The Internet of Things

COMP5047 – Lecture 03

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The Internet of Things (IoT)

The Internet of things (IoT) describes physical objects (or groups of such objects) with sensors, processing ability, software, and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks.

Adapted from Wikipedia

"An information system infrastructure for implementing smart, connected objects"

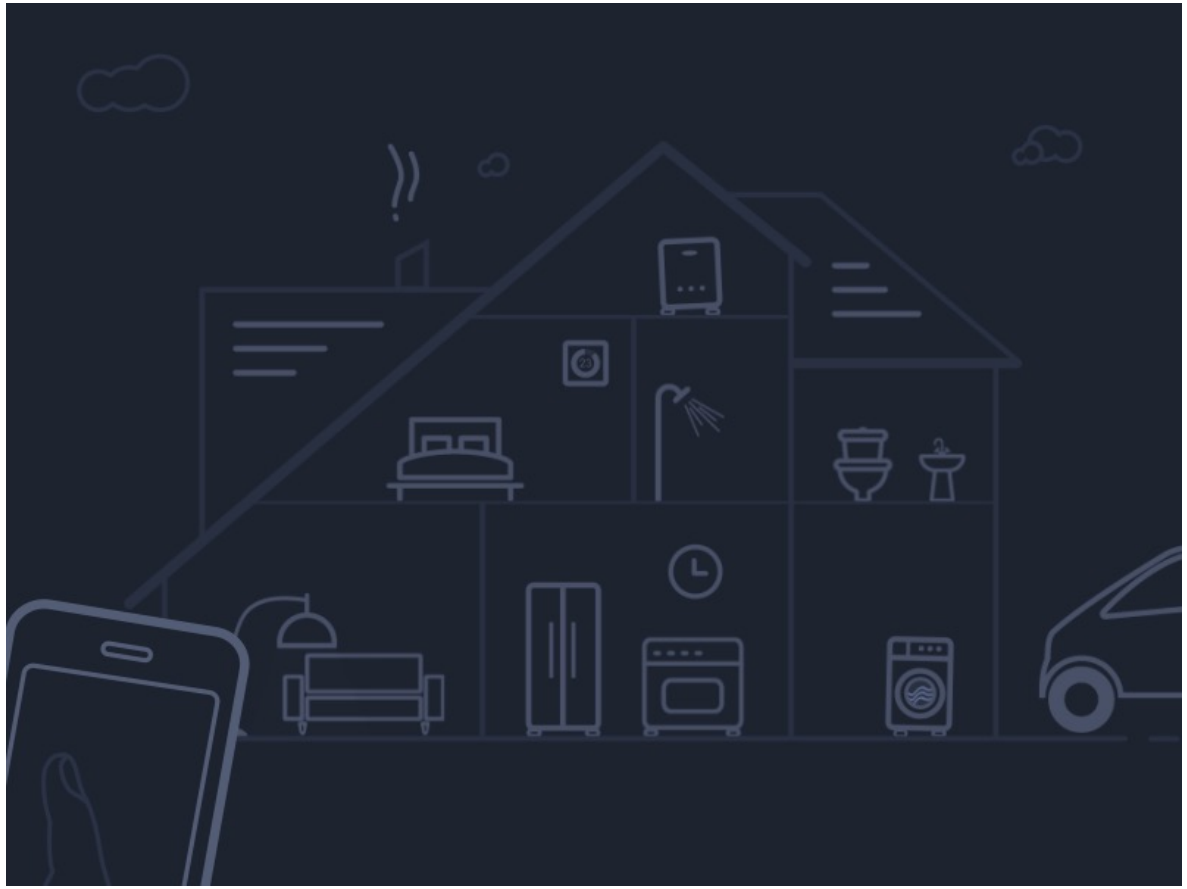
(FRÄMLING, HOLMSTRÖM, et al)

The Internet of Things (IoT)

- **Smart Objects (Devices and sensors)**
  - Embedded computing elements capable of collecting and storing data
- **Connected**
  - Able to transmitting and receiving information through different connectivity mediums (e.g. Bluetooth, WiFi, RFID, etc.)
- **Information System Infrastructure**
  - A system for managing and making use of the objects and data
- **User Interface**
  - User interfaces required to present the information to user

Application Areas of IoT?

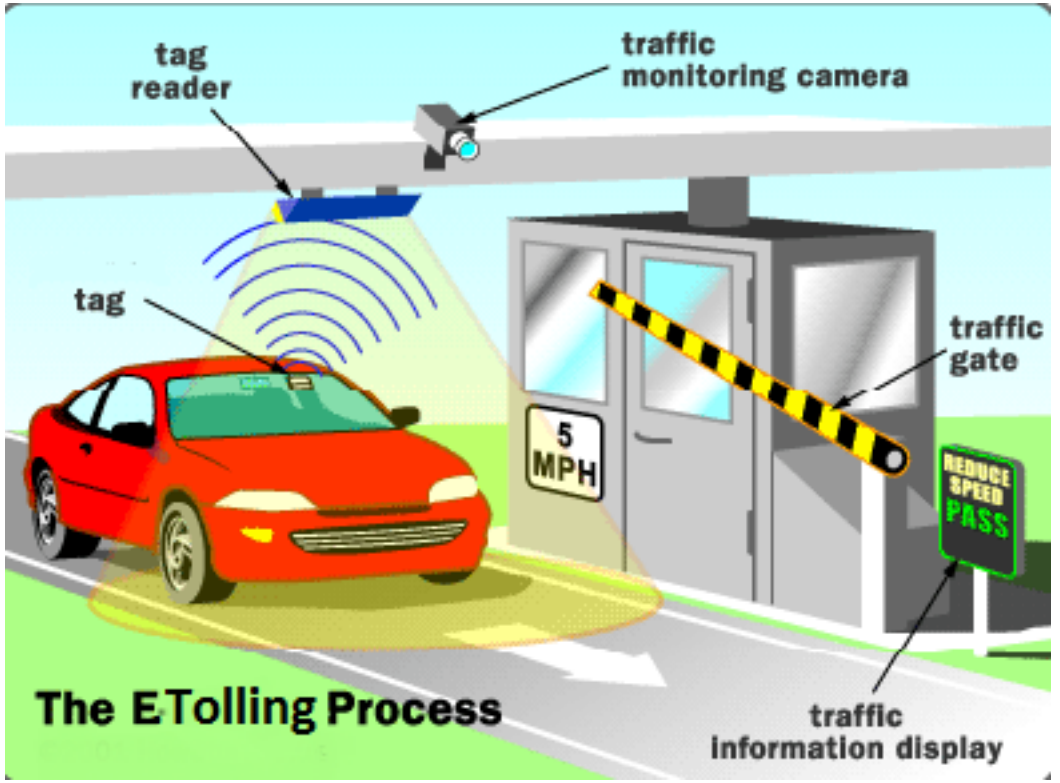
- Consumer
  - smart homes: environmental control, lighting, security
  - health care: monitoring, medication management
  - transport: ride share, service location



https://dribbble.com/shots/6420054-Smart-Home

Application Areas of IoT?

- Commercial
  - building management: monitoring and control
  - transport
  - retail

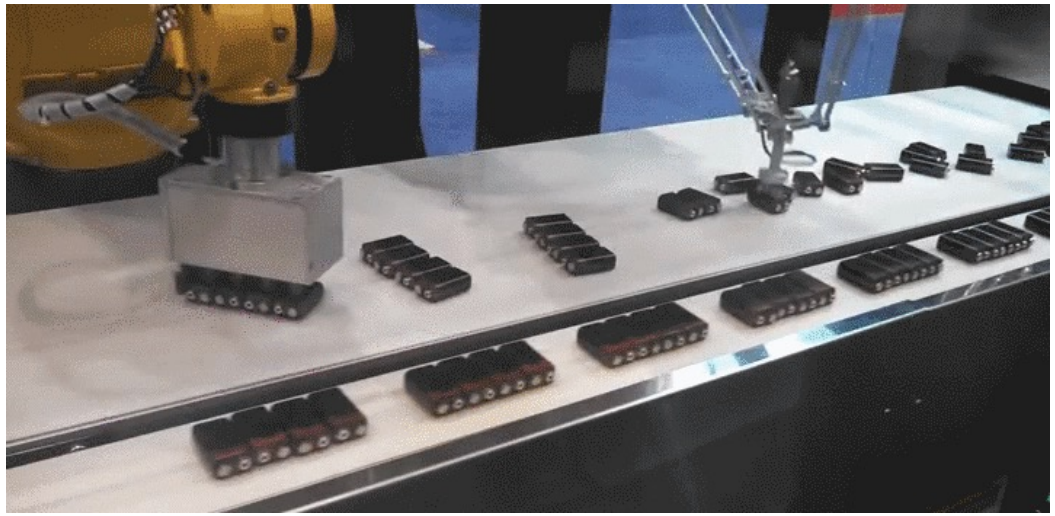


https://rshreffler.wordpress.com/tag/electronic-toll-collection/

Application Areas of IoT?

- Industrial
  - factory monitoring and control

https://blog.spatial.com/industrial-automation-2020



https://gesrepair.com/future-with-robotics-and-automation-manufacturing/

Application Areas of IoT?

- Agricultural
  - crop monitoring
  - paddock to the plate tracking

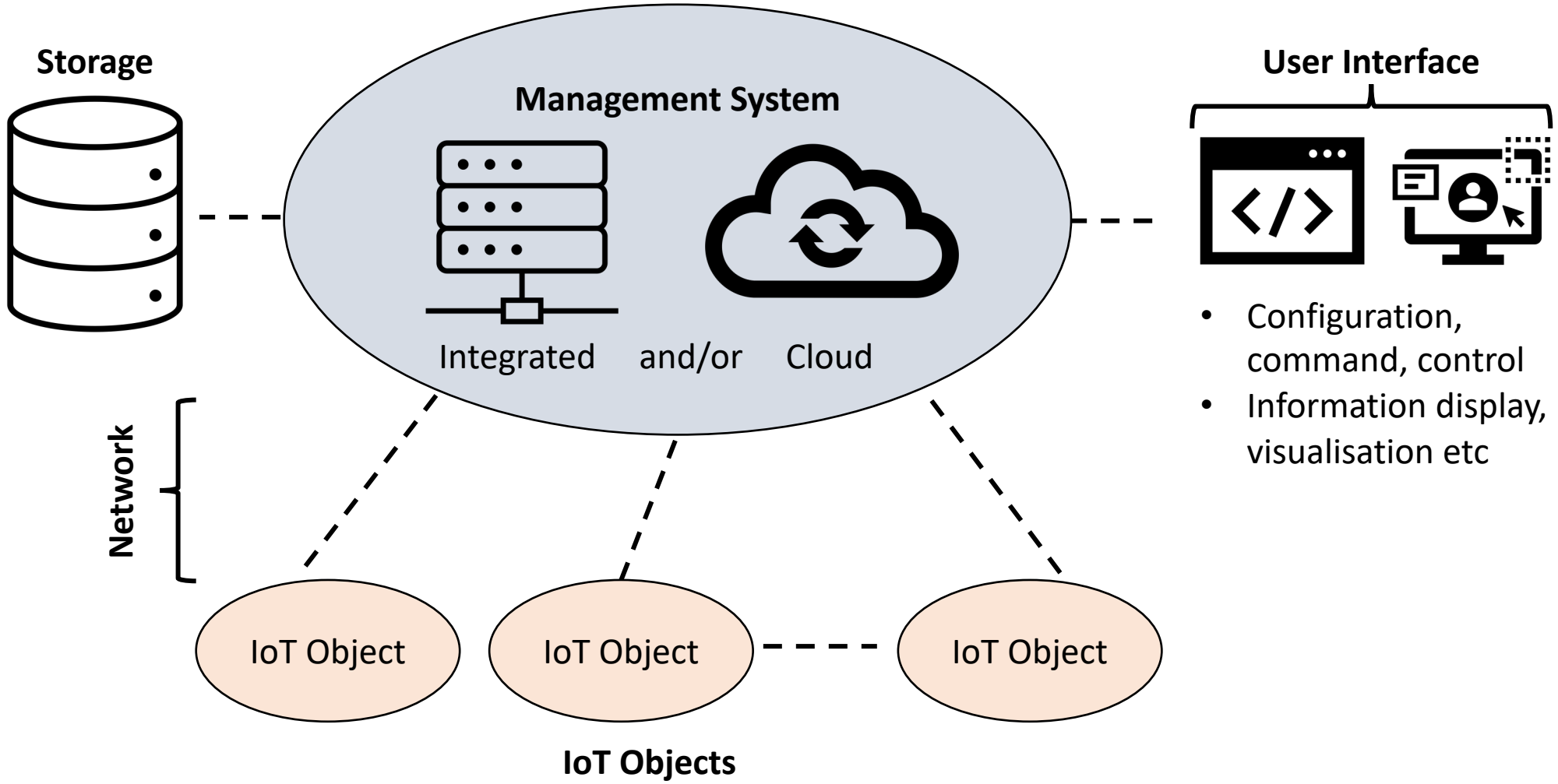
https://giphy.com/explore/timetotell

Application Areas of IoT?

- Government
  - smart cities

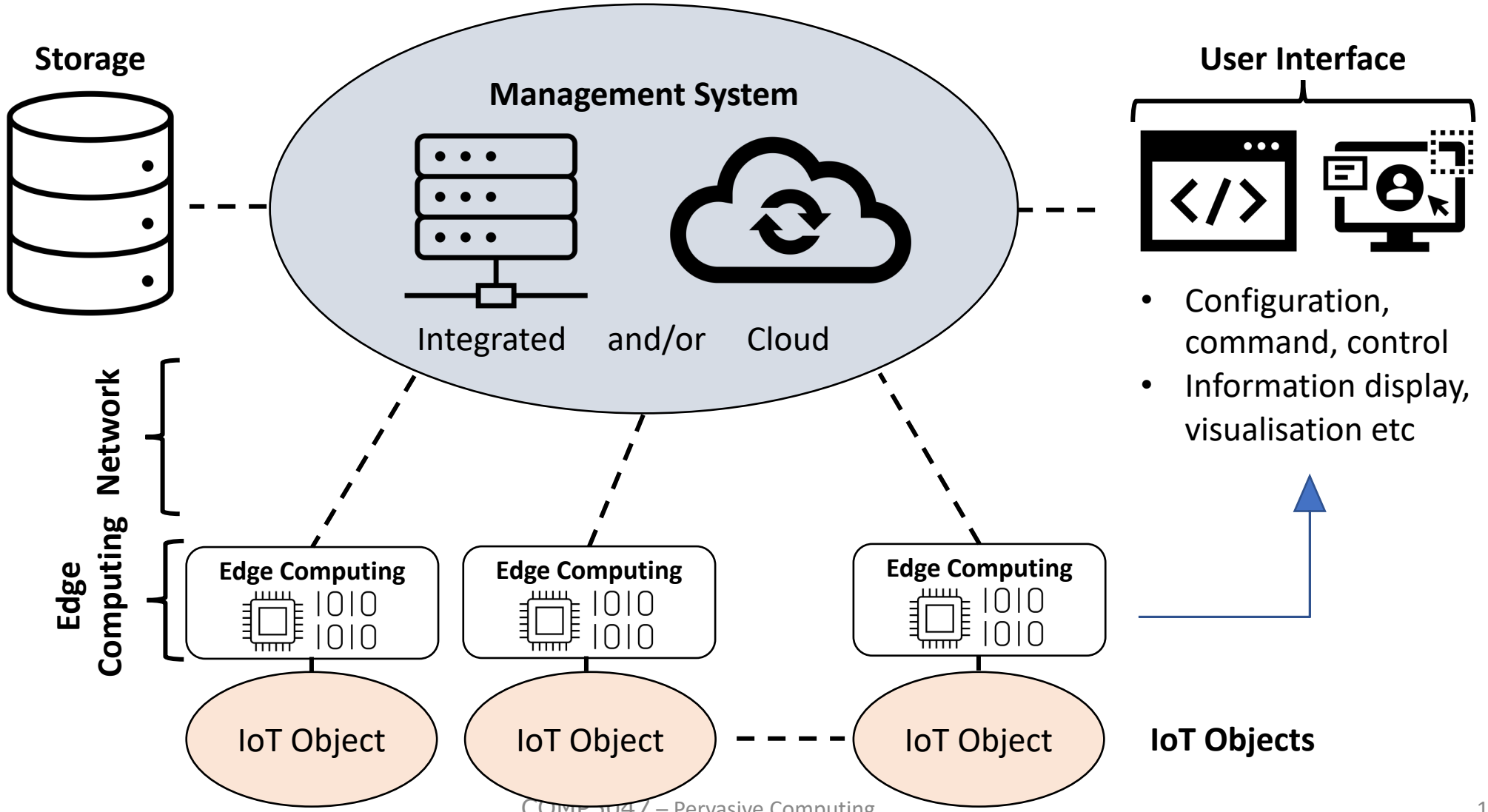
https://www.nokia.com/networks/future-x-cities/

Basic Structure for IoT

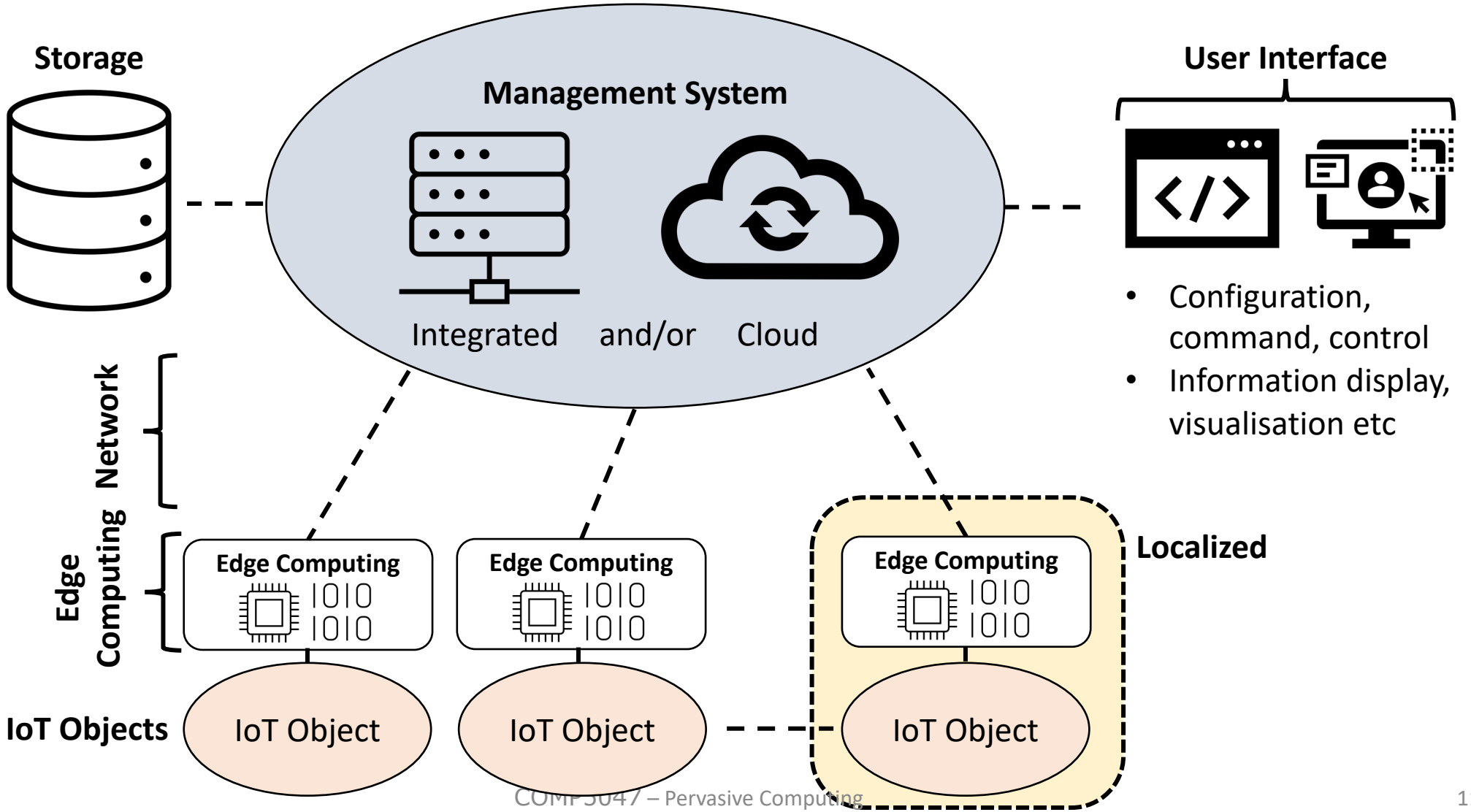


- Configuration, command, control
- Information display, visualisation etc

Edge Computing – Distributed

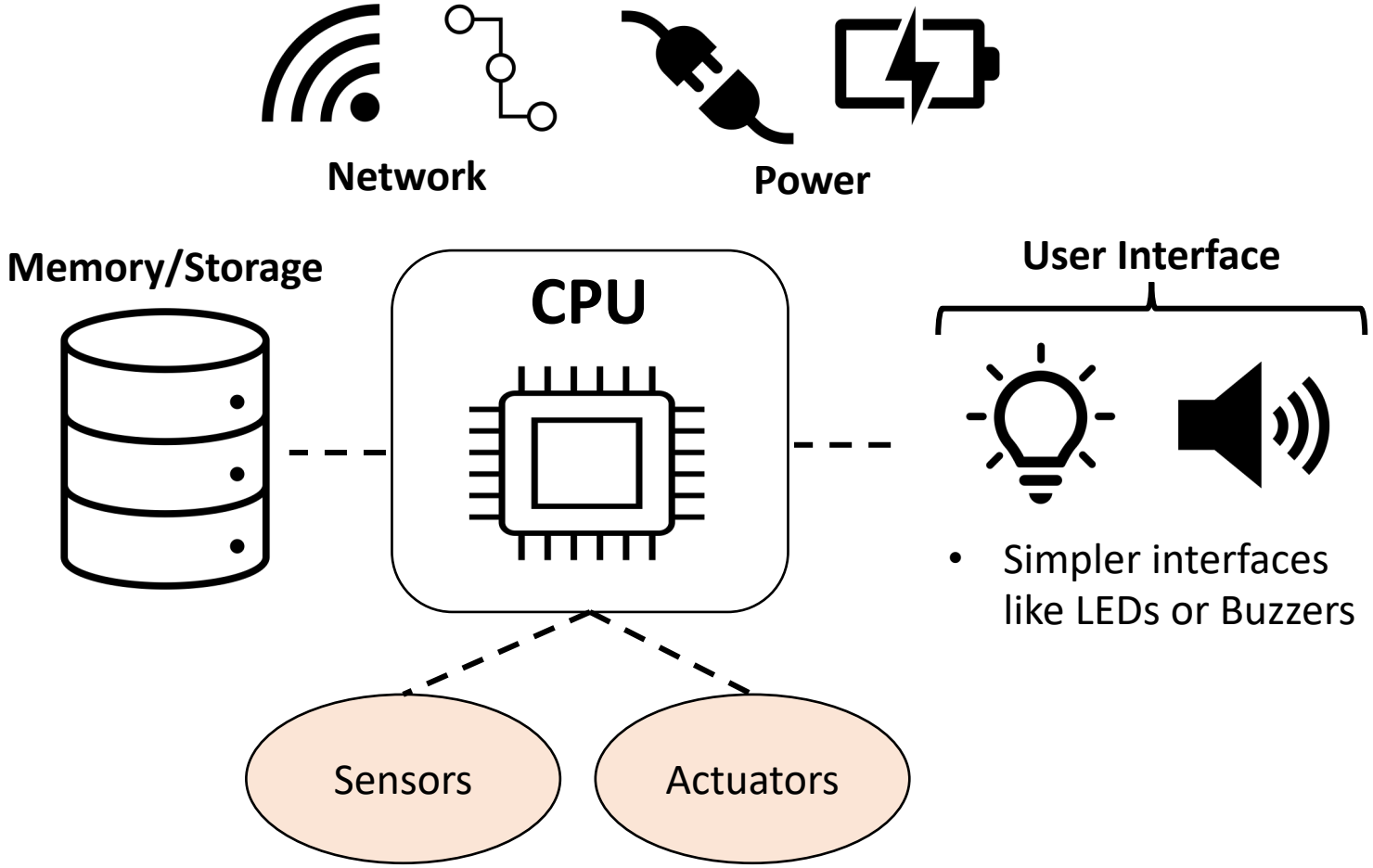


Edge Computing – Distributed



- Configuration, command, control
- Information display, visualisation etc

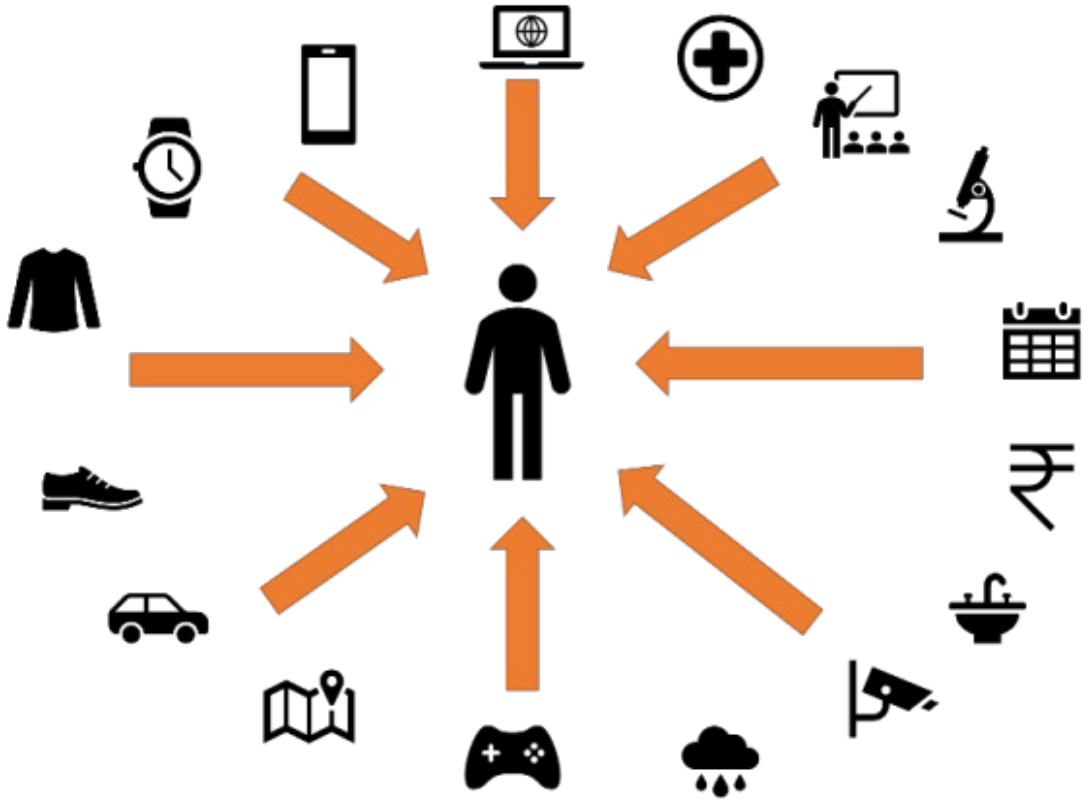
Edge Computing + IoT Object



- Simpler interfaces like LEDs or Buzzers

Managing IoT Systems

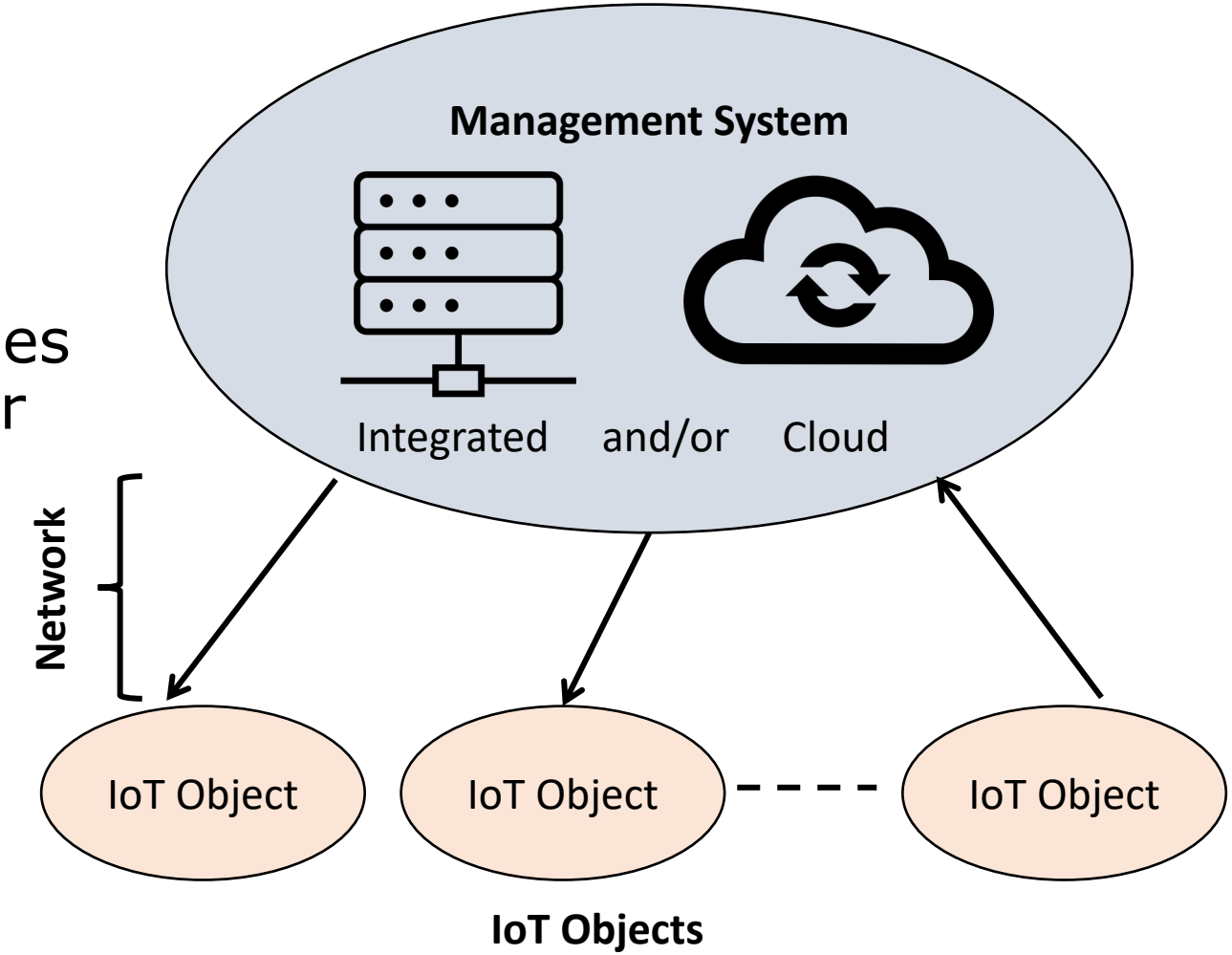
- They are distributed
- Closer to the user
  - Hard to control
- New approaches are necessary to manage
  - Some aspects centrally controlled
  - Some aspects end user controlled



https://www.nic.in/blogs/pervasive-computing/

Managing IoT Systems

- Central Control
  - A series of IoT objects need a software update
  - A new setting that changes the system to save power more

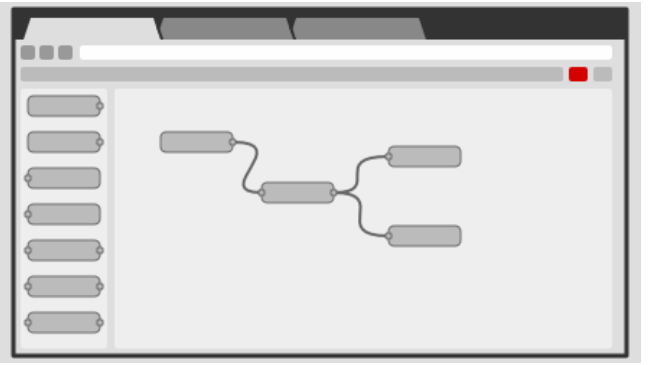


Managing IoT Systems

- End User Control
  - User want to increase their physical activity level by 20% (fitness tracker)
  - Users want to optimize the lighting settings in a smart home
- Simple user interface
  - E.g. Configuration changes
  - Use User Interface (UI) / Voice Interaction
- End user “programming”

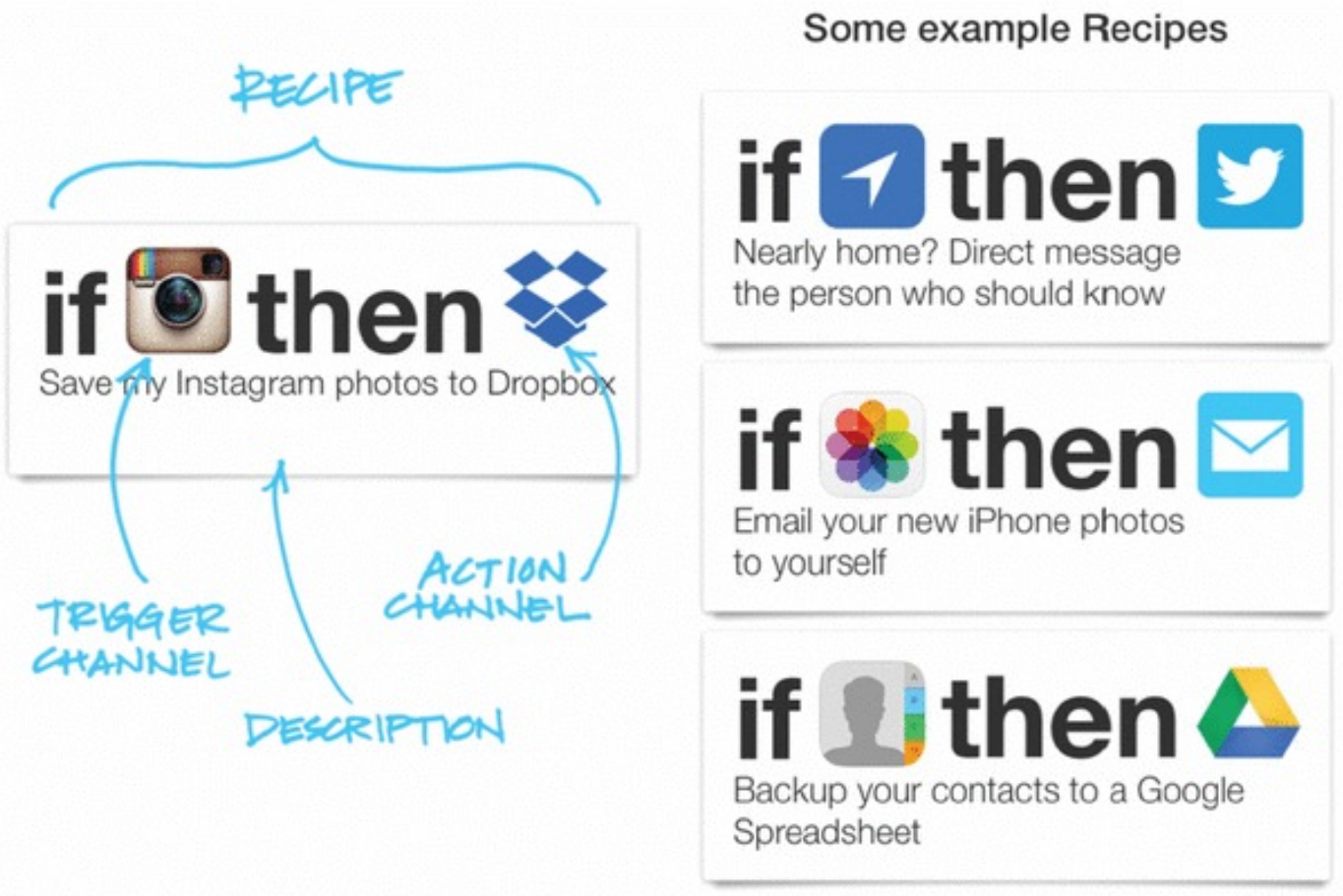
End user “programming” of pervasive systems

- Cannot use traditional programming approaches
  - Majority of end-users can’t program
- Use things like graphical programming
  - Simple rule based logic: if condition then action
  - Chaining of rules
  - Input from sensors, output to displays and actuators
  - Software only or software/hardware systems



End user "programming" of pervasive systems

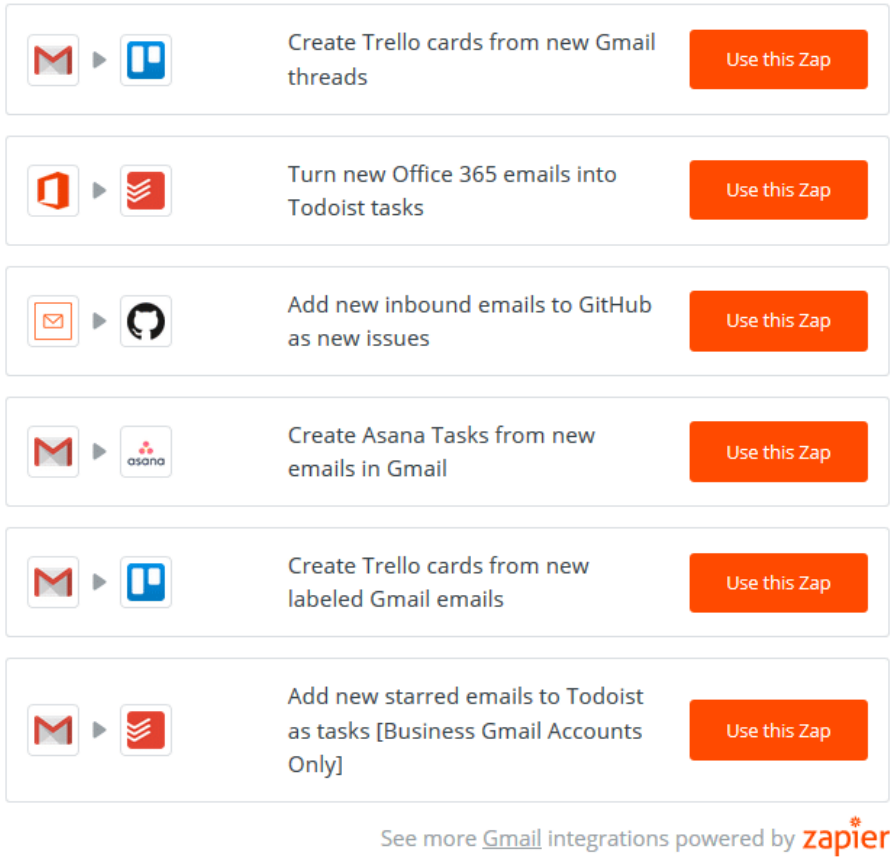
- **IFTTT**
  - if this then that
  - If-then rules with many available predicates and actions.
  - https://ifttt.com/



https://www.researchgate.net/figure/IFTTT-rule-model-recipe-and-its-examples-10_fig1_318930758

End user “programming”

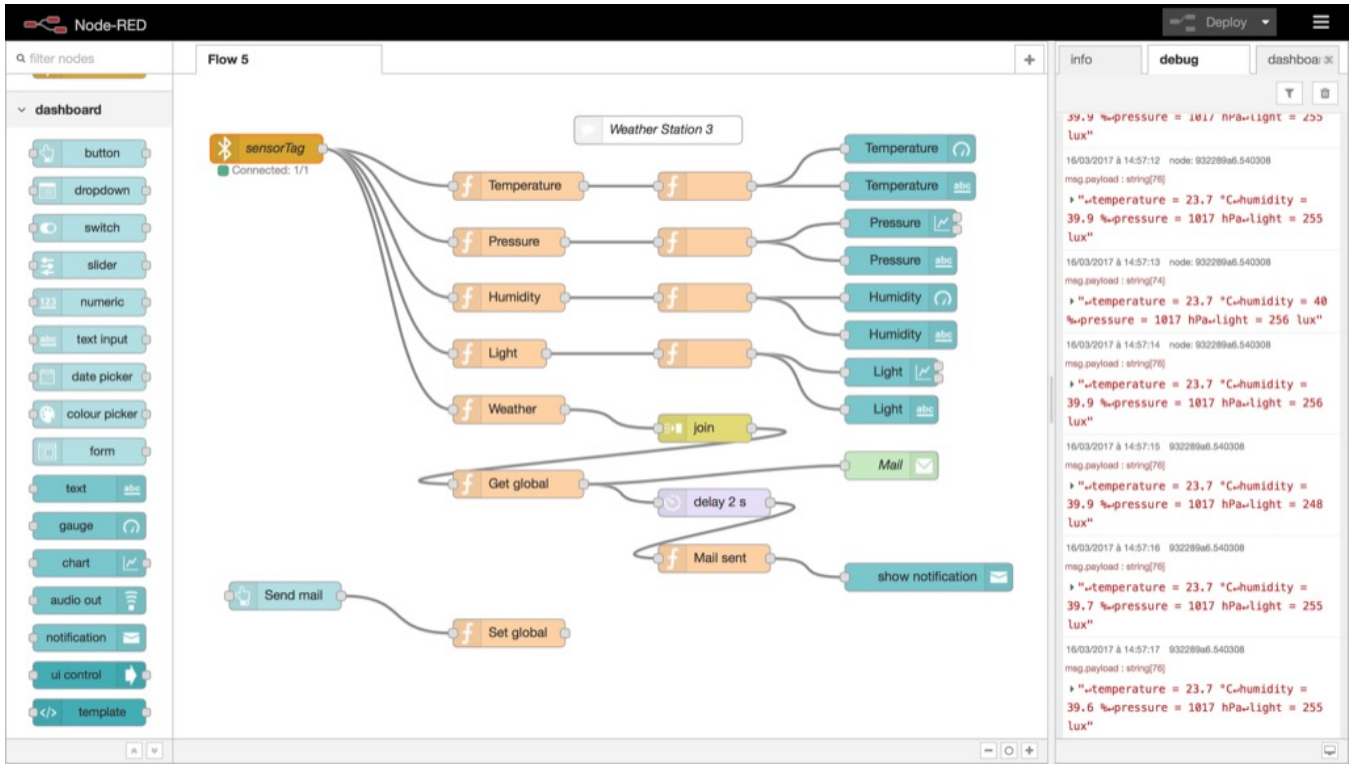
- **Zapier**
  - allows end users to integrate the web applications they use and automate workflows.
  - https://zapier.com



https://www.makeitfuture.com/automation/zapier-examples

End user “programming” of IoT

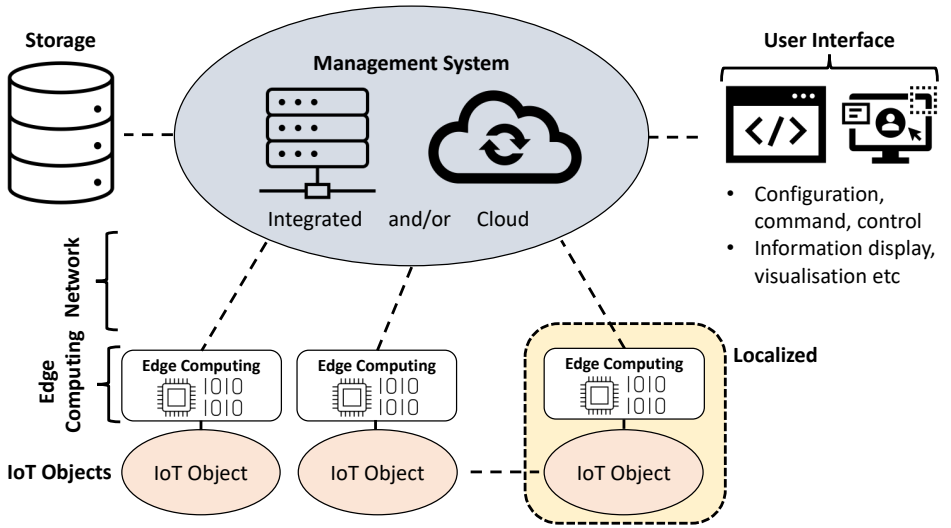
- **Node-red**
  - graphical data flow programming
  - https://nodered.org/



https://embeddedcomputing.weebly.com/iot-with-node-red.html

Summary

- The Internet of Things (IoT)
  - An information system infrastructure for implementing smart, connected objects
- Different components of IoT
- Managing IoT systems
  - Centralized
  - End user management
    - UI
    - End user programming



Practical Work

(Time permitting)