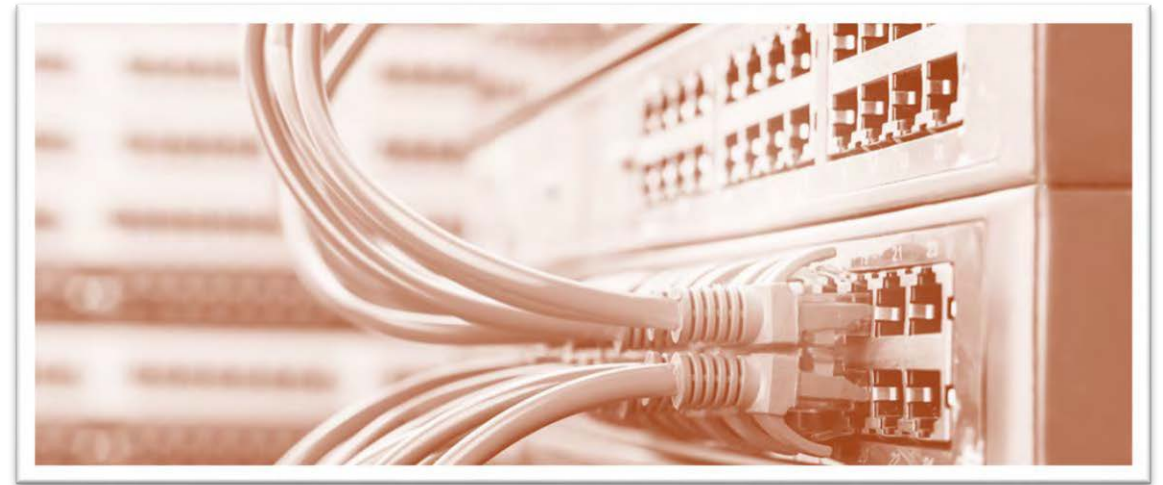


# Networked Devices

DOMAIN 2.0

MODULE 7



# Networked Devices Topics

IP Devices

IoT

ICS/SCADA



# IP Devices



# Voice-over-IP (VoIP)

VoIP is a technology that allows voice calls be established over an IP network

Voice sounds are digitized and carried as a payload of IP

Session Initiation Protocol (SIP) is a signaling protocol that manages a VoIP or video call

- used for initiating, maintaining, modifying, and terminating real-time sessions and services between two or more endpoints on IP networks

# Voice-over-IP (VoIP) Endpoint

A VoIP endpoint is the destination for a voice call, such as a physical IP telephone, a mobile device, a server, or a VoIP application on a laptop

Each physical VoIP endpoint will have its own IP address

VoIP phones can have the same features as analog phones

# VoIP Endpoint Examples



# VoIP PBX

Aka IP PBX

The VoIP equivalent of a traditional telephone PBX

Has its own IP address

Routes calls between internal phones, or routes them in/out to the public system

All VoIP devices are configured to know the address of their IP PBX

Sometimes called a VoIP PABX



# VoIP Gateway

A VoIP Gateway connects a VoIP system to a traditional PSTN

One interface has a SIP/Ethernet connection to the PBX

The other interface goes to the Telco's media converter

Might be built into the VoIP PBX

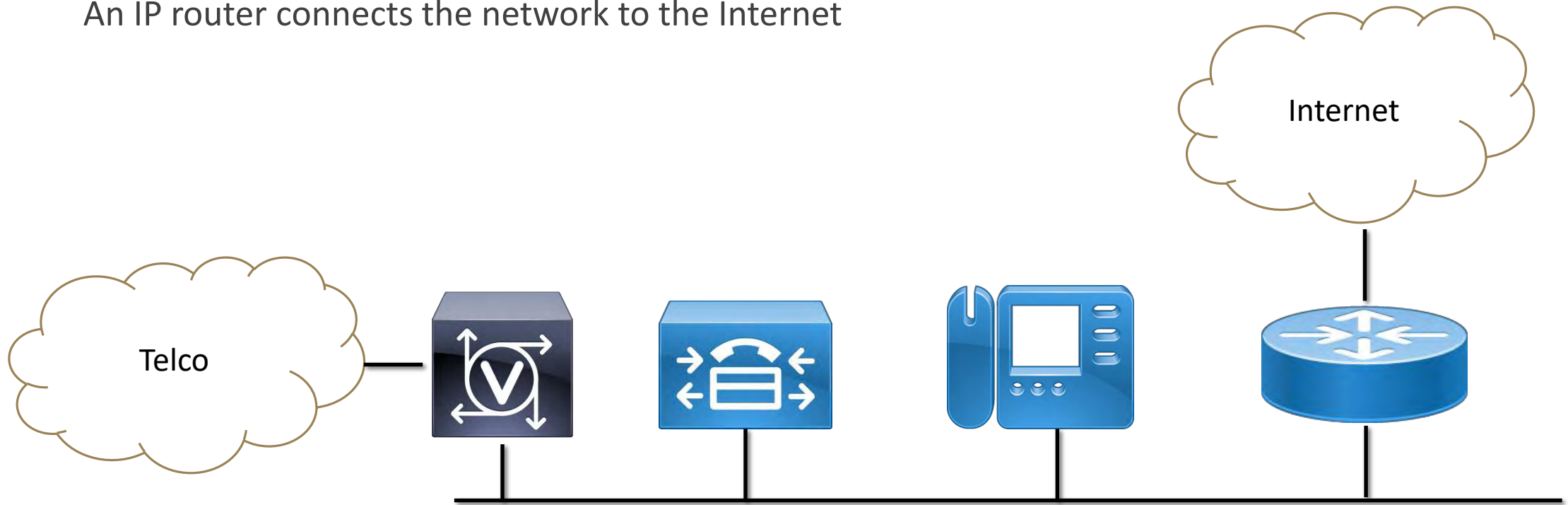




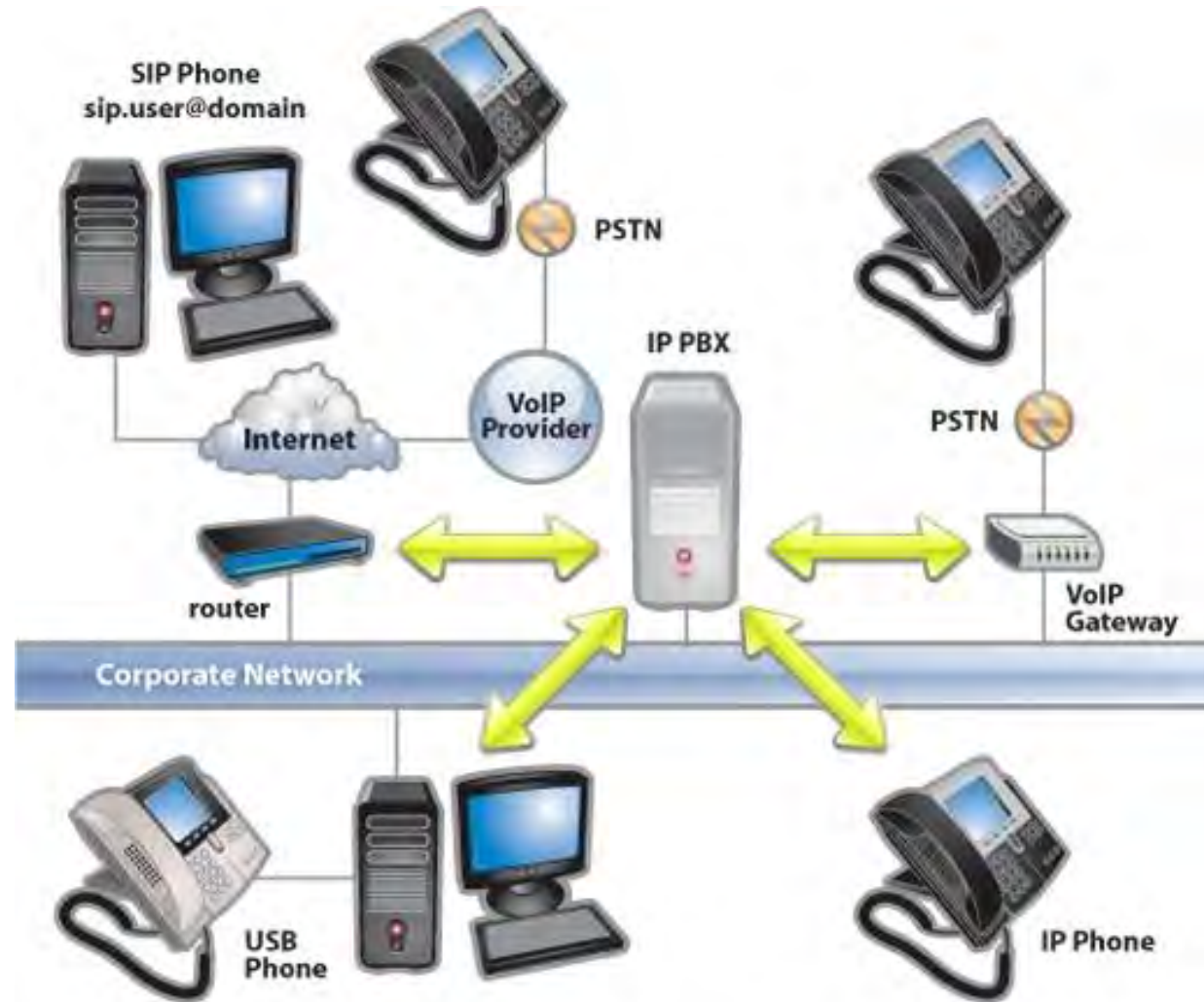
# Do Not Confuse VoIP Gateway with IP Router!

A VoIP Gateway connects a VoIP system to a traditional PSTN

An IP router connects the network to the Internet



# VoIP Example



# Printer

A network printer

Has a built-in network interface card that can be configured with IP address, subnet mask and default gateway

Can either accept print jobs directly from clients, or from a printer server

A print server can be used to:

- Queue and store print jobs from clients
- Assign print and management permissions to users
- Provide printer drivers on demand to different client operating systems
- Accept print jobs via HTTP, SMB, or other Layer 7 file and print protocols



# Physical Access Control System (PACS)

A device that can read Personal Identity Verification (PIV) cards, RFID, mobile device, biometrics, or other authentication methods to grant or deny physical access

PACS devices are IP-based

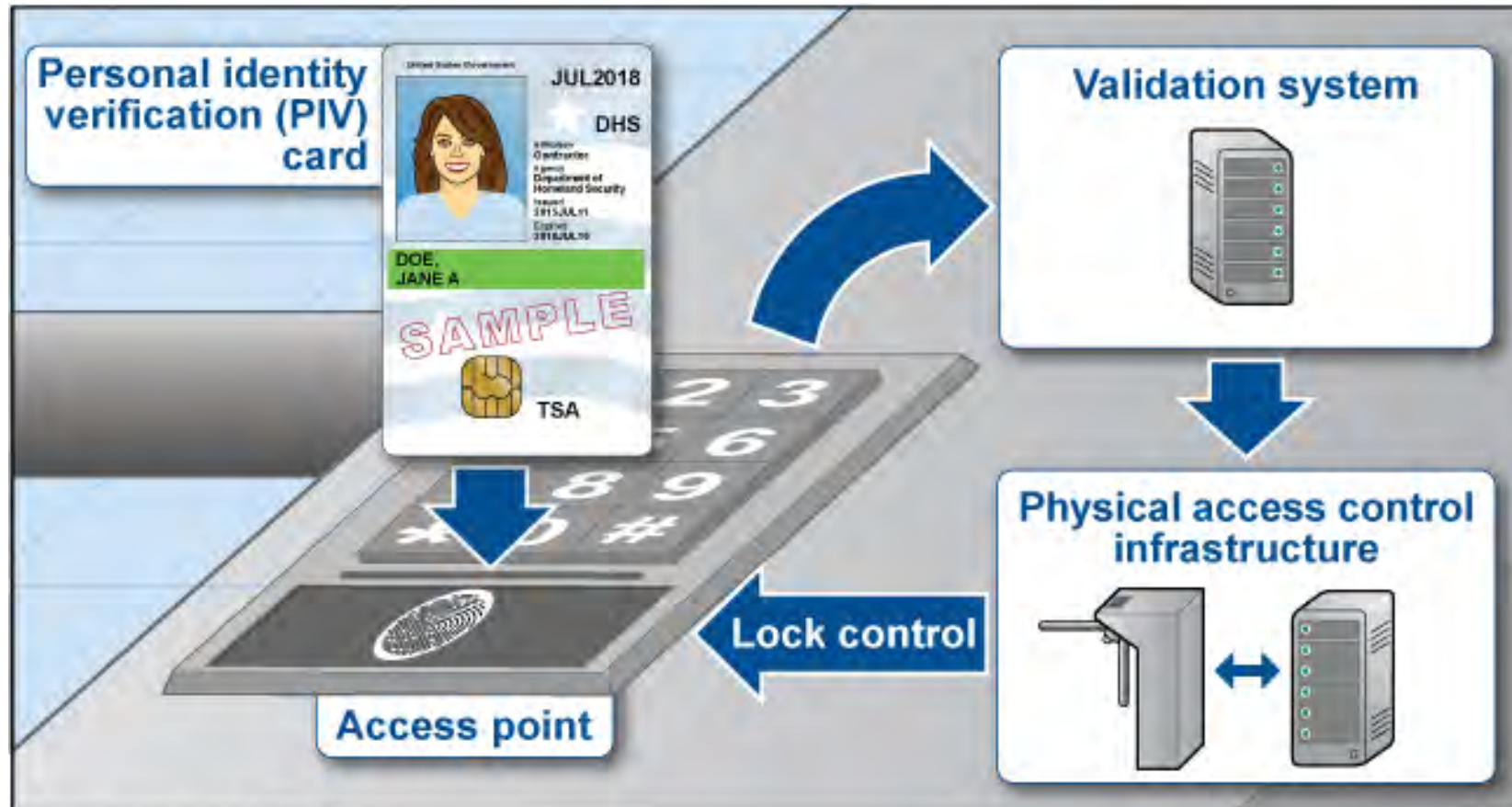
- Traditional security systems were closed (non-IP)

Can use existing network infrastructure (VLAN) or a dedicated separate network

Each device should have its own battery backup

Many PACS devices use Power-over-Ethernet (PoE)

# PACS Example



# PACS Device Examples



# IP Cameras

Video is sent as a payload of IP

Can include features such as Pan-Tilt-Zoom (PTZ), audio, infrared/low light level

Most IP cameras are PoE

the nvr its not going to recored a vidoe it will recored t to a hard a drive

Typically installed in existing LAN infrastructure

Should be separated into their own VLAN

Cameras send their feeds to a Network Video Recorder (NVR)

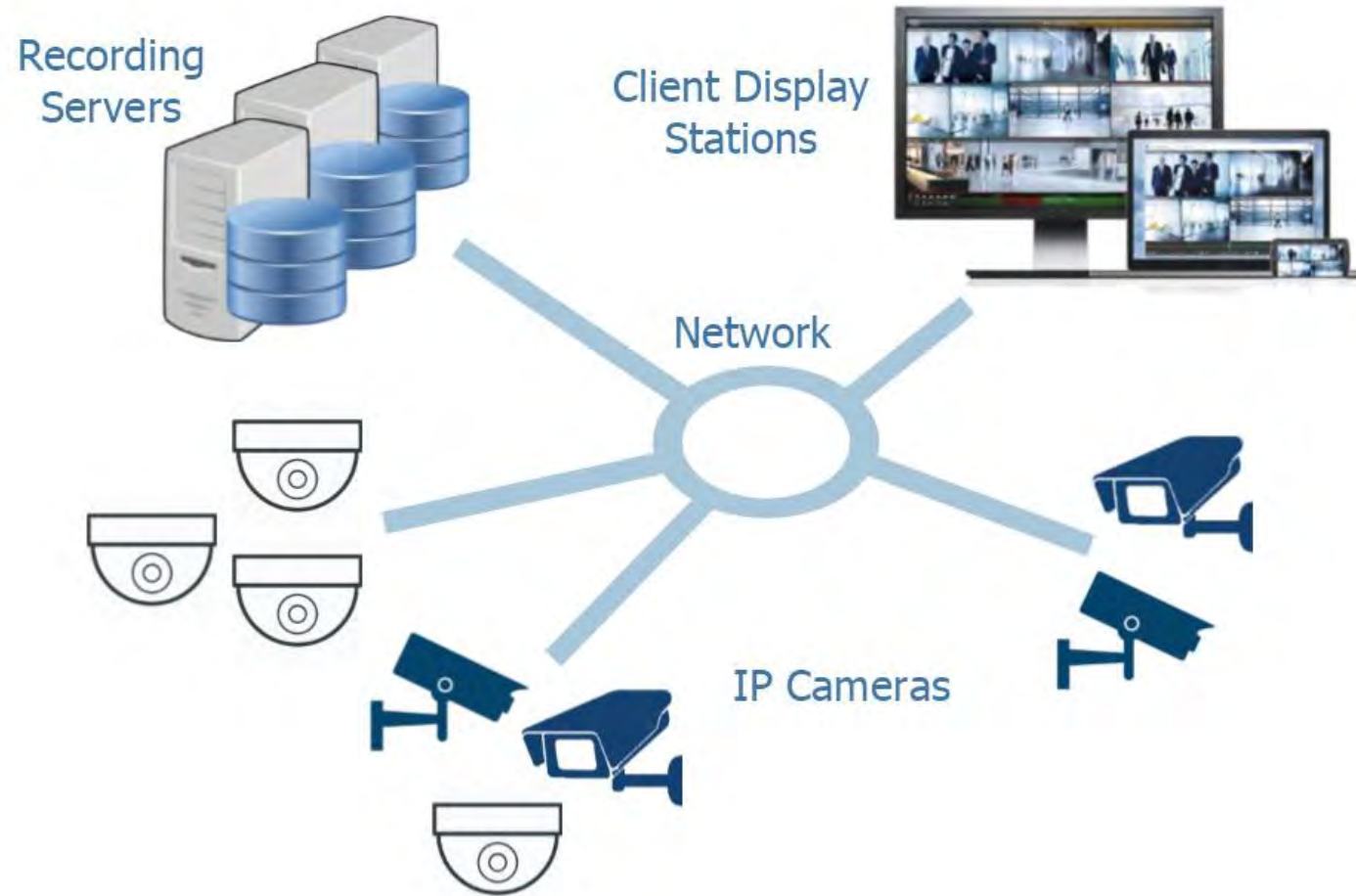
Cameras can be remotely accessed and controlled

Connect using CAT 6a or later





# IP Camera System Example





# Heating, Ventilation, and Air Conditioning (HVAC) Sensors

“Smart” HVAC controllers can be accessed over the network / Internet via a browser/mobile app

- The controller typically will have an IP address

The HVAC controller uses Wi-Fi, Zigbee, Z-Wave and other wireless technologies to communicate with sensors, vents and humidifiers

- Devices usually do not have an IP address

Smart Home HVAC systems are considered part of the Internet of Things (IoT)

# Smart Home HVAC Example





IoT

# Internet of Things (IoT)

The concept of connecting any type of device to the Internet

- Physical objects that are embedded with sensors, processing ability, software, and other technologies

AKA Internet of Everything

All devices have unique identifiers

- IPv6 addresses
- UUIDs or MAC addresses

Devices can transfer data over a network without requiring human-to-human or human-to-computer interaction

Can include home appliances, fitness devices and other wearables, voice-activated personal assistants, home entertainment systems, lighting and security systems, environmental monitors, industrial sensors and much more

IoT devices can use a variety of networking technologies (mostly wireless) including Wi-Fi, Bluetooth, Zigbee, Z-Wave, NFC, RFID, and cellular

# Security Concerns of Internet of Things

Currently, hackers hijack home routers, set-top-boxes and network-attached storage devices

Less interest in the data they contain

More interest in IoT controller computing power:

- Mine bitcoins
- Send spam
- Crack passwords

Most devices can be remotely controlled through a smartphone app

If your phone is hacked, it makes your entire home network vulnerable

# Smart Refrigerator

A programmable refrigerator that is able to detect the type of items stored in it

Keeps track of important details such as expiry and usage

Uses a barcode or RFID system

Collects the batch and manufacture detail directly from the Internet

Can send alerts to the consumer

Can be controlled by a Smart Home console or mobile app

# Smart Refrigerator Example



# Smart Speaker

A home speaker that has a built-in personal assistant

Responds to voice commands to play music, answer questions and manage other Smart devices





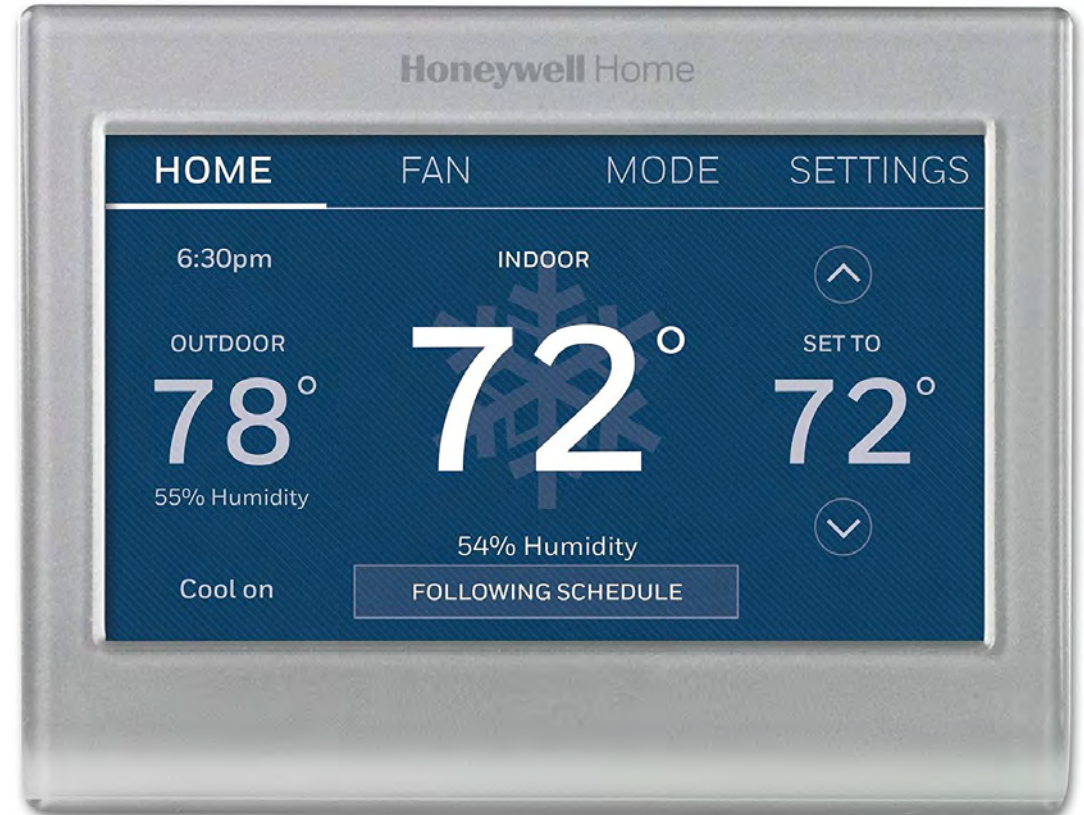
# Smart Thermostat

Personalized programmability

Can be managed via touch screen or remotely via mobile app

Can send alerts to the homeowner

Typically provides weather updates and other information



# Smart Doorbell

Typically includes HD video camera with sound

Allows 2-way communication

Can be remotely monitored via the web or mobile app

Can be voice controlled by a personal assistant







ICS/SCADA



# Industrial Control Systems (ICS)

A general term that refers to a control system and related instrumentation (sensors, actuators)

Used for industrial process monitoring and control

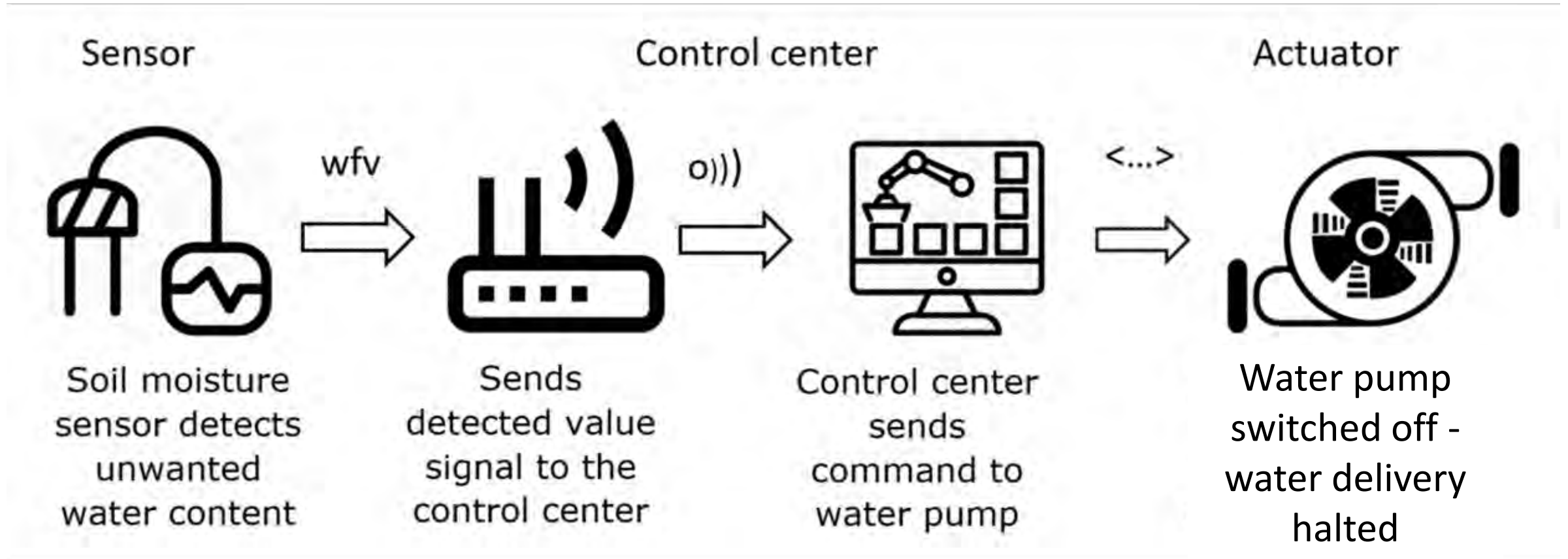
A single ICS system can range in size from a few controllers to thousands of connected field systems

Found in nearly every industrial sector and critical infrastructure including manufacturing, transportation, energy, and water treatment

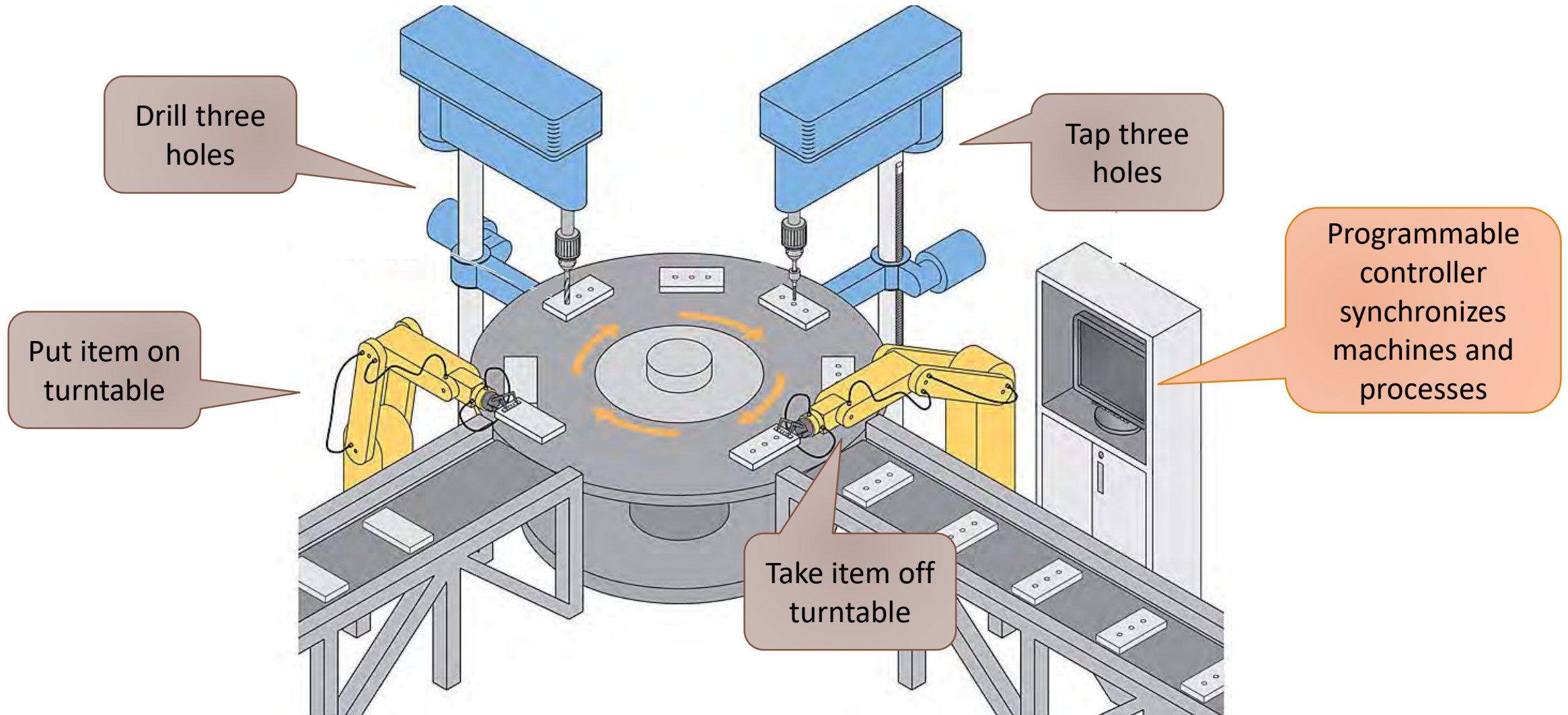
ICS is a subset of IoT



# ICS Example



# ICS Example #2



# Supervisory Control and Data Acquisition (SCADA)

Centralized control system for ICS

Long distance monitoring and control of field sites

Saves time and effort

- Technicians don't have to travel a long distance to the field site to take measurements or apply settings

Network communications can be analog (POTS) or digital (TCP/IP)





# ICS and SCADA Example

