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Industrial Networking Glossary of Terms

Network Terms

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10Base-T - Standard of data transmission over Cat 3, 4 or 5 twisted pair cable at 10Mbps

100Base-TX - Standard of data transmission over Cat5 twisted pair cable at 100Mbps

100Base-FX - Standard for data transmission over fiber optic cable at 100Mbps

1000Base-LX - Standard for data transmission over fiber optic cable at Gigabit speed and a wavelength of 1300 nm

1000Base-SX - Standard for transmission over fiber optic cable at Gigabit speed and a wavelength of 850 nm

-- A --

Access Point - A device that allows wireless devices to connect to a wired network using Wi-Fi

Aging - A mechanism called MAC aging that lets MAC addresses be aged out of an Ethernet switch MAC table (see ARL) after a certain period of inactivity

Aging Time - The length of time that a MAC address entry can remain in the ARL forwarding table. When an entry reaches its aging time, it “ages out” and is purged from the table, effectively cancelling frame forwarding to that specific port. In other words, if the switch doesn’t hear from a device after a specified period of time, the MAC entry in the ARL table is deleted.

AP - Access point

Application Layer - In the seven layer OSI model, the layer which contains all protocols and methods that fall into the realm of process-to-process communications across an Internet Protocol (IP) network

ARL - An internal switch table containing forwarding rules that are based upon MAC addresses

ARP - Address Resolution Protocol: a protocol used to resolve an IP address to a MAC address

Auto Polarity - Determines if the wiring polarity is correct and if not, corrects it automatically

Auto Crossing - The ability of a device to determine and correctly route the transmitted and received signals on twisted pair cable, eliminating the need for a crossover cable

Auto-Negotiation - The ability of a device to determine the data transmission rate and mode (duplex or half-duplex) and set itself accordingly

Automatic - IGMP Snooping - The ability of Ethernet devices to automatically set up IGMP groups, making initial configuration or replacement of devices plug and play

-- B --

Bandwidth - Rate of data transfer, throughput or bit rate measured in bits per seconds (bps)

B-FOC (ST®) - Bayonet Fiber Optic Connector or ST connector

BPDU - Bridge Protocol Data Unit: Data frames used by Spanning Tree protocols containing information about the switches and paths in the redundant topology

Bridge - Legacy Layer 2 device for connecting networks; typically replaced with Ethernet switches

Broadcast - A message that is transmitted to all devices on a network segment except for the device that it originated from

Browser - Software used to view Internet

Bus - Industrial communication system that connects end devices to the control system

-- C --

CIP - Common Industrial Protocol

Client - A device or software program that requests services from a server

CSMA/CD - Carrier Sense Multiple Access/Collision Domain: media access scheme used by Ethernet and 802.3 where devices check for a carrier signals presence or absence in order to transmit; if two devices transmit simultaneously, a collision occurs and each device detects the collision and waits a random amount of time before a retransmission is tried

CRC - Cyclical Redundancy Check: a method of testing data integrity by applying an algorithm to the data in a packet and comparing it to a check digit embedded in the packet

cUL 1604 - Underwriters Laboratories' safety standard for devices used in potentially explosive environments

cUL 508 - Underwriters Laboratories' safety standard for Industrial equipment

Cut Through - A method of packet transmission in which the switch begins forwarding the frame as soon as it has read the destination address. A cut through switch will forward the data before it has completed receiving the frame. These switches function at wire speed, forwarding traffic as fast as received. Nearly all cut-through switches have no RAM buffers for storing frames. (see Store & Forward)

-- D --

Dark Fiber - Unused fiber optic cable

Determinism - Ability to predict the time that elapses between the moment a packet is sent and the moment it is received at the intended destination

DHCP - Dynamic Host Configuration Protocol: a method for automatically assigning IP addresses; addresses are randomly assigned from a pool and leased to devices for a specific time (leases are renewable); there is no mechanism within basic Server-Client DHCP to assure that a device on a particular port will be assigned a specific IP address

DHCP Option 61 - A version of DHCP that assigns an IP address to a device based on the MAC address, string name or HEX value of a switch

DHCP Option 82 - A version of DHCP that assigns an IP address to a device by using a Relay Agent; this method assures that if a device is replaced, the new device gets the same IP address

-- E --

ESD - Electro Static Discharge

Ethernet - Networking standard developed by Bob Metcalf at Xerox and standardized by the IEEE in the IEEE 802.3 standard

Ethernet/IP - Ethernet standard designed for industrial applications

Ethernet Packet - Unit of data for Ethernet transmission, containing address, tag, checksum and payload data

Explicit Messaging - Point-to-point communication used to exchange parameters, status and diagnostics data

-- F --

Fast Ethernet - IEEE 802.3 standard for transmission of data over Cat5e cable at speeds of 100Mbps

FCC - Federal Communications Commission

Flow Control - Procedure for a device to indicate that its port is being overloaded and stop the end device from transmitting data

Frame - A layer 2 datagram; a frame has a source and destination MAC address

FTP - File Transfer Protocol

Full Duplex - The ability to send and receive data independently and simultaneously

-- G --

GBIC - Gigabit Interface converter (see SFP)

Gbps - Gigabits per second

GL - Germanischer Lloyd: technical supervisory society in Germany which grants regulatory approvals for maritime industry

-- H --

Half Duplex - The ability to transmit and receive data, but not simultaneously

Header - Information in an Ethernet Packet that contains information regarding the packet size, sender and receiver address and transmission type

HMI - Human Machine Interface; also an industrial computer

HTML - HyperText Markup Language: standard web page description language

HTTP - HyperText Transfer Protocol : protocol by which data is exchanged between a web server and web client

HTTPS - HyperText Transfer Protocol Secure: protocol by which data is exchanged between a web server and web client and where each packet is encrypted

Hub - A device for connecting Ethernet devices that forwards data out of all ports in half duplex mode

-- I --

IEC - International Electrotechnical Commission

IEEE - Institute of Electrical and Electronics Engineers, US based association for developing standards for IT

IGMP - Internet Group Management Protocol: Layer 3 protocol for managing multicast traffic

IGMP Snooping - A Layer 2 function in which switches examine packets to determine which group the packet should be forwarded to

IP - Internet Protocol

ISO - International Standards Organization

ISO/OSI Reference Model - Model describing network communications; divided into seven layers of device functionality

-- L --

LAN - Local area network

Latency - The amount of time between the arrival of a data packet at a device and the forwarding of that same data to its destination

Layer 2 - The Data Link Layer in the OSI model; function is physical addressing

Layer 3 - The Network Layer in the OSI model; function is path determination and logical addressing

Link Aggregation - Method of connecting physical ports to form a virtual logical port providing redundancy and increasing throughput

Link Status - The condition of a connection: up (operating) or down (not operating)

LLDP - Link Layer Discovery Protocol: network devices use to advertise identity, capabilities and neighbors on an Ethernet network

-- M --

MAC - Media Access Control

MAC Address - A unique identifier of a network device that is hard coded and fixed; in the form of a six byte hex number where 3 bytes contain a manufacturer ID and 3 bytes contain a unique device identifier

MAC Address Table - In an Ethernet switch, it is a software table that associates the MAC addresses (serial numbers) of connected devices with the port to which they are connected

Mpbs - Megabits Per Second

MDI-X -Medium Dependent Interface Crossover: an Ethernet port connection that allows devices to connect to each other using a null-modem or crossover cable

MIB - Management Information Base: a database of objects and functions supported by a device; required for SNMP

Modbus - Modbus is a serial communications protocol published by Modicon in 1979 for use with programmable logic controllers (PLCs)

Modbus Monitoring - Ring and managed switches monitored via Modbus registers

MSTP - Multiple Spanning Tree Protocol: defines an extension to RSTP that allows the configuration of a separate Spanning Tree for each VLAN group

MTBF - Mean Time Between Failure

Multicast - A data packet transmitted to multiple devices (as opposed to a Unicast which is transmitted to one device or Broadcast which is transmitted to all devices)

Multicast Address - A logical identifier for a group of devices on a network

Multimode - A type of optical fiber used for communication over short distances that are usually 2km or less

-- N --

N-Link - Function which allows linking two N-Rings (see N-Ring)

N-Ring - Proprietary N-Tron network protocol that supports a ring topology with ~30ms heal time

N-View - OPC software that works with specially optioned N-Tron switches to monitor network health, including unmanaged switches

NIC - Network Interface Card

-- O --

ODVA - Open Devicenet Vendors Association: promotes the use of Ethernet/IP, Devicenet and CIP for industrial applications

OLE - Object Linking and Embedding

OPC - OLE for Process Control

OSI - Open Systems Interconnection: open structure for networking devices which promotes interoperability between multiple vendors

OSM - Optical Systems Module

OSI Model - A model for describing communications in a network in which hardware is divided into seven layers

-- P --

PD - Powered Device: A device which receives electrical power via PoE from a Power Sourcing Device (PSD)

PLC - Programmable Logic Controller: a device used to control and monitor devices, processes and tasks in an industrial environment

PoE - Power Over Ethernet: a standard defined by IEEE 802.3af and IEEE 802.3at that details the transmission of power as well as data over twisted pair cable

Polymer fiber - Plastic fiber optic cable

Port - Physical interface for a cable on an Ethernet device

Port Mirroring - Function which copies (mirrors) the data from one port to another; typically used for troubleshooting or diagnostic purposes

Port Security - Functionality for preventing unauthorized access to the network; Port Security can limit the MAC addresses that can be learned on a given port

Prioritization - Assignment of more importance to packets based on predefined criteria and sending them before those of lesser importance

PSD - Power Sourcing Device: device which provides power via PoE to Powered Device (PS)

PVID - Port VLAN Identifier (see VLAN)

-- Q --

QoS - 802.1p based Quality of Service (QoS) provides traffic priority. The “threshold” is configurable from 0 to 7. When an incoming 802.1p priority tag value is greater than or equal to this number, the incoming packet will be classified as high priority. The default QoS threshold is 4.

-- R --

Redundancy - Ability of a network to recover from a failure or to find an alternate path for data transmission

RJ45 - Connector commonly used on twisted pair cable for Ethernet

RS-232 - A serial interface standard for point to point data transmission

RS-485 - A serial interface standard for connection of up to 32 devices

RTR - Real-Time Ring: Proprietary Sixnet protocol that supports a ring topology; Red Lion Sixnet ring switches have this feature by default, which enables plug-and-play redundancy without configuration

RSTP - Rapid Spanning Tree Protocol: redundancy mechanism defined in IEEE 802.1W

Rx - Receive: usually seen on a fiber port to differentiate between the transmit and receive connectors

-- S --

SCADA - Supervisory Control And Data Acquisition: as the name suggests, is not a full control system, but rather focuses on the supervisory level. It is purely a software package that is positioned on top of hardware to which it is interfaced, in general via PLCs or other commercial hardware modules. SCADA systems are used in industrial processes such as steel making, power generation and distribution. The size of SCADA installations range from a few thousands to tens of thousands of input/output (I/O) channels.

SFP - Small Form Pluggable: an interface that accepts a plug-in module, offering the ability to make the port copper, multimode fiber or single-mode fiber

Single Mode - In a single mode fiber, the core is so small that only one path length of travel for photons is available for optical transmission. Like multimode fiber except the fiber is the same diameter as the photon allowing only one possible mode of travel.

SNMP - Simple Network Management Protocol: commonly used to configure or monitor the status of devices connected to a LAN; usually performed by a web browser

Spanning Tree - A redundancy protocol using a blocking technique that allows the building of redundant paths; not a good choice for automation environments due to a 30-90 second healing time

SC - Straight Connector: type of connector typically used for 100Base fiber connections

ST - Twist Connector: type of connector where the TX and RX are separate and usually have a twist lock mechanism

Star Topology - A network layout in the form of a star, with a switch in the middle and a direct run to connected devices; good for determinism, not good for redundancy

Store and Forward - Method in which an Ethernet switch will wait to forward a frame until entire frame is received. Most often used in environments supporting reliable physical or datalink protocols. Frame is often checked for errors before forwarding. This type of switch is inherently slower in environments where upper layer protocols already provide reliable services. The key to identifying a store-and-forward unit is determining if switch has buffers (see Cut-Through)

STP - Spanning Tree Protocol: used to provide multiple paths redundant for data in the event a link is broken (see RSTP)

STP - Shielded twisted pair

Subnet Mask - Specifies which part of the IP address is used as the subnet address

Switch - A Layer 2 device which serves to connect devices on the network; forwards packets based on addresses unlike a hub which forwards data to all ports

-- T --

TAG - A field in an Ethernet Packet used to define priority or VLAN assignment

TCP/IP - Transmission Control Protocol/Internet Protocol: a method for insuring that data is transmitted properly

TCP/IP Stack - Software that defines the functions and drivers for communication via TCP/IP

Telnet - Terminal over Network: the protocol used to connect to other devices on the network

TFTP - Trivial File Transfer Protocol: a basic protocol for transferring files, often used to transmit configuration files to a device

Transceiver - Device with both a transmitter and a receiver that are combined and share a common circuitry or a single housing

Trap - SNMP event or alarm message that can be prioritized and sent to a specific address

Trunking - Enables multiple physical ports to be linked together and function as one uplink to a similar switch; increases bandwidth while creating a redundant connection between two switches

Twisted Pair - Copper cable in which the transmit/receive pairs are twisted to reduce crosstalk; Cat5e uses 4 pairs; can be shielded or unshielded

TX - Transmit: usually seen on a fiber port to differentiate between the transmit and receive connectors

-- U --

Unicast - A term used to describe communication where a piece of information is sent from one point to another point; in this case there is just one sender and one receiver; the Address Resolution Logic (ARL) table in the switch will forward this type of traffic to the destination port only and not flood traffic to all ports as a hub would

UPS - Uninterruptable Power Supply: allows devices to function if a main power supply is lost

URL - Universal Resource Locator: standardized scheme for accessing documents and services using browser software

UTP - Unshielded Twisted Pair: refer to definition of Twisted Pair

-- V --

VLAN - Virtual local area network allows users to logically subdivide a single switch to act as individual smaller switches

-- W --

WAN - Wide area network

WEP - Wired equivalent privacy: an encryption method for wireless communication, generally regarded as having be rendered ineffective

Wi-Fi - Wireless fidelity: a technology which certifies interoperability of wireless devices according to IEEE 802.11

Wireshark - A free and open source packet analyzer which can be used for network troubleshooting

Wire Speed - Refers to the ability to process packets at the highest speed the medium will allow

WLAN - Wireless LAN

WPA - Wi-Fi protected access: wireless security technology that utilizes dynamic key exchange