

# CITS 5506

## The Internet of Things

### Lecture 06

## Smart Products

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## Questions on Guest Lectures

1. The Questions will be uploaded at LMS on Tuesday 29 August, 2023 at folder "Assessment- Qs on Guest Lectures"
2. Question Upload time will be 5:30 pm on Tuesday, 29 August, 2023
3. Submission Deadline: 6:30 pm on Tuesday, 29 August, 2023 through Turnitin Submission at LMS link "Submissions"
4. Maximum Similarity 10%.

## Smart Products

## Smart Products – Transforming Businesses

- Products were composed solely of mechanical and electrical parts in the past.
- Products have become complex systems that combine
  - hardware
  - sensors
  - data storage
  - Computing entity
  - software
  - connectivity

Smart, connected products offer opportunities for

- New functionality
- Far greater reliability
- Much higher product utilization
- Capabilities that cut across and transcend traditional product boundaries.

- The changing nature of products is also disrupting value chains, forcing companies to rethink and retool nearly everything they do internally.
- The idea of the **value chain** is based on the process view of organizations, the idea of seeing a manufacturing (or service) organization as a system, made up of subsystems each with inputs, transformation processes and outputs.

- Inputs, transformation processes, and outputs involve the acquisition and consumption of resources – money, labour, materials, equipment, buildings, land, administration and management. How value chain activities are carried out determines costs and affects profits.
- These new types of products alter industry structure and the nature of competition, exposing companies to new competitive opportunities and threats. They are reshaping industry boundaries and creating entirely new industries.

- Smart, connected products raise a new set of strategic choices related to
  - How value is created and captured
  - How the huge amount of new (and sensitive) data they generate is utilized and managed
  - How relationships with traditional business partners are redefined
  - What role companies should play as industry boundaries are expanded

- What makes smart, connected products fundamentally different is not the internet, but the changing nature of the “things.”
- It is the expanded capabilities of smart, connected products and the data they generate that are ushering in a new era of competition.

- Before the advent of modern information technology, products were mechanical and activities in the value chain were performed using manual, paper processes and verbal communication.
- The first wave of IT, during the 1960s and 1970s, automated individual activities in the value chain, from order processing and bill paying to computer-aided design and manufacturing resource planning. This resulted in increase in productivity.

- The rise of the internet, with its inexpensive and ubiquitous connectivity, unleashed the second wave of IT-driven transformation in the 1980s and 1990s.
- This enabled coordination and integration across individual activities; with outside suppliers, channels, and customers; and across geography. It allowed firms, for example, to closely integrate globally distributed supply chains.

- The first two waves gave rise to huge productivity gains and growth across the economy. While the value chain was transformed, however, products themselves were largely unaffected.
- Now, Information Technology is becoming an integral part of the product itself. Embedded sensors, processors, software, and connectivity in products, data storage and analysis, resulting in improvements in product functionality and performance.
- Massive amounts of new product-usage data enable many of these improvements.

- There will be new and better products.
- In addition, production process will alter by changing product design, marketing, manufacturing, and after-sale service and by creating the need for new activities such as product data analytics and security.

Smart, connected products have three core elements:

- Physical components
- “Smart” components
- Connectivity components

Smart components amplify the capabilities and value of the physical components.

Connectivity amplifies the capabilities and value of the smart components and enables some of them to exist outside the physical product itself.

- Physical components comprise the product’s mechanical and electrical parts. In a car, for example, these include the engine block, tyres, and batteries.
- Smart components comprise the sensors, microprocessors, data storage, controls, software, and typically an embedded operating system and enhanced user interface. In a car, for example, smart components include the engine control unit, antilock braking system, rain-sensing windshields with automated wipers, and touch screen displays.
- In many products, software replaces some hardware components or enables a single physical device to perform at a variety of levels.

- Connectivity components comprise the ports, antennae, and protocols enabling wired or wireless connections with the product.
- Connectivity takes three forms, which can be present together:
  - One-to-one: An individual product connects to the user, the manufacturer, or another product through a port or other interface. Example, when a car is hooked up to a diagnostic machine.

## Smart Products : Connectivity

- One-to-many: A central system is continuously or intermittently connected to many products simultaneously. For example, many Tesla automobiles are connected to a single manufacturer system that monitors performance and accomplishes remote service and upgrades.
- Many-to-many: Multiple products connect to many other types of products and often also to external data sources. An array of types of farm equipment are connected to one another, and to geo-location data, to coordinate and optimize the farm system. For example, automated tillers inject nitrogen fertilizer at precise depths and intervals, and seeders follow, placing corn seeds directly in the fertilized soil.

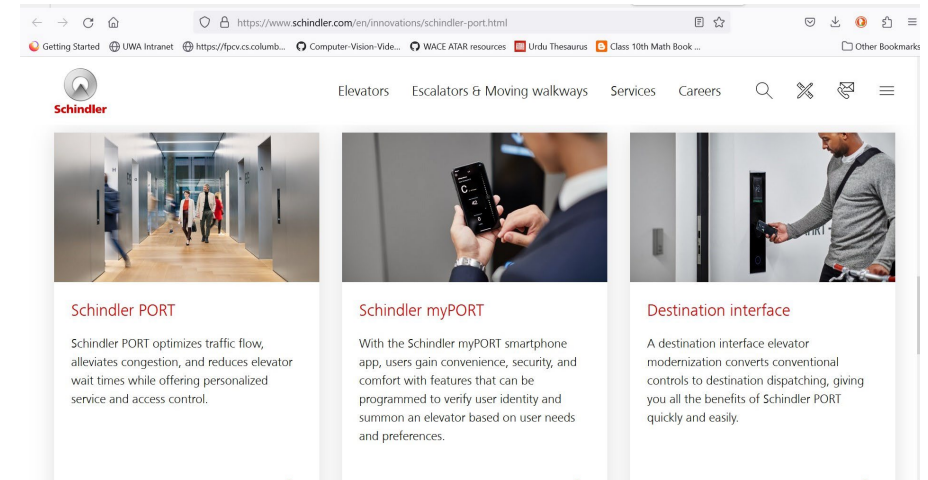
## Smart Products : Connectivity

- Connectivity serves a dual purpose. First, it allows information to be exchanged between the product and its operating environment, its maker, its users, and other products and systems.
- Second, connectivity enables some functions of the product to exist outside the physical device, in what is known as the product cloud. For example, in Bose's new Wi-Fi system, a smartphone application running in the product cloud streams music to the system from the internet.
- To achieve high levels of functionality, all three types of connectivity are necessary.

## Smart Products

- Smart, connected products are emerging across all manufacturing sectors.
- In heavy machinery, Schindler's PORT (Personnel Occupant Requirement Terminal) Technology reduces elevator wait times by as much as 50% by:
  - Predicting elevator demand patterns
  - Calculating the fastest time to destination
  - Assigning the appropriate elevator to move passengers quickly

## Schindler's PORT( Personnel Occupant Requirement Terminal) Technology



The screenshot shows the Schindler website with the URL <https://www.schindler.com/en/innovations/schindler-port.html>. The page features three main sections: 'Schindler PORT' which optimizes traffic flow and reduces wait times; 'Schindler myPORT' which is a smartphone app for user convenience and security; and 'Destination interface' which modernizes elevator controls for destination dispatching.

## Smart Products

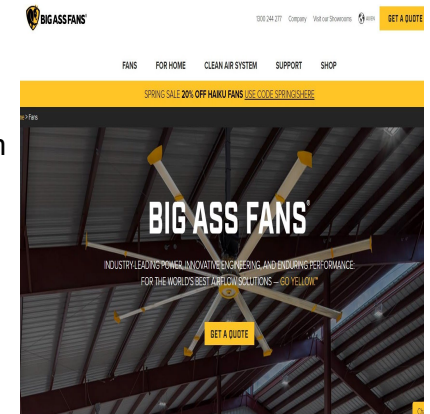
- In the energy sector, ABB's smart grid technology enables utilities to analyze huge amounts of real-time data across a wide range of generating, transforming, and distribution equipment (manufactured by ABB as well as others), such as:
  - Changes in the temperature of transformers and secondary substations.
- This alerts utility control centers to possible overload conditions, allowing adjustments that can prevent blackouts before they occur.

\*ABB (ASEA Brown Boveri) Ltd is a Swedish–Swiss multinational corporation headquartered in Zürich, Switzerland, operating mainly in robotics, power, heavy electrical equipment, and automation technology areas.

## Smart Products

In consumer goods, Big Ass ceiling fans sense and engage automatically:

- When a person enters a room
- Regulate speed on the basis of temperature and humidity
- Recognize individual user preferences and adjust accordingly.



## Smart Products : Tech Infrastructure

Smart, connected products require that companies build an entirely new **technology infrastructure**, consisting of a series of layers known as a “technology stack”.

## Smart Products : Tech Infrastructure

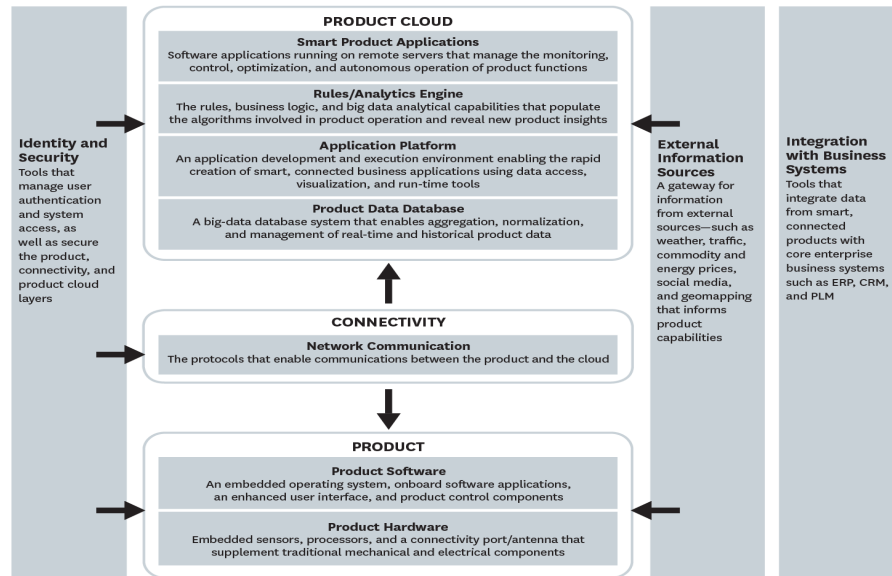
This technology stack includes :

- Modified hardware
- Software applications
- Operating system embedded in the product itself
- Network communications to support connectivity
- Product cloud (software running on the manufacturer's or a third-party server) containing the product-data database
- A platform for building software applications
- An analytics platform
- Smart product applications that are not embedded in the product

## Smart Products : Tech Infrastructure

All the layers are accessed through an identity and security structure, a gateway for accessing external data, and tools that connect the data from smart, connected products to other business systems. For example, ERP(Enterprise resource planning ), Product lifecycle management (PLM) and CRM (Customer relationship management) systems.

- ERP system track business resources (cash, raw material, production capacity, orders and payroll etc.
- PLM is the process of managing the entire life cycle of a product from its inception through the engineering, design, manufacture as well as service and disposal of manufactured products.
- CRM manages the company's relationship and interaction with customers and potential customers.



## Smart Products : Tech Infrastructure

- IoT enables not only rapid product application development and operation but the collection, analysis, and sharing of the potentially huge amounts of data generated inside and outside the products that has never been available before.
- Building and supporting the technology stack for smart, connected products requires substantial investment and a range of new skills—such as software development, systems engineering, data analytics, and online security expertise—that were rarely found in manufacturing companies in the past.