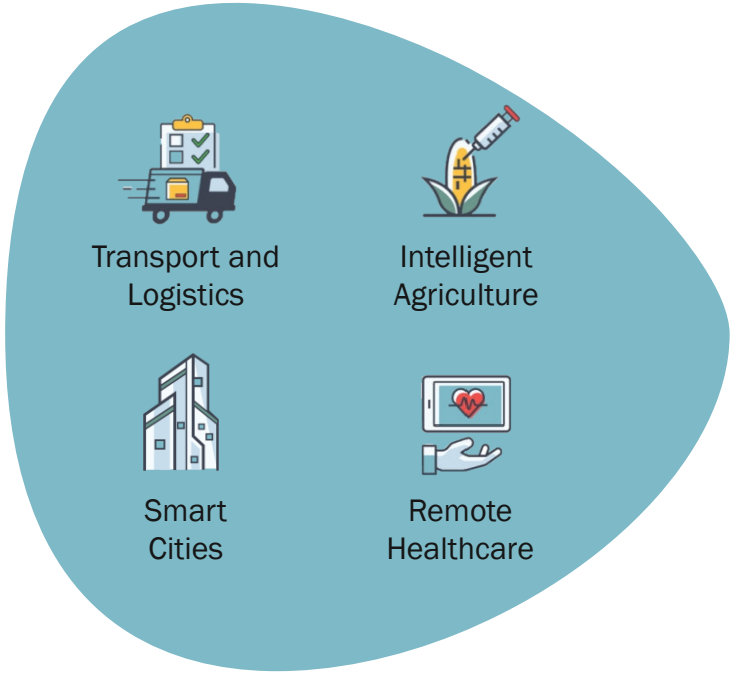
eMBB
Enhanced Mobile Broadband



URLLC
Ultra-Reliable Low Latency Communication

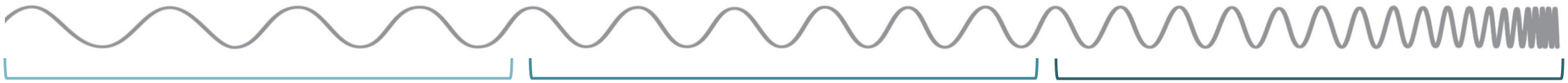


mMTC
Massive Machine Type Communication



SPECTRUM

Unlike 4G-LTE, 5G will operate on three different spectrum bands; low, mid, and high-band. When it comes to performance and coverage, each band consists of different characteristics.



Low-band <1 GHz

"Exceptional Coverage"

Low-band spectrum networks are designed for nationwide coverage and is the ideal choice for targeting rural America.

- Wide coverage area (hundreds of sq. miles)
- This spectrum is the base for FirstNet
- Recommended as the ideal choice for reaching 95% of farmland by 2025

Mid-band 1 – 6 GHz

"Outstanding Capacity"

Recognized as the dominating spectrum category internationally, mid-band networks are well suited for delivering metropolitan network coverage.

- Moderate coverage area (several sq. miles)
- Average speeds around 100 megabits/sec
- The capacity boost allows for a significant increase in connected devices

High-band 24 – 47 GHz

"Revolutionary Creativity"

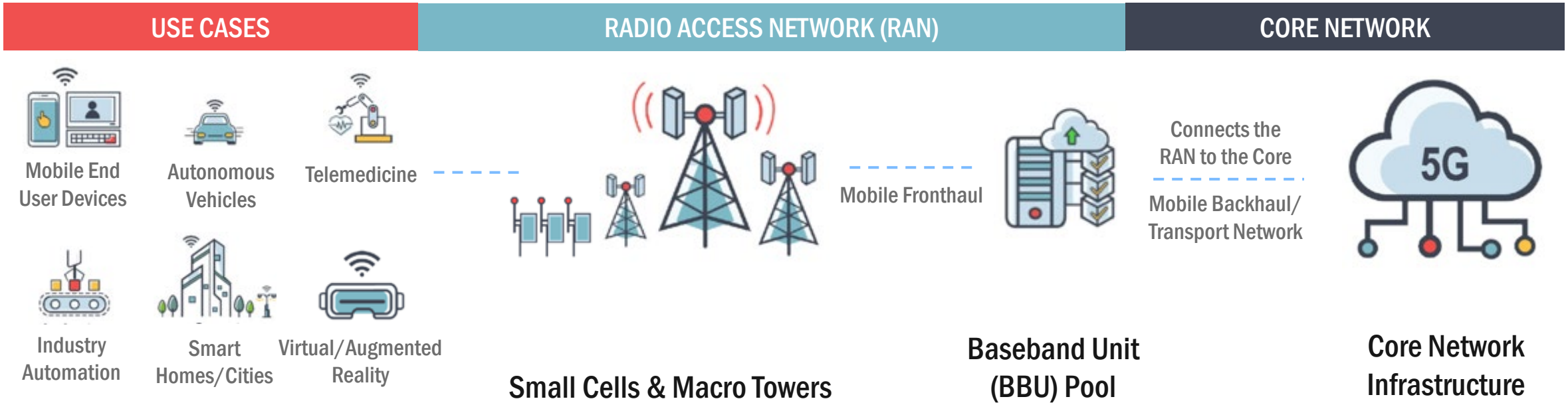
Often referred to as millimeter waves, high-band spectrum unlocks 5G's greatest potential and is designed for high density urban areas.

- Limited coverage area (Less than a mile)
- Gigabit speeds (40 – 80x faster than 4G)
- High-band, millimeter waves do not travel well through walls or windows

[1]https://www.ericsson.com/en/blog/2020/6/what-different-5g-spectrum-options-mean-for-your-business

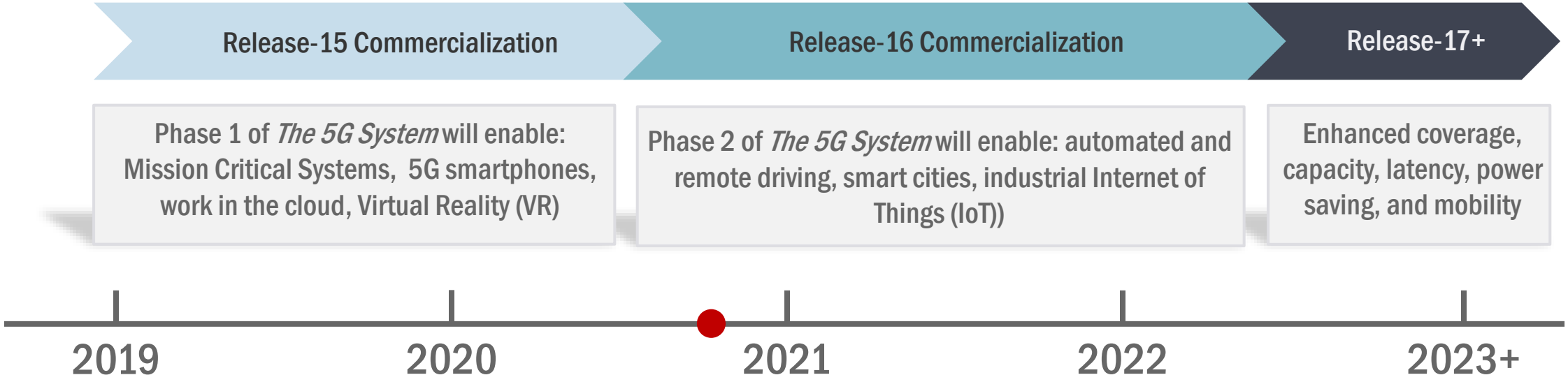
DEPLOYMENT

Initial 5G deployment will primarily operate on a non-standalone (NSA) network, relying on existing telecommunications infrastructure (e.g., 4G-LTE) to provide improved bandwidth, capacity, and reliability of wireless broadband services. The evolution from NSA to standalone (SA) 5G networks is a gradual and phased process; however, some initial deployments will be seen this year.



5G TIMELINE

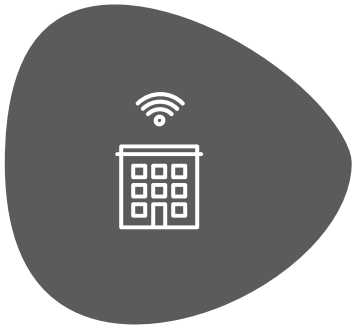
3GPP or the 3rd Generation Partnership Project is a telecommunications standards organization that has developed a series of releases estimating the rollout of 5G. The timeline below depicts the commercialization of these releases (that is, when the public should expect to see the upgrades), rather than their development outlined by the 3GPP timeline.



[1]https://semiengineering.com/should-we-even-be-talking-about-6g/

CURRENT DEPLOYMENT STATUS

While 5G promises to bring many new improvements over 4G LTE, its current capabilities are more in line with the following realities:



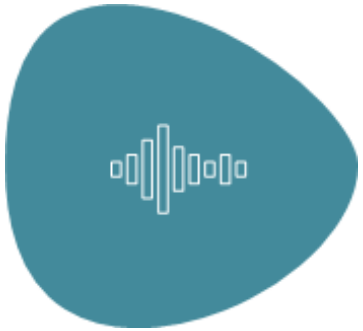
394 Cities Have 5G Deployments

***Coverage and availability may vary**

All these cities have some form of 5G infrastructure currently deployed. However, they may not all have the same type or level of 5G infrastructure, so the experiences of consumers varies greatly by carrier and location.[1]

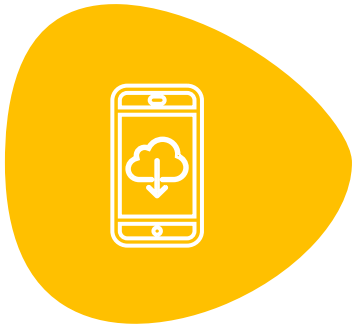
4x Maximum Decrease in Latency

Currently it takes signals on the 4G network about 1 millisecond to travel from a device to a cell tower. The fastest high-band 5G can make this trip in a ¼ of a millisecond, which is not perceptibly faster to humans.[3]



59 Cities have mmWave

While the specific frequencies of high-band mmWave vary by carrier and location, these cities are currently benefitting from the highest-speed 5G deployments currently available.[2]



4x Faster Average Downloads

While typical 4G speeds average around 15 Mbps,[4] the average speeds of current 5G networks are between 40 – 60 Mbps, with peak speeds currently reaching up to 495 Mbps.[5]

[1]https://www.androidcentral.com/heres-every-us-city-5g-coverage-right-now
[2]https:// www.androidauthority.com/5g-cities-us-1105898/
[3]https://www.forbes.com/sites/bobodonnell/2020/02/18/5g-latency-improvements-are-still-lagging/#5537f99d48f1
[4]https://kenstechtips.com/index.php/download-speeds-2g-3g-and-4g-actual-meaning#2G_3G_4G_5G_Download_Speeds
[5]https://www.opensignal.com/reports/2020/06/usa/mobile-network-experience-5g#:~:text=Our%20U.S.%20users%20experienced%20average,T%2DMobile%20at%2060.8%20Mbps.&text=Opensignal's%205G%20results%20represent%20the,to%2Dend%20experience%20of%20users

NEW DEVICES

In order to access the 5G network and its various capabilities, users will need to acquire new devices that can receive 5G connectivity. Some of these devices include:

IoT Devices

- Automotive
- Agriculture
- Industrial
- Security
- Health care
- Infrastructure

Network Hardware

- Enterprise-Class Cellular Gateways
- Home/Office Routers with embedded modems
- Mobile routers with embedded/modular modems

End-User Devices

- 5G enabled phones
- 5G Hotspots
- Wearables
- Appliances

DEPLOYMENT FACTORS

While various forms of 5G are available in many major U.S. cities, deploying nationwide 5G coverage still faces numerous deployment challenges. Some of those challenges include:

Infrastructure Considerations

Infrastructure deployment factors like aesthetic considerations, permitting, and shared small cell sites differ for each city and state.

Misinformation/ Conspiracy Theories

Around the world, misinformation and conspiracy theories around 5G led to public pushback and even damage to key network infrastructure.

Operating and Maintenance Costs

Upgrades to traditional networks, the addition of small cells, and the introduction of large-scale fiberization to support small cells will require large investments to meet capacity and coverage demands.

Cybersecurity Challenges

While 5G will transform the way we communicate, these new capabilities and connections introduce significant risks that threaten national security, economic security, and impact other national and global interests.

EMERGENCY SERVICES APPLICATIONS

5G networks will enable the expansion for billions of IoT devices that will support the advancement of industries like public safety. These devices have the potential to enhance operations, support information-sharing, reduce costs, improve efficiency and response time, augment security, and increase capacity for more connected devices.

Remote Mobile Diagnosis

5G networks will provide reliable, high-speed connection for medical services on the move, allowing hospitals to receive critical patient data from incoming ambulances and begin critical treatment before a patient arrives.

Wearable Technology

5G connectivity will enable a network of devices, such as body-worn cameras and biometric sensors, that remotely monitor first responder vital signs and stress levels. These devices can enhance safety and effectiveness by automatically signaling distress when vital signs are below threshold or sensing threats in the immediate vicinity.

5G Drones

5G connectivity enhances the ability of unmanned drones to capture aerial images and geolocations of personnel in real time over a wide area. These capabilities improve management of large-scale emergencies like extinguishing fires or locating a missing person.

Video Surveillance & Machine Recognition

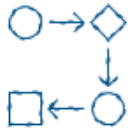
5G networks will increase capacity for high data rates, strengthening connectivity to video surveillance equipment and traffic monitoring/control devices. This will allow public safety operators to leverage Supervisory Control and Data Acquisition (SCADA) systems to support responses from identifying stolen vehicles to deterring lawbreakers.

CISA's Role in 5G

5G TECHNOLOGY RISKS

The Department of Homeland Security (DHS) Cybersecurity and Infrastructure Security Agency (CISA) assesses that the Fifth Generation Mobile Network (5G) will present opportunities and challenges, and its implementation will introduce potential vulnerabilities inhibiting its secure deployment. The following are examples of those risks:

Attempts by threat actors to influence the design and architecture of 5G networks



Susceptibility of the 5G supply chain due to the malicious or inadvertent introduction of vulnerabilities

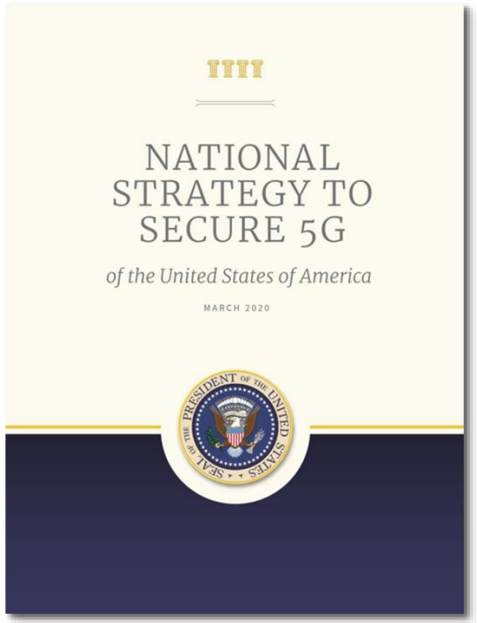
Current 5G deployments leveraging legacy infrastructure and untrusted components with known vulnerabilities

Limited competition in the 5G marketplace resulting in more proprietary solutions from untrusted vendors

5G technology potentially increasing the attack surface for malicious actors by introducing new vulnerabilities

THE NATIONAL STRATEGY TO SECURE 5G

The *National Strategy to Secure 5G* was issued in March 2020 outlining how the U.S. Government will secure 5G infrastructure domestically and abroad by establishing four Lines of Effort:



Lines of Effort:

1. Facilitate Domestic 5G Rollout
2. Assess Risks to and Identify core Security Principles of 5G Infrastructure
3. Address Risks to United States Economic and National Security During Development and Deployment of 5G Infrastructure Worldwide
4. Promote Responsible Global Development and Deployment of 5G

CISA's 5G Strategy

As the nation's risk advisor, CISA, through the National Risk Management Center (NRMC), is leading risk mitigation efforts by working with government and industry partners to ensure the security and resiliency of 5G technology and infrastructure.

CISA 5G STRATEGY:

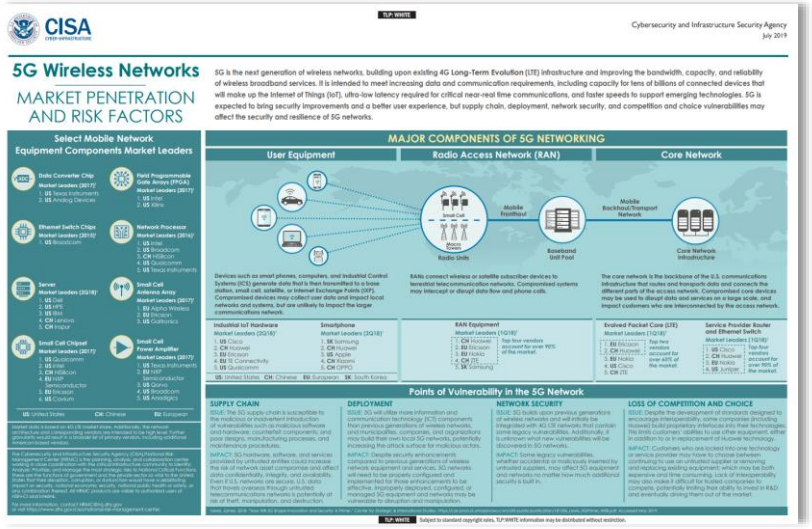
Released in August of 2020 to ensure the security and integrity of 5G technology in our nation.

- Aligns to the four Lines of Effort from the *National Strategy to Secure 5G*
- Identifies 15 Objectives to ensure there are policy, legal, security, and safety frameworks in place to fully leverage 5G technology while managing its significant risks
- Establishes 5 Strategic Initiatives that seek to advance the deployment of a secure and resilient 5G infrastructure

AVAILABLE 5G PRODUCTS

CISA developed the following informational products to provide an analysis and/or overview of the vulnerabilities likely to affect the secure adoption and implementation of 5G technologies:

5G RISK CHARACTERIZATION



MARKET PENETRATION & RISK FACTORS

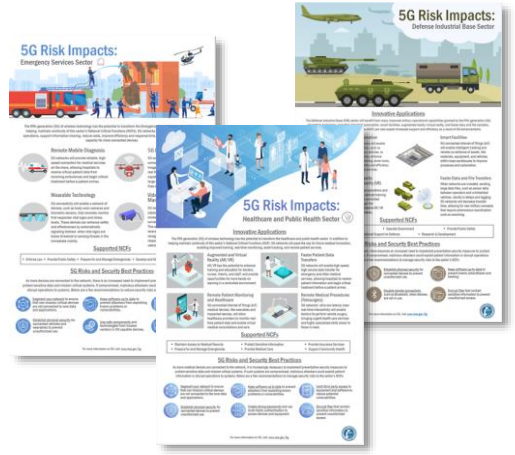
5G: THE BASICS

CISA 5G RESEARCH: RDT&E EFFORTS

5G PRODUCTS IN DEVELOPMENT

SECTOR-SPECIFIC PROFILES

Designed to highlight the 16 critical infrastructure sectors, each profile outlines sector-specific, innovative applications, supported National Critical Functions (NCFs), and best practices to secure 5G adoption.



EDGE COMPUTING: INCREASED RISK FROM UNTRUSTED ENTITIES

An issue paper highlighting the risks of untrusted 5G components in the Radio Access Network (RAN) and how it could expose other network elements to malicious software/hardware, counterfeit components, or component flaws.

5G RISK CHARACTERIZATION v 2.0

Building off the first Risk Characterization paper, this paper will take an in-depth look at 5G risks, analyze their potential impacts, and illustrate various scenarios of consequence.

Resources

- National Emergency Communications Plan
- SAFECOM Nationwide Survey
- CISA 5G Security and Resilience: cisa.gov/5g
  - CISA 5G Strategy
  - Overview of Risks Introduced by 5G Adoption in the United States
  - 5G Market Penetration and Risk Factors Infographic
  - 5G Basics Infographic
- National Strategy to Secure 5G of the United States of America

How You Can Take Action

- Take steps for your organization or jurisdiction to implement the NECP and achieve its success indicators
- Use system lifecycle best practices when adopting 5G capabilities
- Identify and resolve 5G implementation regulatory, compliance, and/or legal issues
- Update governance, SOPs, use, training, and exercises programs to include 5G

Questions?

2021 Webinars

Join the Cybersecurity and Infrastructure Security Agency for webinars focused on:

Implementing the National Emergency Communications Plan

Check out our website for information on the upcoming 2021 webinars:
https://www.cisa.gov/necp-webinars

All webinars start at 1pm ET
To join, use:
Webinar Link (for visual): https://share.dhs.gov/necpwebinars
Dial-In (for audio): 800-897-5813

For more information on 5g:
www.cisa.gov/5G
5G@cisa.dhs.gov

For more information on the NECP:
www.cisa.gov/necp
NECP@cisa.dhs.gov