

Introduction of CCTV System

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What shall you learn?

Analogue CCTV System

- Architecture
- Component used
- Accessories

IP Based CCTV System

- Architecture
- Component used
- Accessories



What is CCTV?

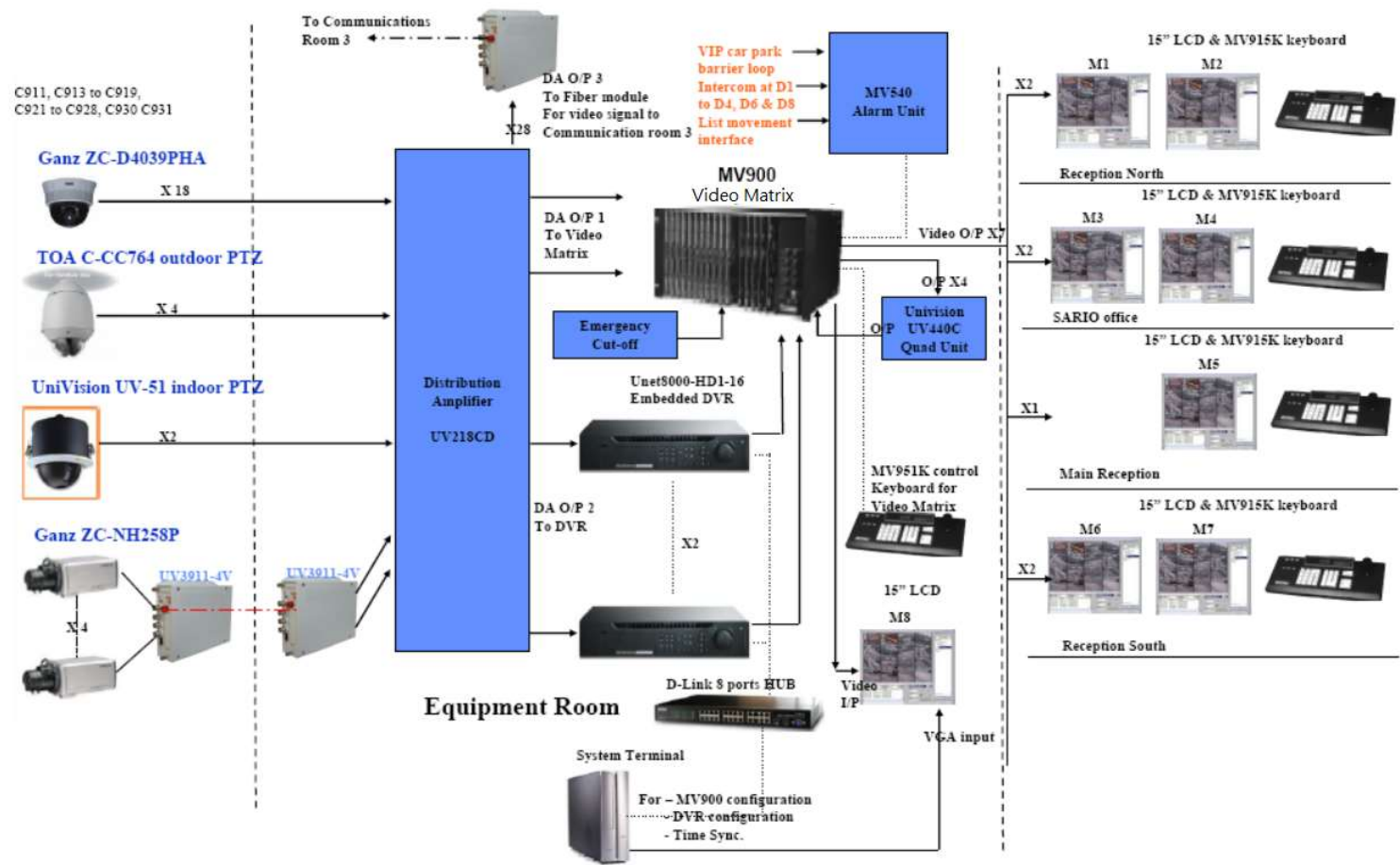
Closed-Circuit TeleVision, also known as Video Surveillance

Why CCTV is need?

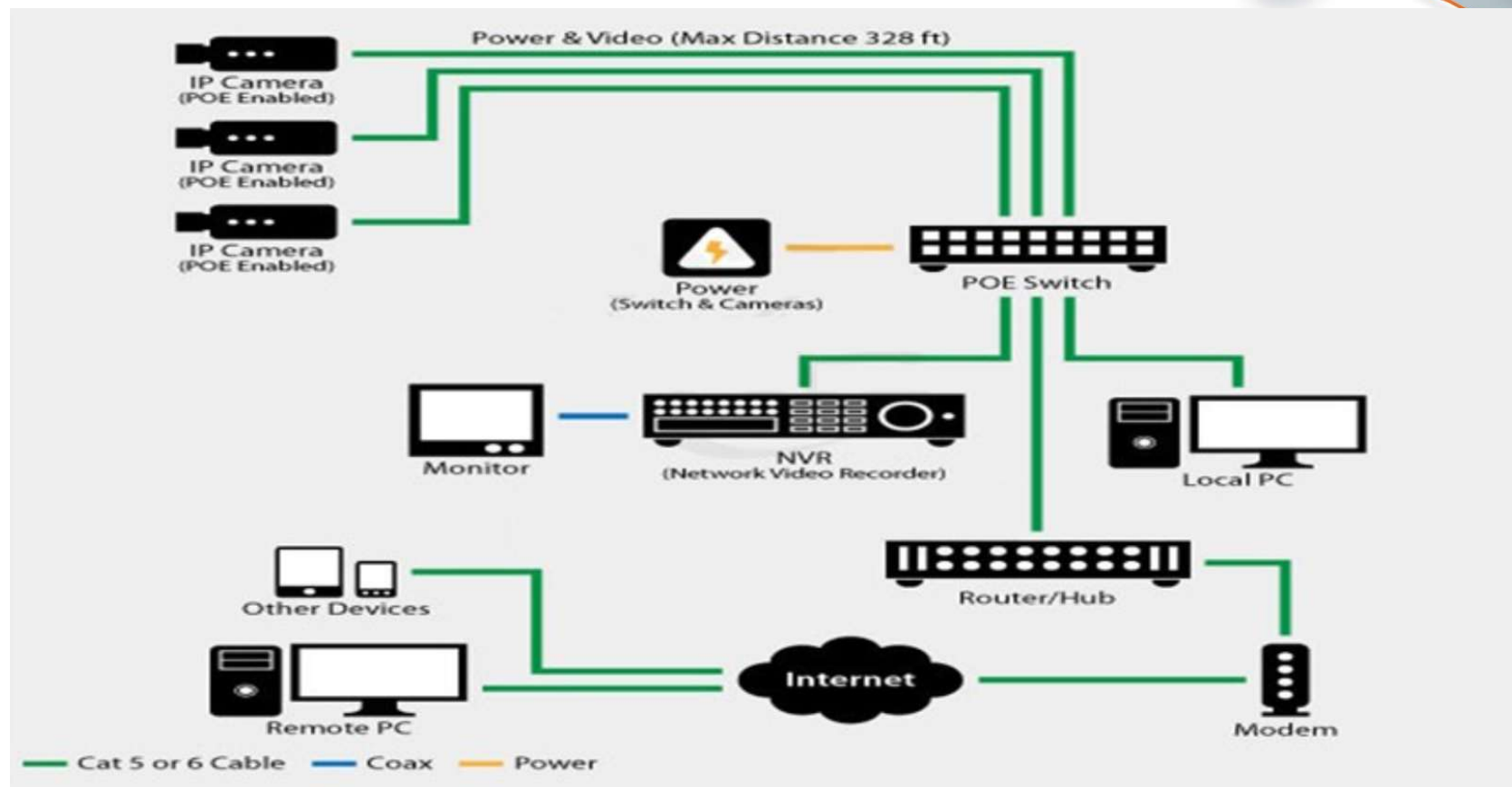
- Security Application (e.g. Anti-thelf or violence)
- Safety Applications (e.g. Monitor hazardous environments or potential accident areas)
- Management Tools (e.g. Monitor plants' activities or video evidence for prosecution of criminals)

Analog CCTV Architecture

System Diagram – VIP CCTV System



IP Based CCTV Architecture



Type of Camera



Fixed Camera

- Mounting in a stationary position
- Single Field of View (FOV) only
- Wide range of mounting locations



PTZ Camera

- Pan and tilt capabilities
- Changing FOV by focal length of lens
- Flexibility of view and image capture



Dome Camera

- Deterrence by dark plexiglass
- Economy
- Aesthetics

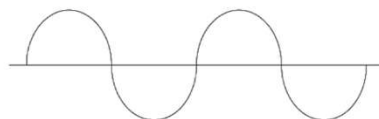
Type of Connectivity

Analogue Camera

- Transmit video signals in analogue form
- Coaxial cable
- Direct connect to Digital Video Recorder (DVR)
- Max. resolution: D1 (720 x 576, PAL)



Analog



Digital



Network Camera

- Connect to IP-based networks
- Provide remote viewing and recording
- High Definition (HD) to 4K resolution



Lenses

Fixed Focal Length Lenses

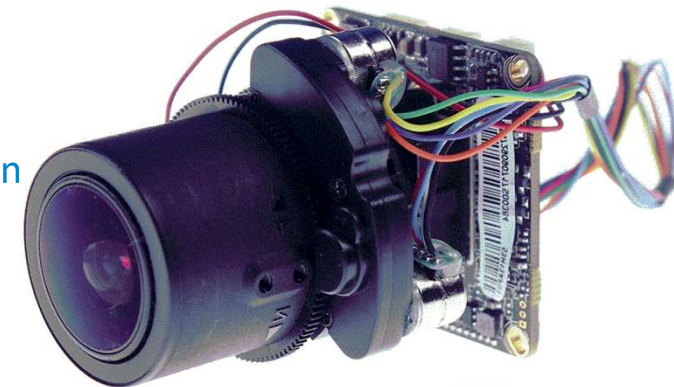
- Built with one set, unchangeable, focal length
- Only use if camera remains in a fixed position
- Observe an area do not change

Varifocal Lenses

- Focal length can be changed within a specific range
- Once focal length is changed, the iris and focus need adjustment also
- Inexpensive compared with zoom lenses
- Once focal length and iris are set, FOV was maintained

Zoom Lenses

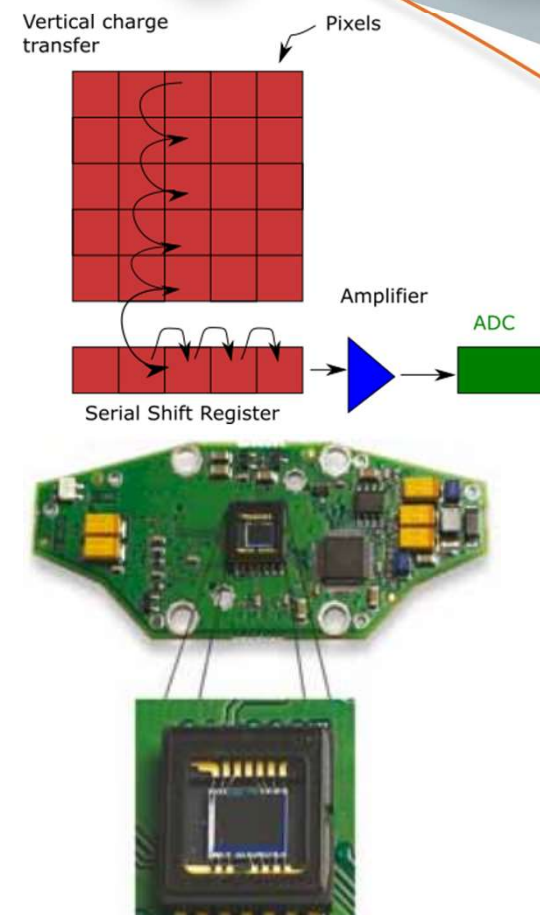
- Maintain the focus setting throughout the focal length range
- Built with integral motors to enable changing focal length from a remote location
- Monitor different parts of a scene / pan and tilt to monitor different locations



Type of Image Sensors

Charge-coupled Device (CCD)

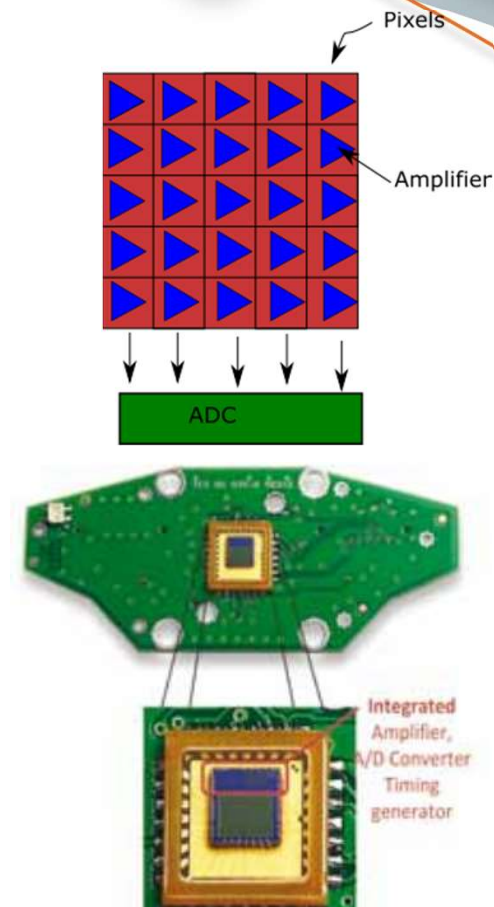
- Photons striking the surface of photodiode create free electrons
- Each pixel generates an electrical signal proportional to the quantity of light it receives
- The electrical signal is transferred to another chip where it is converted to digital information



Type of Image Sensors

Complementary Metal Oxide Semiconductor (CMOS)

- Each pixel is addressed individually
- CMOS process the charge from each pixel on the sensor and transmit a digital bit of information
- Reduces additional processing along the transmission pathway
- CMOS sensors use less power than CCDs



CCD vs CMOS

	CCD	CMOS
Resolution	Up to 100+ Megapixels	Up to 100+ Megapixels
Frame rate	Best for lower frame rates	Best for higher frame rates
Noise figure	Lower noise floor → Higher image quality	Higher noise floor → Lower image quality
Sensitivity	High sensitive	Low sensitive
Color depth	Higher (16+ bits is typical for expensive CCDs)	Lower, although becoming comparable to CCDs (12-16 bits is typical)
Cost	Expensive	Cheaper

Housing



Sealed Housing



Impact-resistant Housing



Tamper-resistant Housing

Housing Features

- **Sun Shields:** To protect camera housings from direct sunlight and reducing the heat load on the camera.
- **Wipers:** To keep the optical window of the housing clean.
- **Heaters and Ventilators:** To prevent fogging, moisture and icing problem.

Ingress Protection (IP) Rating

IP rating specify the extent of protection an electrical enclosure has against environmental conditions

IP 		BRIGADE [®]	
SOLIDS		LIQUIDS	
1	Protection from objects greater than 50mm in diameter e.g. a hand 	1	Protection from condensation 
2	Protection from objects greater than 12mm in diameter but no greater than 80mm e.g. fingers 	2	Protection against water droplets 
3	Protection from entry by objects with a diameter of 2.5 mm or more e.g. tools 	3	Protected against spraying water 
4	Protection against foreign bodies larger than 1mm e.g. fine tools 	4	Protected against water spray and splashes 
5	Limited ingress of dust 	5	Protection against low pressure water jets 
6	Completely dust tight 	6	Protection against high pressure water jets 
Product Example A Brigade Backsense [®] Radar is rated at IP69, and therefore is completely dust tight as represented by the '6'. It is also protected against close range, powerful and high temperature water jets as represented by the '9'.		7	Protection against temporary immersion in water 
		8	Protection against immersion in water over long periods 
		9	Protection against close range, powerful and high temperature water jets 

IK (Impact Protection) rating

The IK rating is an international standard that identifies the degree of protection provided by enclosures for electrical equipment against external mechanical impacts.

IK number	Energy		Equivalent impact
00	Non-protected		No protection
01	Protected against 0.14 joules impact		Equivalent to impact of 0.25 kg mass dropped from 56 mm above impacted surface
02	Protected against 0.2 joules impact		Equivalent to impact of 0.25 kg mass dropped from 80 mm above impacted surface
03	Protected against 0.35 joules impact		Equivalent to impact of 0.25 kg mass dropped from 140 mm above impacted surface
04	Protected against 0.5 joules impact		Equivalent to impact of 0.25 kg mass dropped from 200 mm above impacted surface
05	Protected against 0.7 joules impact		Equivalent to impact of 0.25 kg mass dropped from 280 mm above impacted surface
06	Protected against 1 joules impact		Equivalent to impact of 0.25 kg mass dropped from 400 mm above impacted surface
07	Protected against 2 joules impact		Equivalent to impact of 0.5 kg mass dropped from 400 mm above impacted surface
08	Protected against 5 joules impact		Equivalent to impact of 1.7 kg mass dropped from 300 mm above impacted surface
09	Protected against 10 joules impact		Equivalent to impact of 5 kg mass dropped from 200 mm above impacted surface
10	Protected against 20 joules impact		Equivalent to impact of 5 kg mass dropped from 400 mm above impacted surface

Type of Mounting



Wall Mount



Pendant Mount



Corner Mount



Ceiling Mount



Pole Mount

Camera Features

- **Auto Scan** is the term used to describe a constant cycle of sweeping through the surveillance area.
- **Preset** is a programmed orientation and lens setting, which a PTZ camera moves to either periodically or when a certain type of event occurs.
- **Privacy Masking** can selectively block portions of the video image for the purpose of protecting privacy.
- **Slip Ring** is an electrical connection that allows a PTZ camera to turn without twisting the signal/control cable. It can also transmit power and signal from camera to system.
- **Motion Detection** can be programmed to trigger an alarm if motion occurs within the FOV.
- **Backlight Compensation (BLC)** can compensate for the high contrast of images with a bright background and enhance the image detail.
- **Digital Noise Reduction (DNR)** capture images in low-light or dark environments and it removes the noise from the video image.

Video Monitors

- The function of monitors is to display video images for viewing.
- The video monitor market offers a number of choices, such as Liquid Crystal (LCD) and Light Emitting Diode (LED) displays, various sizes, and other features.
- The requirements of the system will determine the type of monitor for each application.



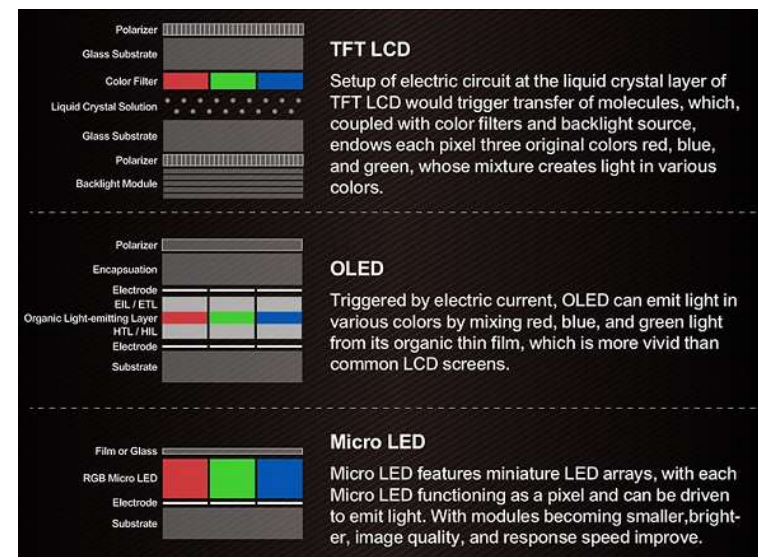
機電工程署  EMSD

Type of Monitor

Type	Pros	Cons*
CRT	<ul style="list-style-type: none"> Good overall picture quality Robust technology Low-cost option that is compatible with most existing CCTV equipment 	<ul style="list-style-type: none"> High power consumption High heat generation High space requirements Manufacturers have largely discontinued Burn-in tendency (when consistent image is permanently etched onto screen)
LCD	<ul style="list-style-type: none"> Compact and relatively light Low power consumption and electromagnetic radiation Wide range of screen sizes available No flicker Less burn-in. Long life expectancy (up to 50,000 hours) 	<ul style="list-style-type: none"> Limitations reproducing true black colors Restricted viewing angle Low image contrast Time lag of pixels can lead to "smearing" effect
OLED	<ul style="list-style-type: none"> Thinner, lightweight, low-power consumption, and better dynamic contrast ratio Brighter display and wide color range 	<ul style="list-style-type: none"> More expensive than other monitor technologies Shorter lifespan



Cathode Ray Tube (CRT)

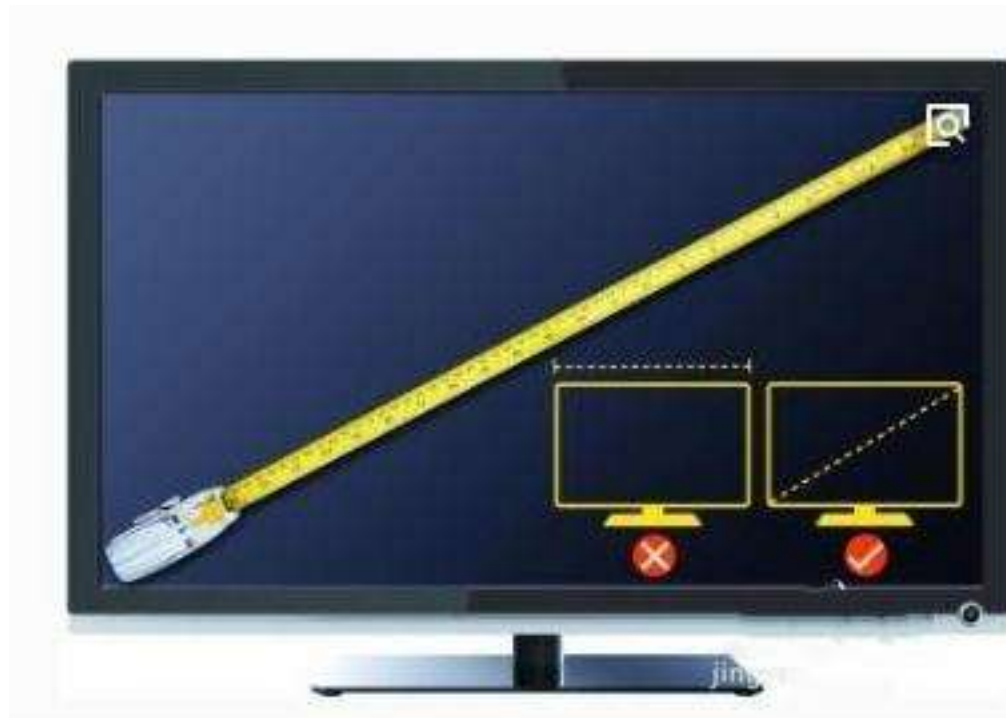


Colour Encoding System (PAL vs. NTSC)

- NTSC and PAL are color encoding systems that affect the visual quality of content viewed on analog televisions
- NTSC delivers a frame rate of 30 frames per second (fps) at an aspect ratio of 720x480
- PAL uses a frame rate of 25 fps and a 720x576 aspect ratio
- PAL offers automated color correction compared to NTSC's manual color correction
- NTSC is popular in places like U.S. and Japan
- PAL is common in UK, Australia and Sweden

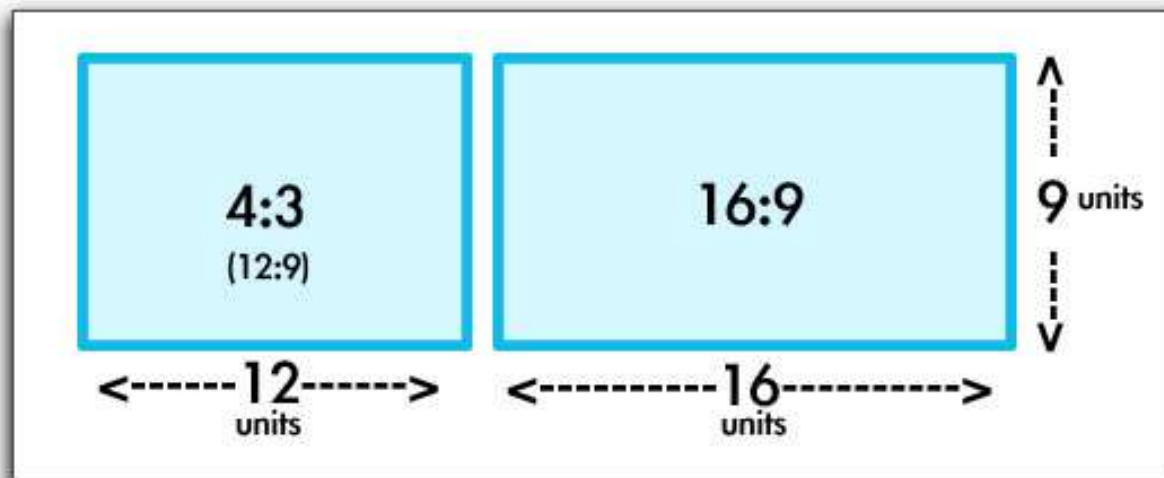
Size

- Size is an important consideration when selecting a monitor and is always expressed as a diagonal measurement.



Aspect Ratio

- A 4:3 aspect ratio is usually applied into the analogue signal
- A 16:9 aspect ratio (width of 16 units and height of 9) has become a standard high definition television (HDTV) format for displaying wide screen images on televisions and computer monitors.
- CCTV systems using digital or IP network components exclusively may benefit from 16:9 monitors



Most Popular CCTV Resolutions

4K - Ultra HD

3840 x 2160

1080P - HD

1920 x 1080

720P - HD

1280 x 720



Scan (Interlaced & Progressive)

Interlaced (i) Scan

- Each video frame is displayed in two fields (i.e. odd lines are shown first then even lines) to create a single picture frame.
- Video consists of an image being created and displayed 24, 30, or 60 times a second.

Progressive (p) Scan

- Non-interlaced, scanning all the horizontal lines in one pass to create a single picture frame.
- Video consists of an image being created and displayed 24, 30, or 60 times a second.

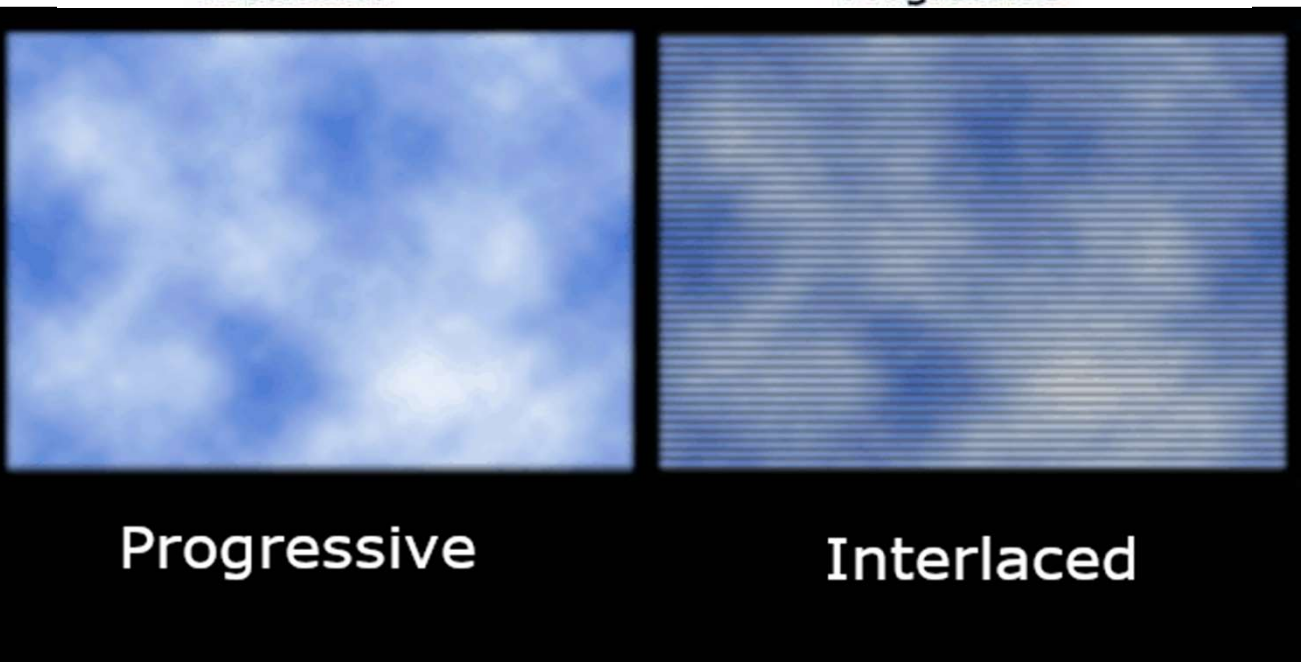


Interlaced

VS



Progressive



Progressive

Interlaced

Video Wall

- It is controlled by a video wall processor, a type of video switcher, which accepts multiple inputs and processes those inputs for display on multiple monitors simultaneously.



Video Recorders

- Video recording is essential for assessment, investigation, and evidence collection.
- Video recording has transformed from tape-based systems (VCR) to digital hard drive systems.



Video Cassette Recorder (VCR)

Digital Video Recorder (DVR)

- Receiving analog video takes two fields of the analog signal and builds one image, which is then digitized and compressed
- Receiving semi-digital video compresses it to save storage space
- Various data compression methods can be used



Network Video Recorder (NVR)

- Recording digital video data transmitted over an IP network from multiple CCTV digital cameras.
- Recording video in digital format to disk drive, portable storage device or mass storage device.
- Digitized video is encoded and processed at the camera and streamed to NVR for storage or remote viewing.
- DVR is wired system but NVR can be wired or wireless system



DVR

NVR

DVR vs NVR

Comparison Chart

1x coaxial cable with BNC connector & 1x power cable per camera



VS



1x Ethernet or POE Cable for power, video & audio with RJ45 connector per camera

Coaxial cable: fatter, use BNC connectors (larger, harder to thread, take longer to install)



VS



Ethernet cable is slimmer, smaller RJ45 connectors, easier to run and install

Each camera needs power source (via splitter): messier, uses more power



VS



Power over Ethernet (PoE): power from NVR. No need for power splitters or wall sockets for

Analogue cameras. DVR processes images.



VS



Digital cameras process the images, hence higher price

DVR	NVR
DVR refers to Digital Video Recorder.	NVR is short for Network Video Recorder.
DVRs are mainly used for recording semi-digital or analog cameras or coaxial-based cameras.	NVRs are a recording device that record data mainly from IP cameras wirelessly over a network.
It can be paired with semi-digital or analog coax-based cameras with resolution 2MP at its best.	It is paired with IP cameras with resolution ranging from 2MP to 12MP or higher.
Installation can be difficult because the wires should always be connected to the DVR.	It connects to the cameras wirelessly so setup is quick and easy.
Recording quality is lower than NVRs.	Recording quality is better than DVRs.
It connects to the cameras via coaxial, fiber optic, or unshielded twisted pair cabling.	A single wire connects to the NVR via PoE (Power over Ethernet) which eliminates the need for excessive cables and wiring.
Lower operating cost than NVRs.	Operating cost is higher than DVRs.

DB Difference Between.net

Video Compression

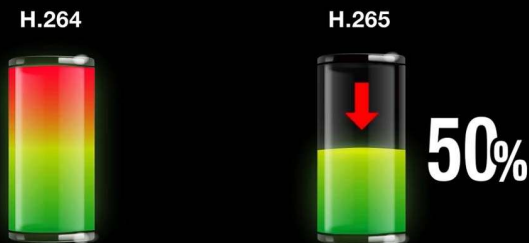
The compression aggressiveness affects how much video data can be stored on a hard drive recorder and the quality of the images during playback

Resolution	Minimum Upload Speed*	
	AVC / H.264	HEVC / H.265
480p	1.5 mbps	0.75 mbps
720p	3 mbps	1.5 mbps
1080p	6 mbps	3 mbps
4K	32 mbps	15 mbps

H.265 vs H.264

	H.265/HEVC	H.264/AVC
Names	MPEG-H, HEVC, Part 2	MPEG 4 Part 10, AVC
Approved date	2013	2003
Progression	Successor to H.264/AVC	Successor to MPEG-2 Part
Key improvement	*40-60% bit rate reduction compared with H.264 at the same visual quality. *It is likely to implement Ultra HD, 2K, 4K for Broadcast and Online (OTT). *New standard use on CCTV systems.	*40-50% bit rate reduction compared with MPEG-2 Part. *Available to deliver HD sources for Broadcast and Online.
Support up to 8K	Yes.	No. Supports up to 4K
Support up to 300 fps	Yes	No. support up to 59.94 fps only.

H.265 COMPRESSION



H.265 provides half the data size of H.264

Video Transmission

1. An appropriate video transmission media is important for a quality CCTV system.
2. Common problems with video image quality can be avoided by selecting right transmission media.
3. The distance between camera, monitor and storage system is important for deciding which means of transmission to use.

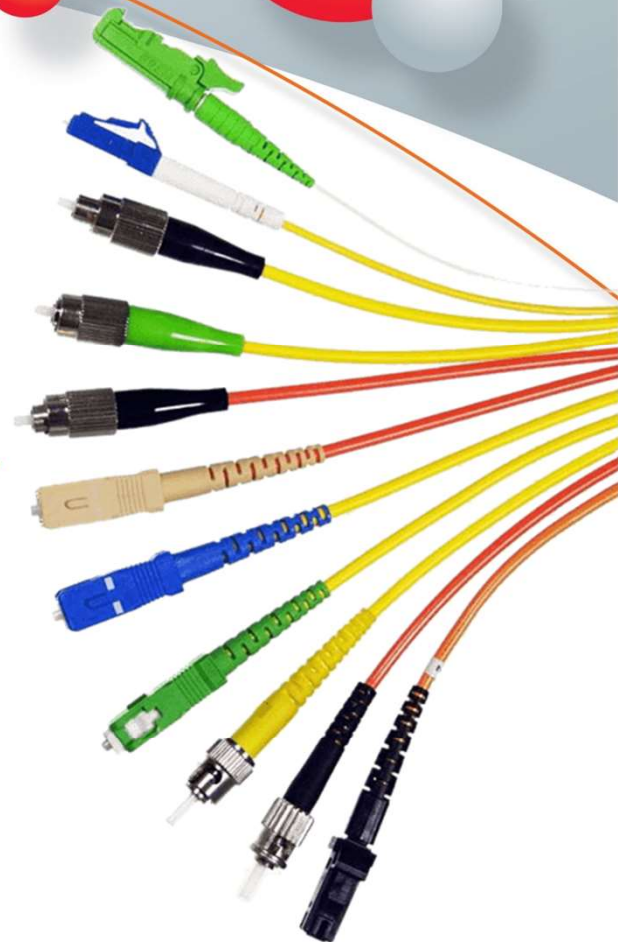
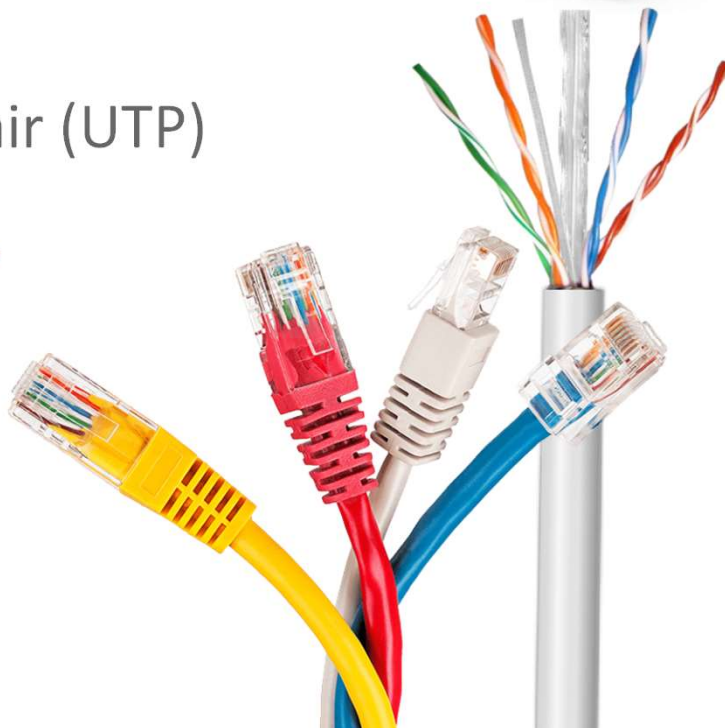
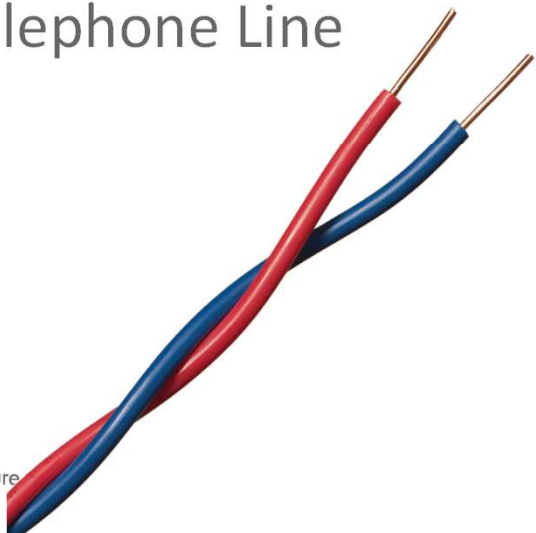


Type of Video Transmission

75Ω
Impedance

• Wired Transmission

- ① Coaxial Cable
- ② Fiber Optics
- ③ Unshielded Twisted Pair (UTP)
- ④ Telephone Line



Comparison of Transmission Cables

Characteristics	UTP	STP	Coaxial Cables	Fiber Optic Cables
Bandwidth	10 Mbps - 100 Mbps	10 Mbps - 100 Mbps	10 Mbps	100 Mbps - 1 Gbps
Maximum cable segment	100 meters	100 meters	200 - 500 meters	2 k.m. - 100 k.m.
Interference rating	Poor	Better than UTP	Better than Twisted Pair Cable	Very good as compared to any other cable
Installation cost	Cheap	Costly than UTP	Costlier than twisted pair wires	Costliest to install
Bend radius	360 degrees / feet	360 degrees / feet	360 degrees / feet or 30 degrees / feet	30 degrees / feet
Security	Low	Low	Low	High

Wireless Transmission

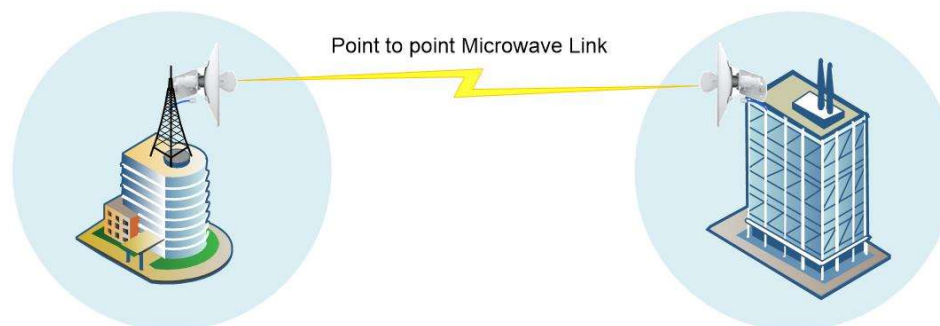
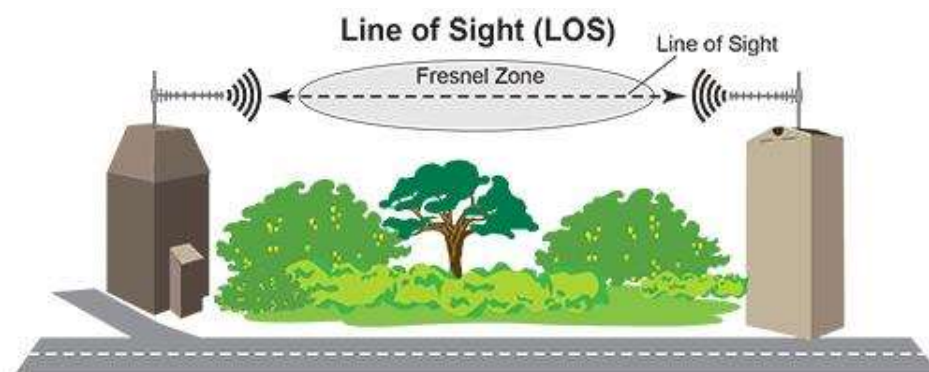
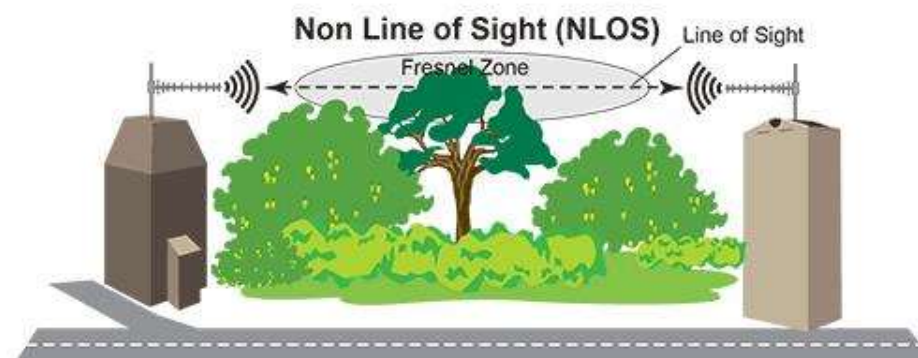
- Microwave

- ① Turns video and data signals into high radio frequency signals and transmits them from one point to another via free air
- ② Offers a large bandwidth to carry video signals
- ③ An option when hardwiring transmission is impossible or impractical

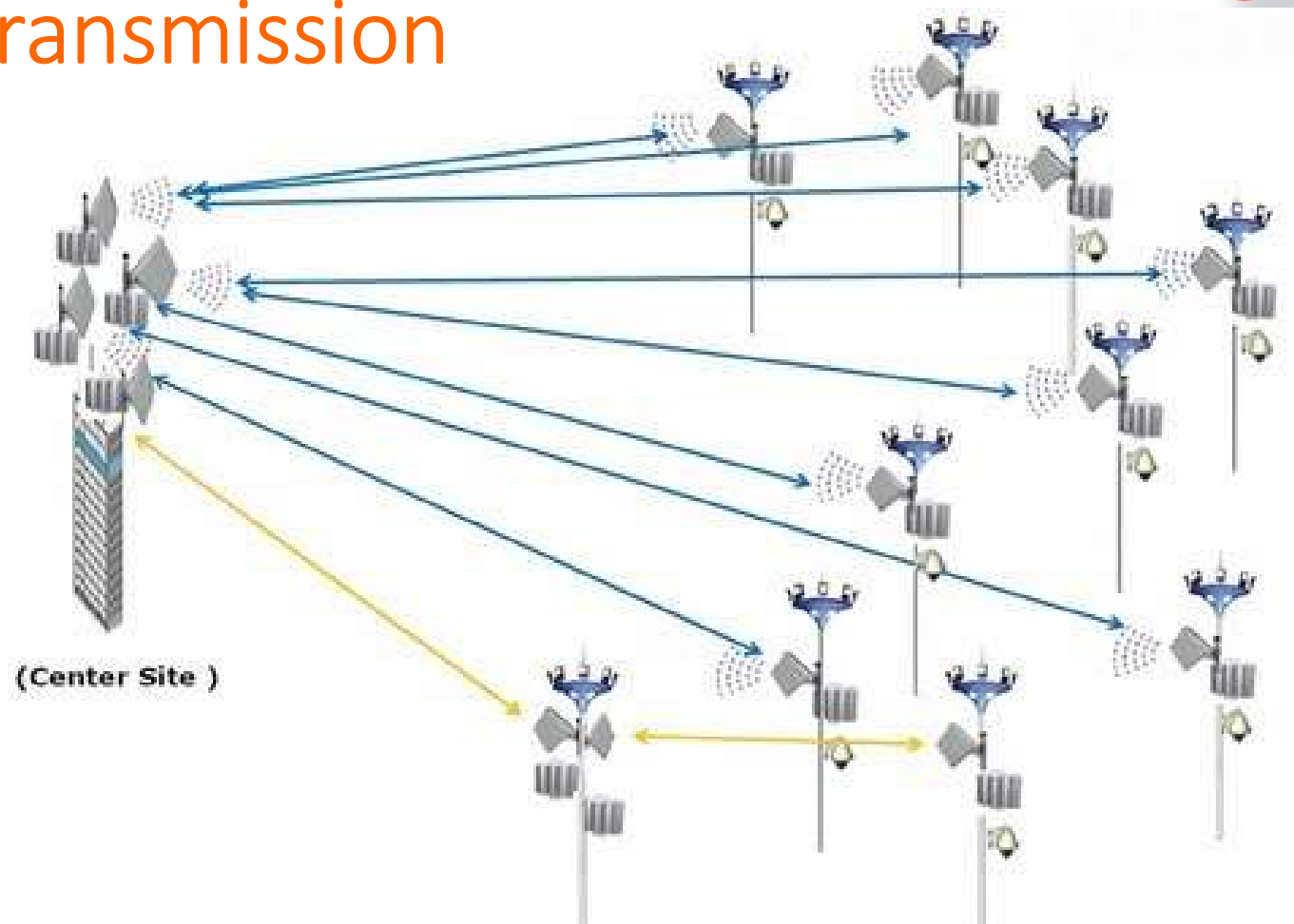
- Radio Frequency

- ① Reliable but short distance, Line of Sight (LOS) video transmission
- ② Reduce cabling costs within large building
- ③ Affected by environment conditions or interference

Microwave Link

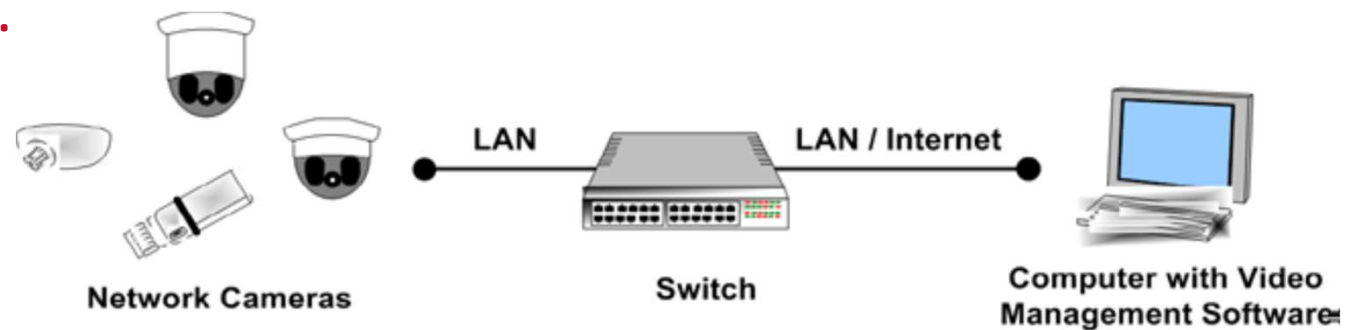


RF Transmission



IP Network Transmission

- Analog-based CCTV systems require dedicated point-to-point cabling from each camera to the recording and/or viewing locations. It's traditionally unidirectional.
- In an IP-based CCTV, video is digitized at camera and can be transmitted over IP network to virtually any location around the world.
- IP-based CCTV is bidirectional, easier to integrate into larger systems, and highly scalable.





Take a Break

Other CCTV Accessories

- Video Media Converter

Convert CCTV analog camera signals to optical signals that include the video transmitter and receiver.



Video Multiplexer

- It's also referred to as Video Mux, CCTV Multiplexer or Color Quad Processor.
- It allows several video signals from cameras or other analog video devices to be combined and displayed on one monitor.



Video Encoder

- It converts analog or digital video to another digital video format for delivery to IP CCTV System.



Video Decoder

- It performs the inverse function of a video encoder, which converts encoded video to Analogue output or Digital output, e.g. VGA or HDMI.
- Supports Split-screen Display, e.g. 1/4/9/16/25/36/64



Code Converter

- It is a code converter among the control protocols for different band of cameras (e.g. BiPhase protocol, Panasonic, TOA, Pelco-P, Pelco-D, and GE, etc.)



CCTV Control Keyboard

- It's used for selection of monitors, cameras, provide the control of cameras such as Pan-Tile-Zoom, Iris Focus and remote functions.
- In addition, it's also used for configuration of the Matrix Switcher.



Video Matrix Switcher

- It's a video managing device that allows switching of cameras and other video inputs to outputs (e.g. monitors and recording devices).
- **Features**
 - ① Camera and lens control
 - ② On-screen text
 - ③ Password protection for programming
 - ④ Partitioning of video for selected users
 - ⑤ Interface capabilities with additional alarm and relay panels



Matrix Switcher

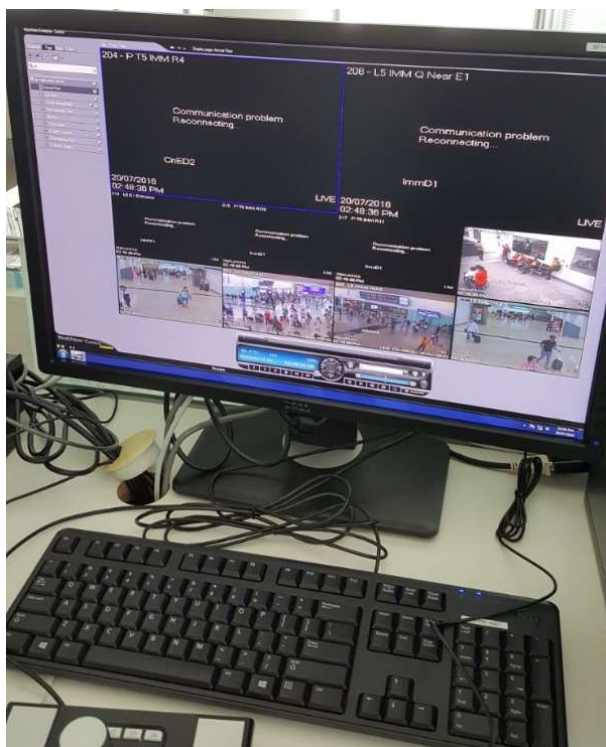


Monitoring stations

Remote Terminal

- Real-time access to live camera view and control the CCTV System
- Live remote viewing and playback from virtually anywhere in the world
- Automated motion alerts and
- Customizable security camera and system settings to suit own surveillance needs
- Pan-tilt-zoom controls to control the movement of cameras
- Motion event timelines to find the moments that matter
- Video recording and image saving for quick retrieval when needed

Remote Terminal



Video Management Server

- It is a component of a IP-based CCTV system that in general:-
 - ① Collects video from cameras and other sources
 - ② Records / Stores that video to a storage device
 - ③ Provides an interface to both view the live video, and access recorded video
 - ④ User Management



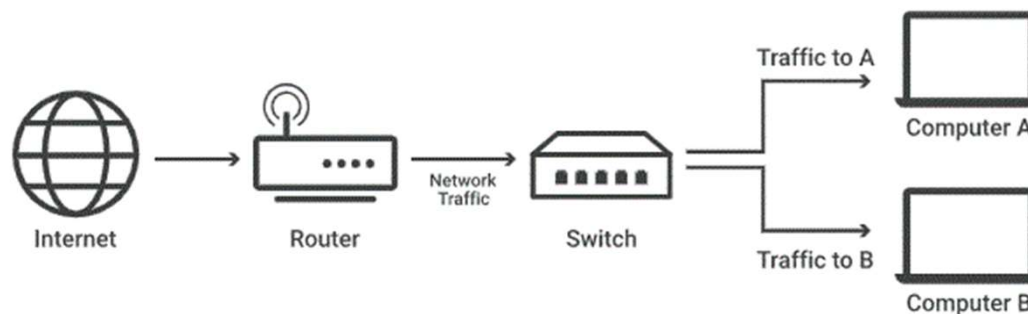
Network Switch

- Connects devices within a network
- Forwards data packets to and from those devices
- Unlike a router, a switch only sends data to the single device it is intended for, not to networks of multiple devices



What is the difference between a switch and a router?

- Routers select paths for data packets to cross networks and reach their destinations.
- Routers connect with different networks and forwarding data from network to network (incl. LANs or WANs) which are the large networks that make up the Internet.
- Routers are necessary for an Internet connection (e.g. homes and small office)
- Network switches are only used for interconnecting devices (Large offices, networks, and data centers with dozens of computers)



Media Converter

- It converts Ethernet or other communication protocols from one cable type to another type (e.g. copper UTP to fibre).
- It is used in pairs to insert a fibre segment into copper networks to increase cabling distances and enhance immunity to electromagnetic interference.
- It can extend LANs, and convert link speeds and fibre modes.



Power over Coax (PoC) Converter

- It supports simultaneous transmission of power, high definition video IP signal over coaxial cable up to 400 m.
- It is used in coaxial cable and network cable mixed wiring CCTV system and network rebuilding project



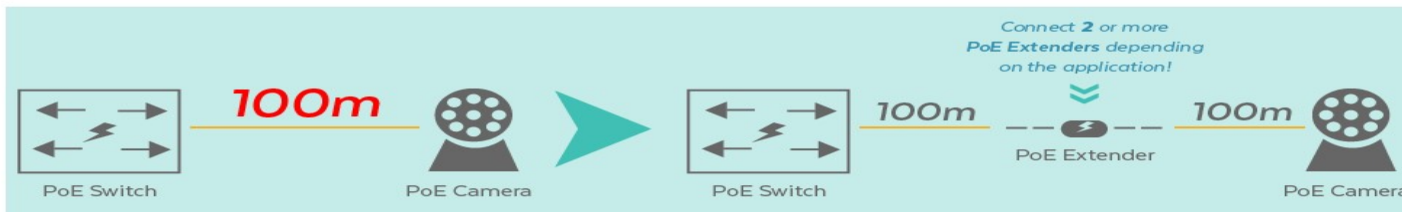
Power over Ethernet (PoE) Equipment

- PoE lets Ethernet cables supply power to network devices over the existing data connection

	Type 1	Type 2	Type 3	Type 4
Name	PoE	PoE+	PoE++, UPoE	High-Power PoE
Standard	802.3af	802.3at	802.3bt	802.3bt
Port Power	15.4W	30W	60W	100W
Devices	 VoIP Phones CAT3, CAT5	 PTZ Camera CAT5	 Mgmt Devices CAT5	 LED Lighting CAT5

PoE [power over ethernet] LIMITATIONS

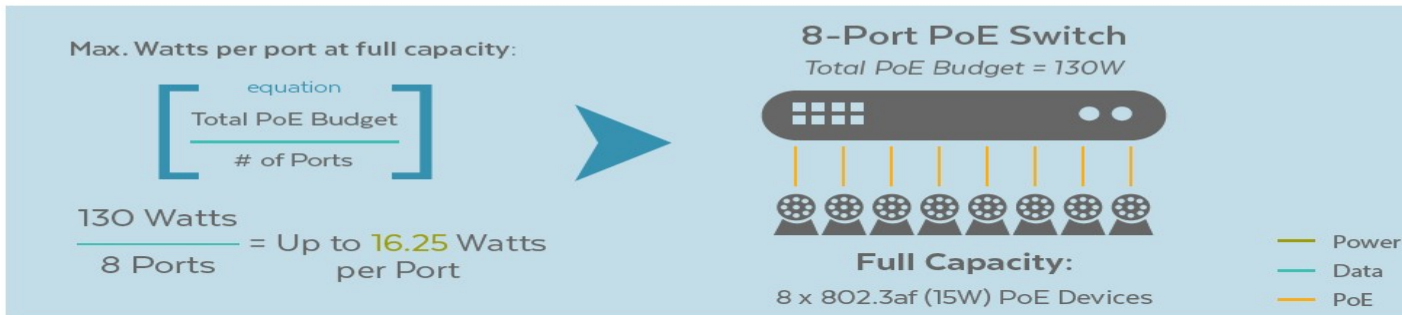
DISTANCE



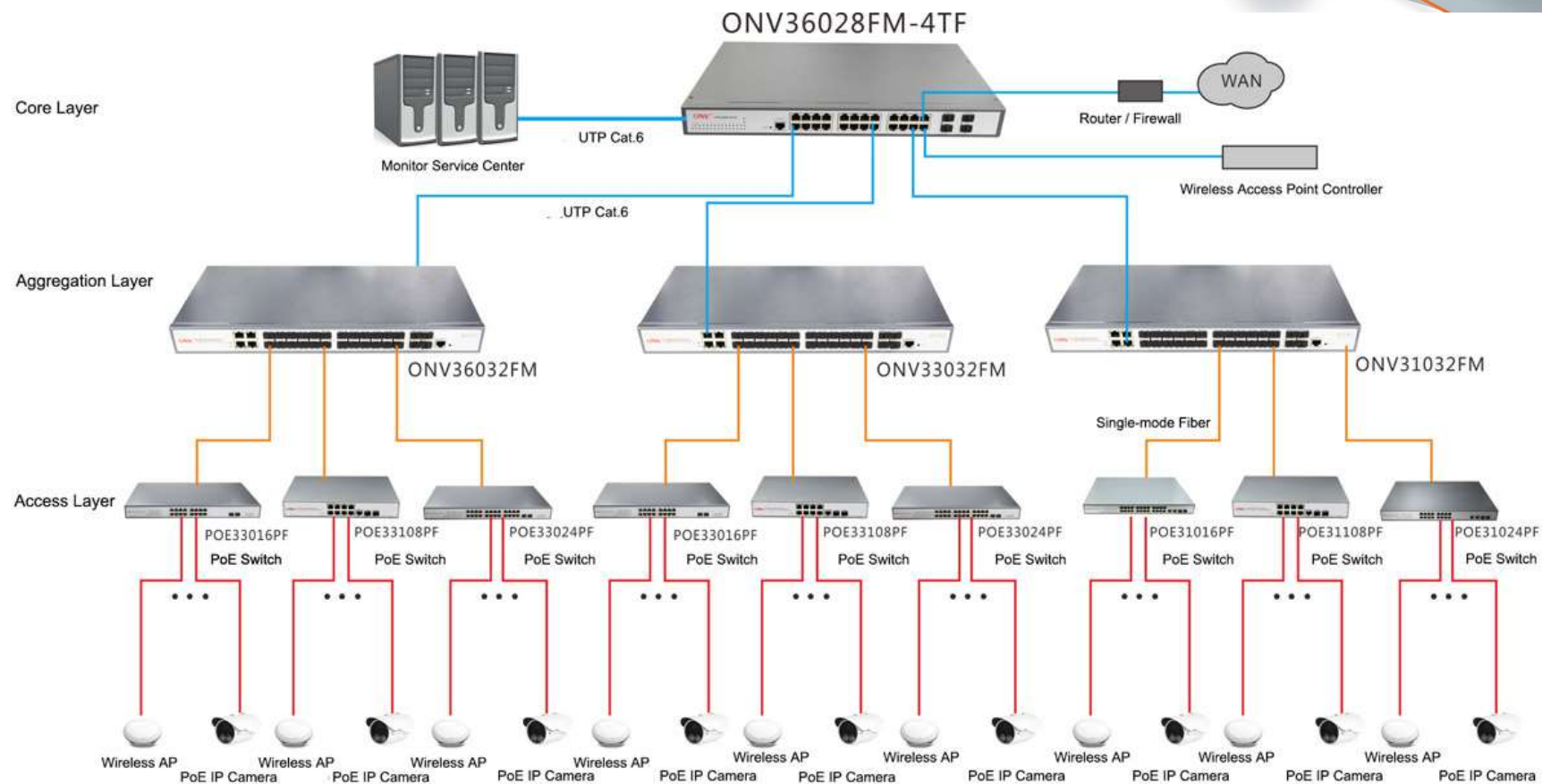
COMPATIBILITY



POWER RATES

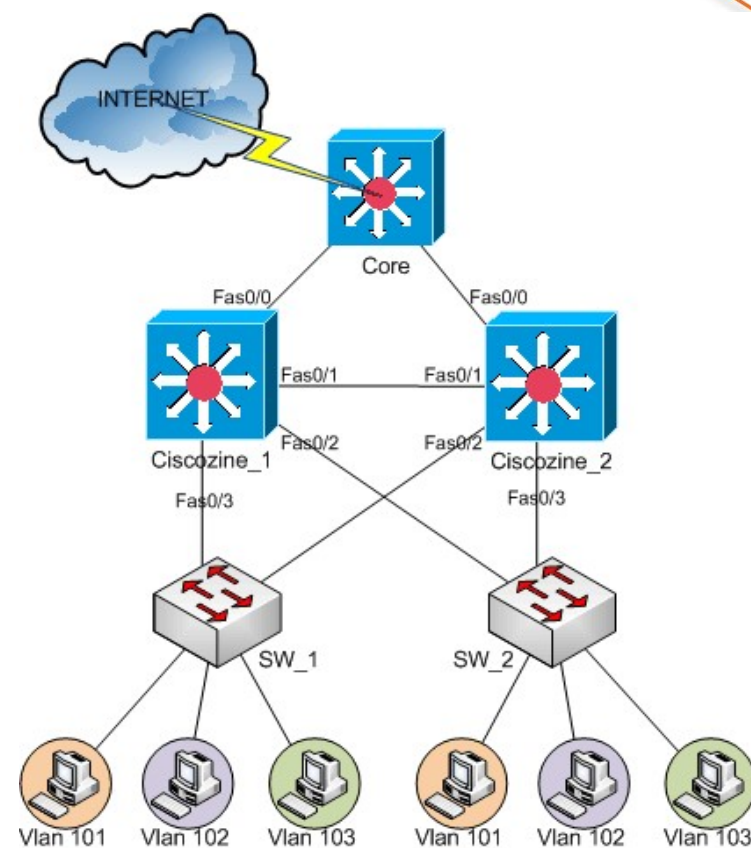


Switch for IP CCTV



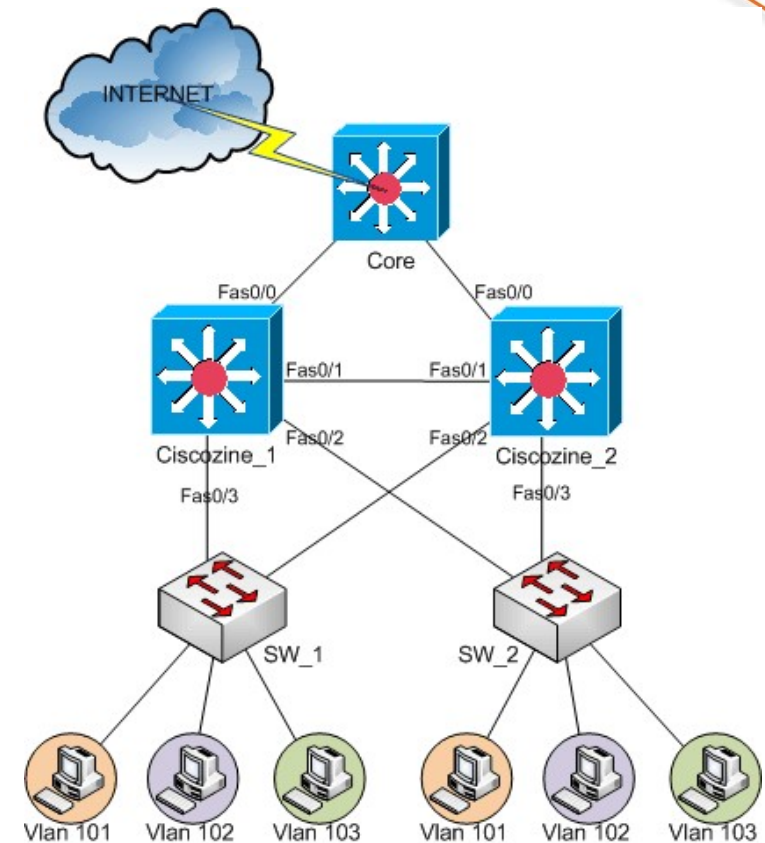
Core Switch

- It is a high-capacity switch generally positioned within the backbone or physical core of a network
- It serve as gateway to wide area network (WAN) or the Internet
- To provide final aggregation point for network and allow multiple aggregation modules to work together



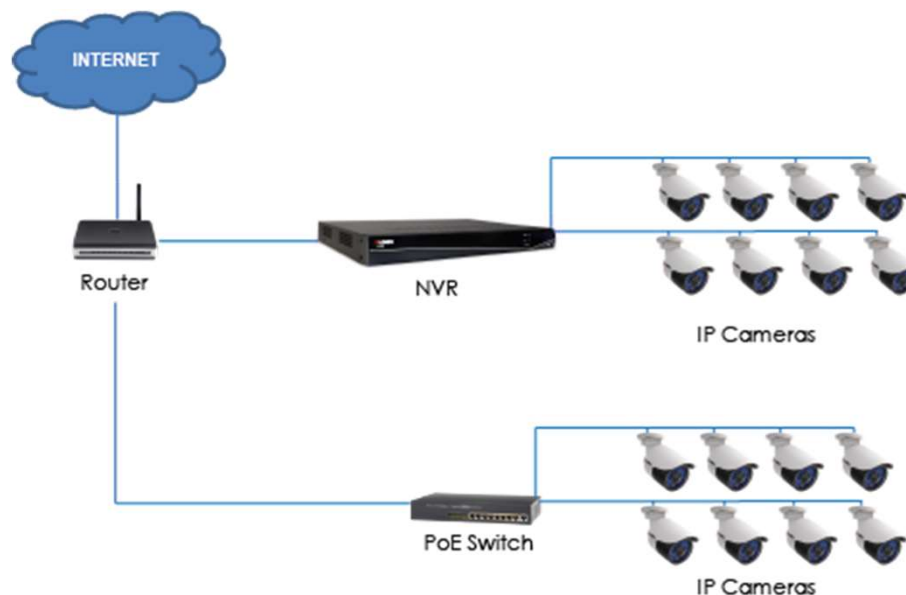
Aggregation / Distribution Switch

- In between functions a bridge between core switch and access switch
- Having large enough capacity to process all traffic from access devices
- When multiple access switches among different VLANs are required to be aggregated, a distribution switch can achieve inter-VLAN communication



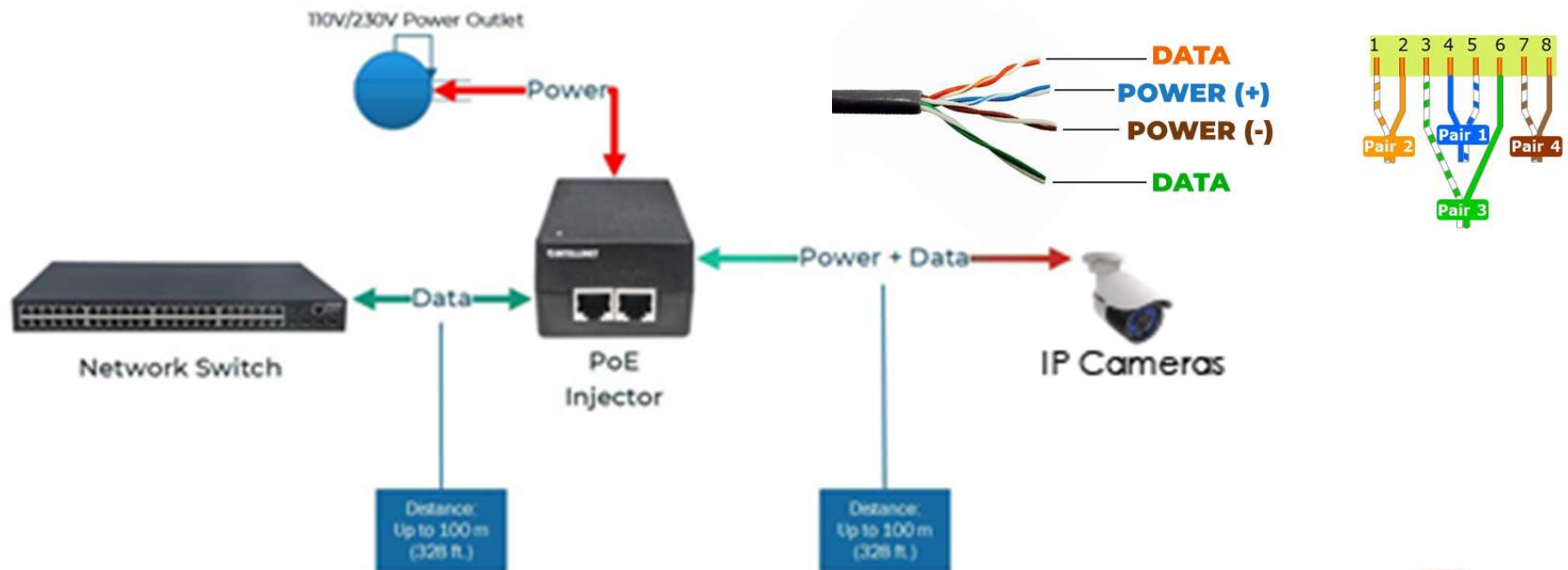
PoE Switch (Access Switch)

- It facilitates connection of end node devices to network
- To provide power and network communications to IP cameras simultaneously
- This allows a PoE switch to expand the reach of an NVR system because IP cameras can connect to PoE switch rather than NVR directly



PoE Injector

- To connect PoE-enabled network device to a non-PoE LAN switch port.
- To avoid the need to run AC power lines for IP camera by using the existing LAN cabling to deliver both DC power as well as data.



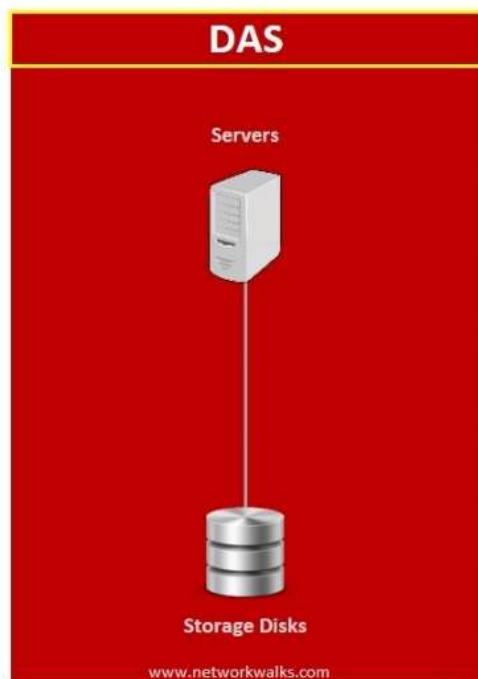
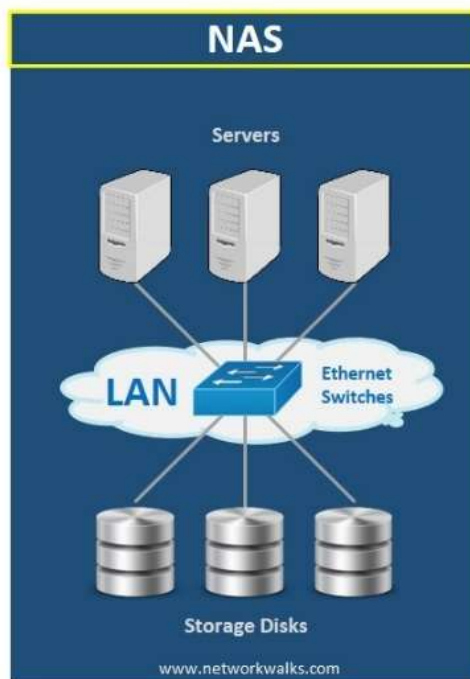
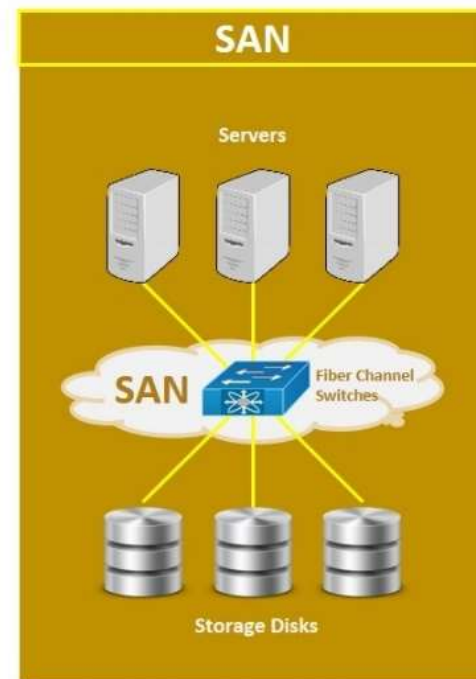
ONVIF[®] Protocol

- Open Network Video Interface Forum (ONVIF)
- Standard for the interface of physical IP-based security products (e.g. IP camera)
- ONVIF created several profiles (incl. Profile A, C, D, G, M, Q, S & T)

Profile S (Streaming Video)	Profile C (Access control)	Profile G (Recording and Storage)	Profile Q (Quick Installation)
<ul style="list-style-type: none">• Video streaming• Audio streaming• PTZ Controls• Video settings	<ul style="list-style-type: none">• Site information• Event and alarm• Door access control	<ul style="list-style-type: none">• Video and audio storage• Configure, request, and control recording• Receive metadata	<p>Plug-n-play compatible supports</p> <ul style="list-style-type: none">• discovery• configuration• control of compatible devices

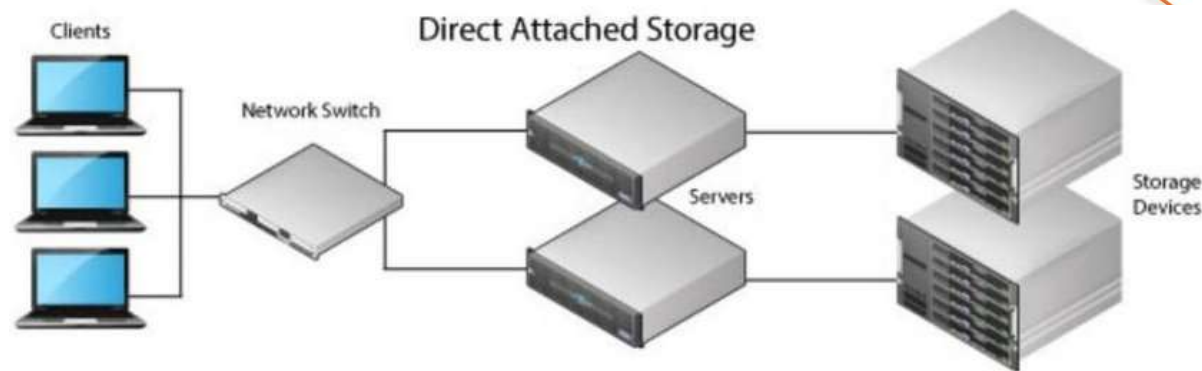
Network Storage of IP-Based CCTV

STORAGE TYPES COMPARISON



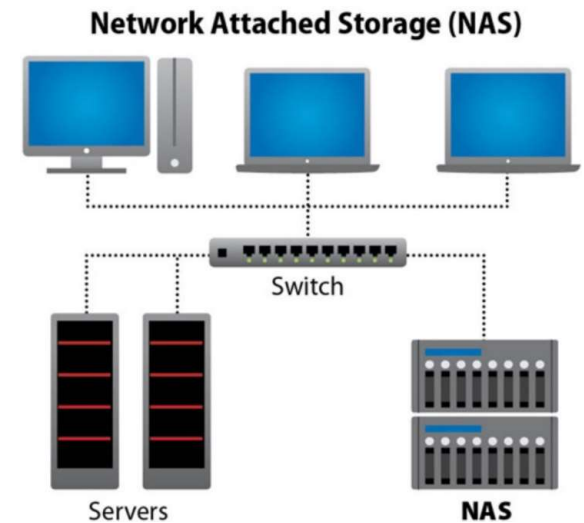
Directly Attached Storage (DAS)

- ① The external storage device (e.g. Single Hard Disk / RAID) is directly connected to PC or Server through USB, IDE or SCSI
- ② Advantages of DAS
 - Simple setup and configure
 - Cost effective than NAS / SAN
 - High performance (speed)
- ③ Disadvantages of DAS
 - Multiple users access data is not allowed
 - Low scalability in data storage
 - Unable to manage DAS via network



Network Attached Storage (NAS)

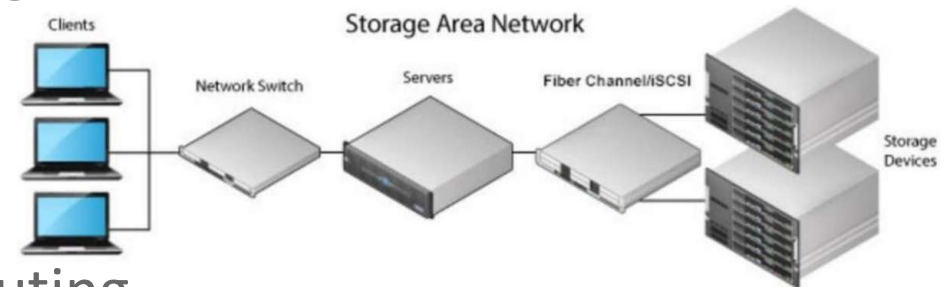
- ① NAS acts as file server comprising hard disks and management software to share files over a network
- ② Advantages of NAS
 - Cost effective way to gain data access for multiple users
 - Easy to provide RAID redundancy to multiple clients
 - Higher storage resources utilization
- ④ Disadvantages of NAS
 - Latency issues due to network problems



機電工程署  **EMSD**

Storage Area Network

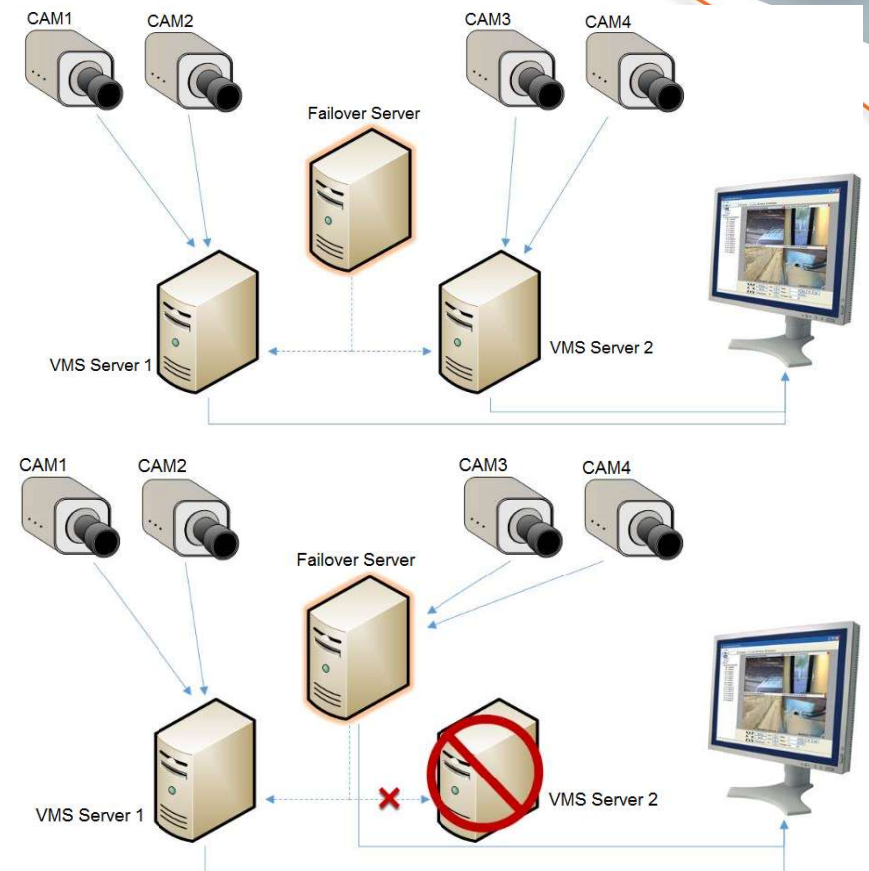
- ① It is a dedicated storage network to transfer data between storage devices and servers for enterprise level application
- ② Fiber channel is used to connect storage devices to servers in SAN infrastructure
- ③ Advantages of SAN
 - Transfer large data blocks
 - Virtual environments & cloud computing
 - Complete reliability and availability of data
- ③ Disadvantages of SAN
 - Limit to enterprise application since huge investment is required



Failover & Redundancy

N+1 Failover

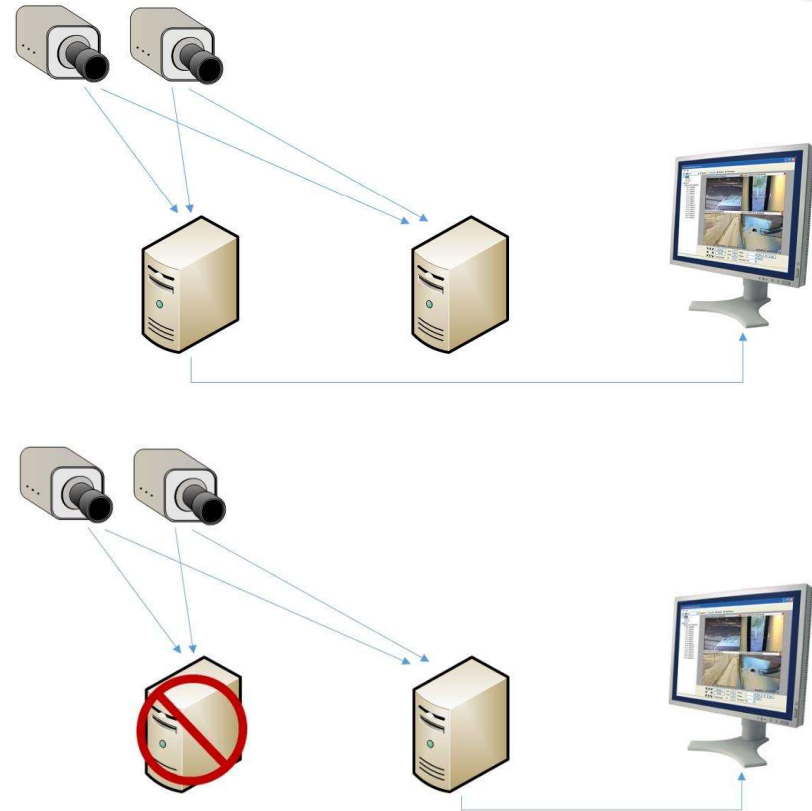
- Failover server sends a “heartbeat” and waits for servers’ response
- Failover server assumes VMS Server 2 is down, if VMS Server 2 is no response
- Failover server uses VMS Server 2’s configuration to record video from CAM3 & CAM4
- Once failure is resolved, VMS Server 2 is back online & resume operation



Failover & Redundancy

Dual Stream Recording

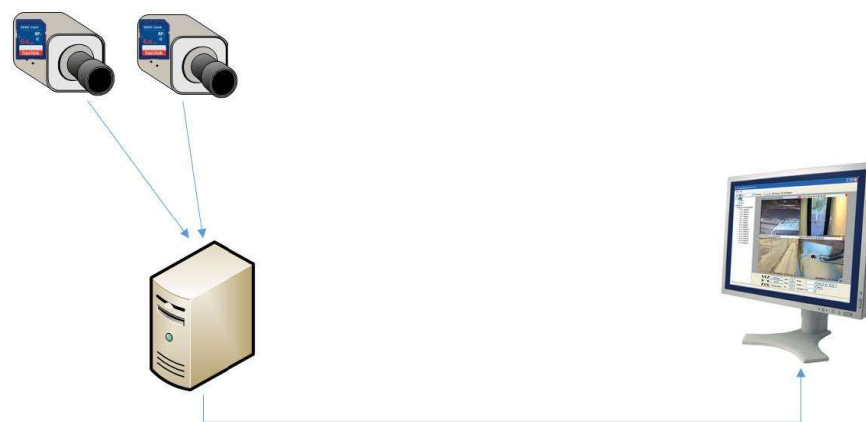
- It is simply recording an IP camera stream to two VMS servers simultaneously.



Failover & Redundancy

Camera SD Card Recording

- Recording video to the designated VMS recording server and simultaneously recording to camera SD cards does provide some unique fault tolerance features.



Tools & Measurement

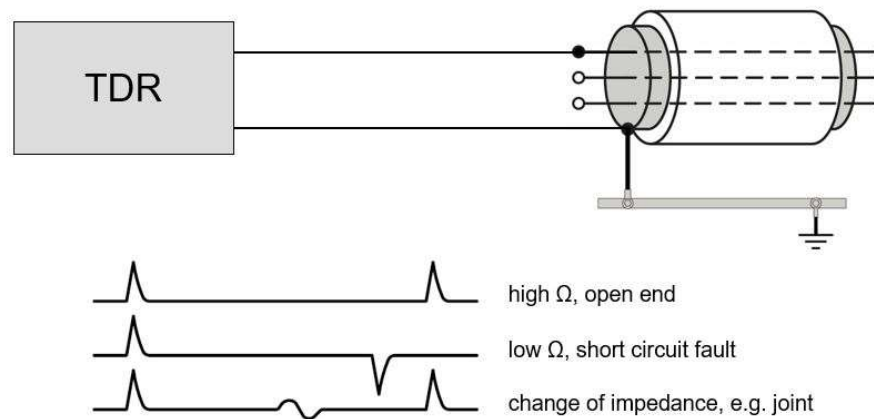


Network Cable Testers

For datacom cabling include length, wire-map, attenuation, DC loop resistance, and return loss



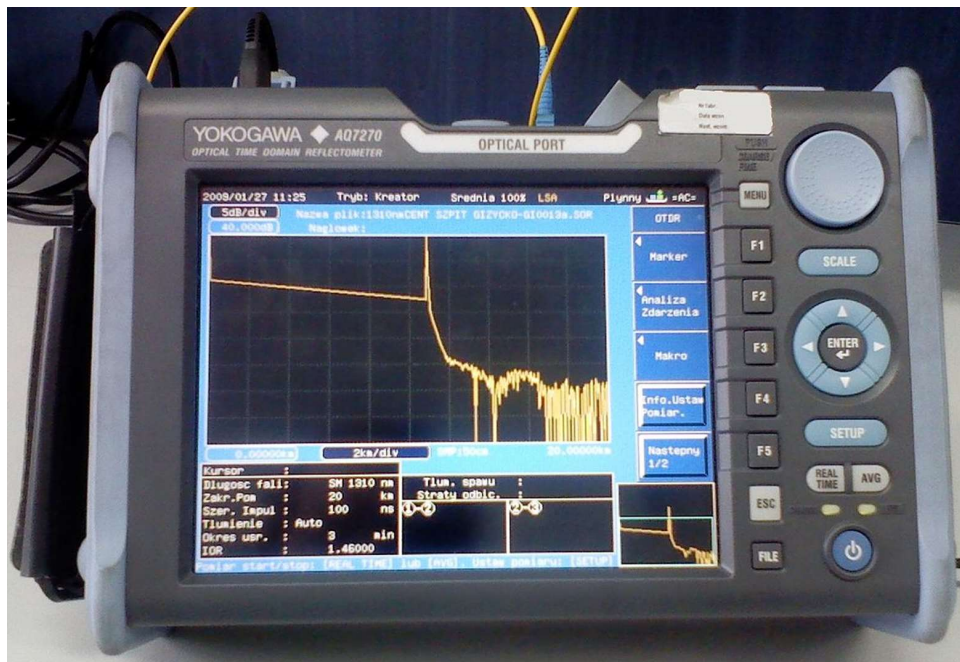
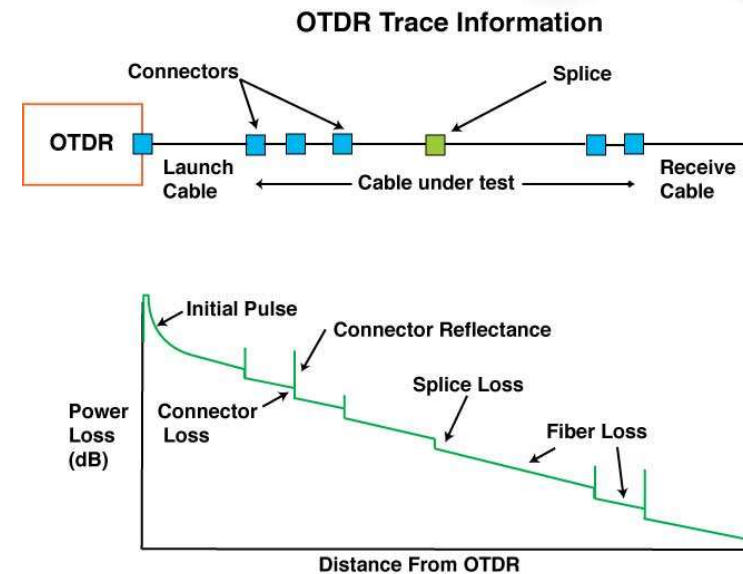
Tools & Measurement



Time Domain Reflectometry (TDR)

It identifies and measures errors related to aerial and underground cable wiring through the analysis of pulse reflection polarity.

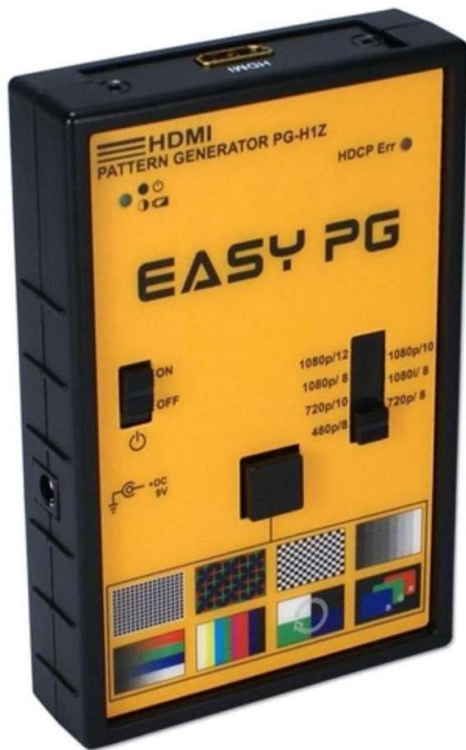
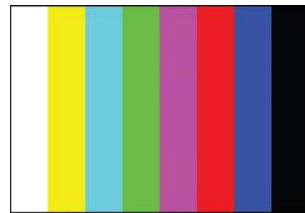
Tools & Measurement



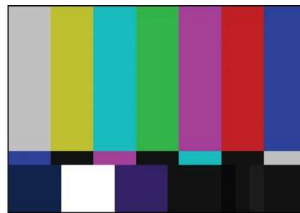
Optical Time Domain Reflectometers (OTDR)

- It is used to evaluate the characteristics of fiber optic link
- It also measures optical fiber parameters such as attenuation, length, optical connector and splices loss
- A single ended test of any cable

Tools & Measurement



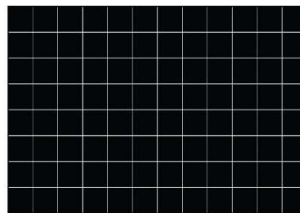
Full field color bar



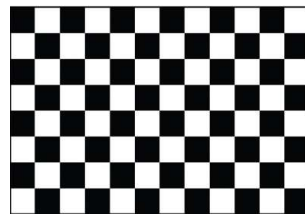
SMPTE color bar



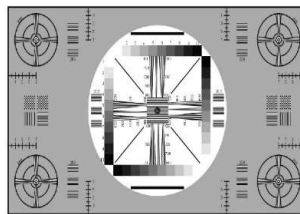
Grayscale chart



Crosshatch pattern



Checkerboard pattern



Monochrome Test Pattern

Video Pattern Generator (VPG)

It is used for emulating desired test patterns for testing functionality and evaluating performance various video processing systems

Tools & Measurement



CCTV Tester

It is an integration tester for installation and maintenance of IP camera, analog camera and network device, with Video display, PTZ control, DC12v output power, Audio test, Color generator, RS485 Data searching and Cable testing

CCTV Troubleshooting Tips

Symptom	Possible cause	Corrective Action
Local (DVR) Viewing Monitor is blank	Monitor has gone into power saving mode	Move the mouse or press a key on the keyboard
	Monitor is turned off	Press power button on monitor
	Power point is switched off	Check switch at power point
	Power cord is disconnected	1. Check power cord is firmly plugged into back of monitor
		2. Check power cord is firmly plugged into power point
	Video cable is not connected to DVR	Check connection of video cable at back of DVR and monitor
	DVR has no power / Faulty	Check DVR Power Has Power
	Monitor is Faulty	Repair Monitor

Q&A



Thank you!

