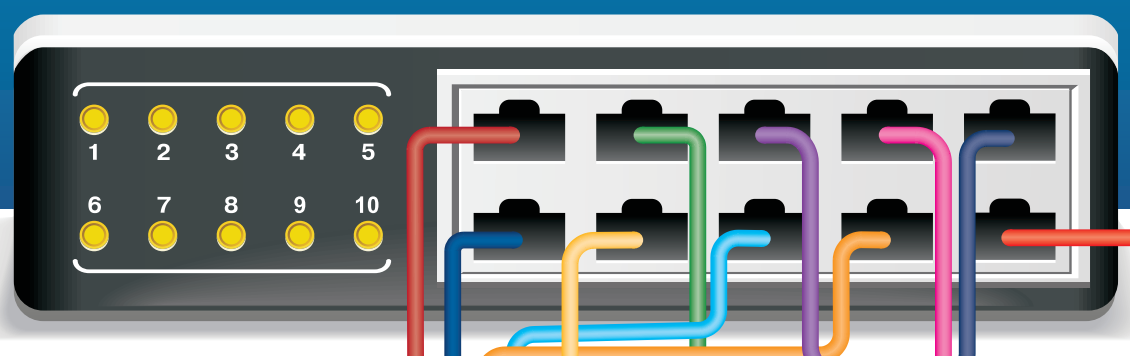
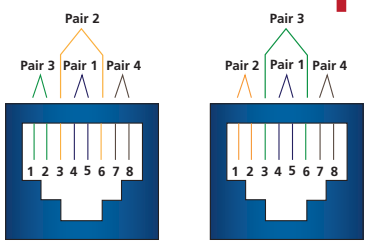
FLUKE networks

Ethernet Connectivity

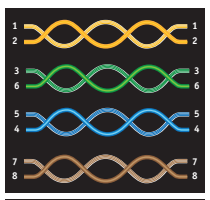
Getting connected on Ethernet is more than turning on a link light – a complex process is required to provide complete connectivity.



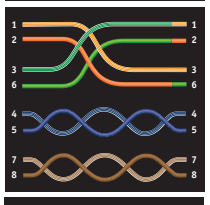
Wire it up



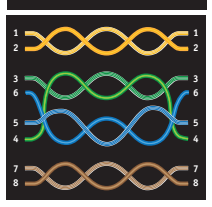
10BASE-T and 100BASE-TX use the 1-2 and 3-6 pairs.
1000BASE-T uses all four pairs.



Good cable



A **crossover cable** can be used to connect two switches together. Most modern devices automatically provide the crossover function.



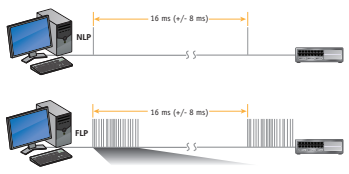
A **split pair** occurs when the cables are paired improperly. For example, pins 3 and 4 are paired together instead of 3 and 6. This can cause errors or a complete failure.

Get up to Speed

Speed [Mbit/s]	Distance [m]	Name	Standard/ Year	Required Cabling
10	100	10BASE-T	802.3 (14)/ 1990	Cat 3 (2 pair)
100	100	100BASE-TX	802.3 (24)/ 1995	Cat 5 (2 pair)
1000	100	1000BASE-T	802.3 (40)/ 1999	Cat 5e (4 pair)
10,000	100	10GBASE-T	802.3an/ 2006	Cat 6a (4 pair)

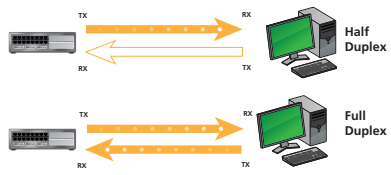
Ethernet can run on twisted pair cabling at rates from 10Mbps to 10Gbps.

Negotiation occurs in this order	
(highest)	1000BASE-T – Full duplex
	1000BASE-T – Half duplex
	1000BASE-T2 – Full duplex
	1000BASE-T2 – Half duplex
	1000BASE-T4
	1000BASE-TX – Half duplex
	10BASE-T – Full duplex
(lowest)	10BASE-T – Half duplex



Link pulse negotiation allows devices to negotiate to a common speed. The Fast Link Pulse (FLP) communicates the speed and duplex capability.

Set your Duplex



Half duplex (HDX) requires one device to wait if the other is transmitting. Full duplex (FDX) allows traffic to flow both ways simultaneously.

Duplex Configuration	Auto-negotiating	Fixed Half Duplex	Fixed Full Duplex
Auto-negotiating	Safe. Selects the best configuration common to both partners	Works because auto defaults to half duplex if the link partner is also not auto-negotiating	Fails because auto defaults to half duplex if the link partner is also not auto-negotiating
Fixed Half Duplex	Works because auto defaults to half duplex if the link partner is also not auto-negotiating	Works, and is safe because auto-negotiation defaults to half duplex	HDX device will be blocked by FDX device traffic
Fixed Full Duplex	Fails because auto defaults to half duplex if the link partner is also not auto-negotiating	HDX device will be blocked by FDX device traffic	Not recommended. Usually OK for servers and uplinks that are never disturbed

Duplex may be set on the device or automatically negotiated. If the settings don't match, the full duplex device will "talk over" the half duplex device resulting in errors or complete link failure.

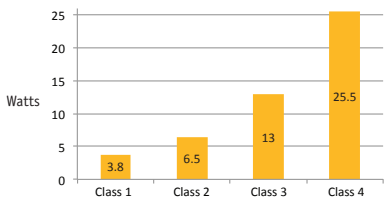
Get the Power

	802.3af (802.3af Type 1)	802.3at Type 2
Year Adopted	2003	2009
Maximum Power	12.95W	25.5W
Voltage Range	37.0 – 57.0V	42.5 – 57.0V
Cabling Required	Category 3 or higher	Category 5 or higher

Power over Ethernet (PoE) is defined in two IEEE standards.

Mode	Cable Pairs Used
A	1-2, 3-6
B	4-5, 7-8

Power may be supplied in one or both of two modes.



802.3at (PoE+) supports four power levels.

Grab an Address

Dynamic Host Configuration Protocol (DHCP) Server provides key IP connectivity information:

- IP address
- Subnet mask
- Gateway address
- Domain Name Service (DNS) server address

Join the right VLAN

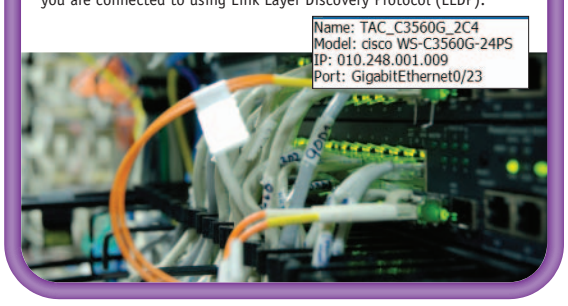
VLAN 180
Voice 182

Virtual LANs (VLANs) allow the network manager to segment traffic on different ports for security and performance. But connecting into the wrong VLAN can prevent access to needed resources.

LLDP packets tell you which VLANs are reachable from this port.

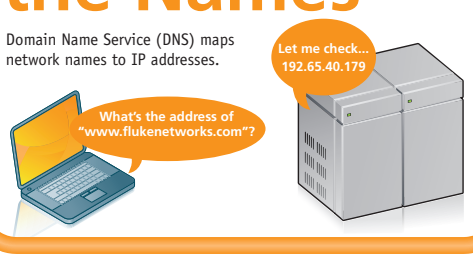
Check your Port

The most common cabling problem is mislabeling – not knowing where the cable really goes. You can determine which switch and port you are connected to using Link Layer Discovery Protocol (LLDP).



Resolve the Names

Domain Name Service (DNS) maps network names to IP addresses.



Ping the Gateway

The ICMP echo request and reply sequence can be used to "ping" the gateway router, verifying connectivity on the local network and beyond.

Handshake with a Server

A TCP syn/ack sequence (aka "three-way handshake" or "port open") tests connectivity by providing a "real" user request and is therefore unlikely to be discarded or blocked by routers or firewalls.