Fakultas Informatika
School of Computing
Telkom University

Internet of Things

MATERI 9:
IoT Application based on Problem

What we learn today ...

- IoT for Consumer (Wearables and Smart Home)
- IoT Potential (Industrial and Manufacturing, Finance, Healthcare, Logistic, Agriculture, Energy, Government)
- IoT for Smart City

Consumer

- Consumer-based devices were one of the first segments to adopt things being connected on the internet. Consumer IoT came into form as a connected coffee pot at a university in the 1990s. It flourished with the adoption of Bluetooth for consumer use in the early 2000s.
- Now millions of homes that have Nest thermostats, Hue lightbulbs, Alexa assistants, and Roku set-top boxes. People too are connected with Fitbits and other wearable technology.
- The consumer market is usually first to adopt these new technologies. We can also think of these as gadgets. All are neatly packaged and wrapped devices that are essentially plug and play.

Consumer

- One of the constraints in the consumer market is the bifurcation of standards. We see, for example, several WPAN protocols have a footing like Bluetooth, Zigbee, and Z-wave (all being non-interoperable).
- The following are some of the consumer IoT use cases:
  - **Smart home gadgetry**: Smart irrigation, smart garage doors, smart locks, smart lights, smart thermostats, and smart security.
  - **Wearables**: Health and movement trackers, smart clothing/wearables.
  - **Pets**: Pet location systems, smart dog doors.

IIoT : Industrial Internet of Things

- **Industrial IoT (IIoT)** is one of the fastest and largest segments in the overall IoT space by the number of connected things and the value those services bring to manufacturing and factory automation.
- The industrial segment is one of the fastest-growing markets. One nuance of this industry is the reliance of brownfield technology, meaning hardware and software interfaces that are not mainstream.
- It is often the case that 30-year-old production machines rely on RS485 serial interfaces rather than modern wireless mesh fabrics.

IIoT : Industrial Internet of Things

Following are the industrial and manufacturing IoT use cases and their impact:

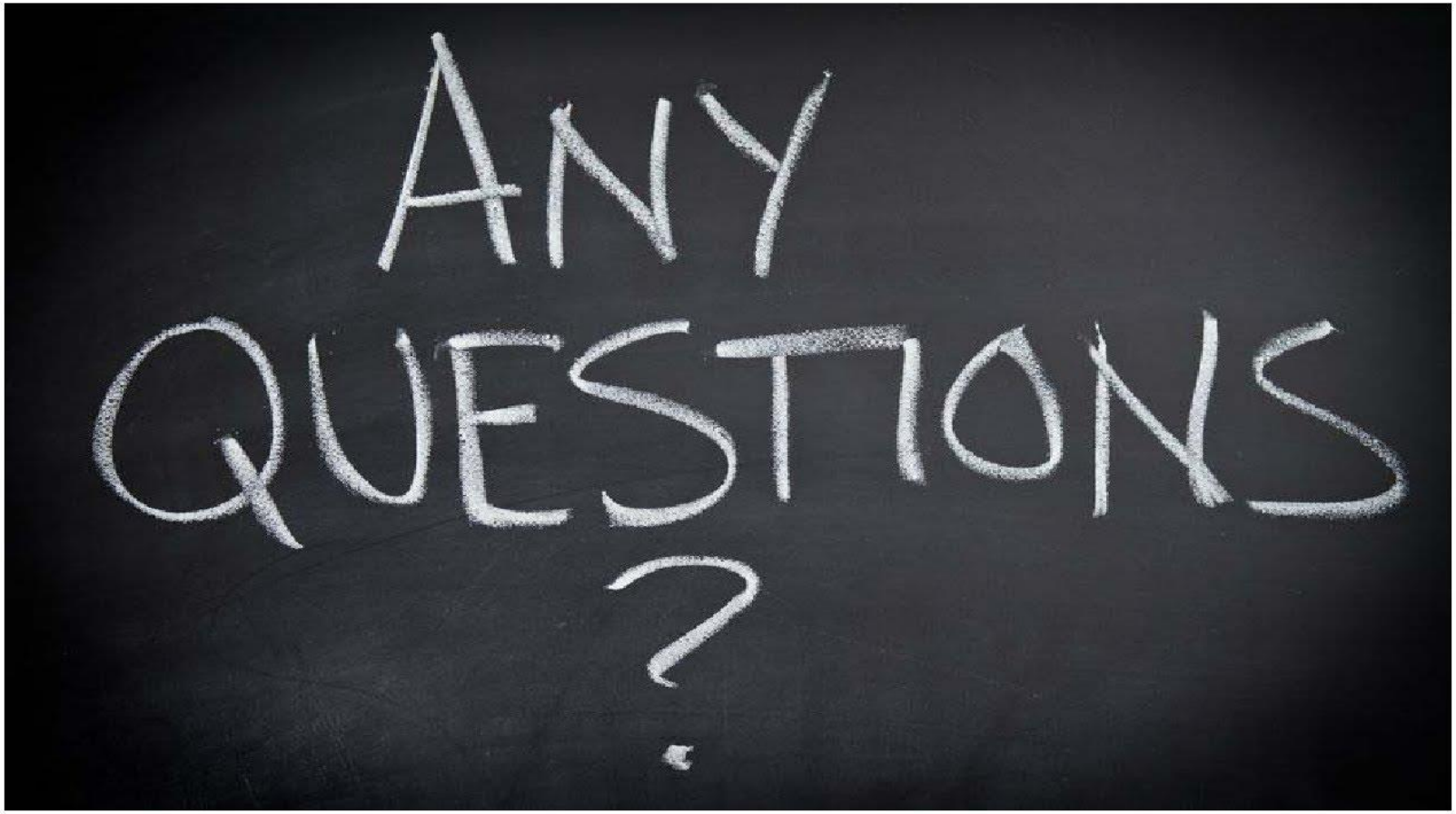
- Preventative maintenance on new and pre-existing factory machinery
- Throughput increase through real-time demand
- Energy savings
- Safety systems such as thermal sensing, pressure sensing, and gas leaks
- Factory floor expert systems

Retail, financial, and marketing

- This drives constraints on finding new ways to either save costs, or drive revenue.
- Allowing customers to be more efficient allows retailers and service industries to move customers quickly, and to do so with less staffing resources.
- Some of the retail IoT use cases are as follows:
  - Targeted advertising, such as locating known or potential customers by proximity and providing sales information.
  - Beaconing, such as proximity sensing customers, traffic patterns, and inter-arrival times as marketing analytics.

Retail, financial, and marketing

- Asset tracking, such as inventory control, loss control, and supply chain optimizations.
- Cold storage monitoring, such as analyze cold storage of perishable inventory. Apply predictive analytics to food supply.
- Insurance tracking of assets.
- Insurance risk measurement of drivers.
- Digital signage within retail, hospitality, or citywide.
- Beaconing systems within entertainment venues, conferences, concerts, amusement parks, and museums.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QUESTIONS
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Healthcare

- Any and all systems that improve the quality of life and reduce health costs is a top concern in nearly every developed country.
- The IoT is poised to allow for remote and flexible monitoring of patients wherever they may be.
- Advanced analytics and machine learning tools will observe patients in order to diagnose illness and prescribe treatments.
- Such systems will also be the watchdogs in the event of needed life-critical care.

Healthcare

- Some of the healthcare IoT use cases are as follows:
  - In-home patient care.
  - Learning models of predictive and preventative healthcare.
  - Dementia and elderly care and tracking.
  - Hospital equipment and supply asset tracking.
  - Pharmaceutical tracking and security.
  - Remote field medicine.
  - Drug research.
  - Patient fall indicators.

Transportation and logistics

- The use cases involve tracking the asset on devices being delivered, transported, or shipped, whether that's on a truck, train, plane, or boat.
- This is also the area of connected vehicles that communicate to offer assistance to the driver, or preventative maintenance on behalf of the driver.
- Right now, an average vehicle purchased new off a lot will have about 100 sensors. That number will double as vehicle-to-vehicle communication, vehicle-to-road communication, and automated driving become must-have features for safety or comfort.

Transportation and logistics

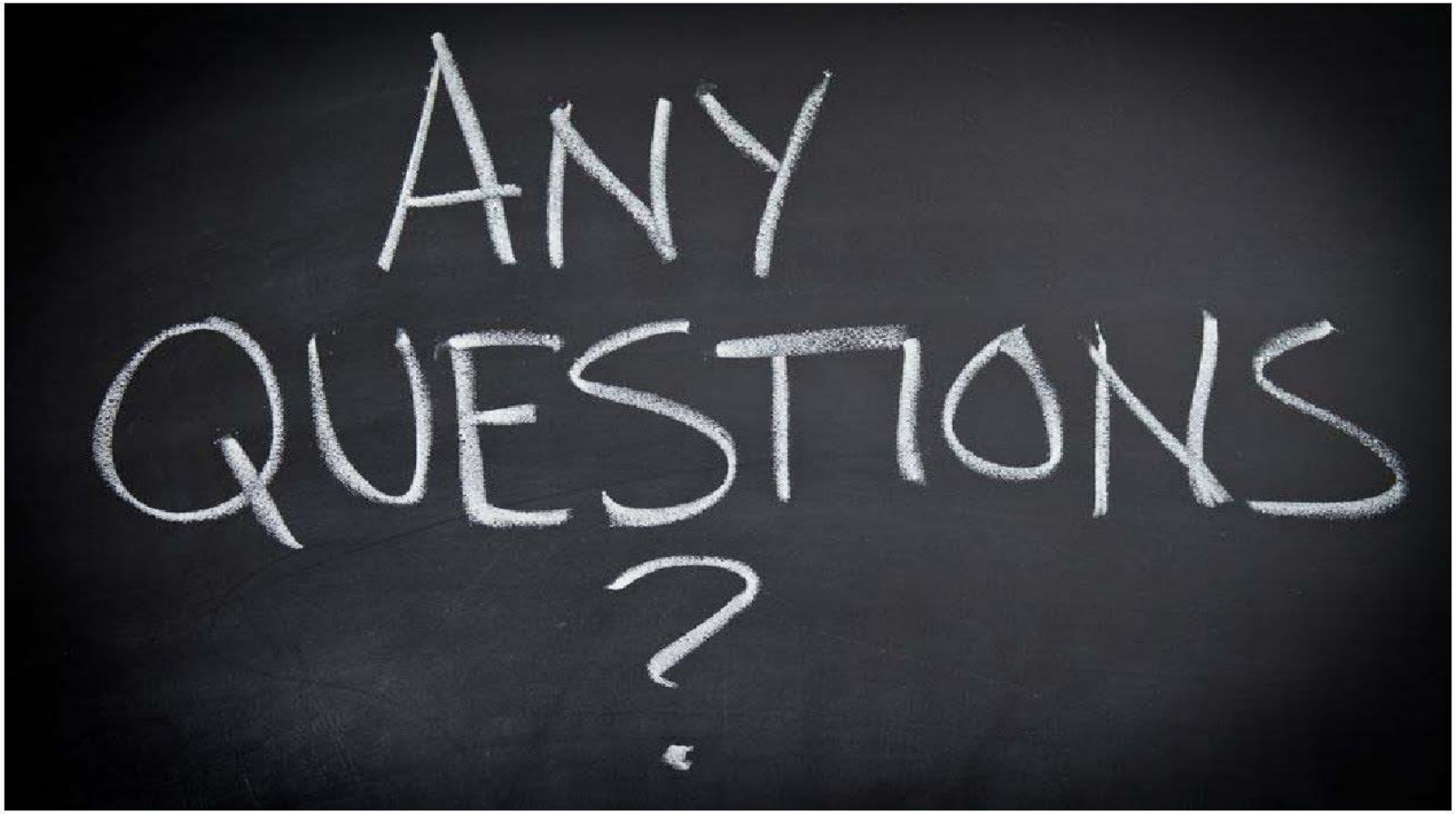
- This mobile-type category has the requirement of geolocation awareness. Much of this comes from GPS navigation. From an IoT perspective, the data analyzed would include assets and time, but also spatial coordinates.
- Following are some of the transportation and logistics IoT use cases:
  - Fleet tracking and location awareness
  - Railcar identification and tracking
  - Asset and package tracking within fleets
  - Preventative maintenance of vehicles on the road

Agricultural and environmental

- Farming and environmental IoT includes elements of livestock health, land and soil analysis, micro-climate predictions, efficient water usage, and even disaster predictions in the case of geological and weather-related disasters.
- Significant efficiencies in agriculture can be achieved through IoT. Using smart lighting to adjust the spectrum frequency based on poultry age can increase growth rates and decrease mortality rates based on stress on chicken farms.
- Other uses include detecting livestock health based on sensor movement and positioning. A cattle farm could find animals with the propensity of sickness before a bacterial or viral infection were to spread. Edge analysis systems could find, locate, and isolate heads of cattle in real time, using data analytics or machine learning approaches.

Agricultural and environmental

- Some of the agricultural and environmental IoT use cases are as follows:
  - Smart irrigation and fertilization techniques to improve yield
  - Smart lighting in nesting or poultry farming to improve yield
  - Livestock health and asset tracking
  - Preventative maintenance on remote farming equipment via manufacturer
  - Drones-based land surveys
  - Farm-to-market supply chain efficiencies with asset tracking
  - Robotic farming
  - Volcanic and fault line monitoring for predictive disasters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Energy

- The energy segment includes the monitoring of energy production at source to and through the usage energy at the client.
- A significant amount of research and development has focused on consumer and commercial energy monitors such as smart electric meters that communicate over low-power and long-range protocols to reveal real-time energy usage.
- Many energy production facilities are in remote or hostile environments such as desert regions for solar arrays, steep hillsides for wind farms, and hazardous facilities for nuclear reactors.
- Additionally, data may need real-time or near real-time response for critical response to energy production control systems (much like manufacturing systems). This can impact how an IoT system is deployed in this category.

Energy

- The following are some of the use cases for energy IoT:
  - Oil rig analysis of thousands of sensors and data points for efficiency gains
  - Remote solar panel monitoring and maintenance
  - Hazardous analysis of nuclear facilities
  - Smart electric meters in a citywide deployment to monitor energy usage and demand
  - Real-time blade adjustments as a function of weather on remote wind turbines

Government and military

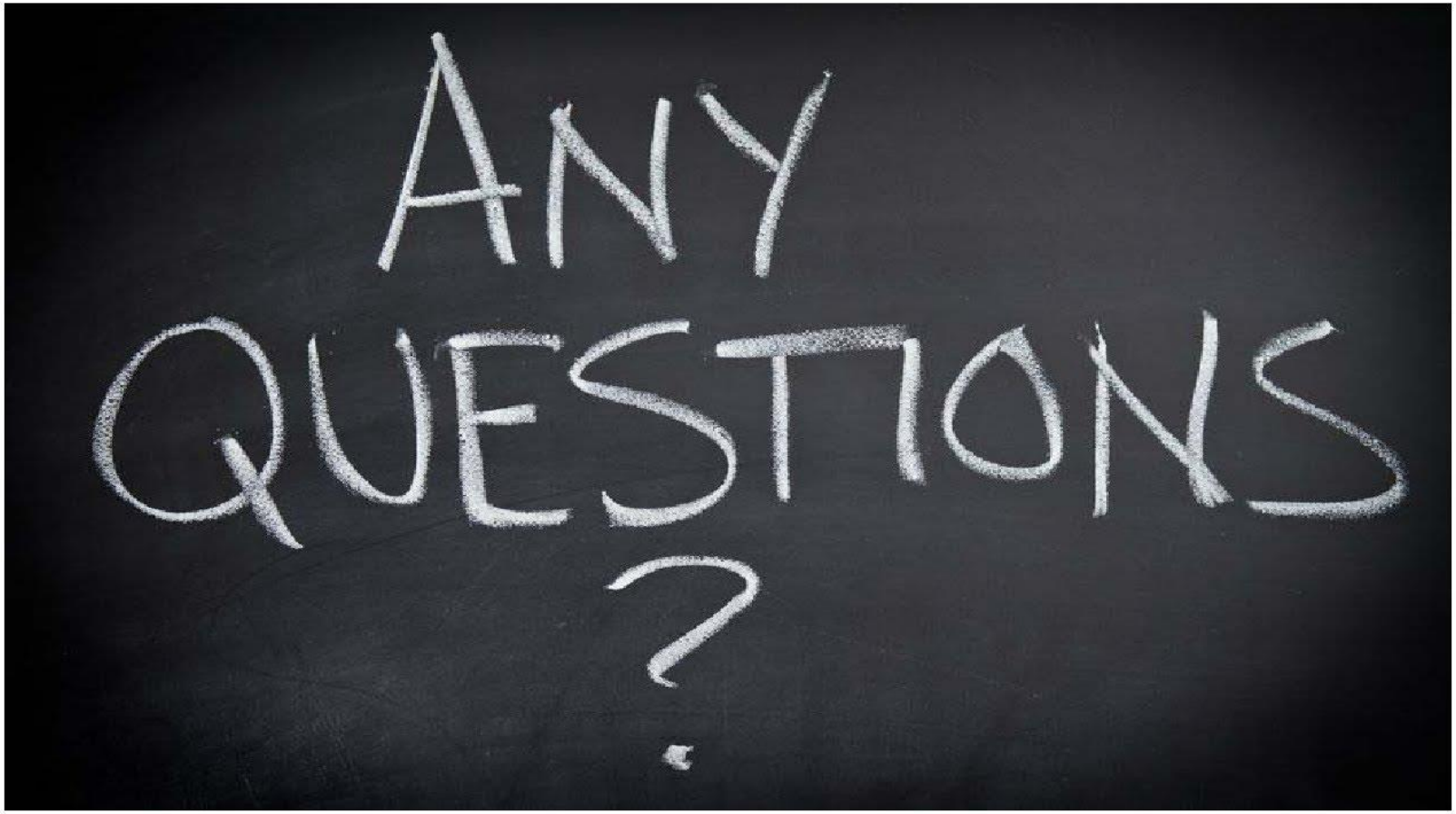
- The government's role in the IoT also comes into play in the form of standardization, frequency spectrum allocation, and regulations. Take, for example, how the frequency space is divided, secured, and portioned to various providers.
- Following are some of the government and military IoT use cases:
  - Terror threat analysis through IoT device pattern analysis and beacons
  - Swarm sensors through drones
  - Sensor bombs deployed on the battlefield to form sensor networks to monitor threats
  - Government asset tracking systems
  - Real-time military personal tracking and location services
  - Synthetic sensors to monitor hostile environments
  - Water level monitoring to measure dam and flood containment

Smart City

- Smart city is a phrase used to imply connecting intelligence to what had been an unconnected world. Smart cities are one of the fastest growing segments, and show substantial cost/benefit ratios especially when we consider tax revenues. Smart cities also touch citizens' lives through safety, security, and ease of use. Some of the smart city IoT use cases are as follows:
  - Pollution control and regulatory analysis through environmental sensing
  - Microclimate weather predictions using citywide sensor networks
  - Efficiency gains and improved costs through waste management service on demand
  - Improved traffic flow and fuel economy through smart traffic light control and patterning
  - Energy efficiency of city lighting on demand

Smart City

- Smart snow plowing based on real-time road demand, weather conditions, and nearby plows
- Smart irrigation of parks and public spaces, depending on weather and current usage
- Smart cameras to watch for crime and real-time automated AMBER Alerts
- Smart parking lots to automatically find best space parking on demand
- Bridge, street, and infrastructure wear and usage monitors to improve longevity and service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THANK YOU