# NETWORK ARCHITECTURE

What Is Network Architecture?

Network Architecture is the physical organization and logical design of software, hardware, protocols, and transmission media (wired or wireless). In a network, any connected device with an IP address is called a host. A host is called a client when it is requesting information, a server when it provides information, and a peer when it is able to both request and provide information.

The two most common types of network architectures are:

Peer-To-Peer networks consist of two or more computers linked to facilitate the sharing of information.
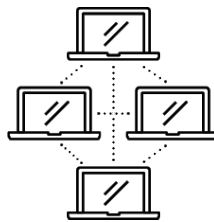
- All computers handle tasks and can communicate with each other.
- Small environments (10 or fewer computers)
- No dedicated server

Client/Server networks are configured so that clients access data from a server.

- Clients do not share data with one another directly.
- The server manages all the data, the network, and security.
- Clients communicate with server to request and receive permission to access data.

Vocabulary

- **Hub** – a device that has multiple ports for ethernet cables connecting devices and sending all of them incoming data
- **Logical network diagram** – graphic showing the flow of information through a network
- **Nodes** – connection points in a network (e.g., computers, printers, modems)
- **Protocol** – rules that govern how computers communicate with each other
- **Router** – a networking device connecting devices to each other and the internet
- **Transmission media** – the communication channel between computers

How will network architecture be used in the workplace?

Juan is an HVAC Technician who works with industrial customers who require troubleshooting, repair, and replacement of their HVAC systems. Juan is on the road servicing customers. After he completes his work at each site, he returns home to complete his work log using software installed on his work laptop. He has a router set up to provide high-speed Internet so that his computer can communicate with his company's server to relay this information. Juan's company uses a Client/Server Network so that HVAC technicians can complete their work logs remotely and the completed logs are available to his supervisor and others to view from the corporate office and/or remote locations. This is essential for record-keeping of company compliance with regulations. For example, when Juan replaces HVAC equipment and needs to dispose of the old equipment, the Environmental Protection Agency (EPA) requires a report from the company listing the amount and type of refrigerant disposed. The company's Health & Safety Manager has access to this information through the Client/Server Network and can complete the monthly EPA report.

NETWORK ARCHITECTURE

Skills Needed for a High-Paying Job

- Consulting on network design
- Configuring software on the hosts and infrastructure devices
- Maintaining and repairing host and infrastructure devices
- Preserving high levels of network security
- Troubleshooting network infrastructure problems
- Communicating network access and usage policies
- Staying informed about new network technologies

Education
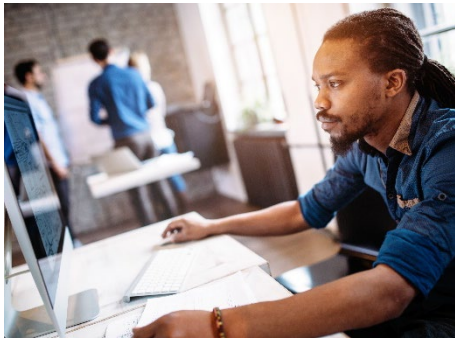
Your local community college provides the advanced technology classes you will need. Skills for planning and designing communications networks are most often taught within Computer Information Systems programs offering associate degrees. Network architecture skills are also important in other technical fields such as cybersecurity, energy, 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

The future of network architecture includes:

- Cybersecurity mesh (security perimeter around a person or thing)
- Software-defined networking (SDN) and network functions virtualization (NFV)
- Use of networks as sensors to report and remediate system issues
- Autonomous networks that run, repair, and report without human interaction
- Edge computing (processing data closer to where it originates)
- Expansion of cloud platforms

Learn More

- Basic Networking Concepts-Beginners Guide
- Computer Network Architecture

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NETWORK ARCHITECTURE

What Is Network Architecture?

A network links two or more host devices to facilitate the sharing of information. These networks can be self-contained Local Area Networks (LANs) which are typically in the same building or Wide Area Networks (WANs) which allow organizations to communicate globally. Network Architecture is the design, implementation, and management of four elements that comprise a network.

1. Something to share — the **Services**
   - Documents, databases, media content, messaging, collaboration (using tools such as Zoom)
2. Physical pathways through which the services can be shared — the **Infrastructure**
   - Physical media (twisted pair cable, coaxial cable, or fiber optics) or wireless (WiFi, cellular or satellite)
   - Devices (routers, switches, and access points)
3. Rules to manage the flow of a service's data through the infrastructure — the **Protocols**
   - A common "language" that the hosts and devices use to pass data through the network
   - Security policies and safeguards to protect the data on the network
4. Devices that provide and/or use the services that are to be shared — the **Hosts**
   - Server/Client network model where servers provide network services and clients use the network services
   - Peer-to-Peer network model where most hosts are functioning as both a server and client

Biotechnology Scenario

Sofia is a Biotechnology Technician hired as part of a nationwide research team studying biofuels. Her work in the lab will involve conducting experiments using high tech equipment with specialized software to transfer data from the equipment directly to a database. Her team also needs to share and access data from other biofuels labs across the country. Her lab manager hired a company to design and build a Client/Server network with cloud storage and asked Sofia to brief their network architect on the project's current activities and anticipated network needs. With Sofia's input, the network architect was able to design, build, and configure an integrated network using a diverse set of infrastructure devices, a combination of protocols, and multiple networking services. She also worked closely with the network security administrators to make sure it and all the data that passes through it are secure.

Manufacturing Scenario

Blake is a Controls Technician at a heavy equipment assembly plant and has recently received approval from his supervisor to work from home two days a week using remote monitoring software that he can access via the Internet, 24/7. There is currently poor Internet access where he lives, but a state agency bringing broadband technologies to rural areas has dispatched Keisha, a Broadband Technician, to set up the network infrastructure to remedy that situation. At Blake's house, she installs a small utility box called an optical network terminal (or ONT) inside the home attached to a wall. She then installs cable from a nearby equipment box outside to the ONT, which typically requires running cable along floors or the ceiling inside the home. Once the cable work is done, Keisha sets up the router which connects to the ONT. Before she leaves, she tests the internet connection and confirms that Blake knows how to connect via Wi-Fi to the router from his computer and other devices. After following his company's security protocols for logging in, he can now access real-time sensor data from his home office.

NETWORK ARCHITECTURE

Activity

This activity is designed to help students visualize the basic structure of a network. Begin by showing a network diagram. Next, the students will watch a video on designing a small business or home network. Then they draw their best rendition of how the network is set up at their home or potentially could be designed.

Warm-Up

Review the vocabulary and concepts provided on the student card, then display this diagram of a network: Visual Paradigm Online. Ask student pairs to identify the familiar components of the network shown in the diagram:

1. Identify the network infrastructure and whether it uses physical or wireless media
2. Identify the infrastructure devices (routers, switches, and access points)
3. Identify the hosts (computers, printers, and multimedia devices)
4. Identify the network services used by hosts (file, print, messaging)

Activity Steps

1. Ask students to think about the networks that they are familiar with in homes, classrooms, and workplaces.
2. Have them watch this video, Designing a Basic Small Business or Home Network (5:44), that demonstrates the options for how a small network can be configured.
3. Ask them to reflect on a network discussed in Step 1 and then draw a rough diagram of it.
4. Students can then share and explain their diagrams.

Network Archicture Competencies

- Designing and installing computer networks, connections and cabling
- Troubleshooting system failures and network infrastructure problems
- Configuring software/firmware on the hosts and infrastructure devices
- Maintaining and repairing host and infrastructure devices
- Preserving high levels of network security
- Staying informed about new network technologies

Cross-disciplinary Skills

- Collaborating with others
- Communicating network access and usage policies
- Following industry-specific regulations related to security
- Seeking ongoing process improvements

Read More

- The Fundamentals of Networking

ABOUT THE PROJECT

Preparing Technicians for the Future of Work, funded by the National Science Foundation Advanced Technological Education program, recognizes that technicians need an expanded skill set to remain competitive. The project's Framework for a Cross-Disciplinary STEM Core outlines recommendations for incorporating knowledge and skills in Advanced Digital Literacy, Data Knowledge and Analysis, and Business Knowledge and Processes. Learn more about implementing the Framework at preparingtechnicians.org.