Realtime Monitoring Framework for Efficient/Green Supply Chain Using Mobile Agent Architecture

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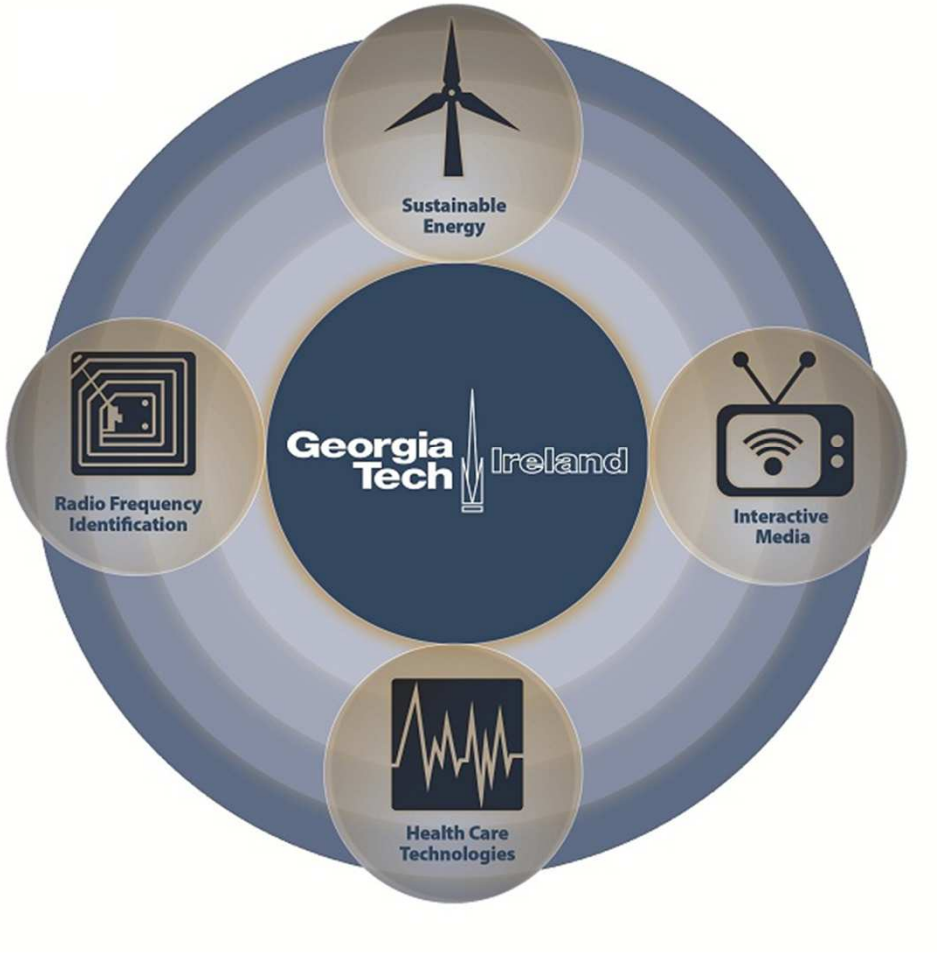
Introduction

- Clinical Laboratory Automated Stockroom System (CLASS) Overview
  - EPCglobal Standards Overview
  - CLASS Architecture
  - Supply Chain & Business Steps
- Multiagent Paradigm
  - Multiagents & Electronic Product Code Information Service (EPCIS)
- Results and Benefits

GTI Overview

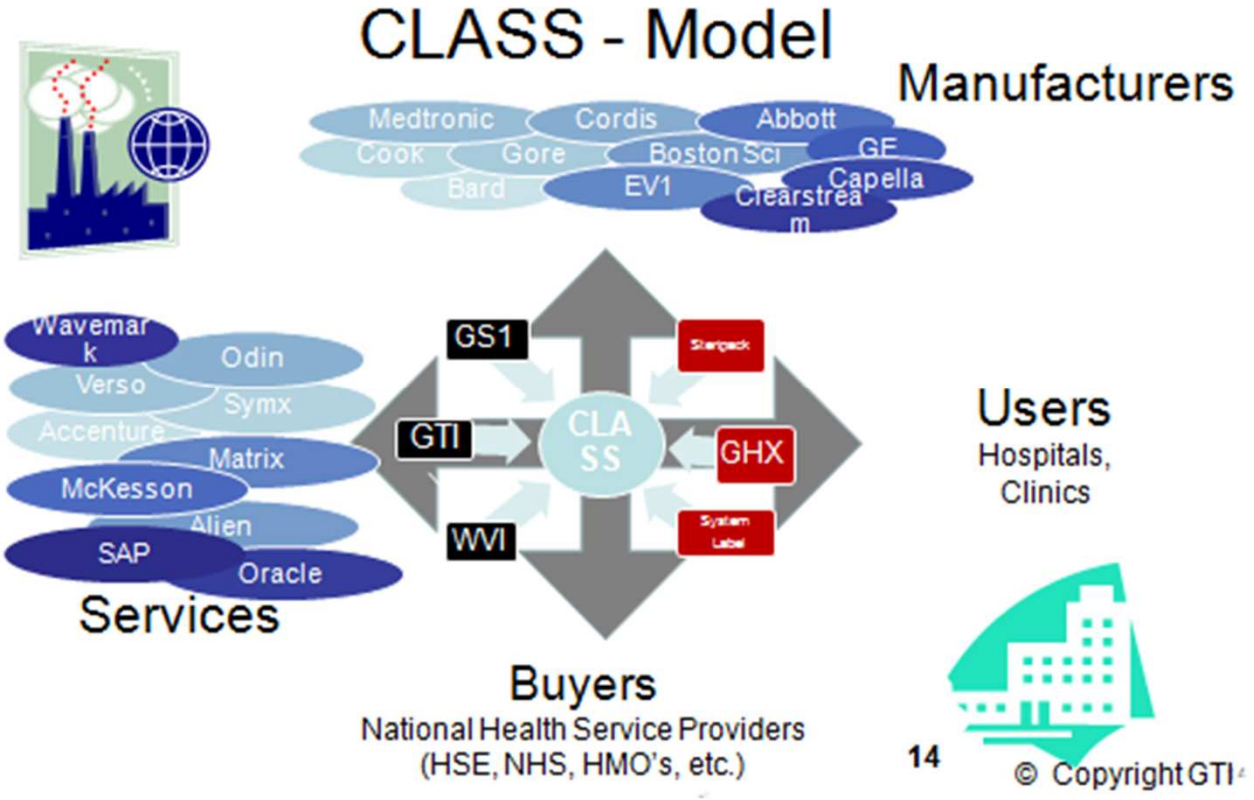


Clinical Laboratory Automated Stockroom system (CLASS)

Management Systems

Asset Tracking

Patient Tracking



Phase #1
Validation
Galway Clinic

Phase #2
MULTI – PILOT
Multiple Sites

Phase #3
Deployment Rollout
Platform Integration

Boston Scientific
Delivering what's next.
Medtronic
Cordis
a Johnson & Johnson company

CLASS – Status

Phase #1
Validation
Galway Clinic

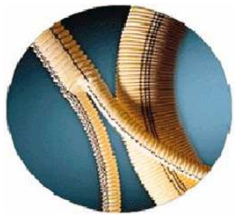
Phase #2
MULTI – PILOT
Multiple Sites

Phase #3
Deployment Rollout
Platform Integration

Phase #1 in Galway Clinic

CLASS – Overview

- **Objective**
  - Systems Certification, standard process, function, performance
  - Research testing, evaluation & development for industry
- **Collaborators**
  - GS1, WVI, GTI
  - GHX
- **Independent Industry Centre**
  - Catheter Lab Automated Stockroom System Test-bed



- **Companies**
  - J&J Cordis
  - Medtronic
  - Boston Scientific

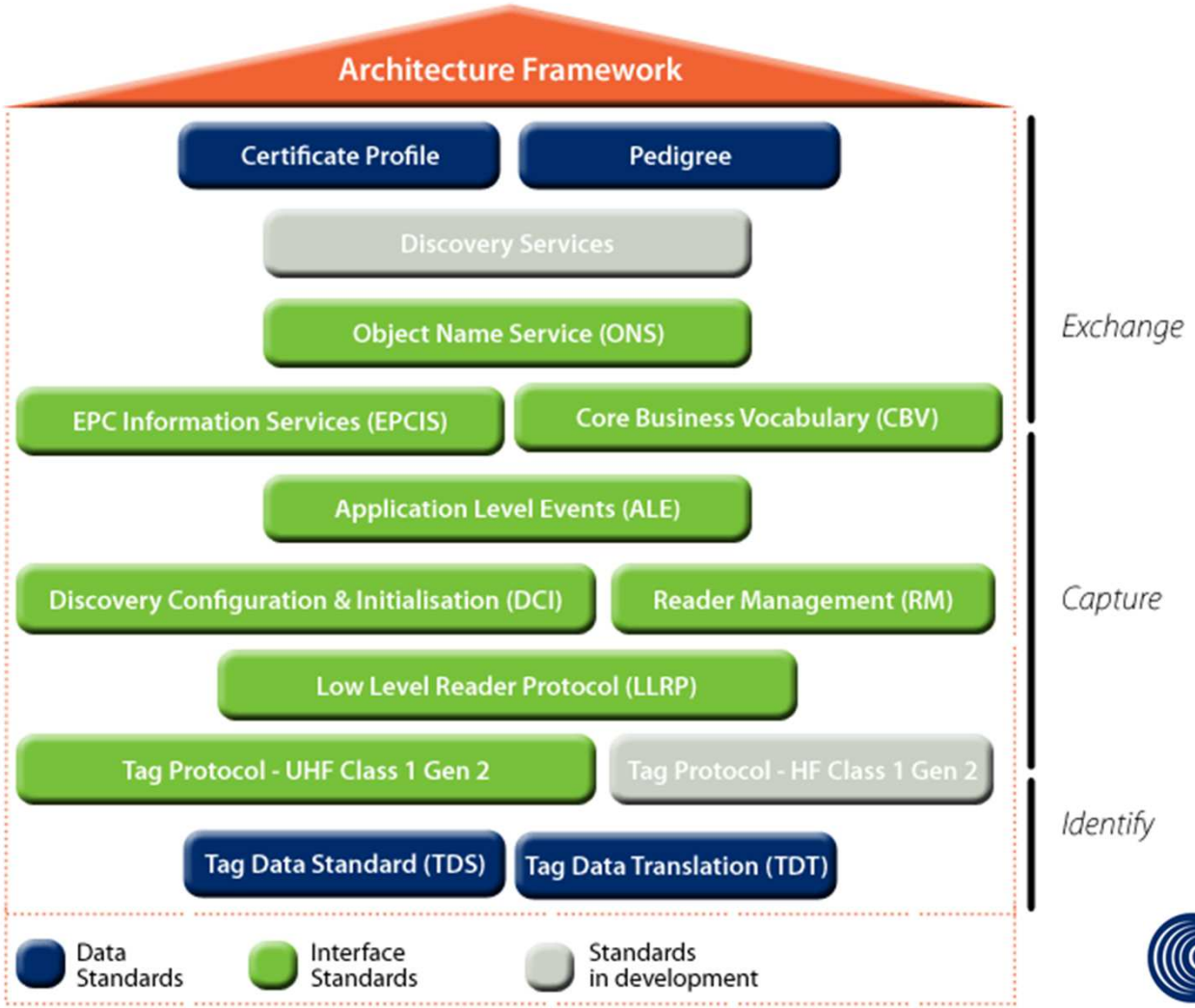
Medtronic

Johnson & Johnson SUPPLY CHAIN

Cordis
a Johnson & Johnson company

Boston Scientific
Delivering what's next.

EPCglobal Standards Overview

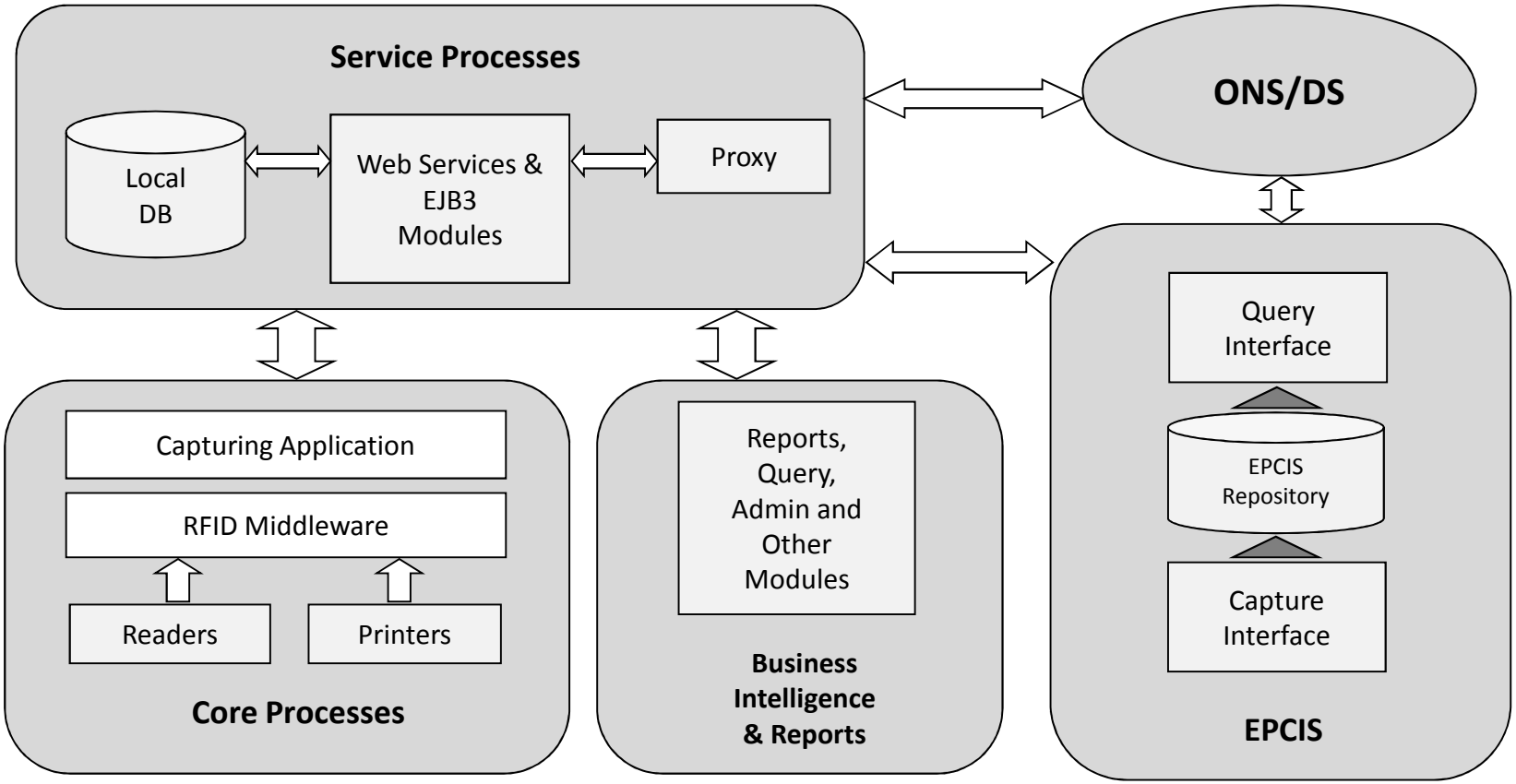


*retrieved from www.epcglobalinc.org/standards

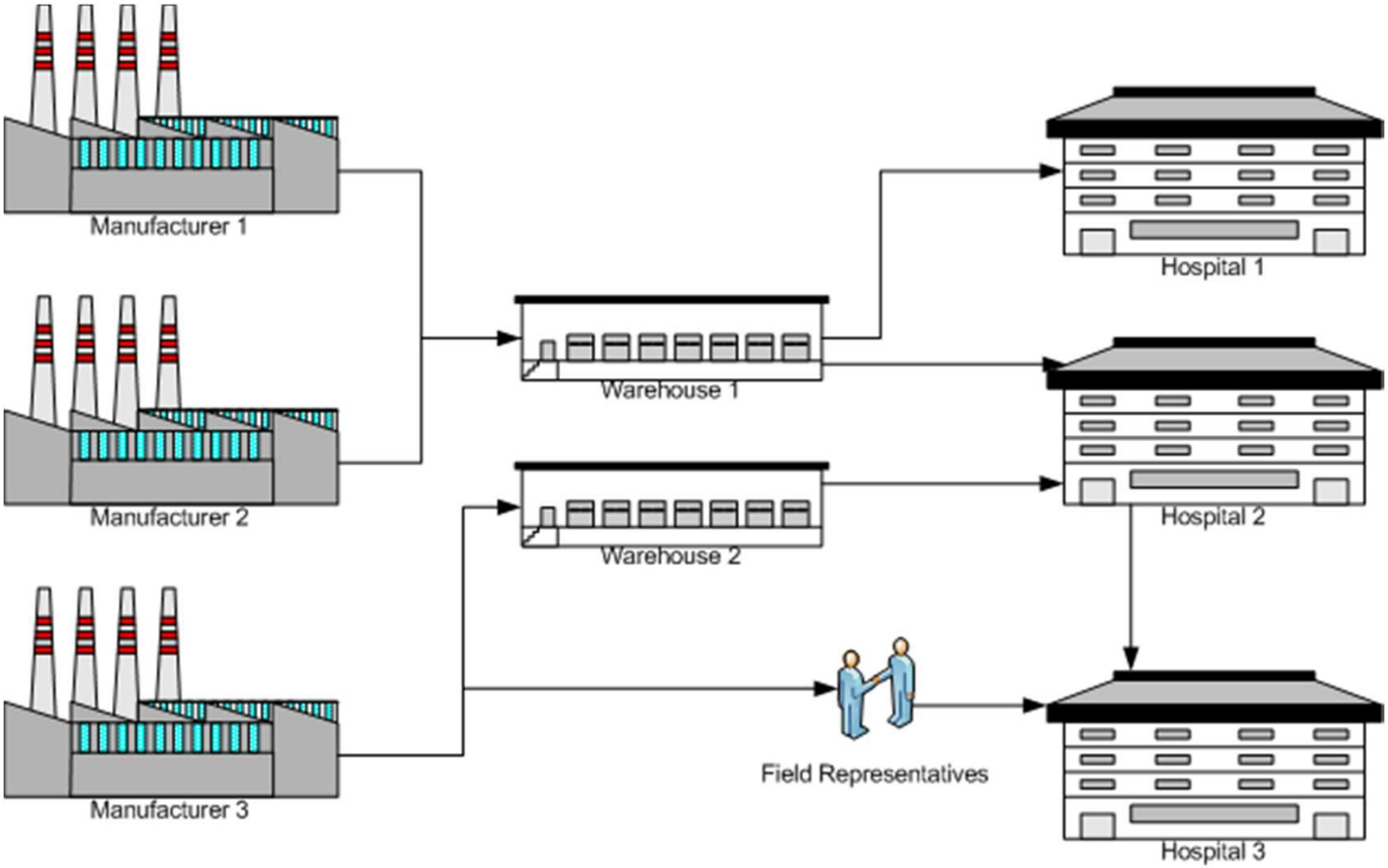
CLASS – Software Architecture

- **Core Processes** (encompass the hardware devices, RFID middleware and capturing application)
- **The EPCIS** (standard query and capture interfaces)
- **Service Processes** (access point to the CLASS project services and the local DB)
- **Lookup Services** – Object Naming Service/Discovery Service (ONS/DS)
- **Business Intelligence and Reports** (represents the front-end for the operators)

CLASS – Software Architecture



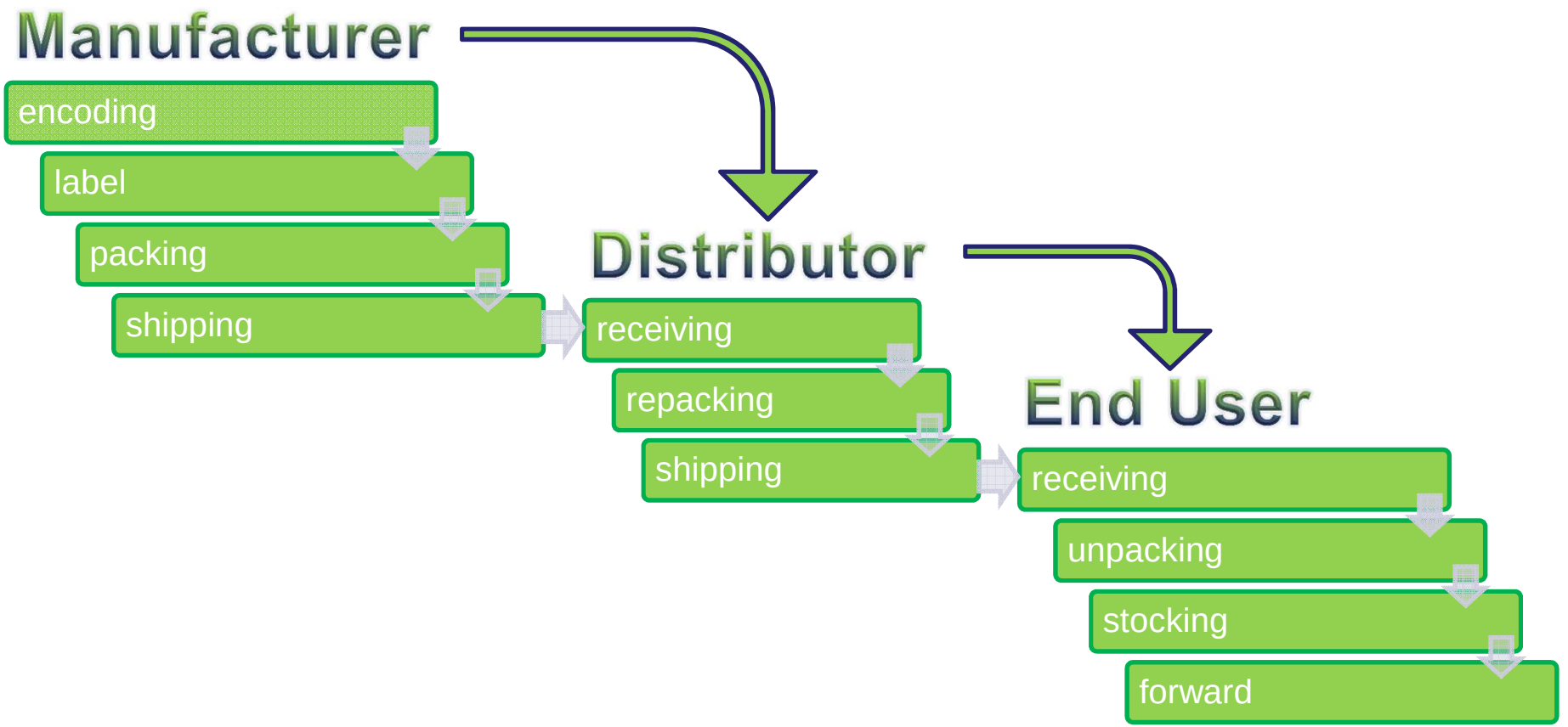
CLASS – Supply Chain



CLASS – Business Steps

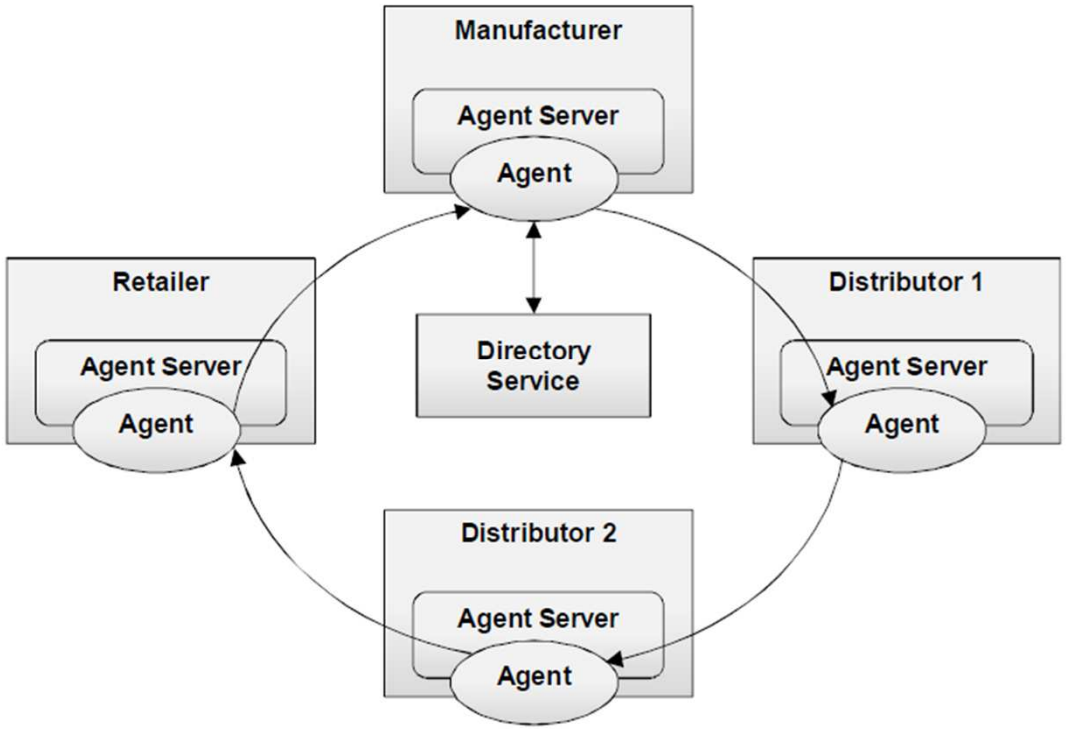
- **Encoding** – print and write a tag. Printed RFID tags are registered with the system at manufacturing plant.
- **Label** – label product. Case and pallet tagging.
- **Packing** – aggregation of cases into pallets.
- **Shipping** – shipment of goods from the manufacturer to distributor and from distributor to clinic. If clinic is acting as a distributor, internal business process of product shipment between clinic branches or affiliated hospitals. Checks performed for order accuracy and aggregated products (cases and pallets).
- **Receiving** – receiving palette in “Goods Inward” at the distributors and hospitals. Verify order accuracy for mix and quantity of aggregated products.
- **Unpacking** – separation of units from the pallet.
- **Repacking** – repack products from different manufacturers (*biz_step* at any given potential distributor).
- **Stocking** – restocking products at the clinic. Monitoring product movement from the store room to the theater.
- **Forward** – product used at the surgery. EPC tag finishes its lifecycle.
- **Quarantine** – contaminated product (e.g. at the surgery product is dropped on the floor and cannot be used) is quarantined for further usage evaluation by an authoritative person.
- **Holding** – product is returned to the holding area (e.g. unused product is moved from the surgery to the storage area).

CLASS – Business Steps



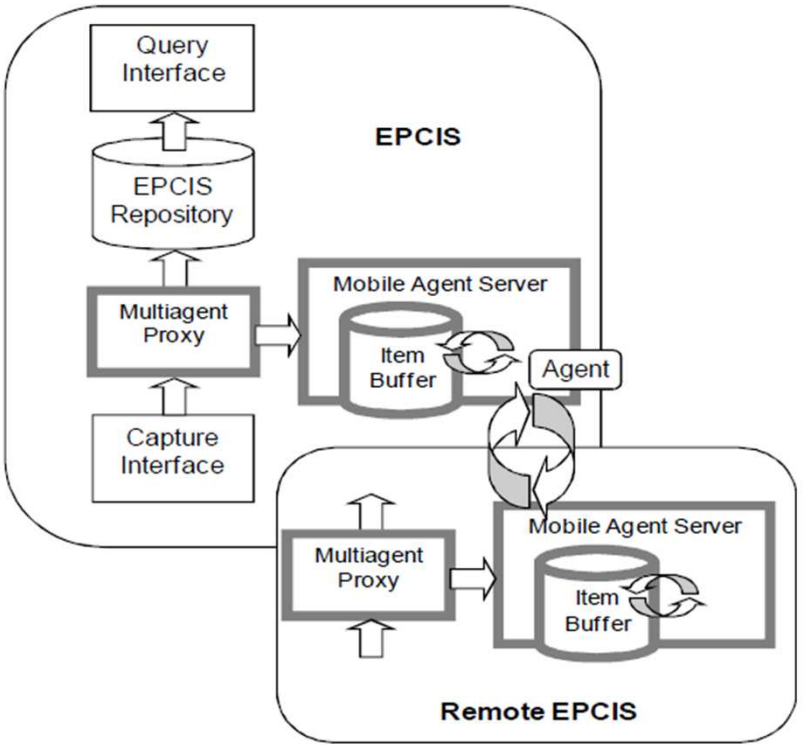
Mobile Agent Paradigm

- Mobile Agent is a distributed computing paradigm and is an autonomous programme that functions on the network on behalf of the user.



Multiagents with EPCIS Architecture

- **Multiagent Proxy -** Multiagent Proxy forwards generated events from the Capture Interface to the Mobile Agent Server. Mobile Agent Server contains multiple logical servers, one logical server per business step.
- **Mobile Agent Server -** supply chain is segmented into logical locations, according to business steps. Each segment has its multiagent server which is responsible for creating, cloning, sending and receiving mobile agents.
- **Mobile Agents –** various types of multiagents. e.g. agent which goes along with the products through supply chain and carries the EPCIS event data generated at each business step.
- **Item Buffer –** Multiagent manager



Benefits

- **Full History of the Product** – Mobile agents traveling alongside the products collect considerable amounts of data, from which the users can extract necessary information.
- **Finding Missed RFID Reads** - Mobile agents are able to intelligently differentiate via inter-agent communication and historically accumulated data about high level events that occur in the supply chain such as missed reads by RFID hardware.
- **Track and Trace** – Multiagents may be released in supply chain by querying significant locations about the specific product. In this scenario multiagents would act similar to search bots on World Wide Web.

Benefits

- **Order Confirmation and Automatic Invoicing** – Multiagents acting as a delivery confirmation, sending and receiving parties can be invoiced accordingly. Also if the agent can distinguish that in fact the product is missing and it is not just a missed RFID read, then product can be reordered automatically.
- **Reduced Human Interaction** – Since the Multiagent Architecture can detect missed reads it eliminates the need for staff to check the accuracy and quantity of the pallet mix. The Multiagents also inform about products that have expired and need to be taken out of supply chain or the inventory of a hospital
- **Other Benefits** - If a product is close to expiration date, adequate notification can trigger an event that would cause the product to be shipped to the location where it is low in stock or ready to use on arrival. The term “on consignment” was introduced in the CLASS project to deal with the high price medical products that are close to expiration date, to be shipped between hospitals, to eliminate high losses by the manufacturers.

Questions & Answers