HEXA-X-II

The 6G series workshop by Hexa-X-II

NEXT G ALLIANCE

An ATIS Initiative

ATIS Next G Alliance: 6G Drivers and Use Cases

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6G Drivers

Next G Alliance Agenda

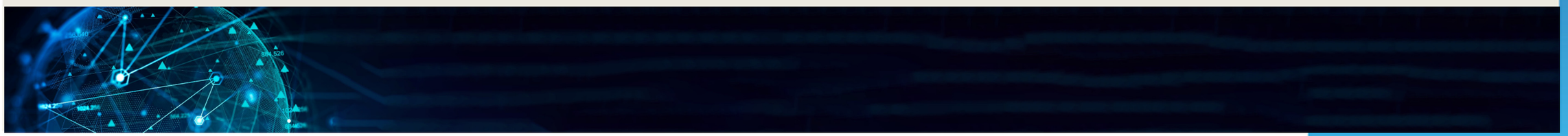
Private sector, academia and government collaborate to position North America as the global leader for Next G technologies.

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.



Six Audacious Goals and 6G Applications

- NGA's Six Audacious Goals
- How are they (being) addressed next?

NGA Reports

NGA's comprehensive library provides future 6G compass for North America

Delivering Powerful 6G Applications that will Drive Future Innovation

#1 Multi-Sensory Extended Reality

- Ultra-realistic interactive sports
- Immersive gaming and entertainment
- MR co-design
- MR telepresence
- Immersive education
- High-speed connectivity to aerial vehicles

#2 Distributed Sensing and Computing

- Remote data collection
- Untethered wearables and implants
- Eliminate digital divide
- Public safety applications
- Synchronous data channels for sensors
- In-body networks for healthcare

#3 Network Enabled Robotics and Autonomous Systems

- Online cooperative operation among a group of service robots
- Field robots for hazardous environments
- Robot sensing systems
- Other critical role needs

#4 Personalized User Experience

- Personalized travel and leisure experiences
- Personalized shopping experiences
- Personalized education learning experiences
- User-oriented security and privacy management
- Situational context

Immersive Education

Role Players: The immersive classroom environment includes teachers (avatar-based instructors) and students (remote and in-person participants)

- **Avatar-based instructors** lead interactive sessions using holographic content to demonstrate complex concepts.
- **In-person students** use AR/VR headsets to manipulate virtual models, conduct simulations, and collaborate in shared virtual spaces.
- **Remote students** engage in real-time through virtual presence interacting with both the instructors and the holographic images

Expected Requirements:

- UL and DL User Experience Data rate range: 1 Gbps to handle detailed holographic and VR content
- Latency UL and DL: education <50 ms for fast feedback and interaction
- Reliability: 99.999% uptime to ensure continuous learning experiences

Study areas:

- Devices and human-machine interfaces
- Multi-level Quality of Experience (QoE)
- Advanced 3D image data compression schemes

Immersive Gaming and Entertainment

Role Players: The environment is a high-tech gaming arena equipped with the latest VR/AR hardware, motion capture systems, and ultra-high-definition displays.

- **Gamers** use VR and AR headsets to enter fully immersive gaming environments and interact with lifelike avatars and virtual worlds.
- **Audience** watches the gameplay unfold in real time, with the ability to switch perspectives and even enter the game as non-interactive characters.

Expected Requirements:

- UL and DL User Experience Data rate range: 1 Gbps to handle detailed holographic and VR content
- Latency UL and DL: <20 ms to ensure immediate response to player actions
- Position accuracy: 0.1 m – 1 m, where position of headset and controllers must be tracked with very high accuracy to avoid motion sickness

Study areas:

- Lightweight, inexpensive, energy-efficient wearable devices that are comfortable for long-term use
- Advanced haptic rendering algorithms

Real-time Health Monitoring with In-Body Network

Role Players: An in-body network of sensors for continuous health monitoring and disease management. This network provides real-time data on various health parameters, enabling proactive healthcare interventions.

- **Patient:** The individual whose health parameters are being monitored.
- **Medical Practitioners:** Doctors or specialists who analyze health data and make treatment decisions.
- **In-Body Sensors:** Miniaturized devices implanted or ingested by the patient to monitor health parameters.
- **Healthcare IoT Platform:** System that collects data from in-body sensors and generates an alert when a critical abnormal reading is detected.

Expected Requirements:

- Reliability – High 99.9999% Network reliability is critical, as data transmission interruptions can lead to missed critical health events.
- Security: Given the sensitive nature of health data, the network must have robust security measures to protect against breaches and unauthorized access.

Study areas:
Security and Privacy-Enhancing Technologies

Smart City Disaster Response and Environmental Control

Role Players: Integrated Sensing and Communication (ISAC) for Urban Safety and Disaster Management

City Environmental Control: Manages normal city functions using ISAC for environmental monitoring and control.
Disaster Relief Command Center: Activates and coordinates rescue operations using ISAC in emergencies.
Smart Buildings and Infrastructure: Equipped with sensors for monitoring and control purposes.
Urban Residents: Opt-in to participate in the ISAC system for safety and rescue services.
Rescue Teams: Utilize portable searching equipment integrated with the ISAC system for live-sign detection.

Expected Requirements:

- UL User Experience Data Rate: 50-100 Mbps to accommodate multiple streams of live-sign detection and environmental data.
- DL User Experience Data Rate : 100-500 Mbps for detailed, real-time 3D mapping and updates.
- Position accuracy: .1 - 1 m, For general sensor data, accuracy within a meter may be sufficient however, search and rescue operations may require accuracy, within centimeters, to detect and locate survivors under rubble.

Study areas:
Federated learning to help train the ISAC, User data privacy

COBOTS in Agriculture

Role Players: The environment includes open fields, greenhouses, and controlled indoor farming environments where COBOTS operate alongside human workers, with the infrastructure to support advanced robotics and data analytics.

- **COBOTS:**. Collaborative agricultural robots equipped with sensors, AI, and precision tools for various farming tasks such as planting, weeding, harvesting, and pruning with high accuracy, reducing physical strain on farmers.
- **Farmers:** Operators who work with COBOTS, overseeing farm operations, and making strategic decisions based on data collected by COBOTS.

Expected Requirements:

- E2E Packet Latency <5 ms DL, <5 ms UL , ensures real-time responsiveness and coordination between cobots and control systems, crucial for tasks that require immediate reaction to sensory input or precise movements
- User Experience Data Rate <1Gbps DL, <100Mbps UL
- Position accuracy – very stringent, 1-30 cm depending on the task (harvesting, seeding, and planting, weeding)

Study items: AI/ML; multi-agent collaboration

Field Robots in Hazardous Environments

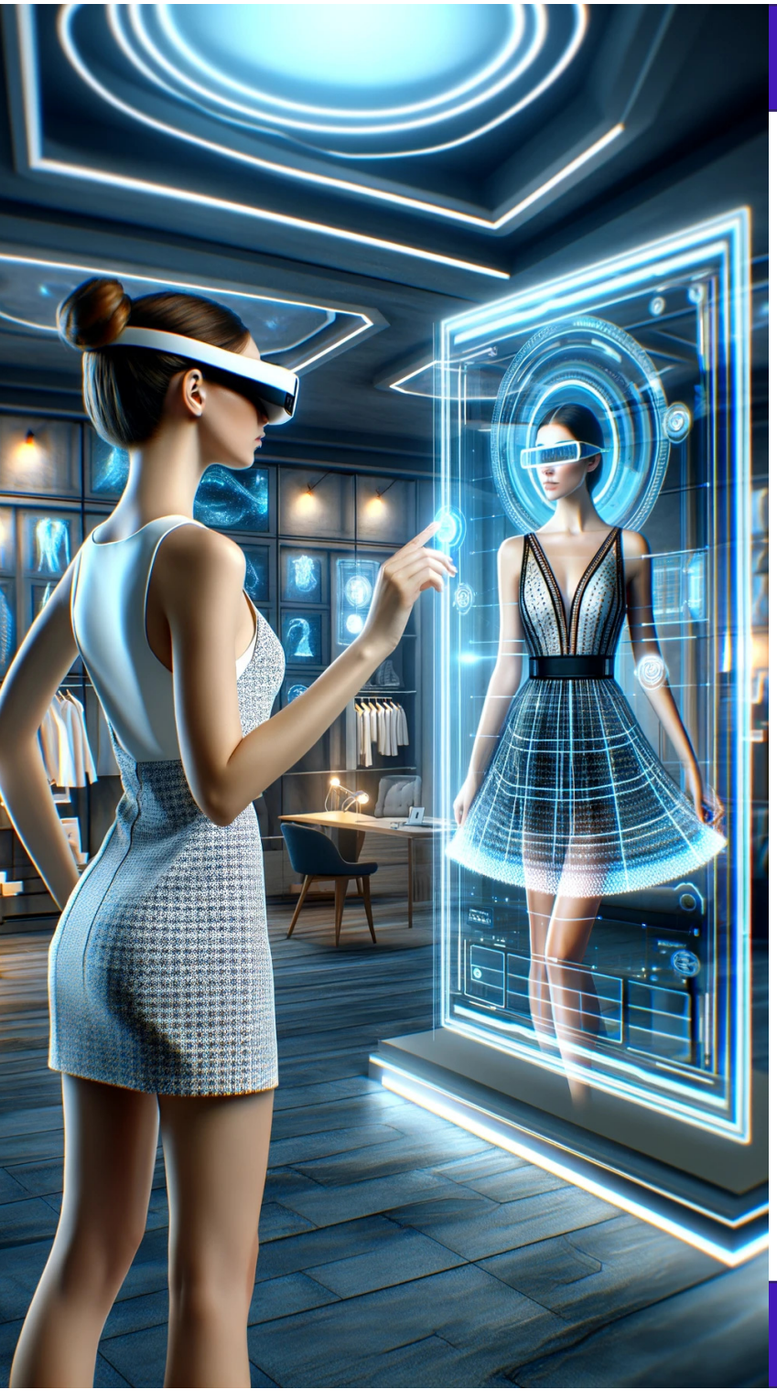
Role Players: Field robots are deployed in challenging and dangerous environments where they might encounter toxic chemicals, radioactive materials, extreme temperatures, or structurally unsafe conditions unsuitable for human presence.

Field Robots: Autonomous robots equipped to navigate and perform tasks in hazardous environments.
Emergency Response Coordinator: Oversees the operation and makes strategic decisions based on the information provided by the robots**.**

Expected Requirements:

- E2E Packet Latency <5 ms DL, <5 ms UL to allow real-time control and feedback from the robots, which is crucial for timely responses to dynamic hazardous situations.
- Service Continuity < 5ms
- Position accuracy – very stringent, < 1 cm to 3 cm, depending on the specific tasks and the danger of the environment.

Study items: AI/ML; multi-agent collaboration



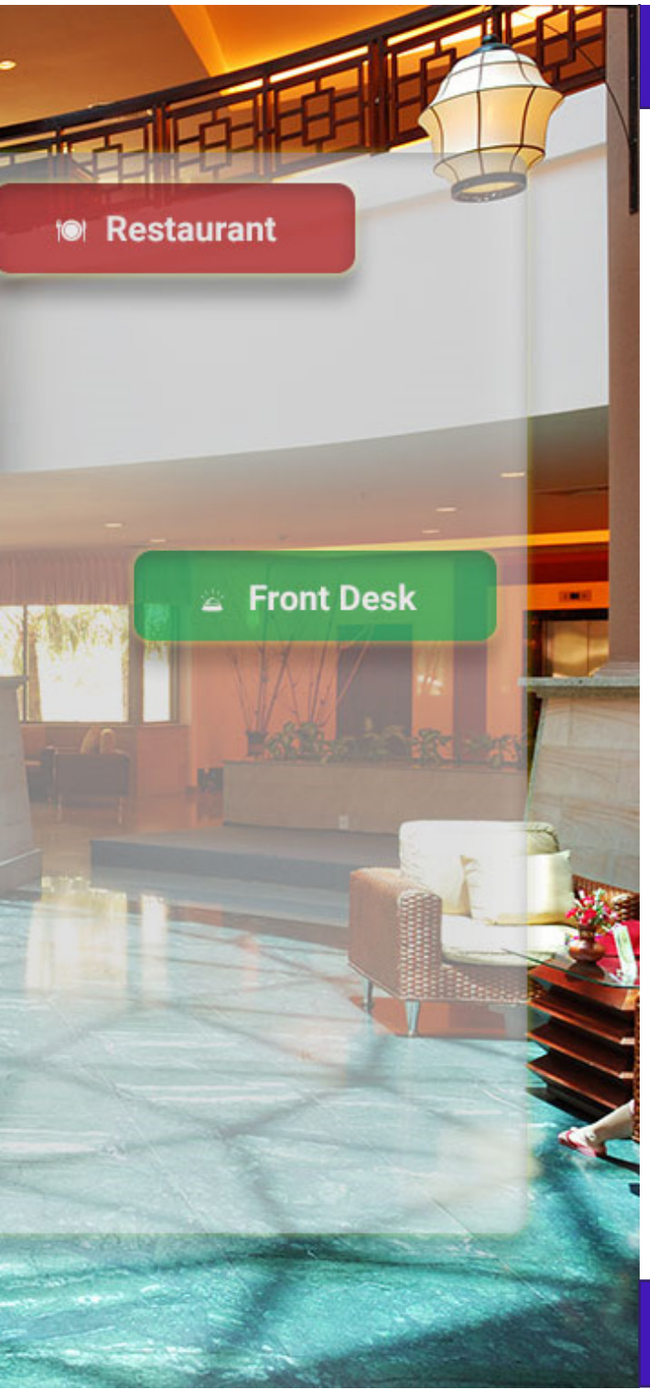
Personalized Shopping Experience

Role Players: Advanced network capabilities, AR/VR technology, and AI-driven personalization enhances and streamline individuals' daily lives and shopping experiences.
User: Engages with the system for personalized content, shopping, lifestyle management.
Integrated Home Ecosystem: Smart home devices that anticipate user needs and preferences.
AR/VR Interfaces: Provide user with immersive and interactive experiences.
Digital Shopping Platform: Offers personalized shopping experiences, product recommendations, and facilitates purchases.

Expected Requirements:

- **AI/Edge Server integration -** AI algorithms hosted on edge servers analyze the contextual data generated by the user's interactions with various devices and platforms, enabling quicker adaptation and personalization of content.
- **Device-to-Device (D2D) Communication** - direct communication between devices, enabling seamless connectivity and real-time interactions among neighbor devices and smart infrastructure

Study items: AI/ML; advanced encryption, authentication for security and user data privacy



Personalized Travel Experience

Socially beneficial?
Economically influencing?
Challenges?

Personalized intelligent assisted living
Scenario 1: Personalized real-time automated guest check-in
Scenario 2: Personalized virtual hotel concierge and automated room service
Scenario 3: Automated hotel check out and privacy assurance

NEXT G ALLIANCE

An ATIS Initiative

Building the foundation for North American leadership in 6G and beyond