**Module 3 Architecture & Design**

**3.5 Embedded Systems**

**Embedded Systems**

* Has software embedded within computer hardware, usually within Read-Only Memory (ROM)
* Computer system with dedicated function with larger mechanical/electrical system

**System on a Chip (SoC)**

* Integrated circuit that integrates all components of computer/other electronic systems on single computer chip

**Real-Time Operating Systems (RTOSs)**

* OS intended to serve real-time apps that process data as it comes in, typically w/o buffer delays
* Designed to have 0 latency
* Eg. Military, Space

**Internet of Things (IoT)**

* System of interrelated computing devices, mechanical & digital machines/objects/animals/people that are provided with Unique Identifiers (UID) & ability to transfer data over a network w/o human-to-human/human-to-computer interaction

**Smart Devices**

* Wearable technology

1. Eg. Watches, exercise & medical devices
2. Often communicates through Bluetooth

* Home automation

1. Security – cameras, locks, lights
2. Thermostats
3. Sound systems
4. Personal assistants
5. Communicates via Wi-Fi

**ICS (Industrial Control Systems)/SCADA (Supervisor Control & Data Acquisition)**

* ICS (Industrial Control Systems)

1. Encompasses several types of control systems & associated instrumentation used for industrial process control

* SCADA (Supervisor Control & Data Acquisition)

1. Used by utilities & manufacturing
2. Collects data from factories/plants/remote locations & forwards it to central computer that manages/controls the system

* PLC (Programmable Logic Controllers) – single use computers used in manufacturing
* Security – access control, monitoring

**HVAC (Heating, Ventilation & Ait Conditioning systems)**

* Many use computer networks/smart technology to regulate sir flow & temperature
* Security

1. Network partitioning/segmentation
2. Access control
3. Monitoring

**Printers/MFDs**

* MFD (Multi-Function Devices) – used for networked printing, scanning & copying
* Web accessible
* Generally little access control

**Special Purpose Devices**

* Medical devices – pacemakers, insulin pumps
* Vehicles – trucks, autos
* Aircraft/unmanned aerial vehicles (UAV)

**Securing Embedded Devices**

* Secure by design & default
* Security integrated into technology
* System hardening
* Shielded from electromagnetic interference
* Network security – encryption using TLS
* Security verification
* Automated patching
* Anomaly alerts