



UNITED STATES
DEPARTMENT OF TRANSPORTATION

ITS ePrimer

Module 16: ITS Emerging Opportunities and Challenges

**ITS Professional Capacity Building
Program**

ITS Joint Program Office

U.S. Department of Transportation



 **United States Department of Transportation**
OFFICE OF THE ASSISTANT SECRETARY FOR RESEARCH AND TECHNOLOGY
Intelligent Transportation Systems
Joint Program Office

 **INTELLIGENT TRANSPORTATION SYSTEMS**
PROFESSIONAL
CAPACITY BUILDING

Instructor



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Learning Objectives

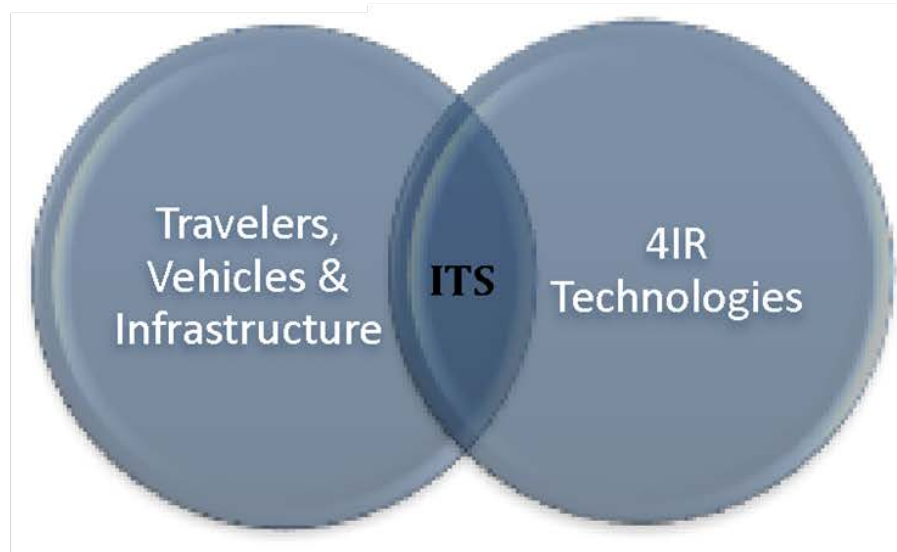
1. Understand how rapid developments in data, computing, and telecommunications are changing fundamental assumptions in transportation demand, supply, and operational management

2. Define ITS use cases for 4IR technologies so transportation professionals can better plan, design, engineer, and implement intelligent transportation systems (ITS) programs and projects.

INTRODUCTION

This module describes key "Fourth Industrial Revolution" (4IR) technologies that are presenting new opportunities and challenges for the transportation professional.

ITS is the intersection of two domains...



**ITS is at the Intersection of Key Transportation Stakeholders
and Fourth Industrial Revolution Technologies**

KEY TRANSPORTATION STAKEHOLDERS



TRAVELERS



VEHICLES



INFRASTRUCTURE

Travelers & ITS

**Smartphones,
smart watches,
and smart glasses**

**Integrated
traveler trip
planning and
decision support**

**Mobility payment
systems**

**Data collected by
travelers**

**Mobility as a
service (MaaS)**

**Mobility on
demand (MoD)**

**Accessible
transportation
technologies**

Vehicles & ITS

Connected and automated vehicles

Onboard data sensing, collection, processing, and transmission devices for navigation and safety

Internal combustion, hybrid, and plug-in electric automobiles, trucks, buses, trains; e-scooters, e-bikes, and urban aerial vehicles

Electric vehicles equipped with onboard alternating current (AC)/direct current (DC) inverters

Digitization and system optimization of electric vehicle charging systems

Data collected by vehicles

Infrastructure & ITS

Roadside sensing, collection, processing, and transmission for traffic monitoring and control

Digital signage for automated driver assistance systems (ADAS)-equipped and self-driving vehicles

Key elements of communications networking architecture

Infrastructure & ITS, cont'd.

Urban aerial drone transport with rooftop and midlevel landing pads and loading zones

Interfacing with power companies for automated load balancing for electric power distribution and storage optimization

Realtime, digital curbside management of ridesharing and freight loading zones

Key 4IR Technologies Suitable for ITS



Data



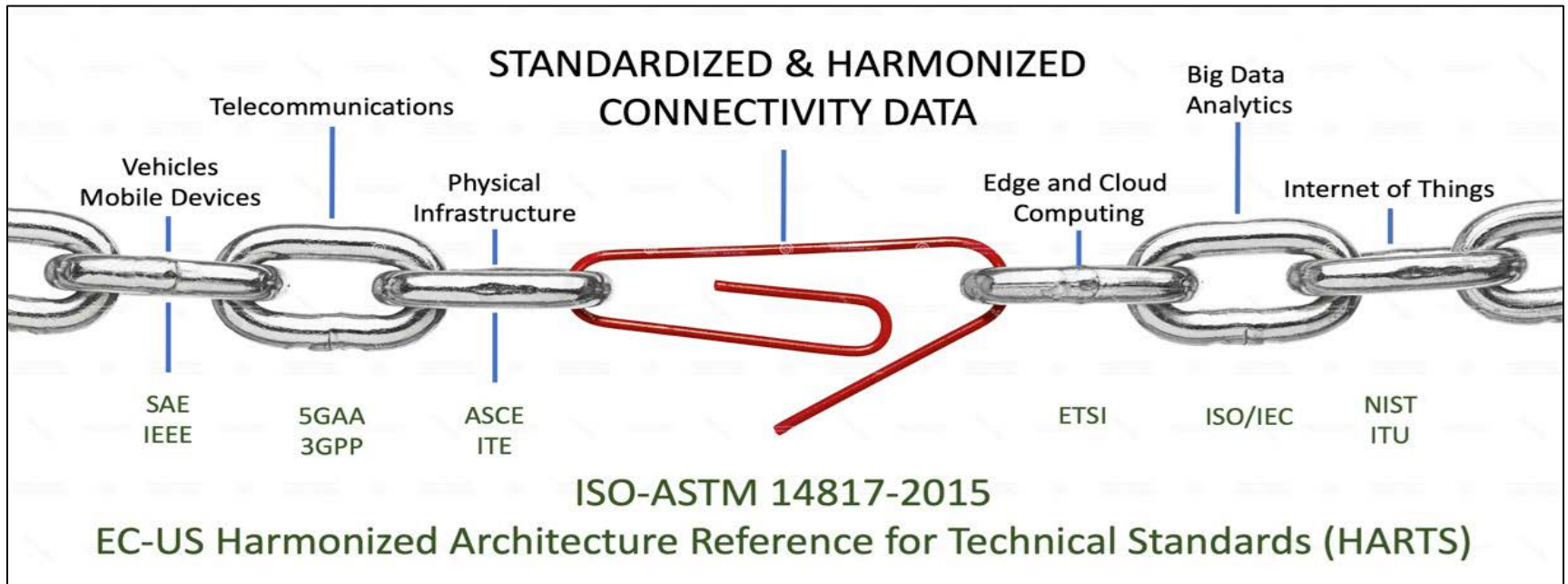
Computing



Telecommunications



Data





Data

Challenges

- **A lot of data** to collect, process, analyze, store, and use
- Ensuring **common definitions** of ITS data and use cases
- Managing **cybersecurity risks**



Opportunities

- Updating the Manual of Uniform Traffic Control Devices
- Optimizing speed and accuracy of ITS data collection
- Collaborative partnerships in data access
- Common data architecture, storage, and sharing
- Development of U.S. DOT Security Architecture



Computing

Challenges

- Handling Big Data
 - Cloud and edge computing architectures
 - Cybersecurity risks
 - Latency effects



Opportunities

- Increased CPU processing speeds
- Common IoT protocols and addressing schemes
- Efficient handling of big data with new advances in computation and data storage methods
- Emergence of Machine Learning Technologies
 - *Augmented Reality*
 - *Virtual Reality*
 - *AI Technologies*



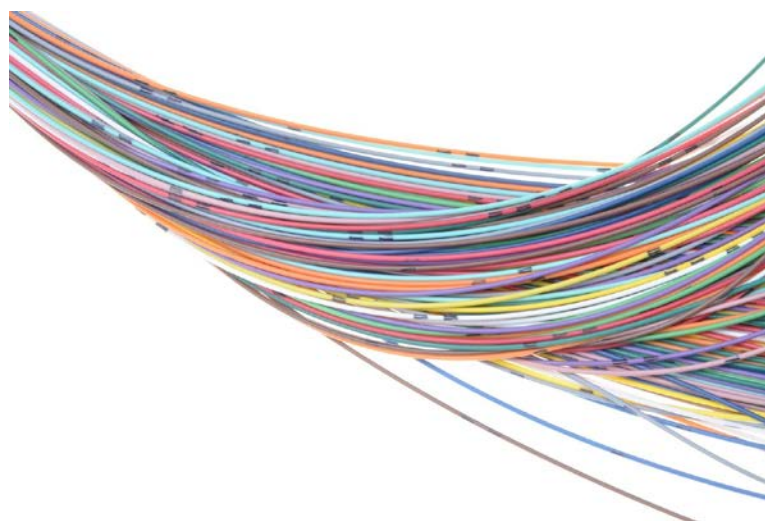
Telecommunications

Challenges

- DSRC and C-V2X policy uncertainties related to frequency spectrum allocations
- Cost and health risk uncertainties of building new 5G networks and base stations

Opportunities

- Evolution of 5G mobile networks
- Integration of 5G networks and communication systems for use by first responders



General Challenges and Opportunities

Challenges

- Despite rapid developments in 4IR, successful adoption in ITS use cases depends on **multiple, collaborative interactions** among multiple disciplines and entities
- Many **obstacles to standardizing** data and application programming interfaces
- **Interoperability / integration** with existing (legacy) communication systems
- **Deteriorating infrastructure** and lack of stable sources of funding
- **National security threats** from collection of data by ITS devices

Opportunities

- Multidisciplinary understanding
- Strengthen the weak links
- New legislation for infrastructure projects
- ***Follow the money***
 - Help make the use of available funding ***count***



Summary

ITS professionals must:

- **Stay up-to-date** with progress in 4IR technologies
- Be willing to engage in **public-private partnerships** to help leverage the private sector's 4IR technology investments and society's best interests in applying those investments in ITS
- Ramp up efforts to **protect against privacy and cybersecurity risks** (domestic and foreign)
- Monitor and plan for **post-COVID-19 pandemic shifts** in urban density and traffic patterns
- Invest in **capacity building** (training and education) in both the domain elements of transportation (Travelers, Vehicles, and Infrastructure) and the 4IR technologies that directly affect how they operate together (Data, Computing, and Telecommunications) in order to truly achieve “intelligent” transportation systems.

Key References

Module 16 contains more than **75 references**, mostly related to **standards** and how they can help to integrate “Travelers, Vehicles and Infrastructure” with” 4th Industrial Revolution Technologies.”

Of particular note:

1. The Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)(2021)
2. National Transportation Communications for Intelligent Transportation System (ITS) Protocol (NTCIP)
3. ISO 14817-2:2015 ITS central data dictionaries
4. 5G Automotive Association (5GAA)
5. “Adoption of Transit Communications Interface Profiles in the Transit Industry,” Intelligent Transportation Society of America (2016)

Questions?

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