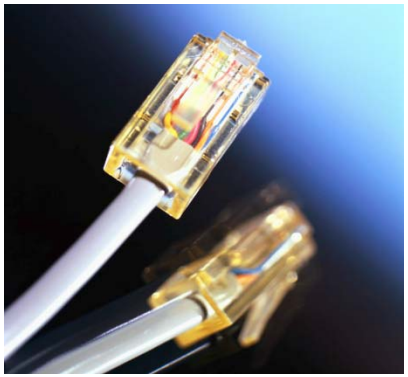
Network Cables

March 2, 2011

Types of Network Cables

There are hundreds of different types of cables that we can use to connect devices on the Internet. We can actually spend many hours exploring all the many types of medium, but we will present five different cables and their specifications. From this base, a technologist will be able to understand the main parameters when choosing using a network cable.



Nomenclature	Name	Bandwidth	Max Length	Max nodes per segment
10base2	Thinnet	10 Mbps	185 meters	30
10base5	Thicknet	10 Mbps	500 meters	100
10baseT	Ethernet	10 Mbps	100 meters	1
100baseT	Fast Ethernet	100 Mbps	100 meters	1
1000baseT	Gigabit Ethernet	1 Gbps	100 meters	1
1000baseLX	Gigabit Ethernet	1 Gbps	2000 meters	1

10Base5 Thicknet

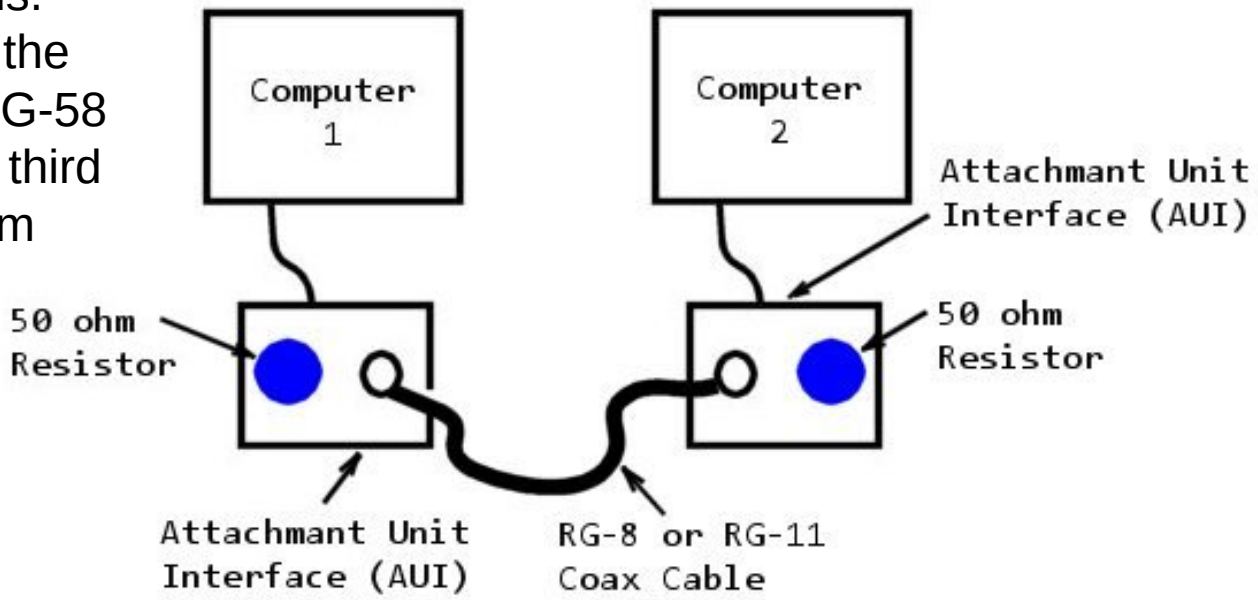
The 10Base2 Thicknet cabling system transmit at 10 Megabits per second from one network device to another. There can be 100 nodes on the coaxial network cable including the two 50 ohm line terminators. The network sends and receives data at 10 Megabits per second.

Nomenclature	10base5
Name	Thicknet
Cable	RG8 or RG11Coax
Max segment Length	500 meters
Maximum Network Length	2500 meters
Max Number of Segments	5
Max Number of Repeaters	4
Maximum Number of Populated Segments	3
Maximum number of Nodes per segment	100

Making a Thicknet Connection

A network technician can connect two computers with a RG-8 or RG11 coax cable by crimping a BNC end connector on each end of the coax cable. Next, we put Network Interface Cards (NIC) that have 15 pin AUI connectors in both machines. On each NIC, we insert a Attachment Unit Interface (AUI).

The AUI has three ends. One goes on the NIC, the second receives the RG-58 coax cable and on the third end, we place a 50 ohm resistor.

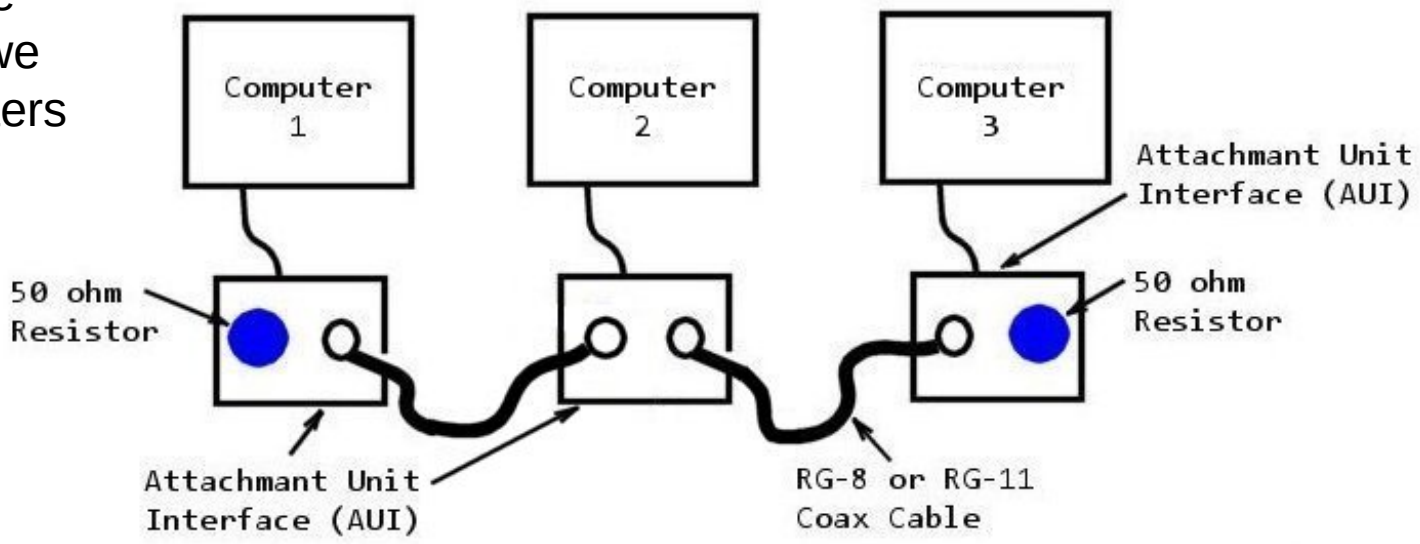


Adding More Computers

We can install a third computer by removing one 50 ohm resistor and installing another segment of RG-8 coax cable with BNC end connectors. We install a NIC that has a 15 pin AUI connector in the third computer. We place a AUI on the new NIC.

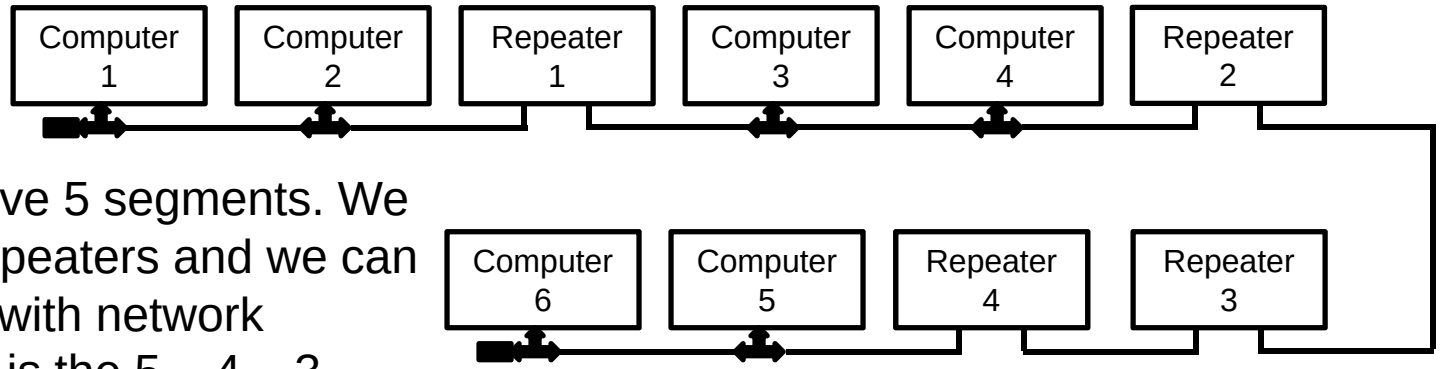
We attach the new RG-8 coax cable segment to the open end of the AUI's BNC connector. On the third computer, we place a 50 ohm resistor.

We can continue doing this until we have 98 computers and two 50 ohm resistors on the network.



Repeaters Getting More Distance

10base5, Thicknet uses a 5 – 4 – 3 rule for the entire network. We can have 5 segments of 500 meters from one end to the other for a total of 2500 meters. We can then remove the 50 ohm resistor and insert the BNC end connector of the last cable into repeater 1. We can continue on with another 500 meters adding more computers along the network. We can add a second, a third, and a fourth repeater with 500 meter long coax cables between each repeater, but the two segments between repeaters 2 and 3 and 3 and 4 cannot contain devices. After the fourth repeater, we can add 500 meters of cable with more computers. The last computer will have a 50 ohm resistor as the line terminator.



So we can have 5 segments. We can have 4 repeaters and we can fill 3 sections with network devices. That is the 5 – 4 – 3 rule.

10Base2 Thinnet

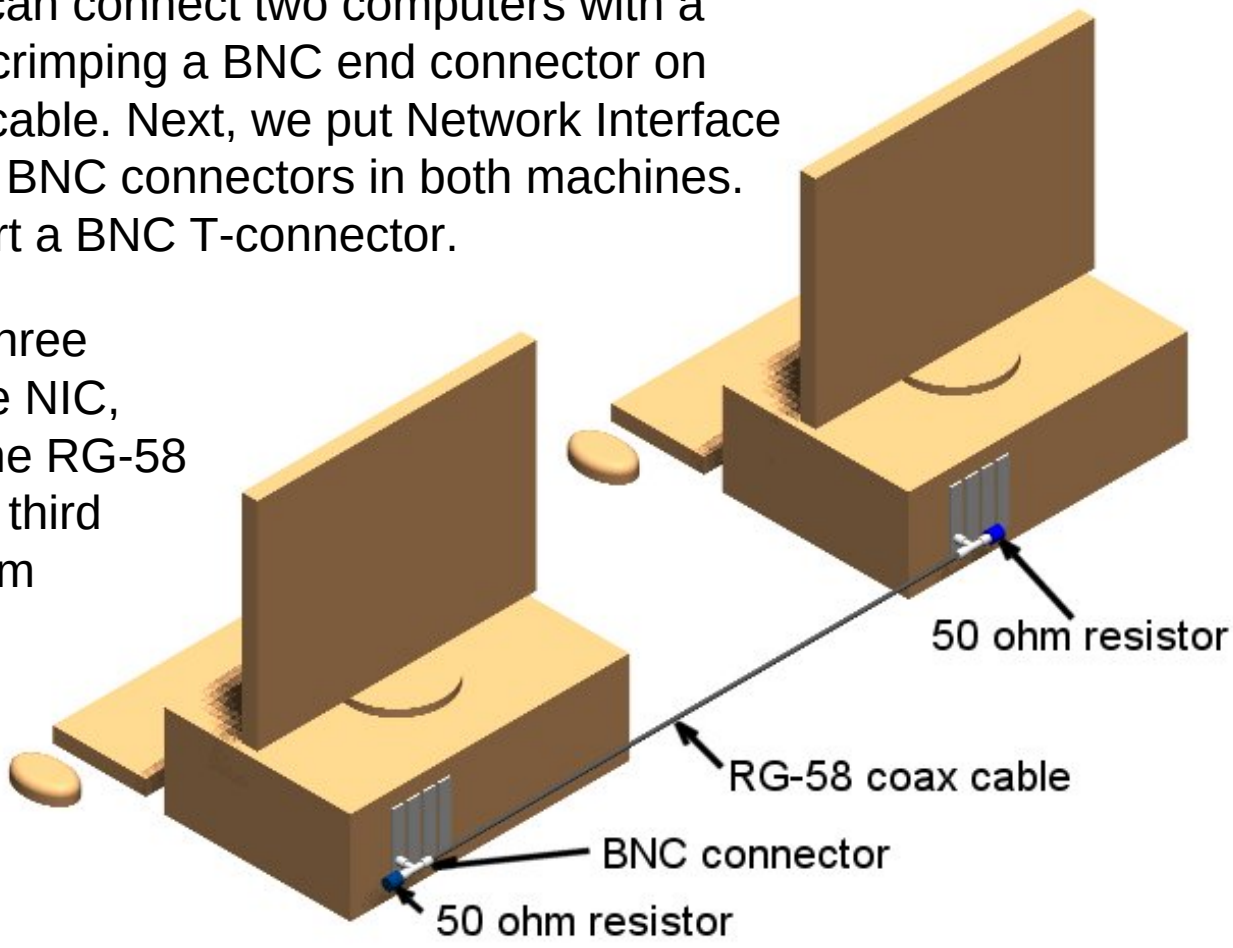
The 10Base2 Thinnet cabling system transmit at 10 Megabits per second from one network device to another. There can be 30 nodes on the coaxial network cable including the two 50 ohm line terminators. The network sends and receives data at 10 Megabits per second.

Nomenclature	10base2
Name	Thinnet
Cable	RG58 Coax
Max Segment Length	185 meters
Maximum Network Length	925 meters
Max Number of Segments	5
Max Number of Repeaters	4
Maximum Number of Populated Segments	3
Maximum number of Nodes per segment	30

Making a Thinnet Connection

A network technician can connect two computers with a RG-58 coax cable by crimping a BNC end connector on each end of the coax cable. Next, we put Network Interface Cards (NIC) that have BNC connectors in both machines. On each NIC, we insert a BNC T-connector.

The T-connector has three ends. One goes on the NIC, the second receives the RG-58 coax cable and on the third end, we place a 50 ohm resistor.

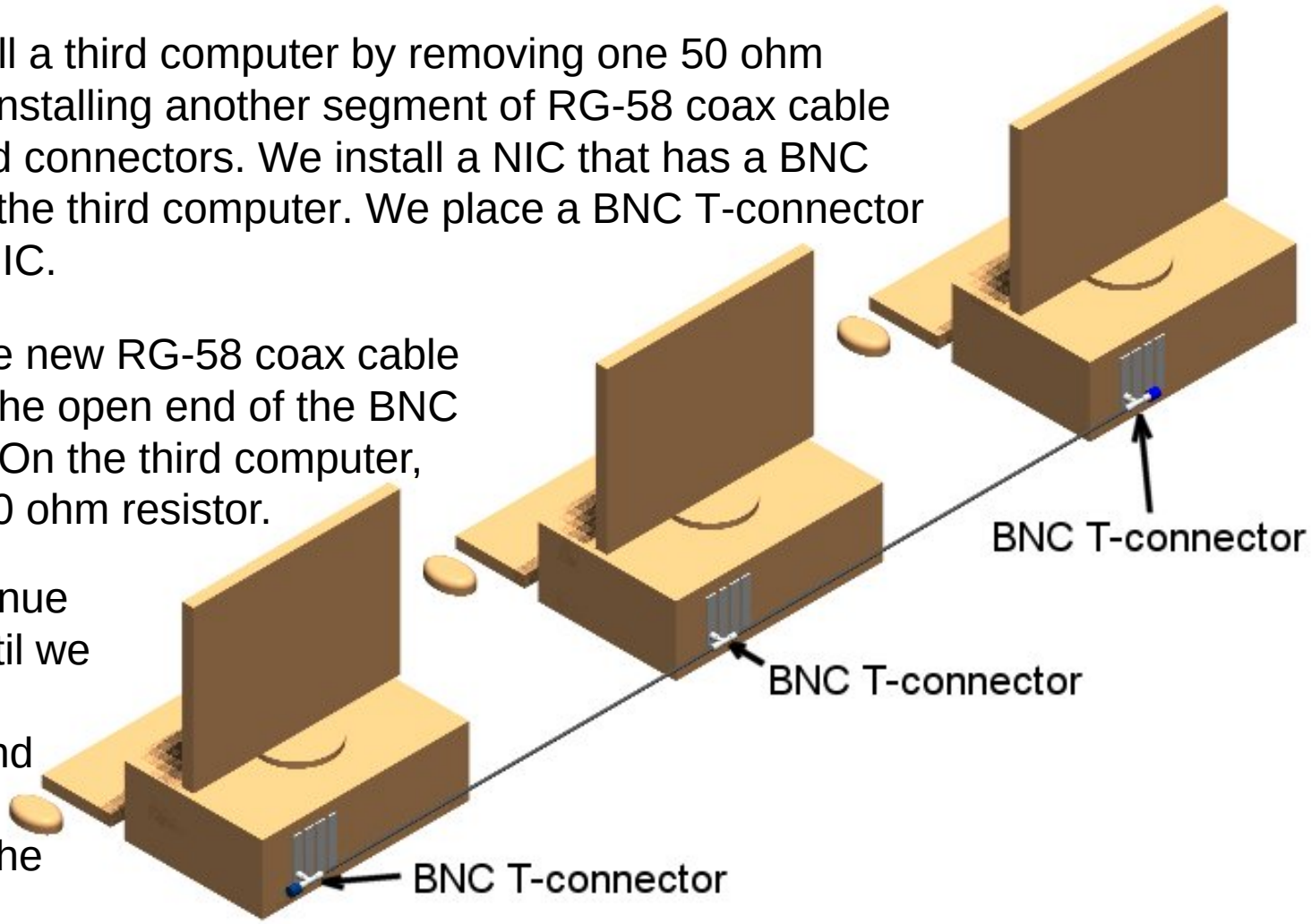


Adding More Computers

We can install a third computer by removing one 50 ohm resistor and installing another segment of RG-58 coax cable with BNC end connectors. We install a NIC that has a BNC connector in the third computer. We place a BNC T-connector on the new NIC.

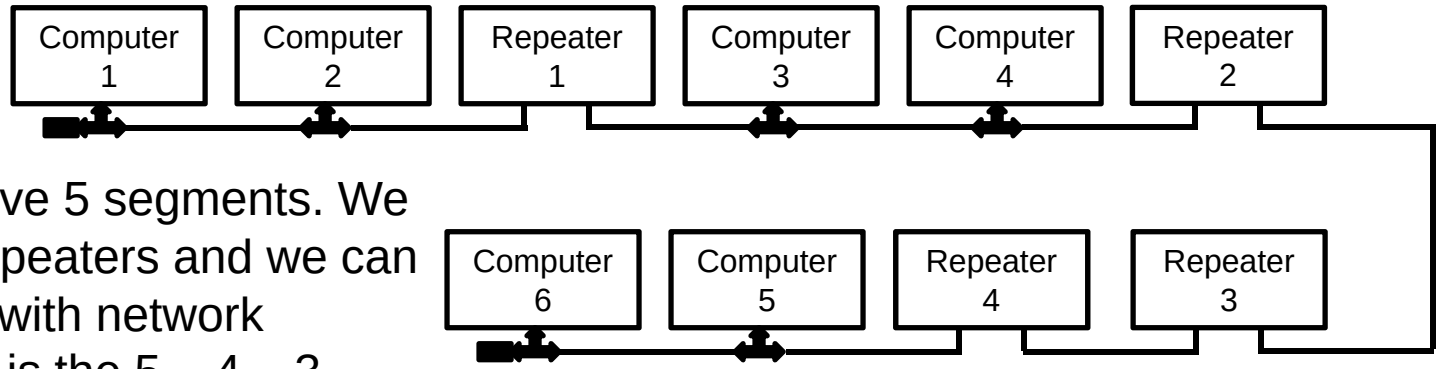
We attach the new RG-58 coax cable segment to the open end of the BNC T-connector. On the third computer, we place a 50 ohm resistor.

We can continue doing this until we have 28 computers and two 50 ohm resistors on the network.



Repeaters Getting More Distance

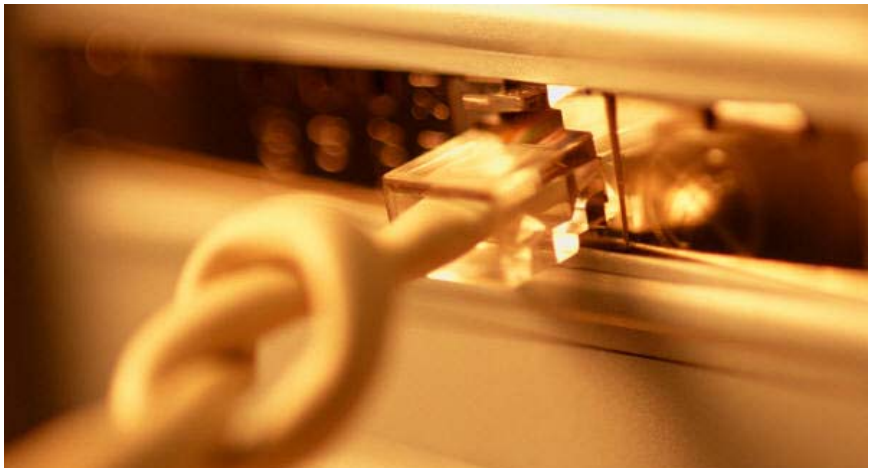
10base2, Thinnet uses a 5 – 4 – 3 rule for the entire network. We can have 5 segments of 185 meters from one end to the other for a total of 925 meters. We can then remove the 50 ohm resistor and insert the BNC end connector of the last cable into repeater 1. We can continue on with another 185 meters adding more computers along the network. We can add a second, a third, and a fourth repeater with 185 meter long coax cables between each repeater, but the two segments between repeaters 2 and 3 and 3 and 4 cannot contain devices. After the fourth repeater, we can add 185 meters of cable with more computers. The last computer will have a 50 ohm resistor as the line terminator.



So we can have 5 segments. We can have 4 repeaters and we can fill 3 sections with network devices. That is the 5 – 4 – 3 rule.

10BaseT Ethernet

The 10BaseT, Ethernet simplified the work of the network technician when the use of 8 conductor cable was introduced. The cable has eight 24 AWG wires. We crimp a RJ45 connector on both ends of the cable and the Network Interface Card now has a RJ-45 receptacle to receive the cable. The network sends and receives data at 10 Megabits per second.



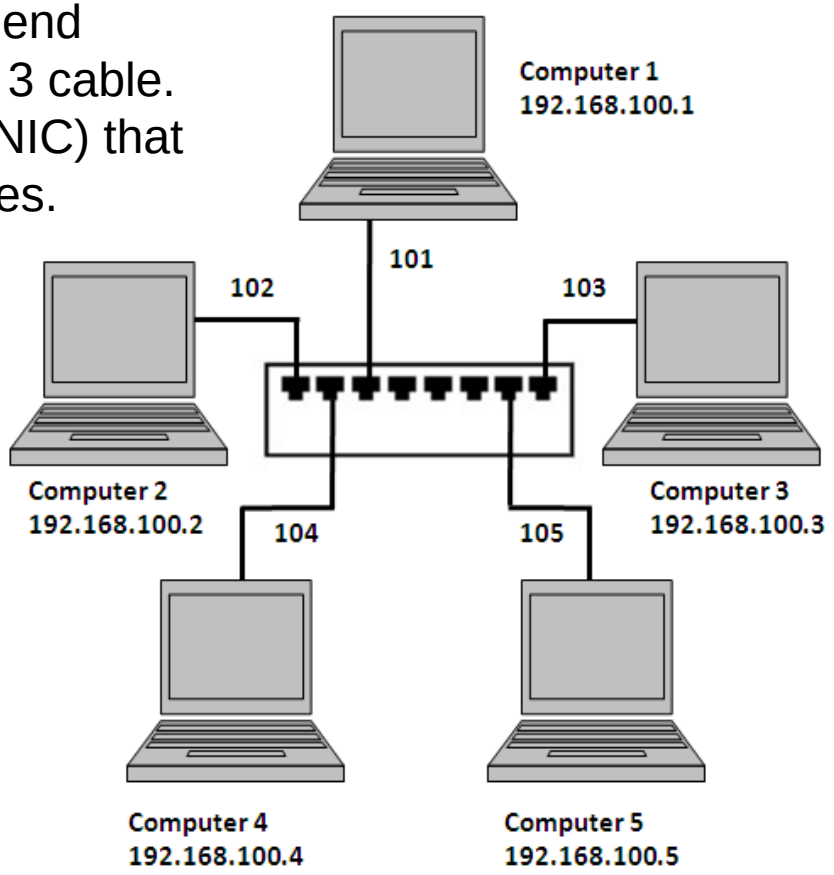
Nomenclature	10baseT
Name	Ethernet
Cable	Category 3
Min segment Length	2.5 meters
Max segment Length	100 meters
Maximum Nodes per Segment	1
Maximum Number of Connected Segments	1024

The 10baseT Network

A network technician can connect two computers with a patch cable by crimping a RJ-45 end connector on each end of the Category 3 cable. Next, we put Network Interface Cards (NIC) that have RJ-45 receptacles in both machines.

In this network, we need a Hub, Switch or Router to connect the two computers. We plug the first end of the patch cable into the computer's NIC and the other end into our hub. The green LED will light on both devices, the NIC and the Hub.

Many Hubs, Switches and Routers come with four to eight ports to plug in more devices.



100BaseT Fast Ethernet

The 100BaseT, Fast Ethernet was an upgrade to the 10baseT Ethernet. The change is that we use Category 5 or 5e cable. The network sends and receives data at 100 Megabits per second.

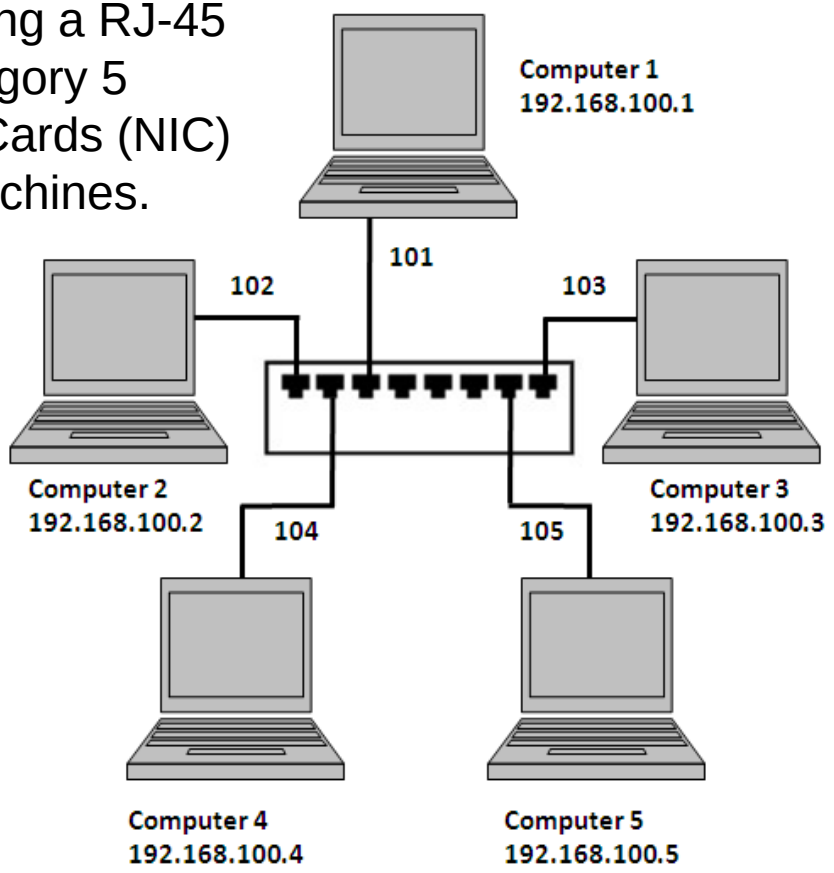
Nomenclature	100baseT
Name	Fast Ethernet
Cable	Category 5 or 5e
Min segment Length	2.5 meters
Max segment Length	100 meters
Maximum Nodes per Segment	1
Maximum Number of Connected Segments	1024

The 100baseT Network

A network technician can connect two or more computers with a patch cable by crimping a RJ-45 end connector on each end of the Category 5 cable. Next, we put Network Interface Cards (NIC) that have RJ-45 receptacles in both machines.

In this network, we still need a Hub, Switch or Router to connect the computers. We plug the first end of the patch cable into the computer's NIC and the other end into our hub. The green LED will light on both devices, the NIC and the Hub.

Many Hubs, Switches and Routers come with four to eight ports to plug in more devices.



1000BaseT Gigabit Ethernet

The 1000BaseT, Gigabit Ethernet was an upgrade to the 100baseT Ethernet. The change is that we use Category 6 cable. The network sends and receives data at 1000 Megabits or 1 Gigabit per second.

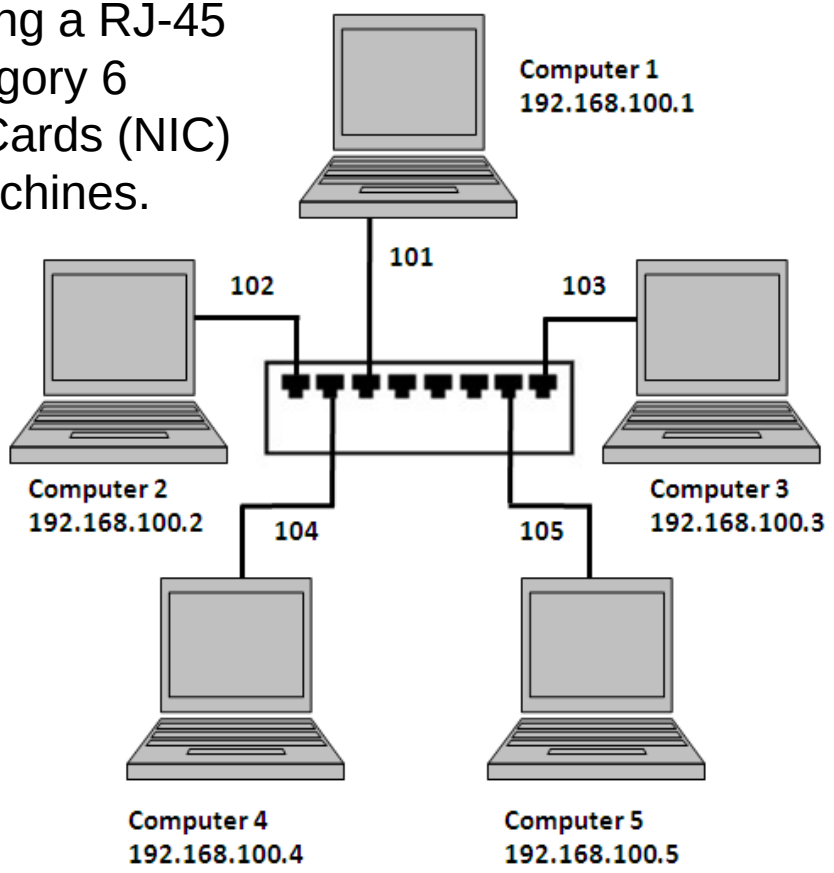
Nomenclature	1000baseT
Name	Gigabit Ethernet
Cable	Category 6
Min segment Length	2.5 meters
Max segment Length	100 meters
Maximum Nodes per Segment	1
Maximum Number of Connected Segments	1024

The 1000baseT Network

A network technician can connect two or more computers with a patch cable by crimping a RJ-45 end connector on each end of the Category 6 cable. Next, we put Network Interface Cards (NIC) that have RJ-45 receptacles in both machines.

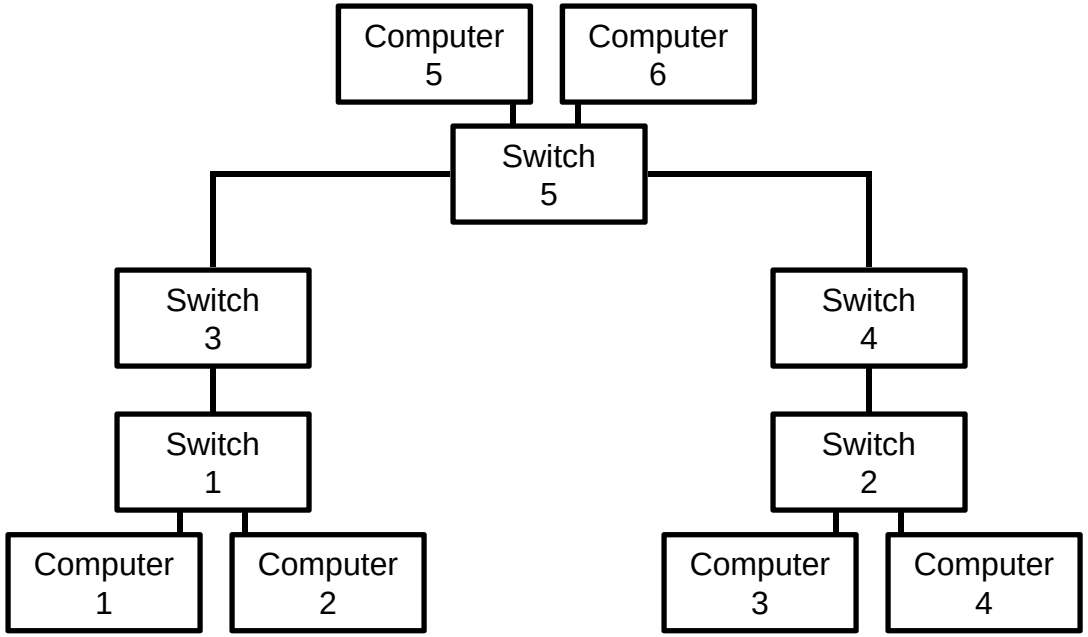
In this network, we still need a Hub, Switch or Router to connect the computers. We plug the first end of the patch cable into the computer's NIC and the other end into our hub. The green LED will light on both devices, the NIC and the Hub.

Many Hubs, Switches and Routers come with four to eight ports to plug in more devices.



5-4-3 Rule with 10/100/1000BaseT

10/100/1000baseT, Ethernet uses the 5 – 4 – 3 rule when we are using Hubs on the network, so we cannot keep adding Hubs between computers and servers without anticipating collisions from devices that are sending data simultaneously. If we are using switches, these devices can send data to the computer on the network even with other computers communicating.



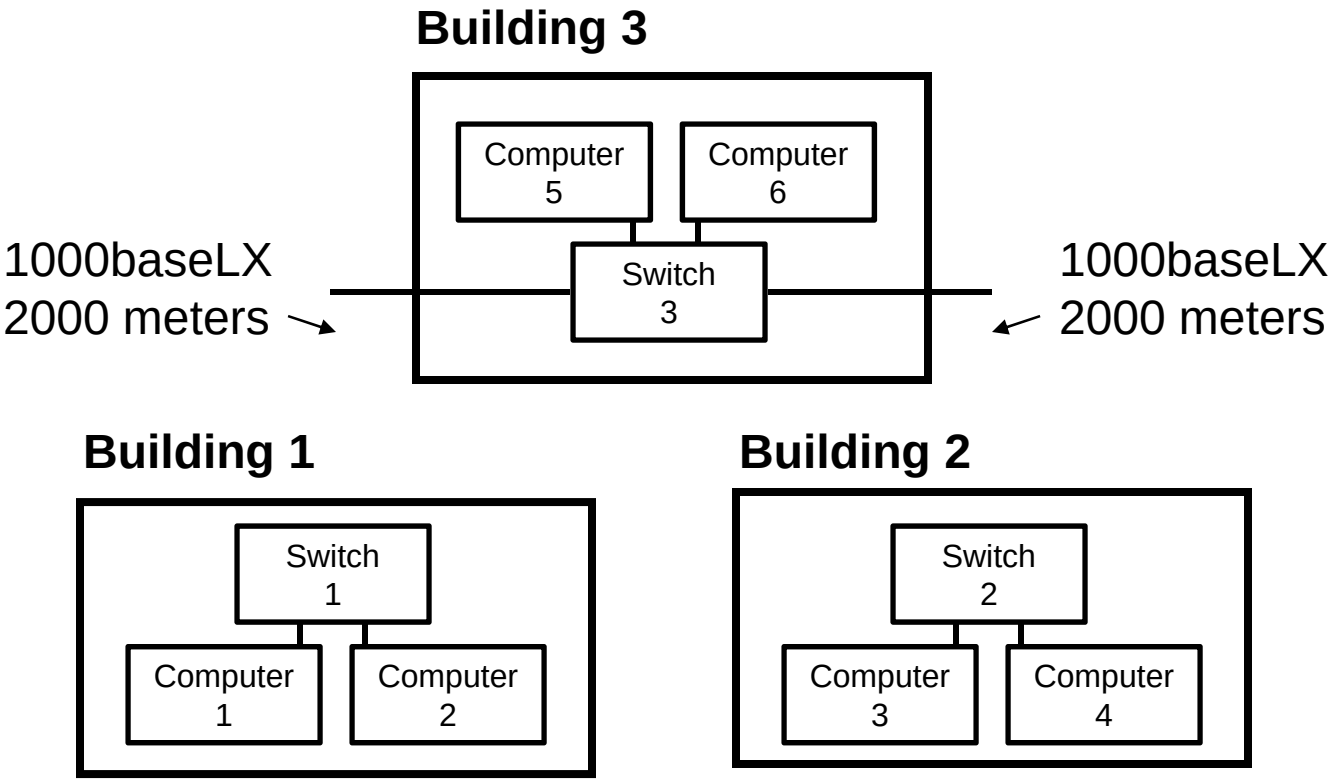
1000BaseLX Gigabit Ethernet

The 1000BaseLX, fiber optic cable network is a great choice for a network backbone where we have long distances to the server room or a building housing one of our LANs. The fiber optic cable can carry a signal 2000 meters between nodes at 1 Gigabit per second speed.

Nomenclature	1000baseLX
Name	Ethernet
Cable	Category 3
Max segment Length	2000 meters
Maximum Nodes per Segment	1
Maximum Number of Connected Segments	1024

Fiber Optic Cable as a Backbone

1000baseLX, fiber optic cable would be selected when we need long runs between switches or computers on a network. The 100 meters maximum distance of the 10/100/1000baseT cable can be a problem in some instances when buildings are far apart, so we can choose the fiber optic cable for the long stretches.



Network Cable Exercise

Fill in the blanks for each network.

Nomenclature	Name	Bandwidth	Max Length	Max nodes per segment
10base2				
10base5				
10baseT				
100baseT				
1000baseT				
1000baseLX				

Network Cable Exercise

Do the following:

1. Draw a 10base2 network.
2. Draw a 10base5 network
3. Draw a 1000baseT network that has 2 LANs connected to a server room.
4. Draw a 1000baseT network that has 2 LANs connected to a server room. The server room is 1500 meters from the two LANs.
5. Make a table indicating facts about 10base2 networks.
6. Make a table indicating facts about 10base5 networks.
7. Make a table indicating facts about 10baseT networks.
8. Make a table indicating facts about 100baseT networks.
9. Make a table indicating facts about 1000baseT networks.
10. Explain the 5-4-3 Rule concerning Segments, Repeaters and Segments containing nodes.