Network Communications - Internet of Things (IoT)

What is the Internet of Things (IoT) and how is it related to network communications?

The Internet of things (IoT) consists of physical devices connected to the Internet. IoT devices are a combination of sensors, software, and electronics that connect to a central location usually in the cloud. They are often connected through a wireless network through which they communicate with one another and feed information to a user's mobile device or computer. Through the device, the user can monitor a condition or control a process through a control panel or dashboard, known as the Human-Machine Interface. Internet-connected doorbells, thermostats, speaker systems and wearable fitness trackers are everyday examples of IoT devices. In industry, a variety of sensors monitoring quality and machine operational parameters for preventative maintenance.

Vocabulary

- Smart sensors – devices that receive and process data before sending to a centralized source; flow sensors used to measure water and natural gas usage – smart meters – are an example
- Cloud computing – delivery and storage of data over the Internet rather than on-site; Google's gmail is an example.
- Information security – processes used to protect information from unauthorized access, modification, or destruction. Requiring password entry to access devices and content is an example.

How will technicians use network communications and IoT technologies?

Network Communication Technicians familiar with IoT technologies will install, monitor, and maintain the IoT devices and the network communication software that connects them to ensure proper operation. This includes tasks such as installing software updates, developing procedures to detect and prevent system hacking, testing the network for malware, and troubleshooting system malfunctions. Their job often requires creative problem-solving, as in this example:

A company that manages large parking garages wanted to reduce the time its customers spent searching for open parking spots. Some drivers spend several minutes traveling up and down multiple floors to find an open parking spot. The distracted drivers looking for open parking spots are also a hazard to other cars and pedestrians. A network technician is assigned to investigate a solution. After reviewing several options, the network technician decided to implement an IoT solution that includes sensors, signs, and a mobile app. IoT sensors were installed to monitor the status of each parking spot. The status of each parking spot was sent to a centralized computer. If a spot were available, signs throughout the garage would provide directions to the exact location on the garage floor to the open parking spot. The status of each parking spot was also available on a mobile app to let people know before entering the garage how many spots were available and on what floors. This IoT solution reduced customer wait times, increased safety, and increased parking garage profits.





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Skills Needed for a High-Paying, Rewarding Career

- Advanced computer programming
- Connecting sensors to networks
- Identifying program errors
- Troubleshooting complicated computer networks
- Interpreting detailed schematic diagrams
- Maintaining complex IoT networks
- Configuring and Testing new software instillations
- Maintaining and repairing hardware and peripheral devices
- Developing robust cyber security interfaces

Education

Your local community college provides the advanced technology classes you will need. Skills for building and maintaining network communications networks within the Internet of Things are most often taught within Engineering Technology, Information Technology, or Computer Information Systems programs offering associate degrees and one-year certificates. You will also find the skills applicable in technical specializations, such as cybersecurity, biomedical, energy, environmental, and engineering technologies. Community college course schedules are designed to accommodate the needs of working students and often include online and hybrid delivery formats. Find your nearest community college here.

Future Trends

Current and Future Career Opportunities include working with:

- "Smart home" technologies
- Complex sensors
- Sophisticated user infrastructures
- Industry and government cyber security
- Dynamic mesh computer interface architecture
- Artificial Intelligence applications
- Data brokering
- Informatics
- Robot/human inter-communications

Learn More

The Internet of Things tutorial (includes Career Opportunities)

Free online course: Introduction to the Internet of Things

ABOUT THE PROJECT:
Preparing Technicians for the Future of Work, a project of the National Science Foundation Advanced Technological Education program, recognizes that technicians graduating today need an expanded skill set to remain competitive in the global economy. The project focuses on three skill areas: data knowledge and analysis, advanced digital literacy, and business knowledge and processes. Learn more at preparingtechnicians.org.





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The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects (e.g. car with lane sensors), animals (e.g. livestock with biochip transponders) or people (e.g. heart rate monitors) that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. "Internet of Things (IoT)," TechTarget IoT

Network communication defines a set of protocols (rules and standards) that allow application programs to talk with each other without regard to the hardware and operating systems where they are run. "Basics of Network Communication," IBM Knowledge Center

Scenario 1
Manufacturing Technologies

A manufacturing facility had problems with consistent equipment breakdowns causing the assembly lines to stop working. The equipment was overheating, vibrating, and losing electrical connectivity. The maintenance technicians would find the problems but only after the assembly line broke down. The company was losing money on a weekly basis. The plant manager asked Cynthia, a production technician, to find a solution. After a few days Cynthia reported to her manager she found a solution using IoT. Cynthia's plan was to install IoT devices to monitor the part of the assembly line that was breaking down. The IoT devices were attached to the motors, conveyor belts and electrical systems. and then connected to a central monitoring system. The central monitoring system allowed the maintenance technician to identify and repair parts that were going bad before they failed and shut down the assembly line.

Scenario 2
Energy and Environmental Technologies

IoT is helping people save energy and make money savings decisions about their power usage. Smart meters that attach to buildings and connect to a smart energy grid have become the top IoT device among utility companies. Data from IoT energy smart meters can be sent to a mobile app to monitor how much power has been consumed. It allows people to know exactly how much they are spending so they only use what they can afford. Consumers can use IoT devices attached to appliances to turn off the power to appliances to reduce electrical waste and save money.

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Read More

- "IoT and Biotechnology: A Promising Technology Fusion for Sustainable Development," *Biotech Express Magazine*
- "The Relation between IIOT, SCADA, and HMI Explained," *Schneider Electric Blog*
- "Case Studies in Agtech Smart Farming"

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IoT Technician Competencies

- Designing and installing well-functioning computer networks, connections, and cabling
- Troubleshooting system failures and identifying bottlenecks to ensure network efficiency
- Testing and configuring software
- Maintaining and repairing hardware and peripheral devices

Cross-disciplinary IoT Skills

- Using sensors to collect information
- Transferring information to and from the cloud
- Analyzing information provided by internet-connected devices
- Storing information safely
- Applying appropriate digital communication protocols

Read More

IoT Case Studies: Companies Leading the Connected Economy

Workforce Domain Curriculum and Faculty Development Resources for IoT

Activity

This activity is designed to help students think about connected equipment and processes in their field of study. Begin with the guiding questions in the warm up. Students will identify connected devices and the tasks they automate, relative to their field, and illustrate the connections.

Warm-Up

- What equipment are we operating remotely?
- What processes are we monitoring?
- What types of equipment and devices need to communicate with each other?
- What are the critical parameters in which we are working?

Activity Steps

1. List three tasks from your field of study that have been automated
2. Describe how a technician monitors the process for safety, efficiency, and accuracy
3. Identify the central data hub (i.e., cloud, physical server, other)
4. Sketch a diagram showing the network of connected devices
5. Explain why the specific devices are connected.