Cargo Handling System

The PLC and e-Cargo-controlled system represents a typical Cargo Handling System from the forwarders' handover at the acceptance desk to the loading of the aircraft or from the unloading of the aircraft until the handover to the transportation agent.

Description

The system provides an optimized environment to practice the IATA regulations and procedures for efficient and compliant air cargo management and aviation security. It also allows for a more technically oriented training for maintenance and service personnel, allowing to practice relevant technologies like PLC, SCADA, electric and pneumatic drives, conveyor belts and mechanics, bus technology (i.e. ProfiNet and ASI-Bus), barcode and RFID-readers, as wel as system security (Scalance).

The cargo handling system by default includes the e-Cargo system, the Cargo Scan Simulator and the Cyber Security Training System. It can be extended with a dual view x-ray scanner.

Features

The conception of the system takes account and supports training in the context of the following regulations:

- IATA e-Cargo
- ACC3 Programme of the European Union
- Dangerous Goods Regulation (IATA Regulation 618 Attachment "A")
- IATA ULD Regulation
- IATA CARGO-XML message protocols and standards
- IATA Aviation Cyber Security Toolkit
- EUROCONTROL Manual for National ATM Security Oversight

This training laboratory takes specific consideration of the ACC3 ('Air cargo and mail carrier operating into the Union from a Third Country Airport') programme.
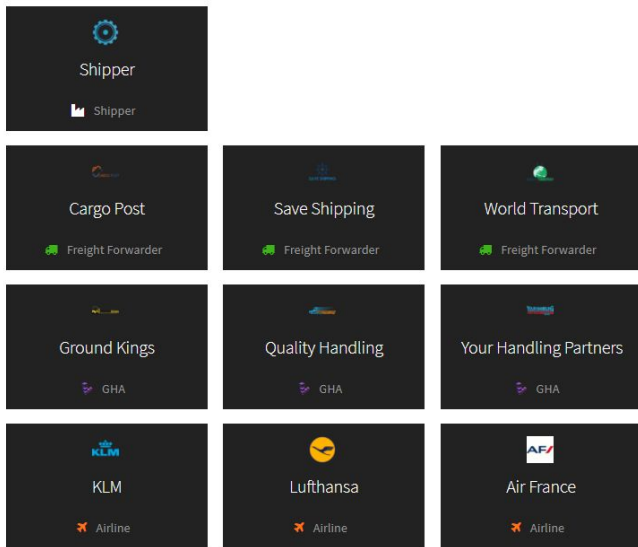
The FreeScopes applications get active in a plug-and-play approach, as soon as the corresponding radar, simulator or training environment is plugged in.

Topics

Cargo Handling System is a training environment for the following subjects:

- Cargo flow management, analysis and optimization with Conveyors, SCADA and PLC control
- Technical Maintenance of cargo handling systems including mechanical subsystems, control environments, bus-systems, electric drive systems pneumatics
- Aviation security training including cyber-security training, procedural training, handling process security training, rapid recovery training (diagnosis, fault and attack identification)
- General end-to-end process training including the roles of forwarders, ground handling agents, carriers and customs
- e-AWB (e-Airway Bill)
- e-CSD (e-Cargo Security Declaration)
- e-DGD (e-Dangerous Goods Declaration)
- e-ACI (e-Advanced Cargo Information)
- ULD Configuration
- The interconnection of the processes with Flight Plan and Flight Data Processing Systems
- Cybersecurity Training for eCARGO processes and secure supply chains
- Cargo X-ray scan

Parts

The e-Cargo system consists of:

- One (1) Transfer System / Conveyor Belt System
- One (1) Automation System including PLCs, Drive Control, Cyber-security, etc.
- One (1) Surveillance, Control and Data Acquisition System SCADA with Control Architecture
- One (1) SCALANCE Firewall System
- Twenty (20) Optoelectronic Sensors
- Fifty (50) small Unit Load Devices ULD
- One (1) Pneumatic Lift controlled by the PLC
- One (1) e-Cargo Software including e-AWB, e-CSD, e-DGD, e-ACI, ULD-configurator, a small Flight Plan and Flight Data Processing system on one (1) server
- One (1) Cyber-Attack Experimentation on one (1) server
- One (1) Cyber-Attack Simulation on one (1) server
- One (1) license for e-Cargo software utilization
- One (1) Operating manual in English language freely downloadable.

Prerequisites

- Computers with latest HTML5 enabled browser. Current versions of Chrome, Firefox, MS Internet explorer, Opera and Safari are able to read HTML5.
- One (1) SkyRadar CloudServer

Extensions

- All applications of the SkyRadar Modular Radar Training System Family
- Dual view Cargo Scanner

SkyRadar's e-Cargo software is accessible by an unlimited amount of concurrent users. It can be extended by a broad range of solutions required for ICAO and EuroControl ATCO and ATSEP training programs as well as IATA qualifications makes SkyRadar the preferred choice of many aviation academies and IATA TrainAir Plus accredited institutions.

Many universities and military academies use SkyRadar's hardware and software solutions within their qualification, education, training or research programs.

Cargo Handling System

This Cargo Handling Training System provides an environment for technical and procedural training of aviation security and the CARGO supply chain as expected by IATA and EU in the context of ACC3 (protected supply chain limited to certified forwarders, carriers and GHAs). Computers get access the LAN or Wireless LAN, enabled through the SkyRadar Cloud Server. The solution in fully integrated into the e-CARGO System. The hold and storage process is triggered by e-CARGO's Flight Data Processing system, process data are seamlessly exchanged between this system and e-CARGO.

This training laboratory helps to train the service, management, operation and optimization of secure supply chains with respect to

- Secure physical CARGO supply chains, with state-of-the art automation and drive architecture, Surveillance, Control and Data Acquisition (SCADA), RFID- and bar-code readers, integration into eCARGO and the possibility to isolate specific Unit Load Devices (ULDs) in a fully automatized approach

- Secure e-CARGO supply chains including certified agents and communication, protected against malicious attacks, manipulation, data theft and intrusion of unregulated players.

- Cyber Security Training subsystem, teaching the cyber-protection of the eCARGO supply chain

- Help air carriers and their supply chains to get ready for successful ACC3 designation.

SkyRadar's hardware cargo training system has a modern modular and mobile design (on wheels) and consists exclusively of high tech industrial components.
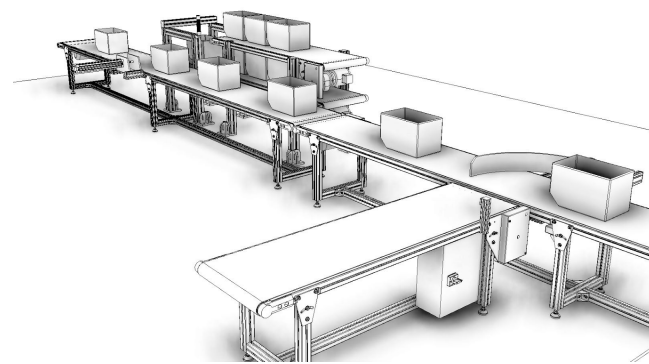
Transfer System / Conveyor Belt System (included)

The transfer system is completely modular, consisting of autonomous units, connected via ProfiNet. The overall assembly can be changed and enlarged.

In the standard configuration is approx. 11 m long and includes the following

- Feeding Belt for Cargo Scanner (Length: 1 m):
  The conveyor belt transports the Unit Load Devices (ULDs) to the Cargo Scanner. Hereafter the ULDs move on to Belt Main 1. If the configuration includes no physical cargo scanner, the operator can manually select whether the ULD content is compliant, requires manual check or whether the alarm needs to be activated.
- Conveyor Belt Main 1 (Length: 2 x 2 m):
  In function of the results of the CARGO screening,

the ULDs are either transported to the conveyor belt main 2 or to the bypass 1 or 2.

- Bypasses 1 and 2 (Length: 2 m each):
  In case of irregularities or suspected problems the ULD can be deviated to Bypass 1 and 2 for in depth analysis. After that it can be either transported back to conveyor belt main 1 or excluded from the cargo handling procedure
  (to be isolated, confiscated to returned to the supplier).

- Conveyor Belt Main 2 (Length: 2 x 2 m):
  Conveyor belt main 2 transports the ULDs to the exit point (optionally to two exit points). As not all ULDs can be

immediately embarked, a high rack storage area allows for interim storage.
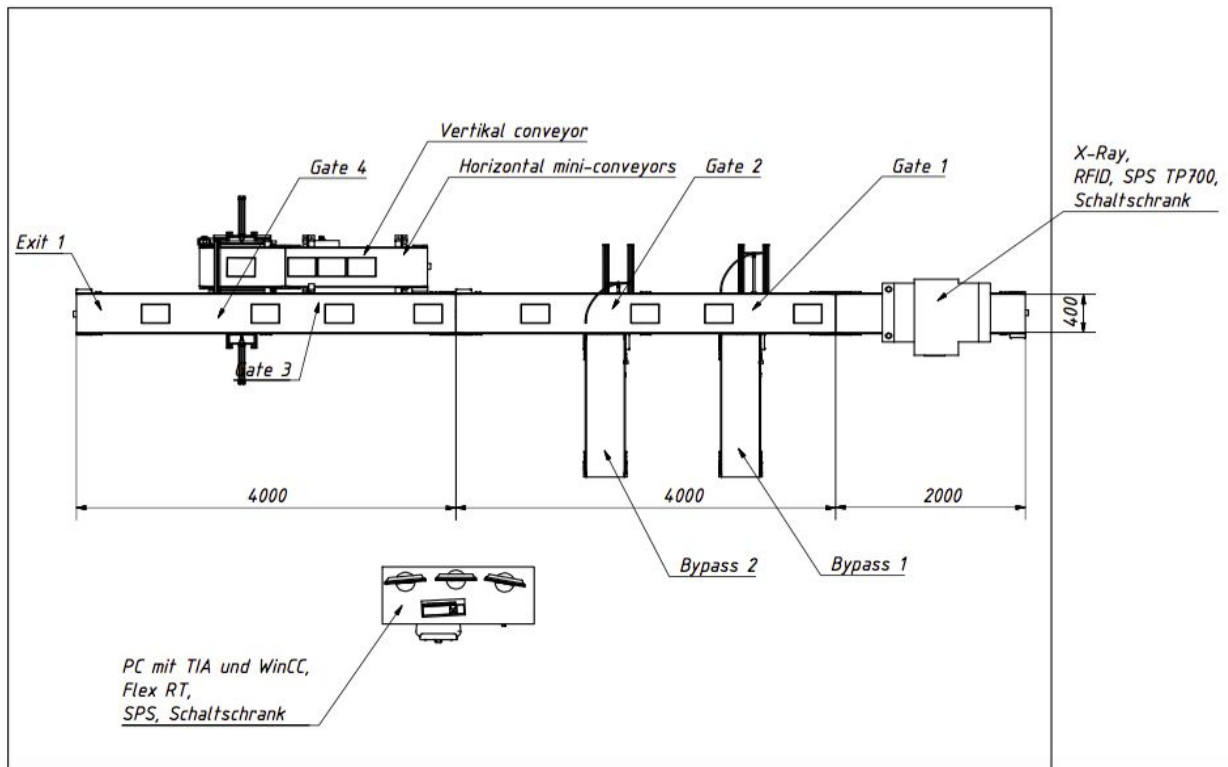
- High Rack Storage Area (Length: 2 m): ULDs can be stored on two levels. A linear gripper fetches the ULDs and places them on an elevator unit (1 m). This elevator unit is pneumatically moved up and down to bring the ULDs to the storage belts.
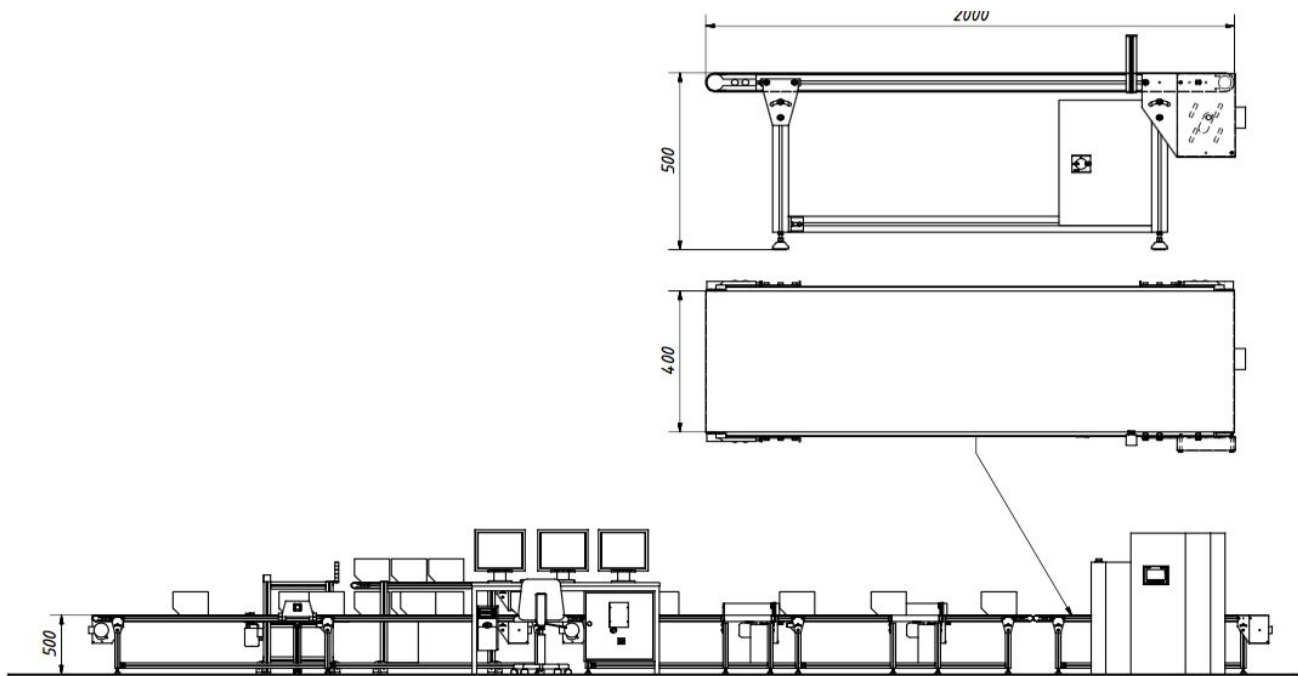
Automation System and Components (included)

Industrial Siemens components build the automation system. Those high end components find application in modern airports, due to their MTBF > 10,000 h. S7 PLCs automate the system, Siemens SINAMICs drives control the motors. Siemens SCALANCE security switches provide the firewall and SIMATIC Human Machine Interfaces enable communication with the ProfiNet environment. In addition, the solution includes industrial RFID and Optoelectronic sensors. The components in an overview:

- 1 x ET 200SP Distributed Controller CPU 1512SP F-1 PN
- 2 x SIMATIC S7-1512C-1 PN
- 1 x SIMATIC HMI TP1500 COMFORT with ProfNet and MPI/Profibus DP
- 1 x SIMATIC Basic Panel KTP700
- 1 x SIMATIC NET Industrial Security Switch - SCALANCE S623 and 3 x managed SIMATIC NET SCALANCE X208
- 8 x SINAMICS G120 drive 1 AC 230V network
- 8 x RFID - RF200
- 20 x Optoelectronic Sensors
- 50 x ULDs (Unit Load Devices)
- 1 x Pneumatic Lift controlled by the PLC

SCADA System (included)

The Surveillance, Control and Data Acquisition system (SCADA) Siemens WIN CC provides professional analytics and live data from the CARGO Handling System.

SIMATIC WinCC® is a scalable process visualization system (SCADA) that is graduated by performance, with efficient functions for controlling automated processes.

With SIMATIC WinCC, "perfect process visualization" stands for complete operating and monitoring functionality under Windows for all industry segments ranging from simple single-user systems through to distributed multi-user systems with redundant servers and the structure of a cross-site solution including Web clients.

Apart from the central computer, 12 students can concurrently access the SCADA system via the SkyRadar CloudServer through the local Ethernet.
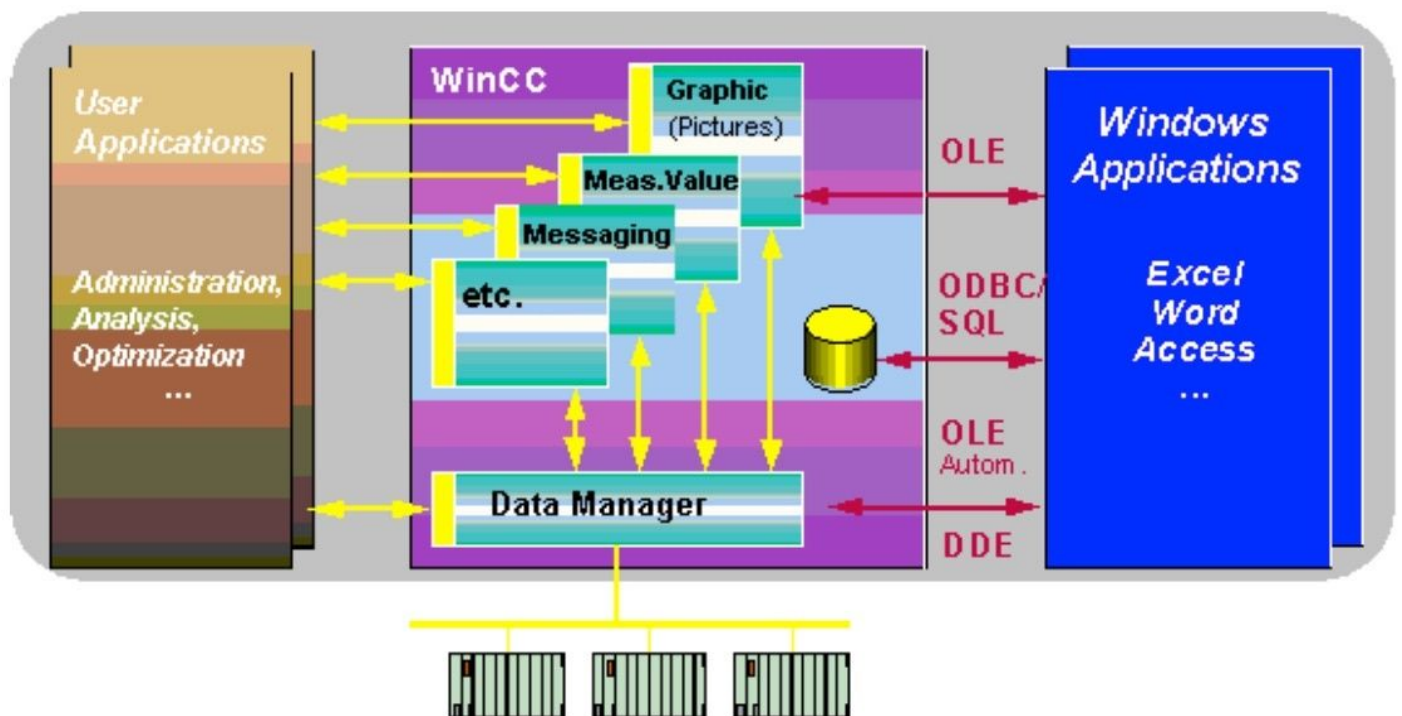
e-Cargo (included)

SkyRadar e-Cargo (also referred to as "eFreight") is a simulation application based on the IATA e-CARGO standard and the air cargo industry transportation business process (Air Cargo Industry Master Plan) by the Air Cargo iQ Interest Group. Using this tool, you can track the movement of air cargo from the point of booking it with a freight forwarder as a consignor, and ensuring its arrival at the consignee.

1. Booking a shipment with a freight forwarder
2. Selecting a carrier
3. Generating a waybill and other documents
4. Reaching the shipment to the carrier (airline)
5. Completing ground handling activities
6. Loading the shipment at the port of origin
7. Unloading the shipment at the destination
8. Transferring the shipment to the freight forwarder at the receiving end
9. Reaching the shipment to the consignee
10. Enabling a view of the customs activity within the application

Cyber Security Trainer (included)

Simulator to create threat awareness and to teach threat detection, prevention and post-attack recovery around the eCargo supply chain.

The objective of these practical exercises is to help teaching system designers, managers and users as well as students to gain the following competences:

- Understand the nature and impact of cybersecurity threats and being able to judge airline system threats and vulnerabilities
- Learn to analyze latent threat-potential through security weaknesses in existing or new systems in a structured way and be able to close loopholes
- Learn to detect attacks and handle them with the objective to reach rapid system recovery and most limited damage

The trainer includes

- attack scenarios: sniffer attacks, insider threat, trojan horse, identity spoofing, upstream attacks, etc.
- defence scenarios: firewall, SSL, 2 factor authentication, etc.

Interactive simulator

The interactive simulator provides a guided learning environment. It includes 3 panels:

- The left panel consists of a status window, allocating the user / student within a process
- The middle panel shows a procedure a transaction, followed by the student
- The 3 panel simulates the procedure and a potentially involved thread scenario
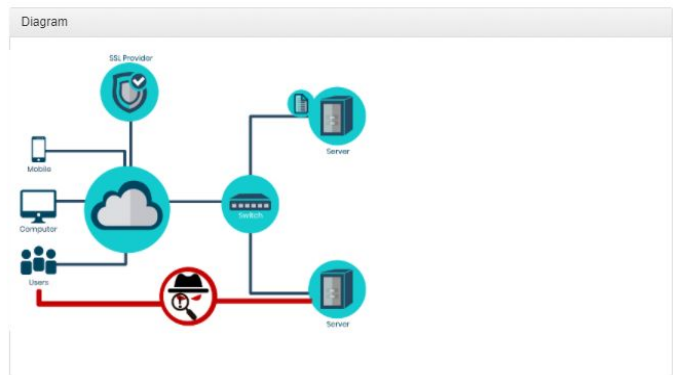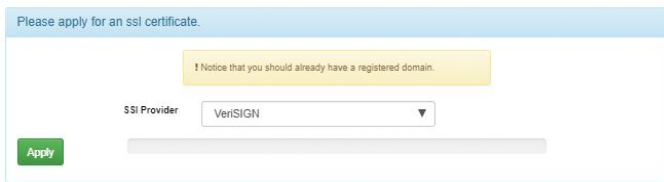
Cyber attack experiment environment

The cyber attack experiment environment allows to practice within the e-freight route network. It is connected to the Cargo Management and e-Freight (Training) System.

The trainer is equipped with a control panel, an analytics screen as well as attack panels for the teachers to activate threats.
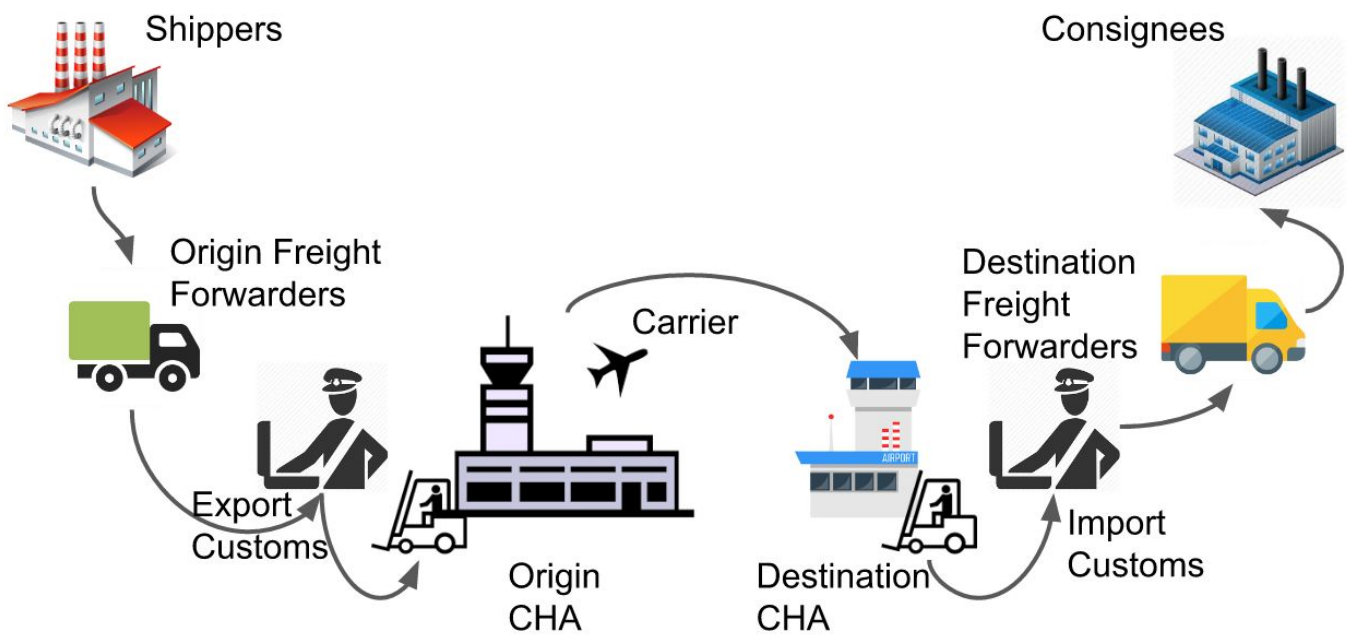
X-Ray Scan Simulator (included)

This simulator provides capability for student with image interpretation skills and experience to be able to detect a wide variety of threat items within a restricted time.

The simulator represents a typical graphical user interface of an x-ray scanner with typical functions such as pseudo-colors, grayscale, organic, or metal.
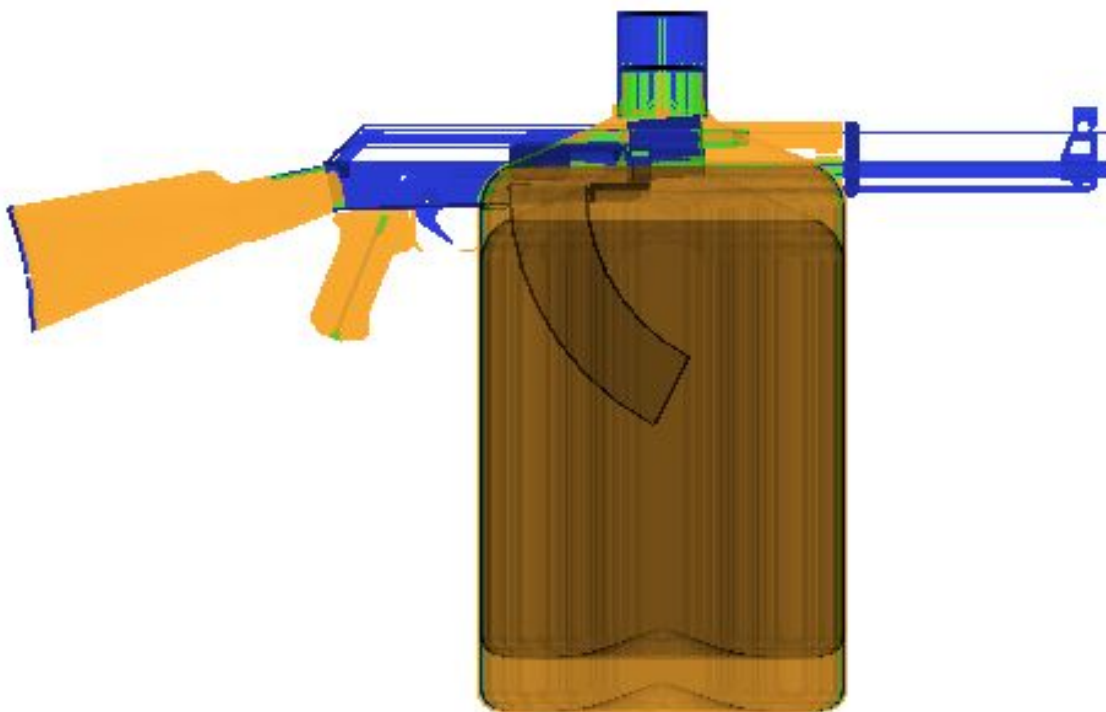
Technical Specification, server hardware

Each application (e-Cargo, cyber security simulation, cyber security experimenter, x-ray simulator) is supplied preinstalled on an industrial rack server.

HPE ProLiant DL20 Generation 9 servers or similar

We provide for all applications the Hewlett Packard HPE ProLiant DL20 Generation9. Only the SCADA & Conveyor system as well as the CloudServer have a different hardware, due to their specific system requirements.

The HPE ProLiant DL20 configuration includes the following:

- Intel® Xeon® Processor E3-1240 v5 (4 Cores, 3.50 GHz, 8M Cache)
- 8GB (1 x 8GB) DDR4 2133MHz UDIMM
- 1 x 1TB SATA 3.5" LFF Hot Plug
- Network Adapter 10/100/1000 Mbps Ethernet LAN,
- Integrated Bluetooth 4.0 and wireless LAN 802.11 b/g/n featuring Single Band

- Integrated Intel Graphics Media Accelerator HD (DX10.1)

Hewlett Packard Server HP Prodesk 400 G4 or similar

The SCADA & Conveyor system uses the Hewlett Packard HPE ProLiant DL20 Generation9 (Gen9), including:

- Intel® Xeon® Processor E3-1240 v5 (4 Cores, 3.50 GHz, 8M Cache)
- 8GB (1 x 8GB) DDR4 2133MHz UDIMM
- 1 x 1TB SATA 3.5" LFF Hot Plug
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