NEXT G ALLIANCE
An ATIS Initiative

A Sampling of Practical 6G Use Cases, Excerpts from the Next G Alliance, Applications Working Group Report

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6G Overview

> ATIS formed Next G Alliance in late 2020

> "Roadmap to 6G" published February 2022 provides foundation for North American 6G vision and leadership

> Broad ecosystem of contributors

Operators
Vendors
Hyperscalers
Academia
Government
Research Labs

> More than 800 experts across 100+ members

Foundational Goals

Next G Alliance Agenda

Private sector, academia and government collaborate to position North America as the global leader for Next G technologies.

North American Model for Success

A comprehensive model built on North American 6G technology developments, R&D needs, standards goals and market readiness.

6G Market Leadership

Strategies that will lead to rapid commercialization and adoption of Next G technologies across domestic and global markets.

Foundations for
Next G Alliance 6G Vision

North American 6G Roadmap defines the path for connecting every stage of the lifecycle and progressing to an end-of-decade 6G vision

6G Leadership Priorities incorporate innovative applications, societal needs, economic goals, government actions, and technology developments

Audacious Goals create the framework for advancing North American leadership and positioning a robust 6G marketplace
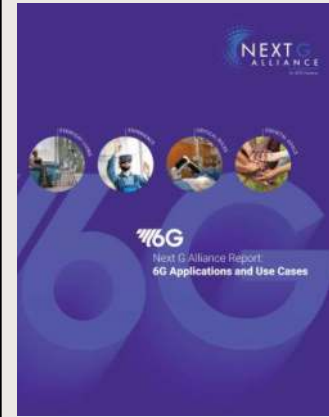
Next G Alliance Reports

The Path
Toward
Sustainable
6G

Roadmap
to 6G

6G Applications
and
Use Cases

6G
Technologies

6G Distributed
Cloud and
Communications
System

6G Trust,
Security, and
Resilience

Key 6G Application Classes

Multi-Sensory Extended Reality

Rapidly developing collection of immersive technologies that include AR and VR for entertainment, gaming, education, and other interactive applications.

Distributed Sensing and Communications

Support broad range of markets that require sensors tightly integrated with communications to support autonomous systems.

Network-Enabled Robotics and Autonomous Systems

Systems that can perceive their surroundings using sensors such as GPS, light detection and ranging, sonar, radar, camera, and odometry, and interact with humans in natural ways.

Personalized User Experiences

Real-time, fully automated, and secure personalization of devices, networks, products, and services based on a user's personal profile and context information

Applications that affect all aspects of life, society, and industries – drivers in foundational areas

Everyday Living

Service robots for home assistance

Indoor/outdoor delivery services

Intelligent travel assistance

Experience

Real-time interactive gaming

MR entertainment

MR-powered classrooms

XR-enriched transportation

Critical Roles

Digital twins

Robotics for hazardous conditions

Remote surgery, therapy & monitoring

Manufacturing & agriculture

Societal Goals

Digital equity

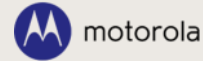Cultural and civic participation

Public safety

Sustainable society

Founding and Full Members

Contributing Members

Government Members

North America's Six Audacious Goals

> Top priorities for North America's contribution and Next G leadership

> Selected by Next G Alliance membership

> Address multiple stakeholder interests

Trust, Security, and Resilience

Digital World Experiences

Sustainability

Audacious Goals

AI-Native Wireless Solutions

Distributed Cloud and Communications Systems

Cost-Efficient Solutions

#1: Trust, Security, and Resilience

The 6G system will be trusted by people, businesses, and governments to be resilient, secure, privacy preserving, safe, reliable, and available under all circumstances.

National Imperatives

> Dependable and trustworthy networks that underpin and accelerate digital transformation

> Secure sourcing for 6G technology and supply chains

> Greater competition from more diverse solution providers

Research Challenges

> Mission-critical service availability

> Resilience through automation and resource optimization

> Security and privacy for hardware and data

> Uses of trustworthy artificial intelligence

#2: Digital World Experiences

6G will support multi-sensory experiences to enable transformative forms of human-human, human-machine, and machine-machine interactions that bring life-improving use cases and create new economic value.

National Imperatives

> Closer integration of North American strengths in cloud computing and communications

> New and enhanced approaches to education, healthcare, and workforce development

> Policies and programs to scale-up experimentation with 6G digital world applications

Research Challenges

> Innovation in cyber-physical technologies, going beyond sight and sound

> Knowledge systems and extreme automation

> Open and interoperable standards across application and technology domains

#6: Sustainability

6G systems will reduce environment impact, be more energy-efficient, and will implement circular economy principles

National Imperatives

> Reduce ICT sector's energy consumption and decarbonize the energy supply

> Leverage North American expertise in: component design & manufacturing, advanced data modeling & optimization, power-efficient radio technologies, and carbon-neutral data center facilities

Research Challenges

> Energy reduction across Radio, Core Network, Cloud and Edge compute, IoT & connected devices

> Environmental impact reduction related to raw materials, land and water use

> Use of Green Credentials and metrics to promote resource efficiency

Collaboration is the Key to Success

NGA is progressing an action-oriented agenda:

> Foundational documents lead to recommended priorities and actions

> Prioritization of 6G research aligned to NGA vision and North American needs

> Increasing the velocity of 6G research and collaboration across the ecosystem

> Holistic approach that leverages research outcomes to promote
new opportunities (e.g., jobs of the future, education, innovation, and future
societal needs).

North American 6G leadership requires collaboration across government, industry, and academia

Technical Working Groups

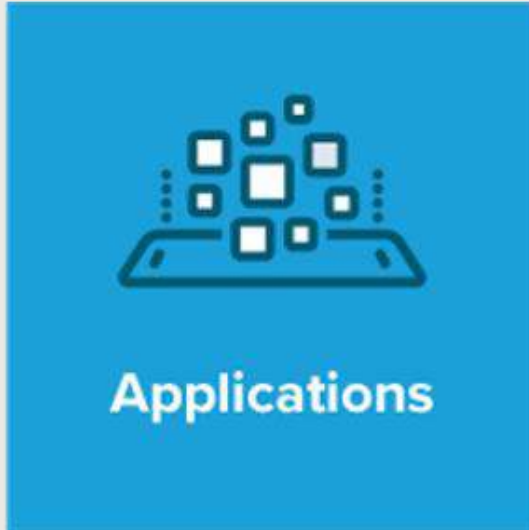National 6G Roadmap

Technology

Applications

Societal/Economic Needs

Spectrum

Green G

Applications

Addressing the 6G-related application needs that will drive innovation and development for consumers, enterprises and verticals in a Next G world

The Applications Working Group is identifying the leading vertical applications that will leverage network infrastructure in the Next G environment. The work is designed to ensure that their 6G-related application needs align with the vision set forth by the Next G Alliance.

Leadership

Ki-Dong Lee • LG Electronics • Chair

Mitch Tseng • ITRI • Vice Chair

John Macias • Verizon • Vice Chair

Next G Alliance, AWG

- Next G Alliance, Applications Working Group
  - Foster innovation, influence emerging applications to drive 6G network Evolution

- Consider Technology Elements
  - Dynamic Network Deployment
  - Enhanced Connectivity – End to End, Exceptional / Extreme performance
  - Devices everywhere – embedded and trustworthy connections
  - AI/ML usage with Cognitive Networks
  - Compute at Network level – bringing physical elements into the compute domain

Service Use Case Example

Field Robotics for Hazardous Environments

- Highlighting the trend of pairing robots with humans
  - Inspection and maintenance, detection and action
  - Mission Critical Tasks, combined sensor and human vision detection
  - 6G AI-native fabric is enabler
    - Monitoring methods for autonomous robotics require 3CLS
    - Convergence of Communications, Computing, Control, Localization, Sensing

- Business: Maintenance Robotics, Mobile Inspections
  - Rapidly expanding business
    - Quickly access remote, difficult to access, and dangerous locations
    - Safely address issues w/o endangering staff or requiring expensive training

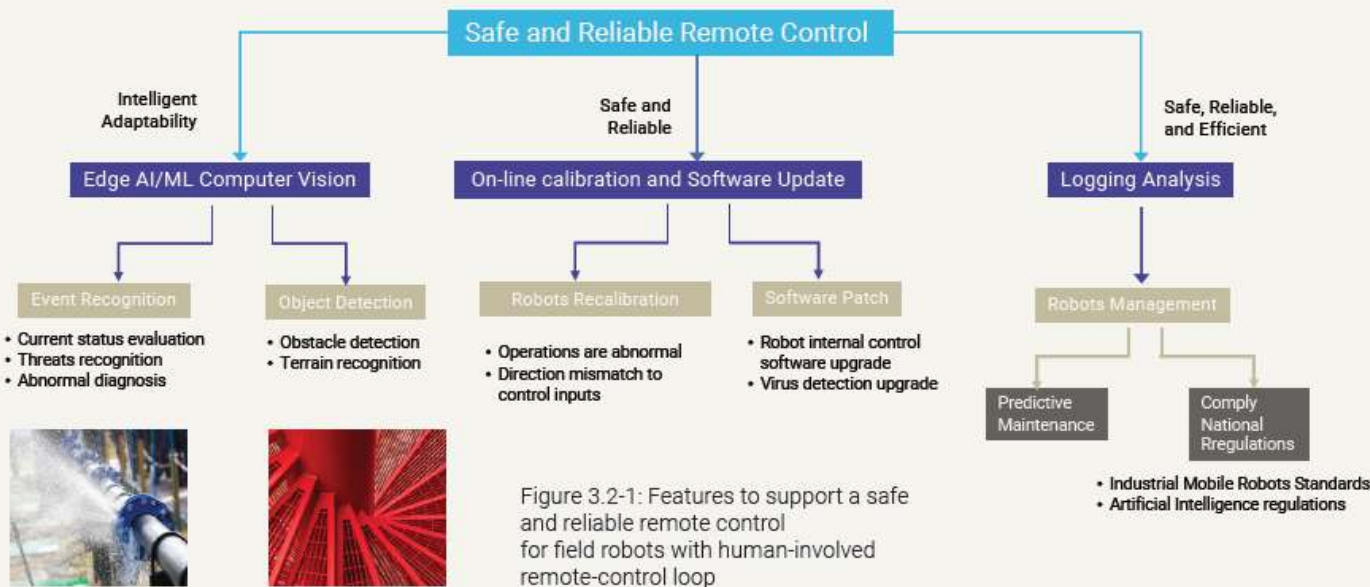| Goals	Remarks
AI-Native Network	Orchestrate communications-computing-control-localization-sensing resources to achieve a reliable and responsive control system, specifically, on: (i) Network compute fabrics (ii) Internet of senses and (iii) Precise localization.
Trust, Security, and Resilience	Utilize acquired AI outcomes to enhance the decision-making process to build trust among users.

Audacious Goals Mapping

Service Scenario Example

Field Robotics for Hazardous Environments

- Tele-operated Robots Operate in Extreme Environments
  - Environmental Exploration
  - Oil and Gas Industry, Electrical Power Grid
  - Offshore power generation, remote manufacturing
  - Nuclear Decommissioning
- 6G Network Enablers for Robots
  - Real-time edge AI/ML computer vision
  - Real-time field calibration - maintain accuracy, detection model
  - Real-time logging analysis, tracking of issue severity

Service Scenario Example

Field Robotics for Hazardous Environments

Figure 3.2-1: Features to support a safe and reliable remote control for field robots with human-involved remote-control loop

Address scenarios such as:
- Real-time operation, single robot paired with human operator
- Real-time operation with multiple robots teamed with operator
- Autonomous robots in disaster conditions relaying data

REQUIREMENTS:

Latency: 6G Systems to provide ultra-low latency. The Low E2E packet latency enables remote operator to interact appropriately, taking timely and accurate actions

Data Rate: Transmission of high-data rate video or telemetry

Service Availability: Robust service availability and dynamic re-establishment

Position, Sensing Accuracy: Centimeter level accuracy, recalibration as needed, navigation

Autonomous Robotics: High levels of localization and mapping, AI assisted decision making. 6G intelligent resource management capabilities for processing, transmission and storage.

Coordination Among Robots: Secure an trusted network to share data and distribute decision-making logic, coordinate activities

Service Use Case Example

Mixed Reality Co-Design

- MR CD highlights remote or co-located collaboration
  - The MR co-design process obtains additional context captured by spatial mapping and imaging technology
  - Advanced user equipment in conjunction with wearables will transform the next generation of industrial IoT

- Business: Collaboration on real-time platforms, work projects simultaneously
  - Substantial benefits, especially for workers in different locations
  - Increased productivity and common vision among participants
  - Reduction in time to complete tasks

Goals	Remarks
Digital World Experience	MR co-design is a remote or co-located collaboration, a concept where MR merges the real and virtual world. Designed to capture movement, emotions, and facial expressions, MR will enable new human collaboration, human-machine communications, and man-machine interactions. In MR co-design, spatial computing is one component that may be utilized to capture vital measurements of the human body.

Audacious Goals Mapping

Service Scenario Example

Mixed Reality Co-Design

- MR enables team to see 3D designs superimposed over a real environment
  - The team - different disciplines and co-located or dispersed geographically
- Onsite MR co-design-based community, city, or building planning
  - Local devices and applications monitor and react to the local environment
  - Properly position the virtual objects in relation to real objects

Requirements

- Higher data rates
- Possibly a new frequency band specifically allocated for 6G
- This level of collaboration requires
  - Low E2E latency in application level, high reliability, and synchronization support
  - Precise localization, spatial computing, HMI, and imaging technologies

Service Use Case Example

Public Safety Applications
- Highlighting utilization of high-resolution video for public safety
- Public safety services include
  - Establishing rules and regulations - benefit of functioning communities
  - Security, and access to information to understand / address challenges

- Business: Cities compete for residents, providing services
  - Cities receive taxpayer dollars
    - Finance operations and improvements when servicing their communities
  - Public safety application providers need 6G
    - Enable new services in and around ultra-high-definition video
      - Enabling better service from public safety entities
    - 6G will offer massive symmetrical bandwidth
      - Service customers wanting bi-directional video and immersive experiences

Goals	Remarks
Trust, Security, and Resilience	Security monitoring within the smart city.
Cost Efficient Solutions	Provide ultra-high throughput at reasonable prices.
Digital World Experience	Creating digital content from remote locations.
Distributed Cloud and Communications Systems	Video and non-video sensors within the 6G network.

Audacious Goals Mapping

Service Scenario Example

Public Safety Applications
- Enhanced multimedia communication support for first responders
- Wide-area monitoring, including urban and rural areas
- Infrastructure monitoring, Natural resource monitoring
- Parking, traffic, and public safety services

Requirements
- Ability to stream ultra-high resolution, high FR video from all areas at acceptable costs
- Course-change detection for potentially damaged assets (e.g., bridges)
- Detection and reporting of adverse conditions (Weather, fire, disaster)
- Support for customized use cases required smart city managers /users

Service Use Case Example

Personalized User Experience

- Highlighting the value of automating in real/pseudo-real time
  - Secure personalization of devices, networks, services, and applications based on a user's profile and current situational context
- Some examples
  - Personalized leisure and travel experiences, personalized shopping experiences, personalized learning, and education experiences

Business

- Technology advancements such as AI, smart bots, and a growing number of connected IoT devices
  - Allow businesses to realize new forms of personalization between users and machines
- Technology personalization is expected to be a major focus and differentiator for businesses in the 6G timeframe

Goals	Remarks
Trust, Security, and Resilience	Personalization of the 6G system (devices, network resources, services, and applications) for individual users will require collecting, storing, and applying a user's personal profile and situational context information. Hence personalization will introduce new and challenging security threats, as well as privacy and trustworthiness implications that the 6G system must address.
Digital World Experience	Personalization of the 6G system will enable customized, multi-sensory experiences that provide transformative forms of human-to-human and human-to-machine interactions based on the personal preferences, routines, habits, and social relationships of users.
Distributed Cloud and Communication Systems	Personalization of the 6G system will enable on-demand and customized distributed cloud and communication systems for different individual users, as well as categories of users. This will enable communications and unified computing services to work together and scale across devices, network computing resources, and data centers in a manner that meets users' personalized requirements and needs.
AI-Native Network	6G AI-native systems will have the intelligence to learn how users engage and interact with devices, network resources, services, and applications. Based on this knowledge, the 6G system will be equipped to personalize itself by making dynamic adjustments to its resources to align with each user's needs and preferences and their context of use.

Audacious Goals Mapping

Service Scenario Example

Personalized User Experience

Personalized real-time automated guest check-in

- While in transit, a guest's location and estimated arrival time at the hotel may be tracked to enable customized preparation of their room and other hotel services can be arranged and ready upon arrival

- Upon arrival, intelligent sensors perform facial recognition of the guest and detect the guest's personal device (e.g., smartphone, watch, and glasses) for automatic check-in

Requirements

- Securely monitor and collect user preference data and the interactions with 6G devices in a manner that does not jeopardize user privacy.

- Learn patterns and preferences involving interaction users have with 6G devices, network resources, services, and applications

- In real/pseudo-real time detect trigger conditions based on the situational context of the user and securely perform actions on 6G devices and network

Standardization Efforts

Standards Groups Efforts

- Next G Alliance
  - Provides ongoing contributions to the IMT Vision for 2030 and beyond as invited by ITU-R
- ATIS is an Organizational Partner with 3GPP
- ATIS and the O-RAN ALLIANCE Collaborations
  - Advancing the state-of-the-art open radio access network
  - Including Open RAN security and stakeholder requirements for Open RAN

Next G Alliance has signed agreements

- 5G Forum in Korea
- 6G Smart Networks Services Industry Association (Europe)
- Japan's Beyond 5G Promotion Consortium

North American Voice
to 6G Global Activities

Established collaboration relationships with global 6G partners

Contributions to ITU-R IMT-2030 covering North American vision