

Research Projects in RFID and Auto-ID (RAID) Labs



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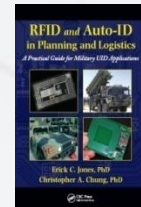
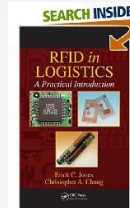
Presentation Outline

- Who We Are
 - Presenters Background
 - RAID Labs
- Research Projects
 - R-WMS in Cloud
 - Multimodal Automatic Identification
 - IRES-Mexico
 - NASA ISS Automation
 - CVISN License Plate Automation
 - RFID in Healthcare
 - Intelligent Cities



Presenters Background

- Industrial Experience (10+ years)
 - Companies: UPS, Academy Sports, Tompkins Associates, Arthur Anderson, LLP
 - Positions: IE Specialist, IE Manager, **Director of Engineering**, Senior Consultant, Project Manager, **Executive Manager**
- National Recognition
 - Current RFID Certification Chair for International Supply Chain Educational Alliance
 - RFID Journal Live Best in Show Judge
 - Member of RFID National Certification Groups (GS1, EPC Global, AIM)
 - Former NSF I/UCRC Nebraska Site Director for Logistics
- Academia
 - Texas A&M (BS), University of Houston (MS, PhD)
 - Associate Professor - University of Texas at Arlington
 - Associate Professor - University of Nebraska-Lincoln
 - Courses: Production Planning, Logistics Optimization, Six-Sigma Quality & Manufacturing
 - Former Chair for University of Nebraska's Black Belt Certification Program
 - Former Chair for University of Nebraska's Logistics Certification
 - Published 62 transcripts, **2 co-authored textbooks**, and **1 industry certification book** and over 40 conference and speaking transcripts.
 - Research Funding for over **\$ 3.06 Million** from over 30 Federal/State Agencies



Academic Background

- Education

- Texas A&M B.S. Industrial Engineering
- University of Houston MS and PhD Industrial Engineering



- Academic Appointments

- University of Nebraska-Lincoln, Assistant Professor
- University of Nebraska-Lincoln, Associate Professor
- University of Texas Arlington, Associate Professor



- Research Positions

- University of Nebraska-Lincoln, Director – RFID Supply Chain Lab
- University of Nebraska-Lincoln, Director – Transportation Logistics Lab
- National Science Foundation, Director – Centers for Engineering and Logistics Distribution Nebraska Site
- University of Texas Arlington, Director – AutoID
- University of Texas Arlington, Director - RFID Labs



Introduction to Radio Frequency Identification & Auto-Identification (RAID) Center



Introduction

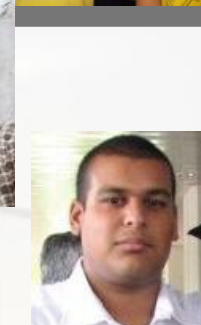


The University of Texas at Arlington's College of Engineering provides one of the most comprehensive engineering programs in North Texas and the nation, with eight baccalaureate programs, 13 master's and 9 doctorates. It is the fourth largest engineering college in Texas, with about 3,900 students



RAID Labs Team

- Faculty
 - Dr. Erick C. Jones (Director)
 - Dr. Richard Billo
 - Dr. John Priest
- Post Docs
 - Dr. Vettrivel Gnaneswaran
- Phd Students
 - Maurice Cavitt
 - Gowthaman Ananthakrishnan
 - Shernette Kydd
 - Restu Sunarto
- **MS Students**
 - Hamid Ghorashi
- **Undergraduates Students**
 - Juan Robles
 - Chidebe “Stanley” Ugoji
 - Mohammad Siddiqui



RAID (RFID & AutoID) Labs Goals

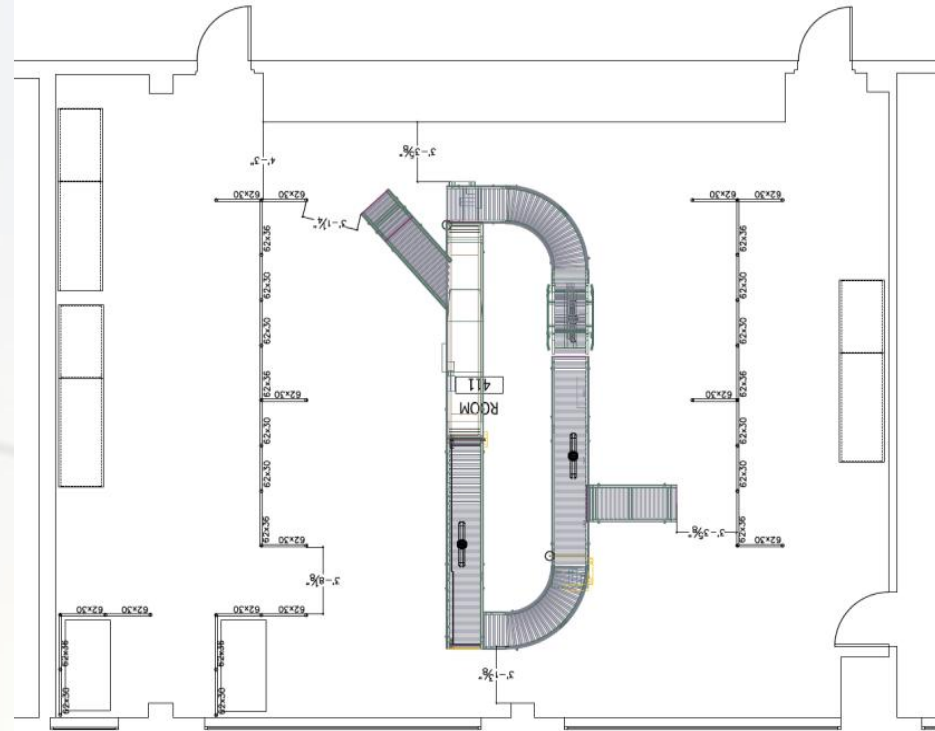
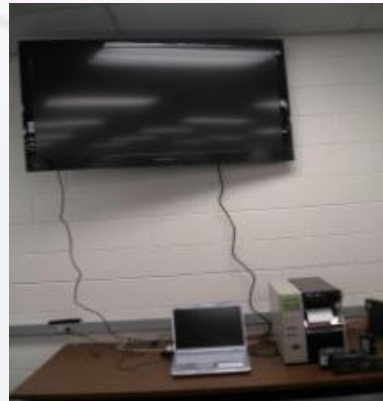
- Mission:
 - *“Providing integrated solutions in logistics and other data driven environments through automatic data capture, real world prototypes, and analysis”*
- Objective:
 - *Attract Recognized Funding from notable federal agencies and nationally recognized organizations*
 - *Provide a research facility that inspires future STEM researchers from K-12 and undergraduate students*
 - *Attract national attention from academic rankings and research recognition*
- Facilities:
 - RFID Lab - Room 411/413 Woolf Hall
 - AutoID Lab - 309-Engineering Research Building



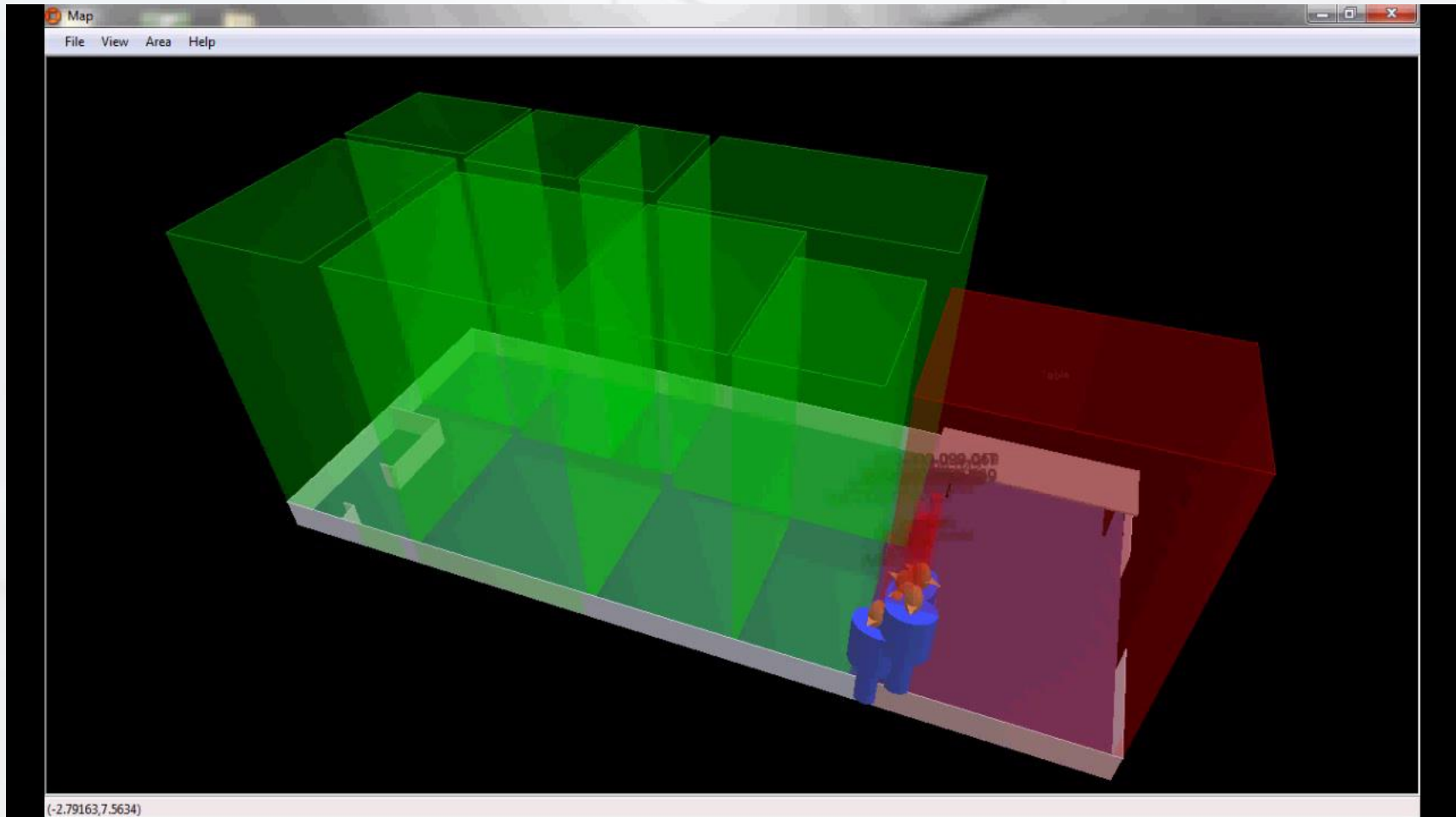
RFID Lab Facilities

Equipment/

- Military grade Fixed and Mobile Active RFID Systems (Savi technologies, RF Code)
- Industry grade high speed automated conveyor (Hytrol conveyor)
- Industry recognized RFID edgware, ERP and WMS systems, (Global Concepts)
- Walmart/DOD mandated standard fixed and mobile passive RFID systems (Alien Technologies, Matrics)
- Hospital tracking location systems (Ubisense Ultra Wide Band Real Time Location System)
- Automated locks with MavID



RFID Lab Facilities Real-Time Location Tracking



AutoID Lab Facilities



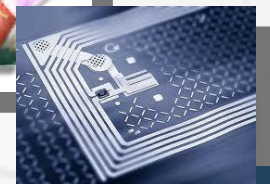
Equipment/

- Barcode Readers
- Optical Character Recognition
- Satellite Tags
- 2-D Barcode Etching Machines
- Industrial Antenna enclosures



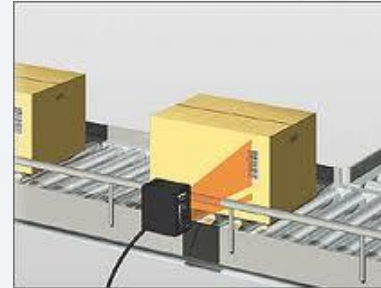
Automatic Data Capture

- Technologies that are used to help machines identify and capture information about objects
- Aims
 - Increase efficiency
 - Reduce data entry errors
 - Free up staff to perform more value added functions

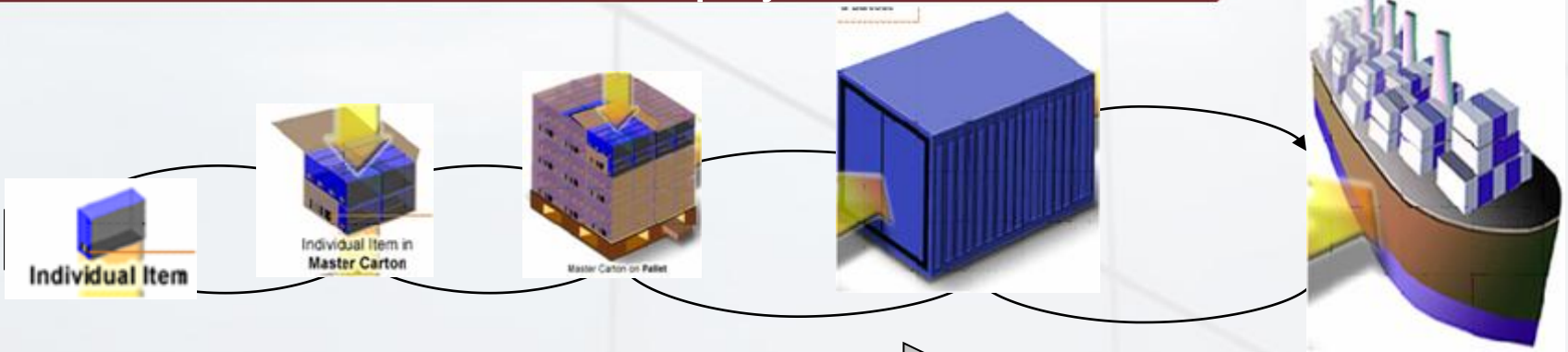


Types of Automatic Data Capture Technologies

- RFID
- Bar Codes (Linear/2D Barcodes/UID)
- GPS
- Satellite tags
- Smart Cards
- Biometrics (fingerprint, facial, iris, palm)
- Contact Memory Buttons
- Optical Memory Cards



AutoID Philosophy



Increasing net value

Barcode



Passive RFID



Active RFID



GPS & SATCOM



Increasing net investment

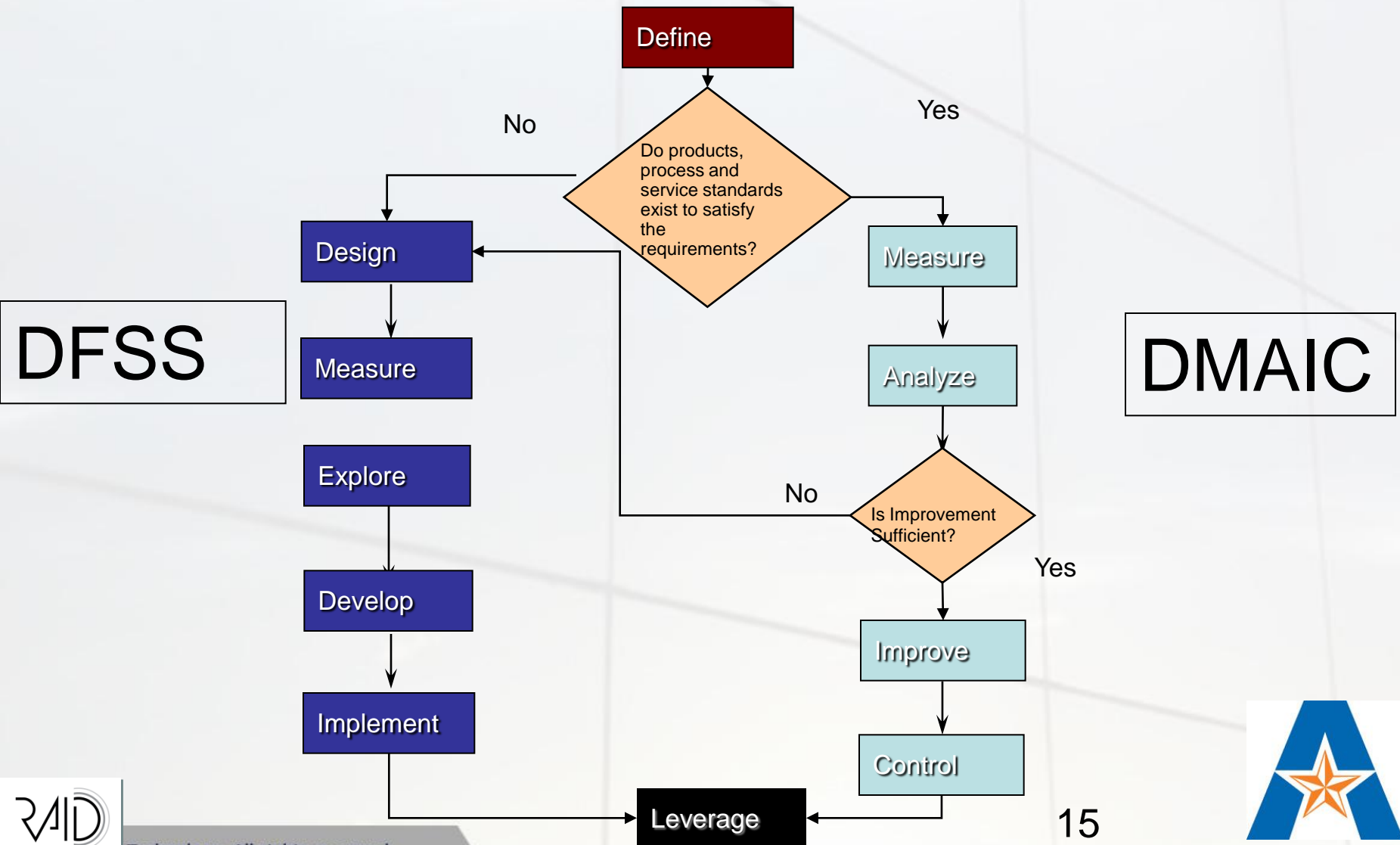
Similar nesting for:

- Retrograde
- Manufacturing, kitting, assembly
- Remanufacturing, disassembly, demilitarization

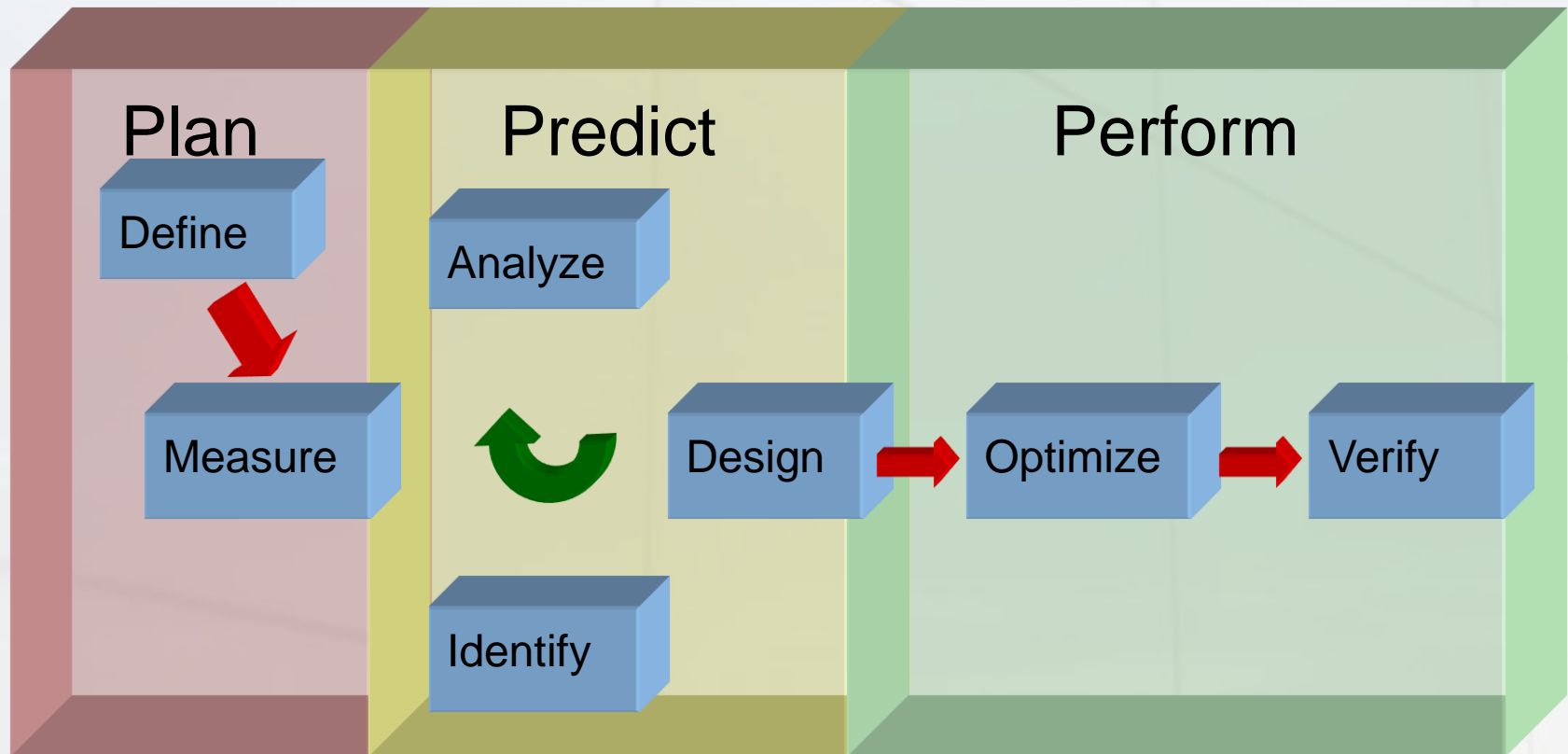


Design Six Sigma- Research

Our lab uses a modified Six Sigma Communication Strategy



DFSS-R , Research Methodology



Everything Will be Tracked Wirelessly in 10 Years

- **Every Conveyance and Mobile Asset Will be Tracked Using Some Type of Automatic Identification and Data Collection Technology (AIDC)**
 - Connect People with Things
 - Interoperable Networks Leveraging Bar Codes, Passive and Active RFID, GPS
- **Networks Will Be Integrated with Complete Solutions, Services and Apps**
 - RFID is the Technology Enabler within the Network
 - Once Networks are Deployed, 'Push Button' Solutions Linked with Asset Management and Security Software Apps Will Provide Greater Decision-Making
- **Dynamic Management of Supply Chains**
 - Tracking Conveyances and – by Association – Their Contents (Inventory)
 - RFID's Real Value is Tracking and Securing Assets End-to-End – Not just within The four walls or point-to-point



What is RFID and How Does it Work?



Radio Frequency Identification (RFID)

Radio Frequency Identification is an automatic data capture (ADC) that identifies physical objects through a radio interface.

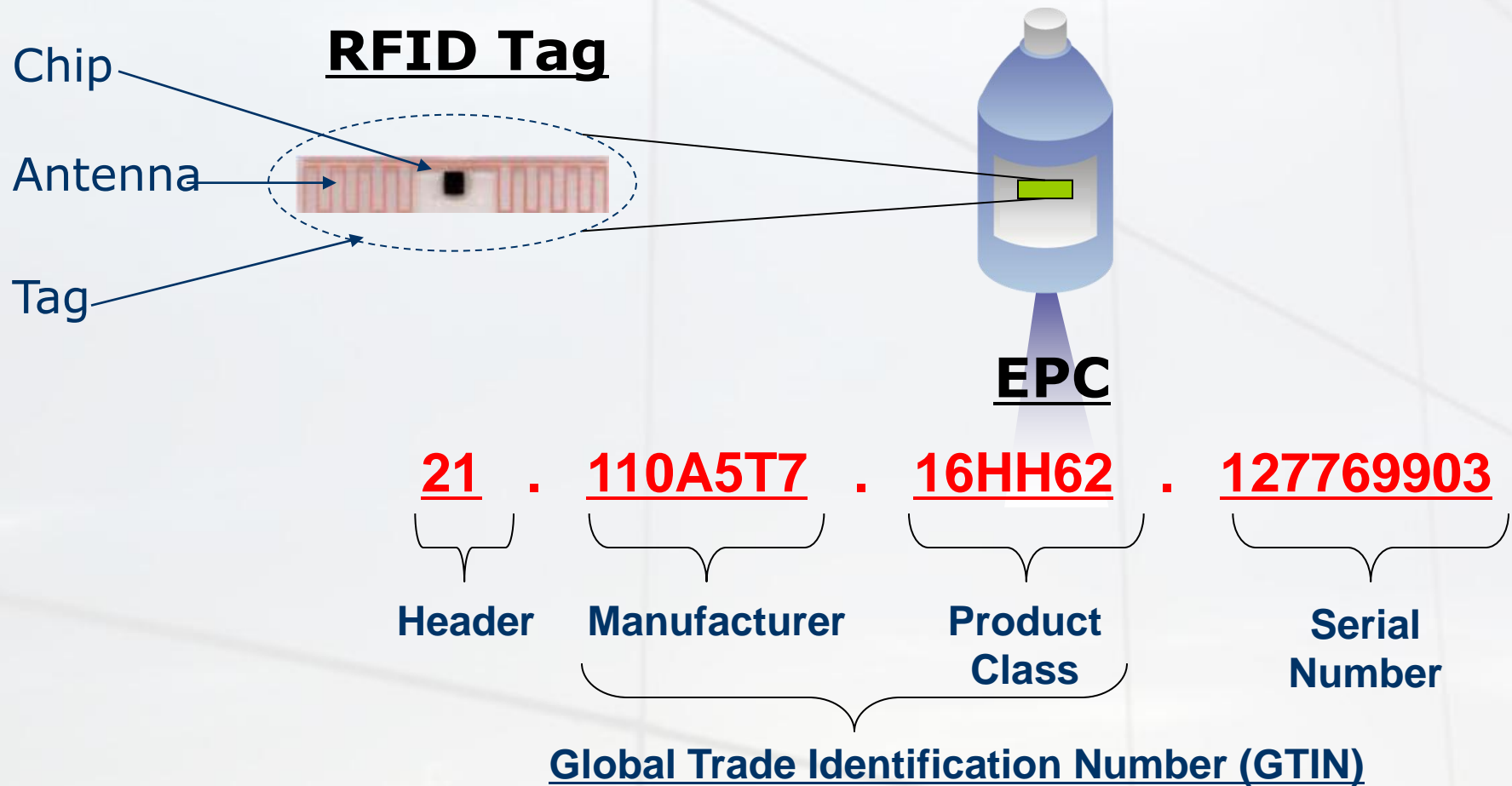


Main Components of RFID

- Readers
- Antennas
- Tags



Information Encryption on Tag



How RFID Systems Work

1. The antenna of the interrogator (reader) emits radio signals

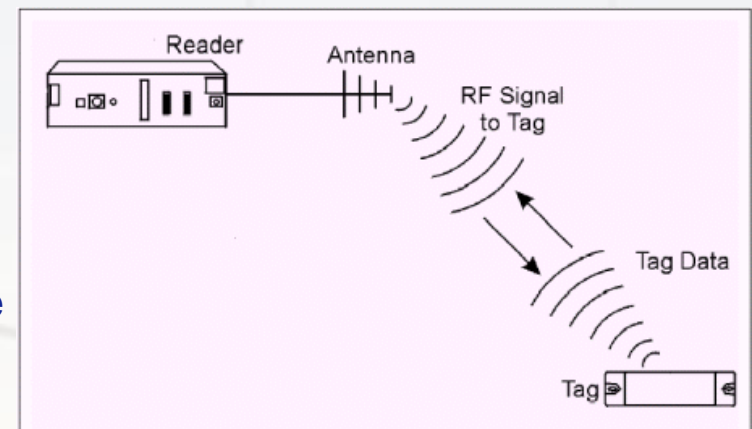
- EM field transmitted can be continuous
- Antennas come in a variety of shapes/sizes
 - Can be built-in or external
 - Circular polarization of reader antenna allows any tag antenna orientation
- Range: 1 inch to 100+ feet

2. Transponders (tags) respond with their unique code

- Microchip / Integrated Circuit
- Antenna: copper or aluminum coil
- Encapsulating material: glass or polymer

3. Reader receives and decodes tag information and sends it to a computer via standard interfaces

- Fixed or portable
- Software available to filter data and monitor the



RFID Capabilities

- Non operator intervention
- Non line of sight
- Large simultaneous read capability
- Large unique numbers
- Read/Write Capability
- Rugged and reliable



Projects



Previous Projects

- **RFID and AutoID**
 - Integrating RFID into Healthcare Manufacturing Plant
 - Cost analysis for implementing RFID in Libraries
 - RFID impact on enforcing the use of collaborated tools at a defense manufacturer
 - Integration of RFID and GIS system for ticket/seat location
 - Applying RFID technology to sports timing in a marathon
 - RFID testing of consumables in NASA Space Center (ISS) storage containers
 - Integration of Animal ID into systems for Cattle Tracking
 - RFID in the Operating Room with surgical tags
 - RFID in Construction



Current Projects

RFID and AutoID

- Intelligent Environments for Large Cities
- Game Changing Science and Technologies
- Cost reduction of tags through micro manufacturing process design for Health Care Drug Delivery for dosage level samples and ingestible Bio enabled pills
- NASA Gen 2 RTLS
- RFID Reader for WMS direct to Cloud (CiC)
- NSF International Research Experiences in Science for undergraduate students in Mexico
- I/UCRC Planning Research Center for Automatic Identification Technology



R-WMS on Cloud



R-WMS on Cloud

- Warehouse Management System (WMS) is software that has been designed to provide instructions to the end-user on the many warehouse activities needed for fulfilling customer's orders.
- The volume of the data and information traffic generated in warehouse management operations can be extremely high.
- The **goal** of this research project is to develop a mobile application involving pervasive computing of a data-driven warehouse management system through cloud architecture.
 - *Objective #1: Develop a mobile RFID WMS application to transmit and receive data from warehouse operations from databases*
 - *Objective #2: Develop scheduling algorithms minimizing data processing time using fuzzy logic and genetic algorithms for cloud computing.*
 - *Objective #3: Optimally partition the WMS processes between the developed application and the cloud using a simulated cloud environment.*
 - *Objective #4: Evaluate the performance of the cloud-based warehouse management system application on a third-party cloud platform.*



R-WMS on Cloud

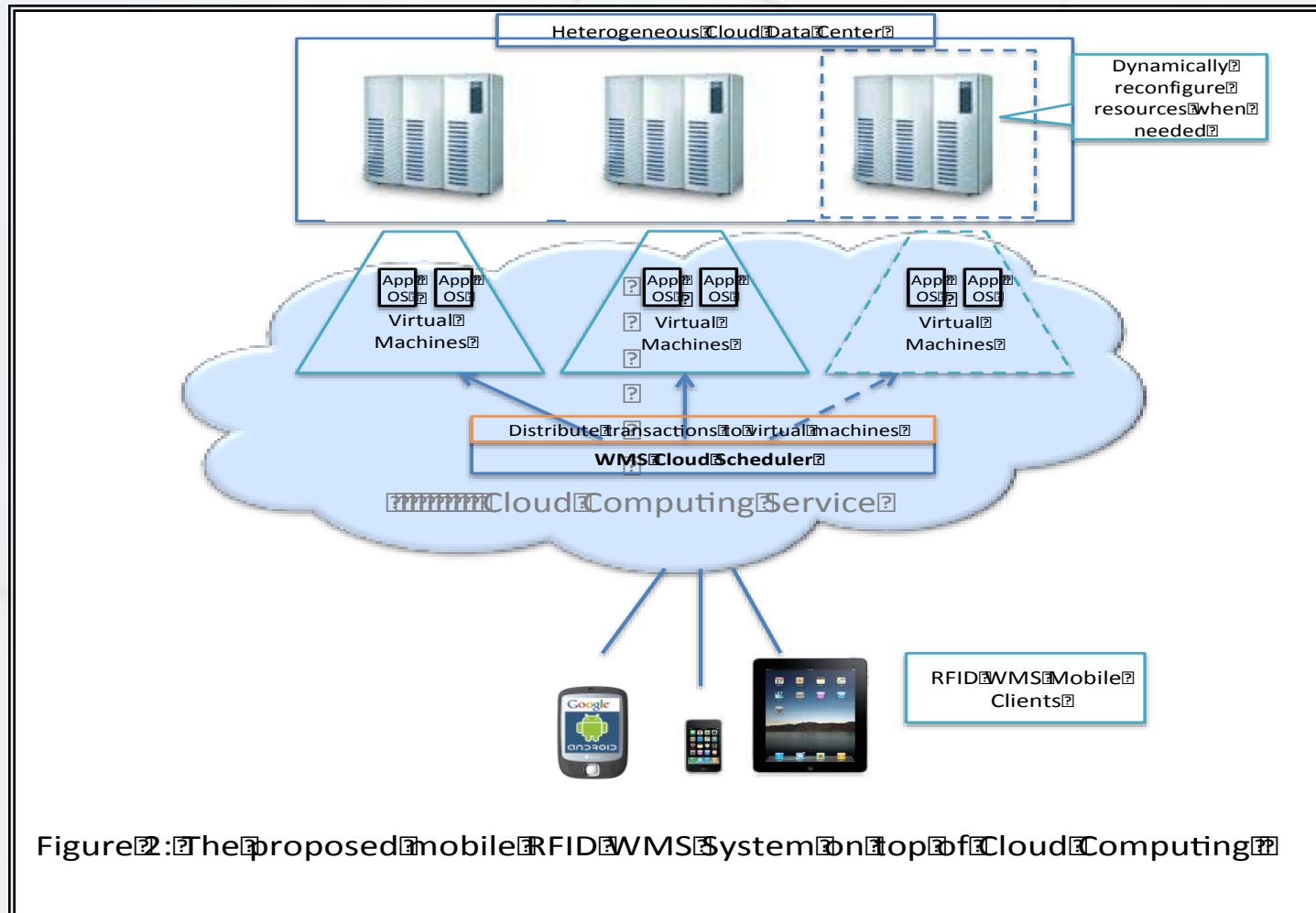


Figure 2: The proposed mobile RFID WMS System on top of Cloud Computing



Multimodal Automatic Identification (MMAID)

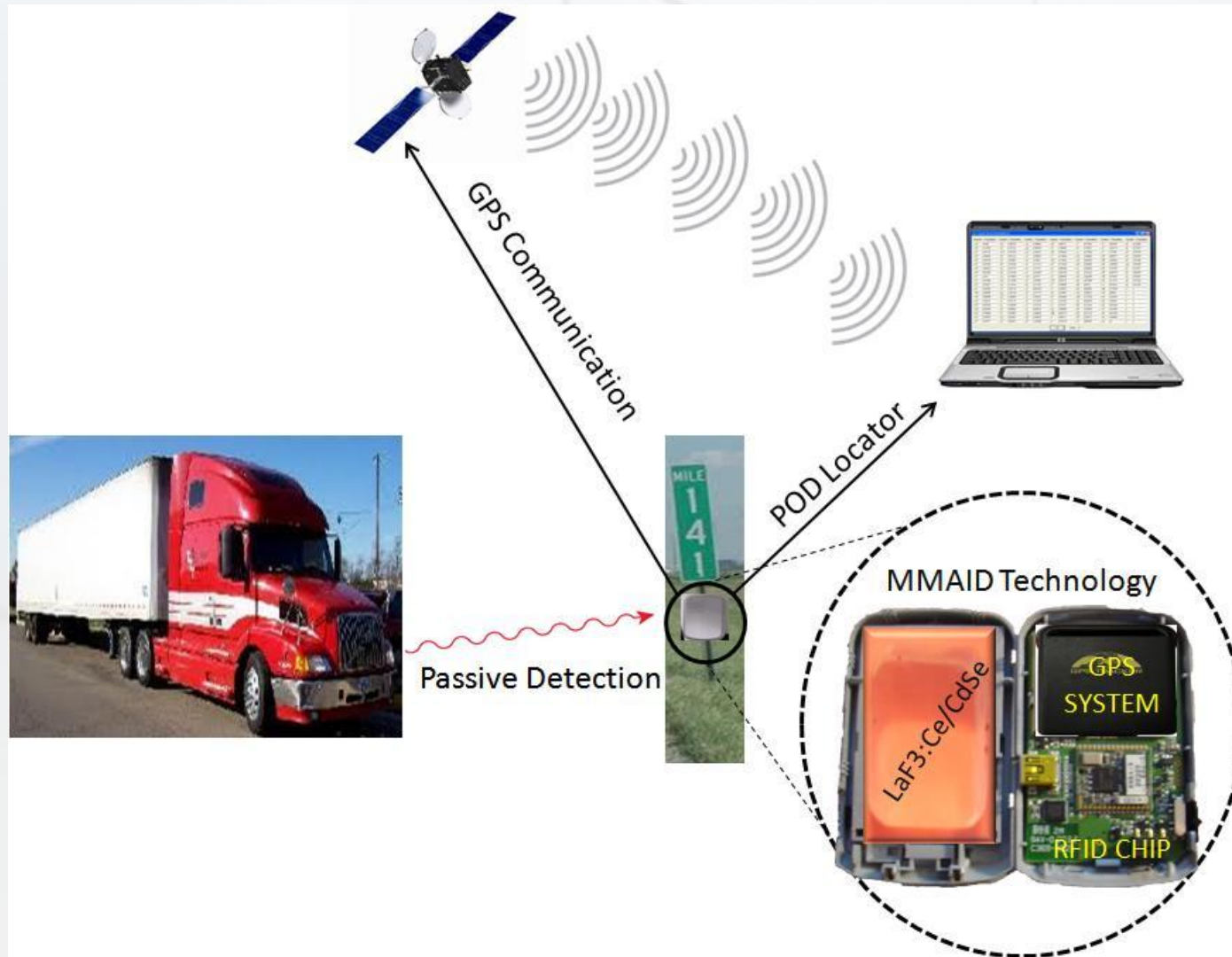


Multimodal Automatic Identification (MMAID)

- Detecting and interdicting the precursors to hazardous radiation and nuclear materials while they are in transport and as they pass through the nation's commerce pathways of air, water ways, cargo ports, and in-land ports is crucial to the long term safety concerns of the nation.
- The broader impacts of this research are the enhanced safety, security and reduced radiation exposures leading to huge cost savings from an operational standpoint.
- In addition, the viability of such technology will lead to development of automatic alert systems to evacuate regions prone to radiation.



MMAID Concept



IRES-Mexico



NSF IRES MEXICO Program

- Program Funded by the National Science Foundation is to create an International Research Experience for Students (IRES) Program at
 - 1) Tecnológico de Monterrey, Campus Monterrey
 - 2) Tecnológico de Monterrey Campus Querétaro
 - 3) University of Texas in Arlington (UTA)
- **Become familiar with the Spanish language to increase effectiveness** when working with others from Spanish-speaking cultures.
- **Increase students' comfort level when working** with people from different cultures by exposing them to the technological, economic, and socio-political aspects of Mexican society.



NSF IRES Mexico Student Projects

- The IRES Program in Mexico will consist of an intensive **six-week** research program comprising a series of activities for students
- These activities have been planned to engage students in the context of an international research experience preparing them for a future in global cooperation. The basic activities of the summer research experience are:
 1. Pre-trip and on-site orientation;
 2. International language instruction;
 3. Research methods seminar;
 4. Graduate student development seminars;
 - 5. Field research projects;**
 6. Oral and written presentations; and
 - 7. Assessment and evaluation.**



NSF IRES Mexico Student Projects

- ***Continuous Process Improvement Management Using RFID Technologies:*** Investigating how automated tracking can confirm the impacts that specific manufacturing processes has on product defects.



- ***Reducing Backorder Costs and increasing throughput using RFID inventory control.*** In food manufacturing the spoilage and loss of inventory has a major impact on throughput, backorders and sales. Reducing backorders through automation was investigated.



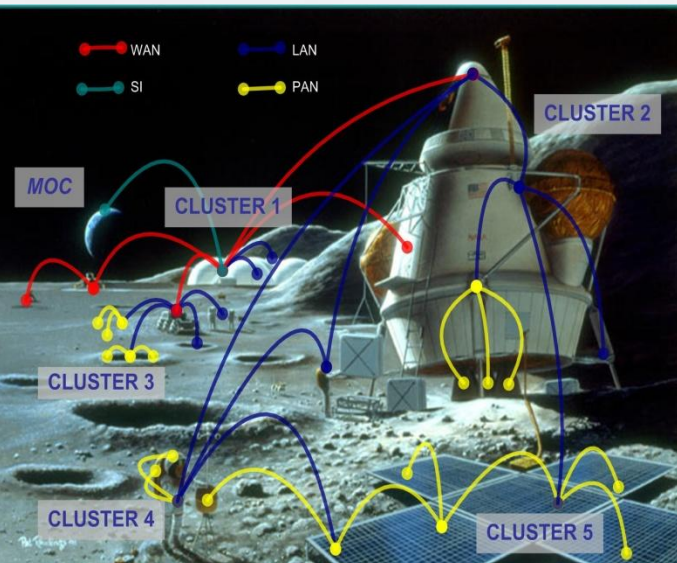
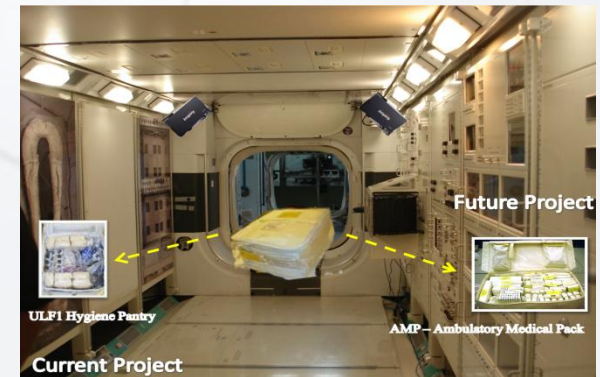
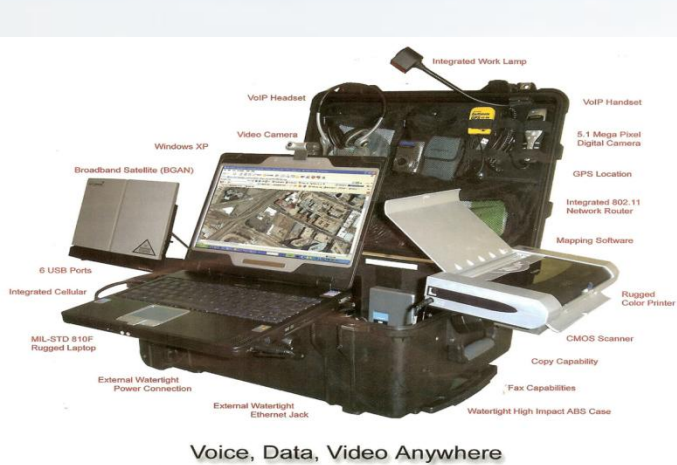
- ***Using a Web Based Web Portal to reduce Carrier Errors.*** The need to use more than one transportation mode in order to cost effectively have products delivered from suppliers to customers is more important than ever. With high gas prices, companies are seeking reduce transportation costs in every possible way.



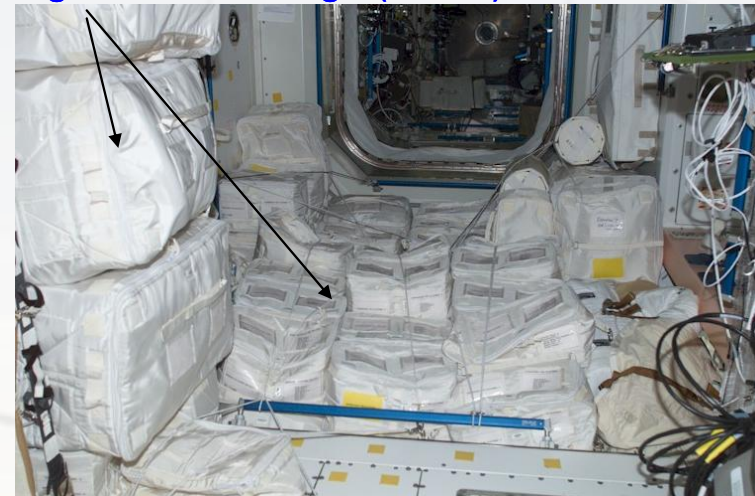
NASA ISS Automation



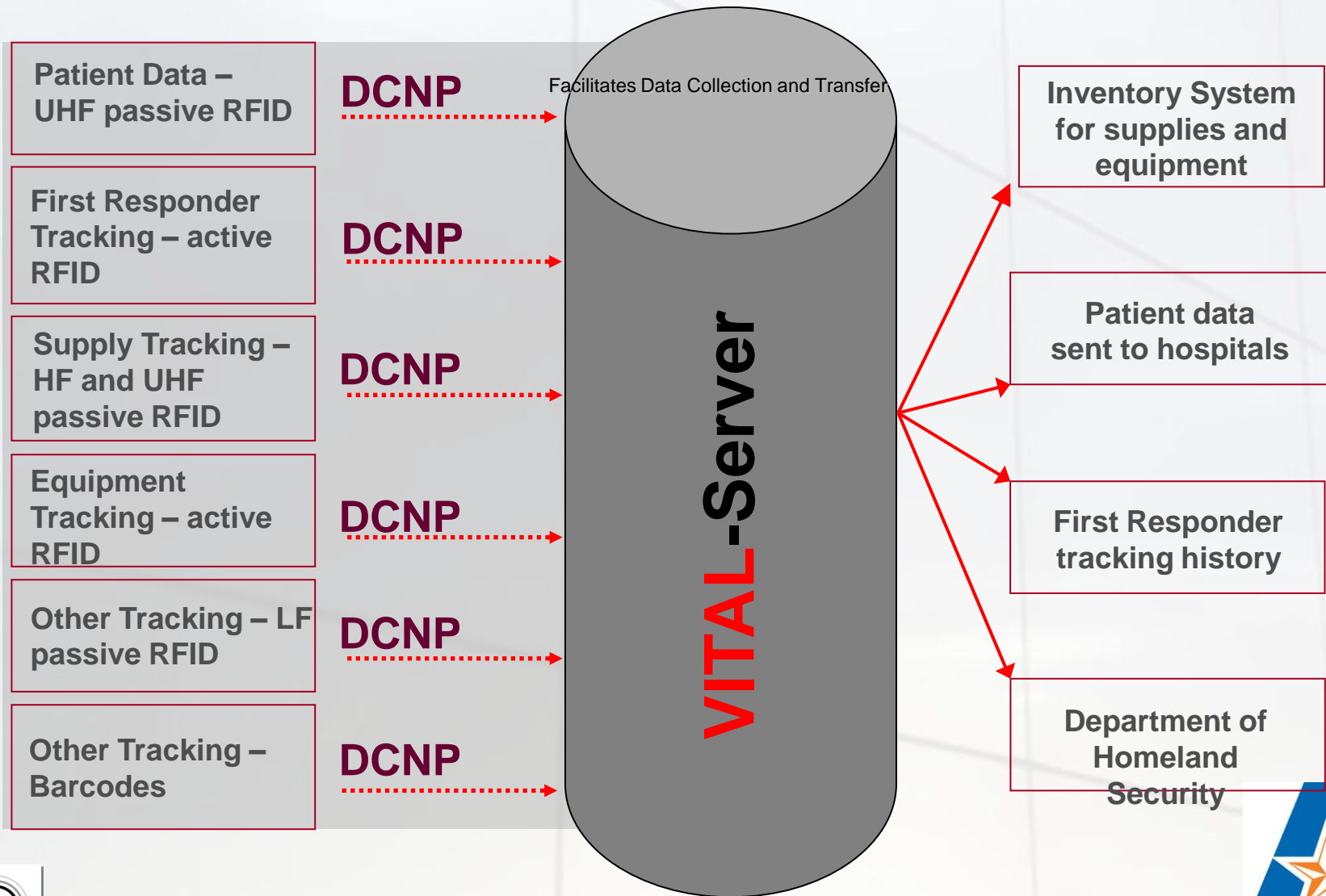
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Cargo Transfer Bags (CTBs)



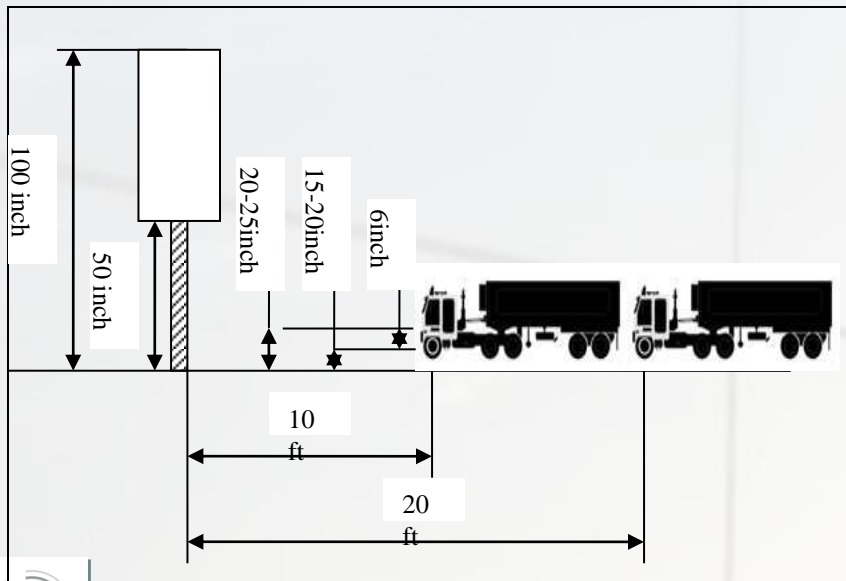
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CVISN License Plate Automation

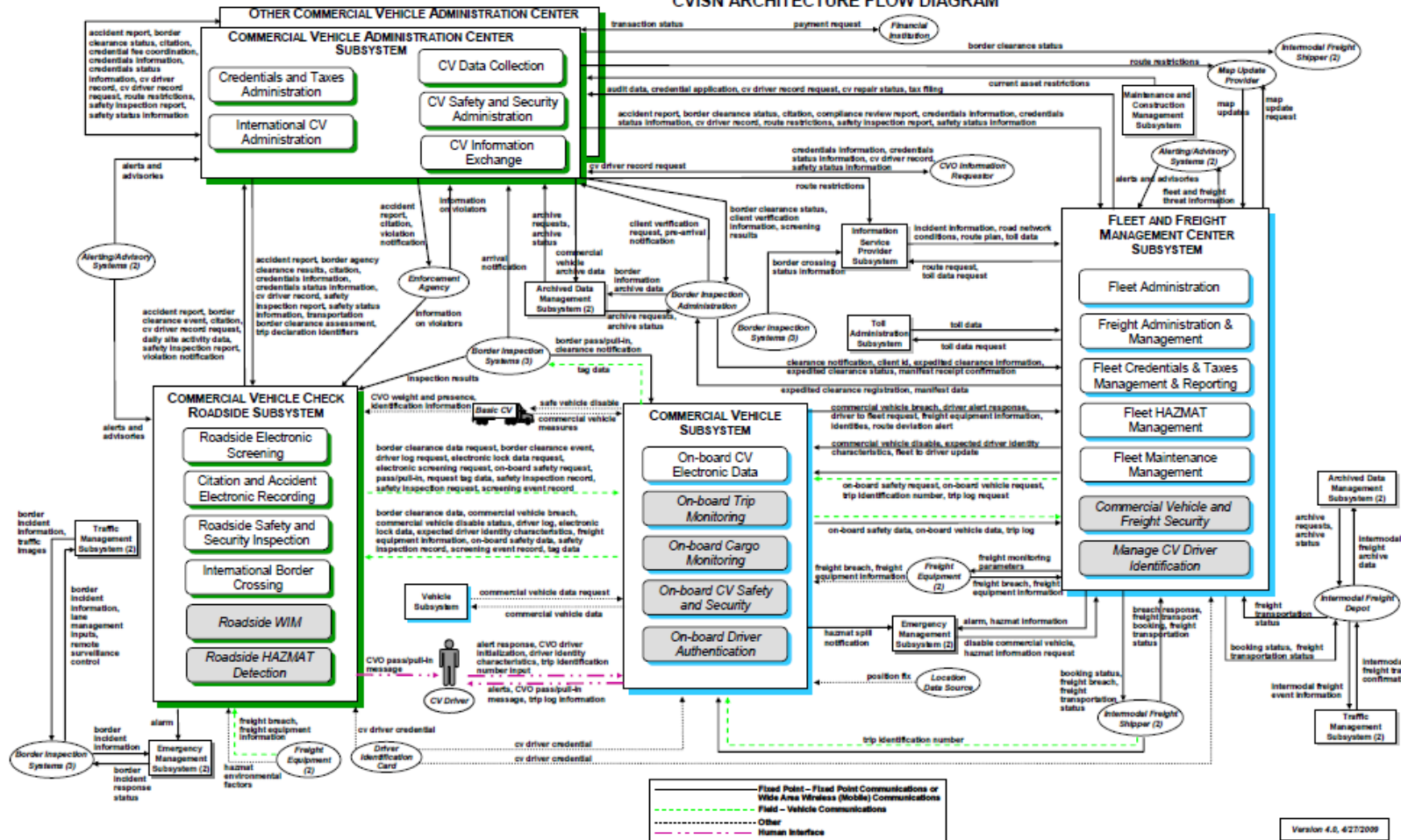


CVISN License Plate



CVISN Architecture

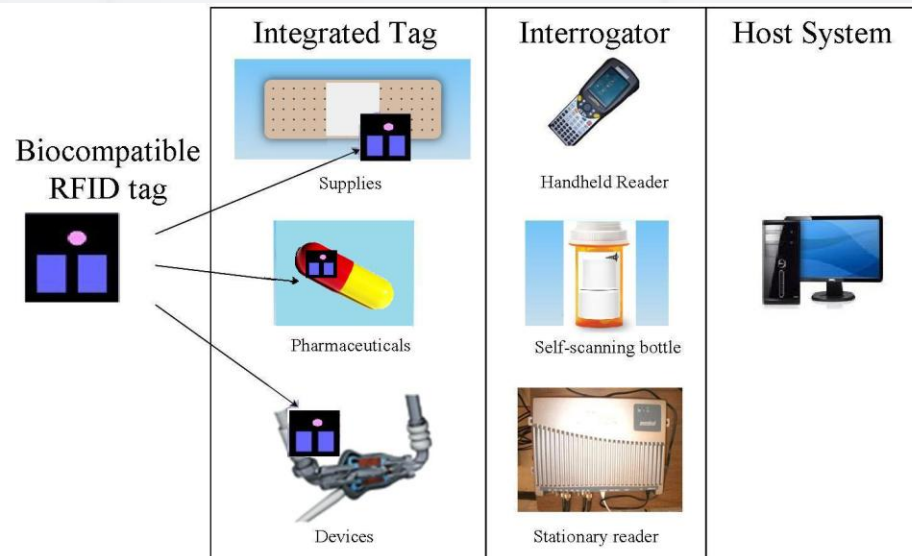
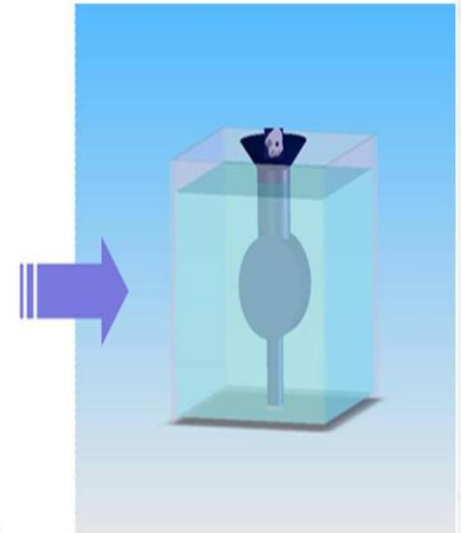
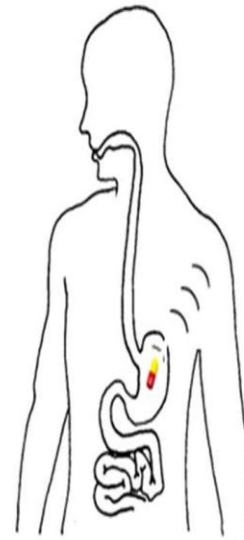
CVISN ARCHITECTURE FLOW DIAGRAM



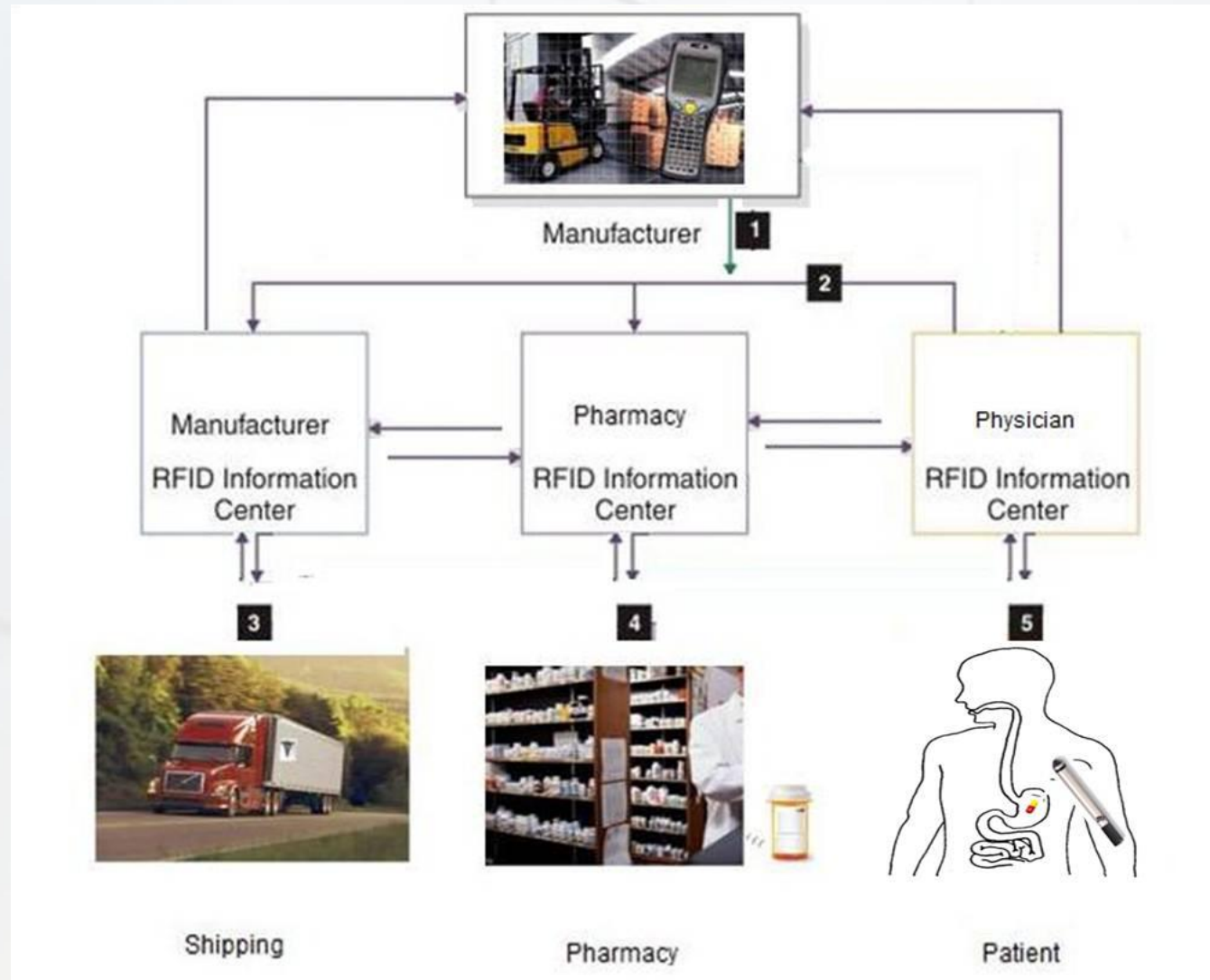
RFID in Healthcare



RFID in Healthcare



RFID in Healthcare Supply Chain



Intelligent Cities

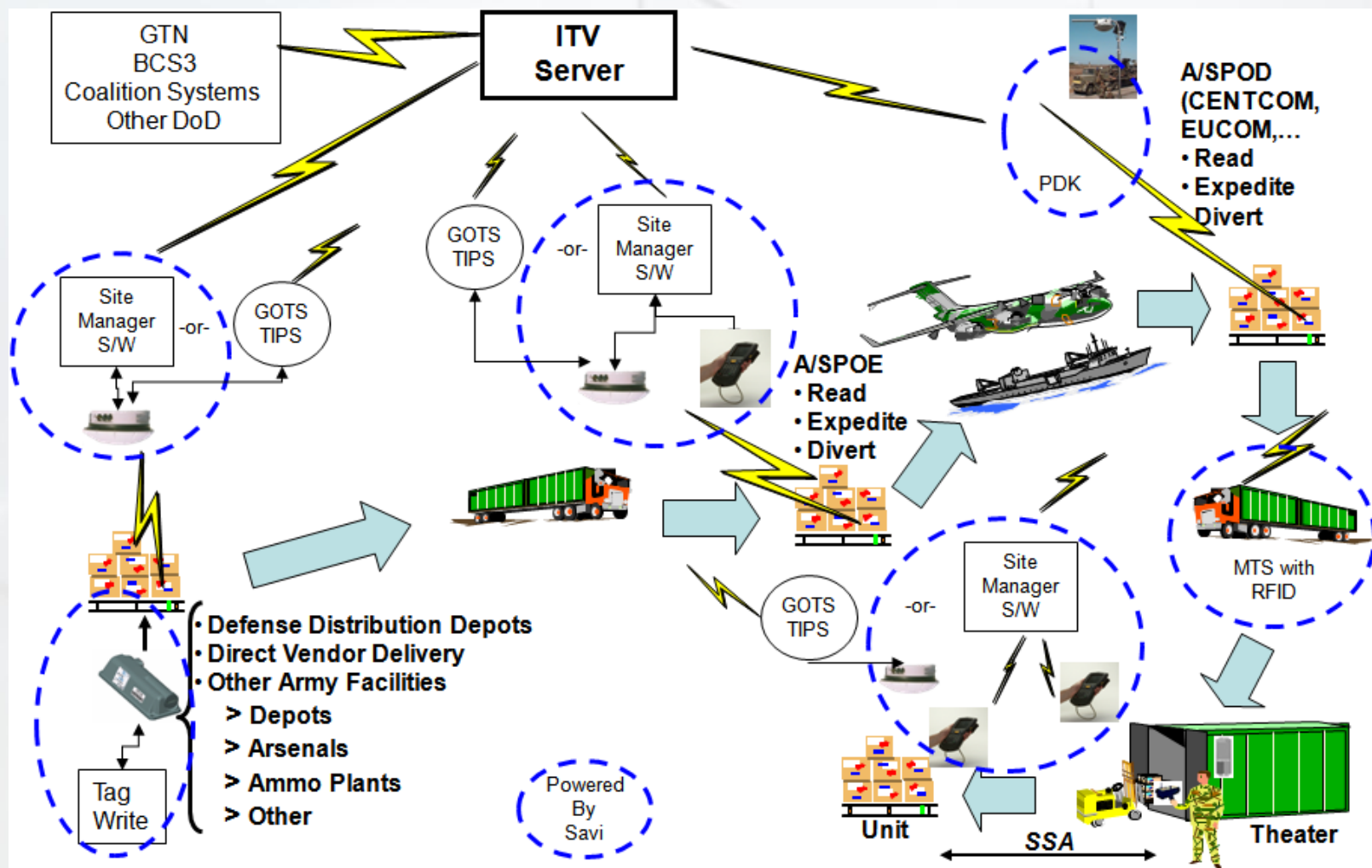


NSF PIRE EXTENSION

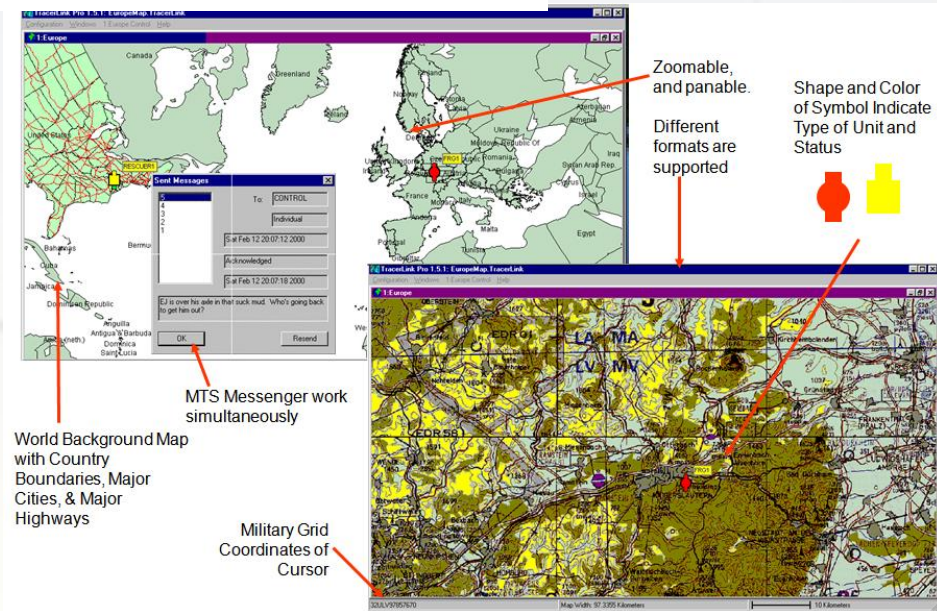
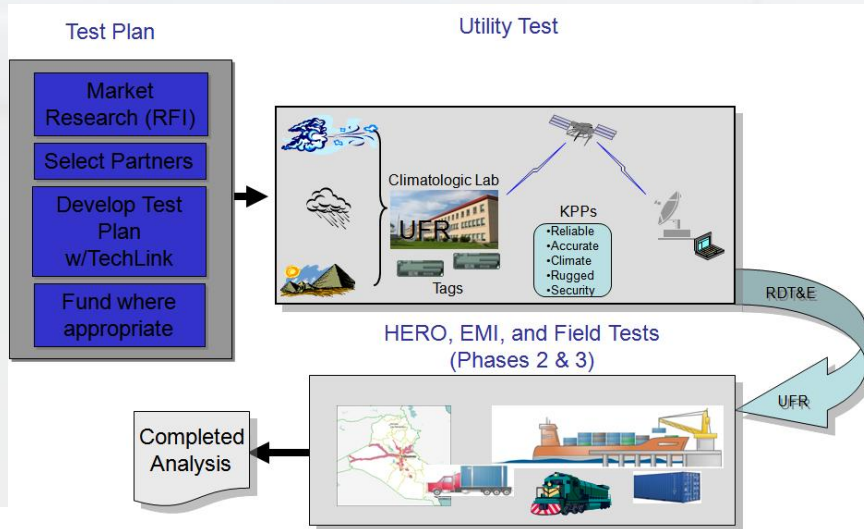
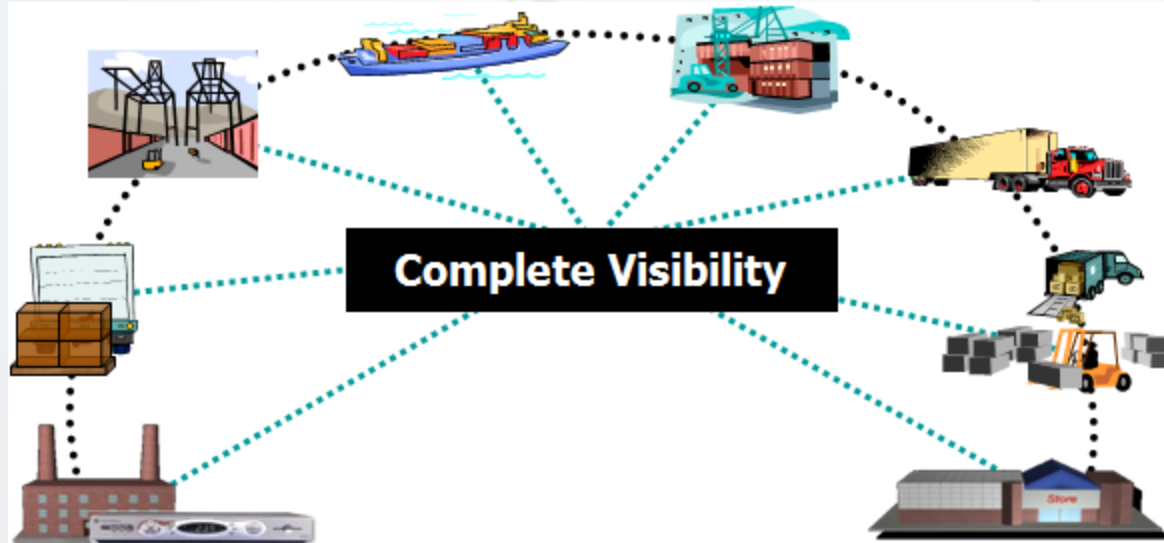
- Conduct high-quality research with researchers in Mexico and CONACYT
 - Research on intelligent environments for problems in large cities
- Collaborate with CICESE
- Enhance students' research skills and conduct high-quality research in the Science, Engineering, and Education for Sustainability (SEES) disciplines that requires international collaboration
 - Internationally emerging engineering fields of study.
 - The engineering fields of sensors controls, RFID, and Logistics
- Increase students' working with different cultures
- Increase student abilities in research methods and problem-solving skills
 - Competitive in an international research environment.
 - Increasing the student's interest in graduate school.



Intelligent Cities



Intelligent Cities



Questions?



Contact Information

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