

Video Surveillance Basics

HiLook Certification Program

First Choice for Security Professionals



Objectives

- Understand the basic knowledge of network
- Be familiar with basic knowledge of optical lens
- Master the common functions of camera imaging

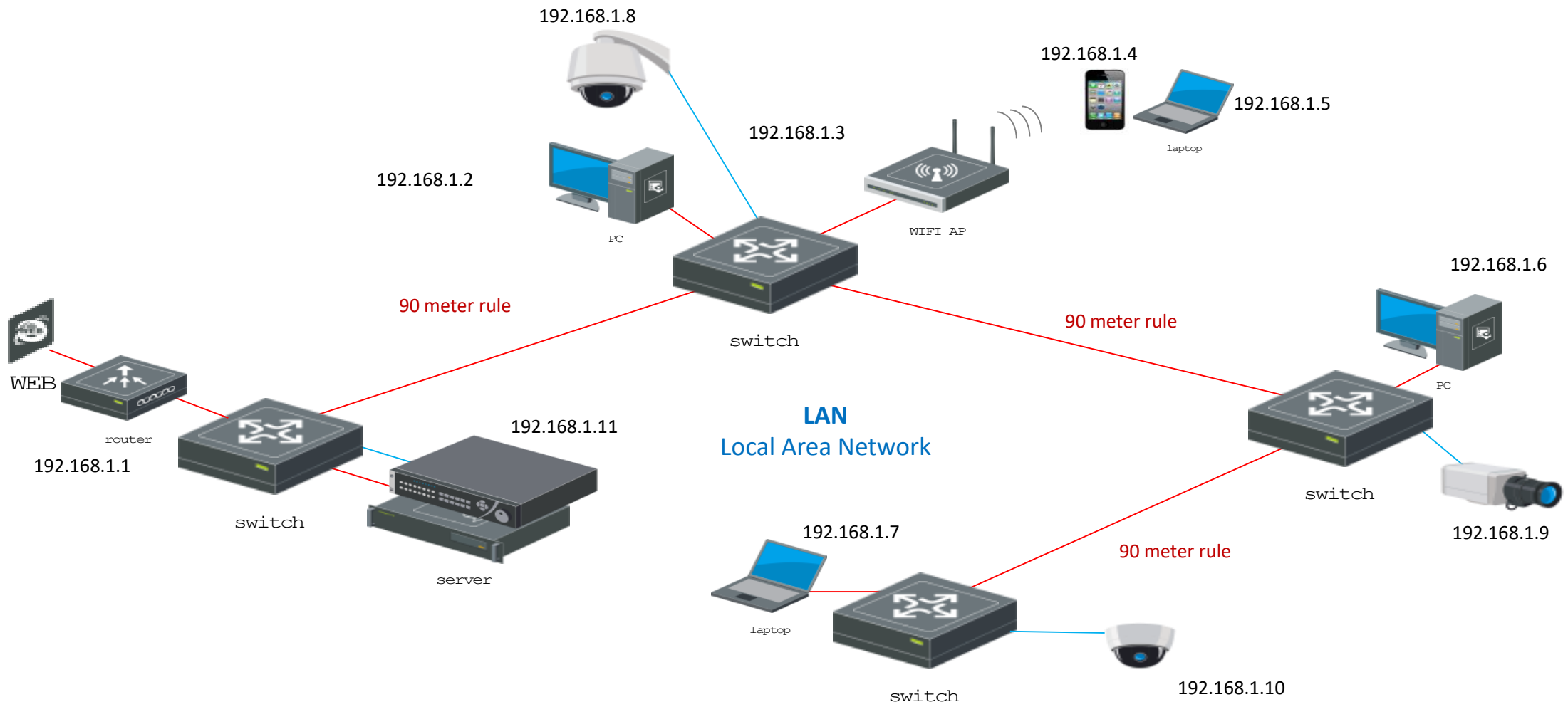


Contents

- **Network Basics**
 - IP Address
 - TCP/UDP
 - Remote Surveillance
- Optics Basics
- Camera Image Basics

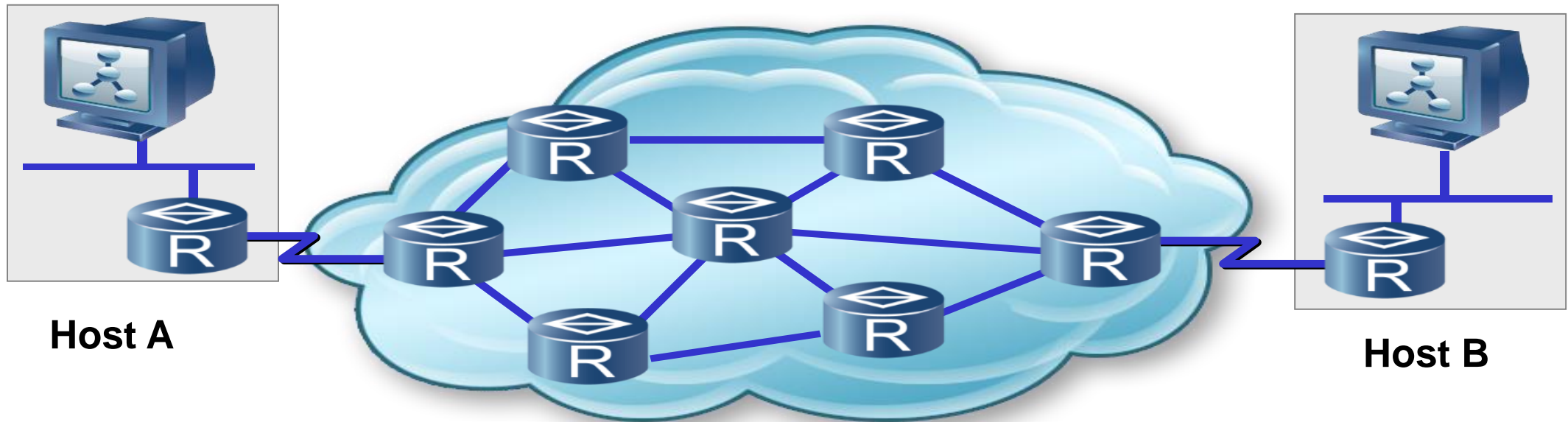
Why Do We Need IP Address

- The components of an IP CCTV system are the same as any other IT device on a network, they need an address and to be visible to connected devices. Switches may include PoE (Power over Ethernet) to power the CCTV camera.



Function of IP Address

- An IP address is the only way to identify a device in the network.
- The IP address is assigned by NIC (Network Information Center).



Private IPv4 Address

- Private IP address cannot be used on public network.
- On the public network, IP address is unique. While in different private networks, the private IP address can be the same. It is an effective way to save IP address.

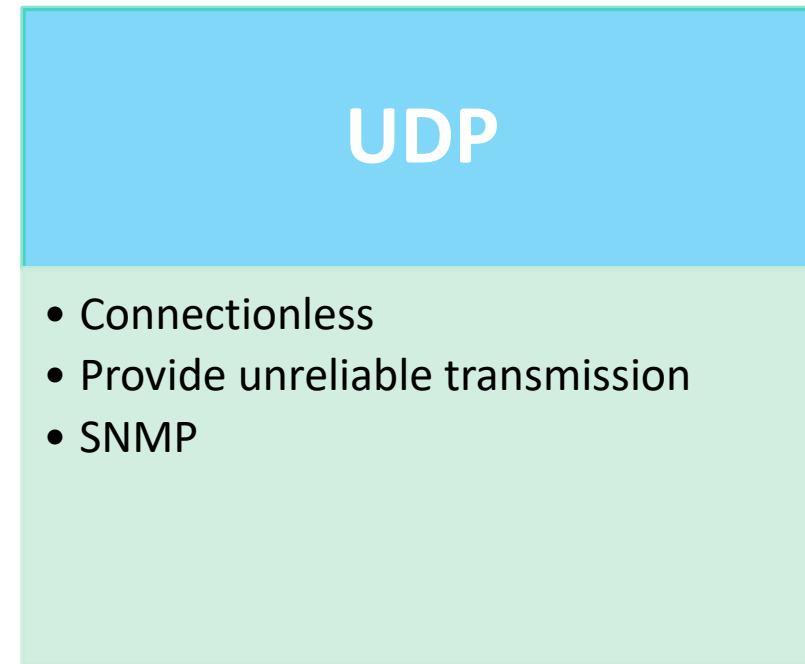
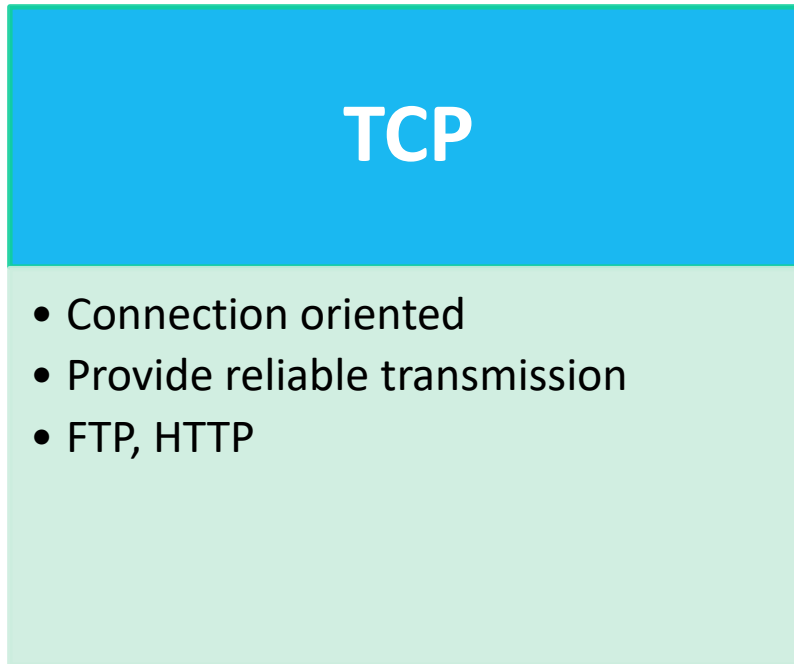
10.0.0.0/8 — 10.255.255.255/8

172.16.0.0/12 — 172.31.255.255/12

192.168.0.0/16 — 192.168.255.255/16

TCP vs UDP

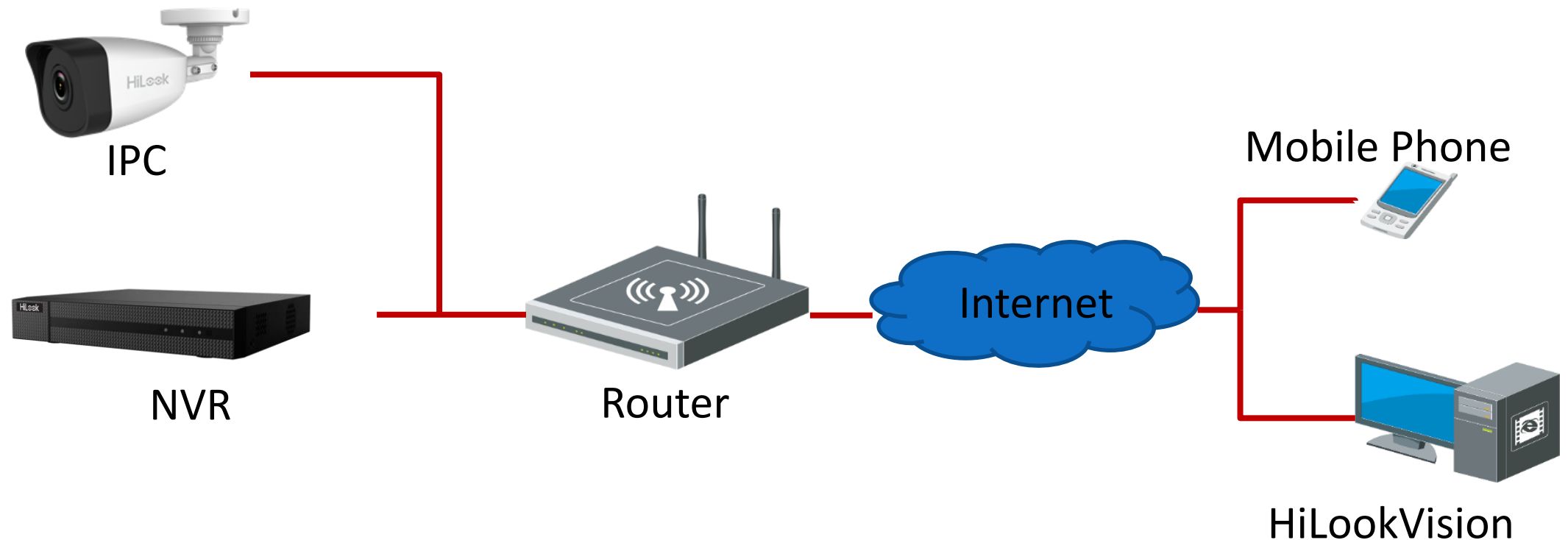
- **TCP(Transmission Control Protocol):** Ensures complete delivery of streaming data and better video quality, yet the real-time transmission will be affected.
- **UDP(User Datagram Protocol):** Provides real-time audio and video streams.



Remote Surveillance

When we want to remotely view a device, we can do so across a network (LAN & WAN) as long as the devices are '**visible**'. Live view, playback, video downloading and parameter configuration can be utilized by an authorized user via client software or web browser.

Remote viewing from outside the LAN or WAN will require '**route**' to be provided to the network and then a '**access**' to the devices.



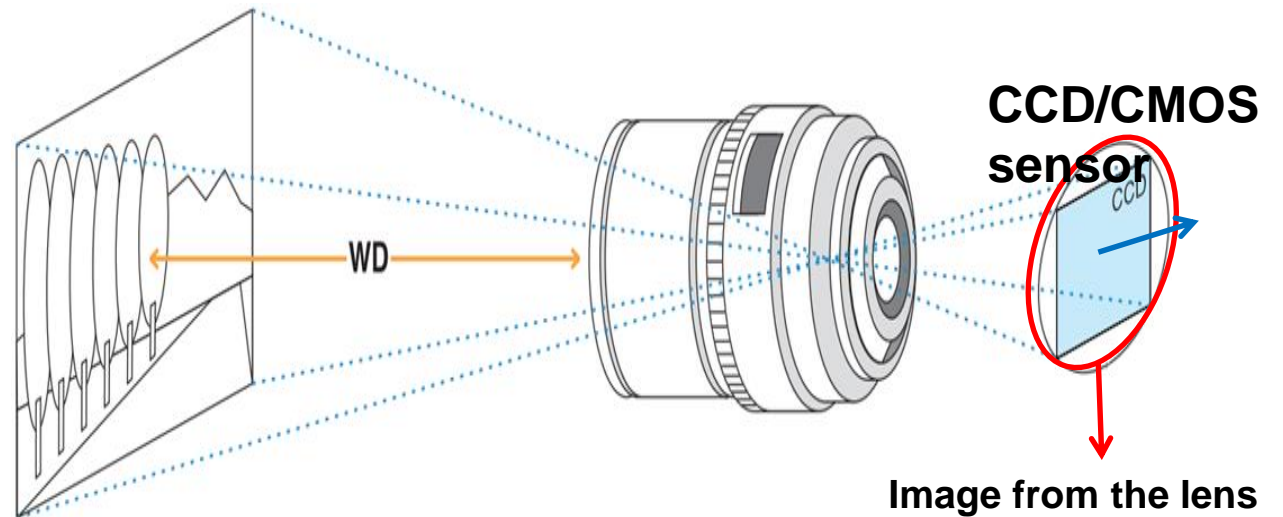
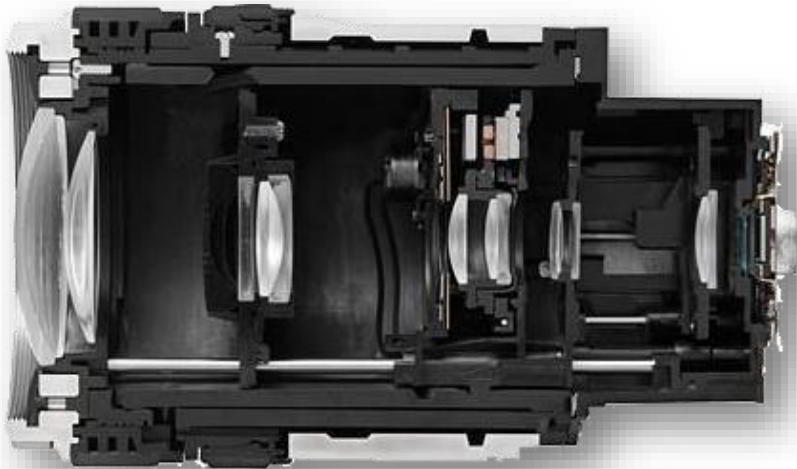


Contents

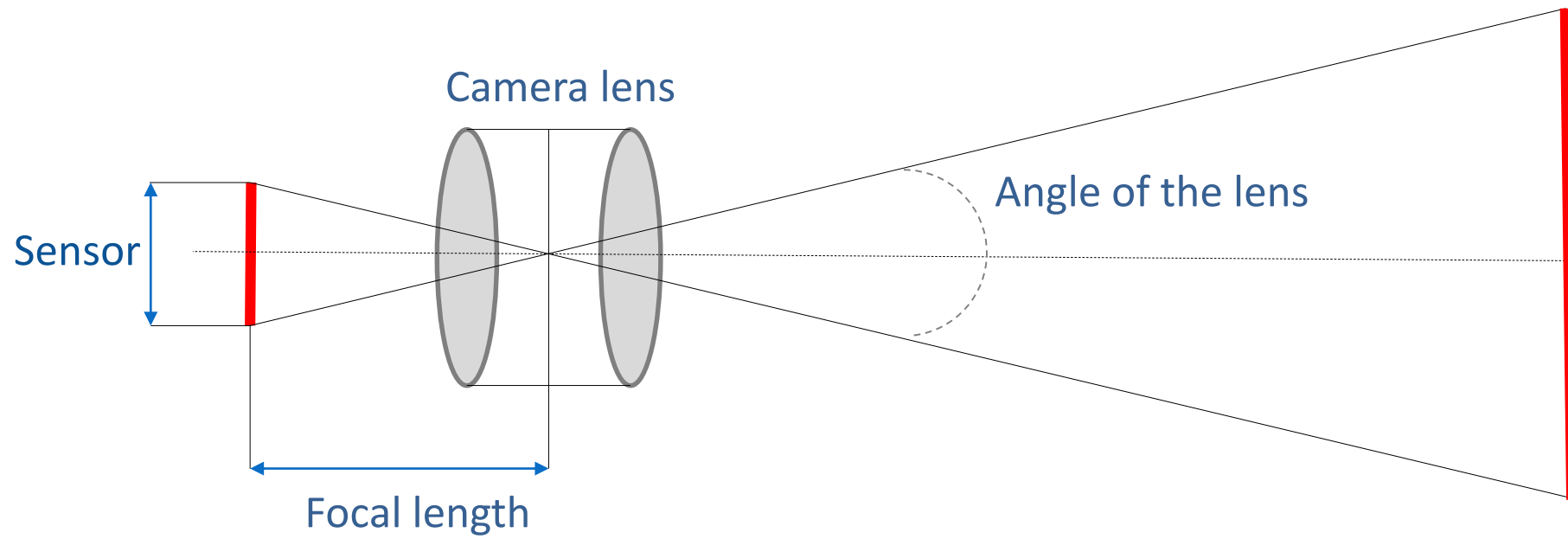
- Network Basics
- **Optics Basics**
 - Overview of Lens
 - Imaging Size
 - FOV
 - Iris
 - Depth of View
- Camera Image Basics

Lens

- Lens is to collect optical signal and form an image on the sensor. The lens is the camera's eye.
- Lens consists of one or more groups of optical glasses. A lens can focus light to form an image. Different combination of lenses results in different focal lengths.



Lens

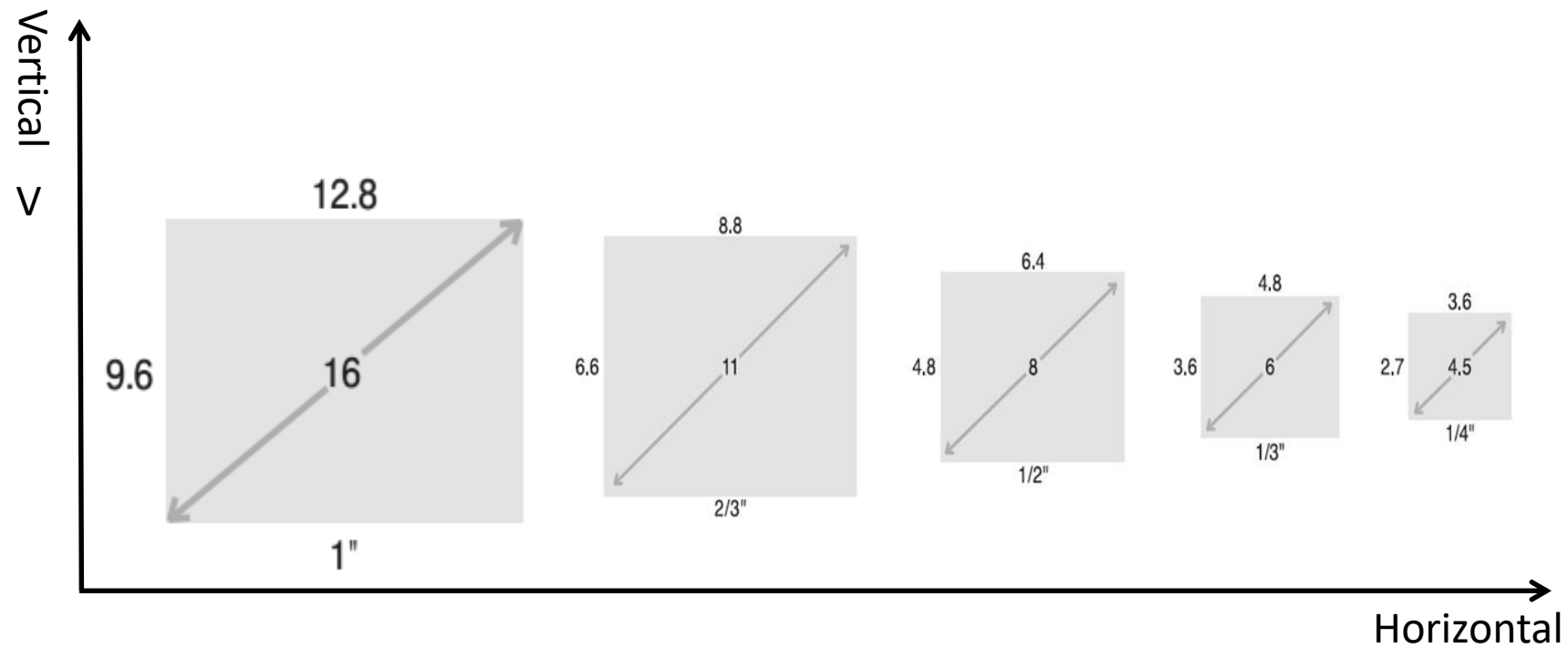


Classification of Lens

Items	Classification				
Imaging size	1/3''	1/2''	2/3''	1''	4/3''
FOV	Telephoto (FOV≤20°)	Standard (FOV around 53°)	Wide angle (FOV≥90°)	Fisheye (FOV≥180°)	
Mount	CS-mount	C-mount	M12-mount	Φ14-mount	
Focal length	Vari-focal lens		Fixed lens		
Iris	Auto iris	Manual iris	Fixed iris	P-iris	
Resolution	SD	HD	2MP	4MP	5MP
IR	IR lens		Non-IR lens		

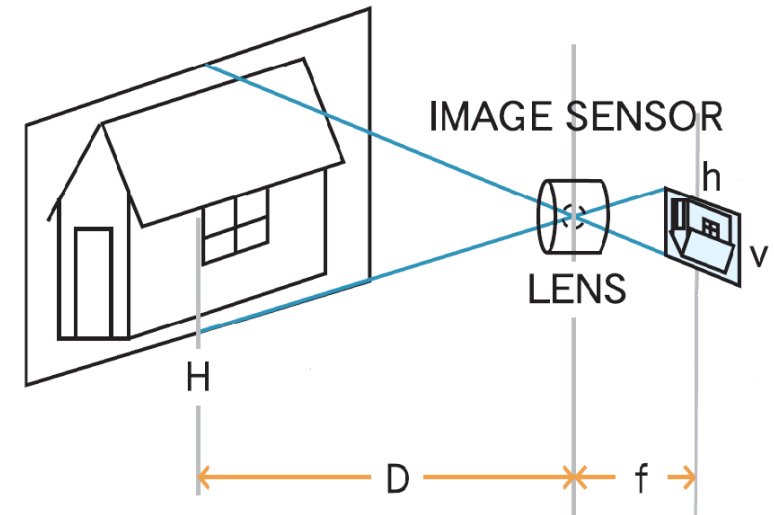
Imaging Size

- Common sensor size ratio is usually 4:3.



FOV (Field Of View)

- FOV is the extent of the observable world that is seen. It can be measured horizontally, vertically and diagonally.
- Factors:
 - Sensor size
 - Focal length

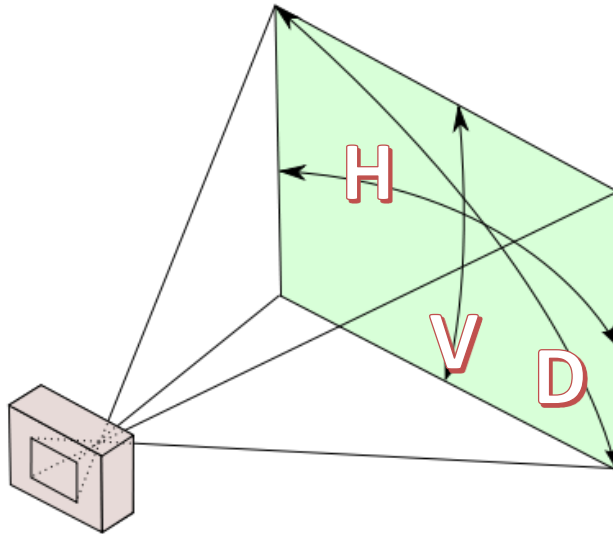


$$\frac{f}{D} = \frac{v}{V} = \frac{h}{H}$$

- ✓ You can choose the lens according to the monitoring scene.
- ✓ When the sensor size is fixed, longer focal length will cause smaller FOV.
- ✓ When the focal length is fixed, larger sensor size will cause larger FOV.

FOV Example

- Sensor is rectangular, so FOV has three directions ie. H/V/D.
 - H: Horizontal
 - V: Vertical
 - D: Diagonal



1.3MP

1280x960 1/3" & 1/2.8"			
	HFOV	VFOV	DFOV
4X1X 2.8~12mm	98.4-30.2°	71-22.7°	131-37.8°
4X1X 8~32mm	27.8-9.1°	20.7-6.86°	34.9-11.3°

2MP

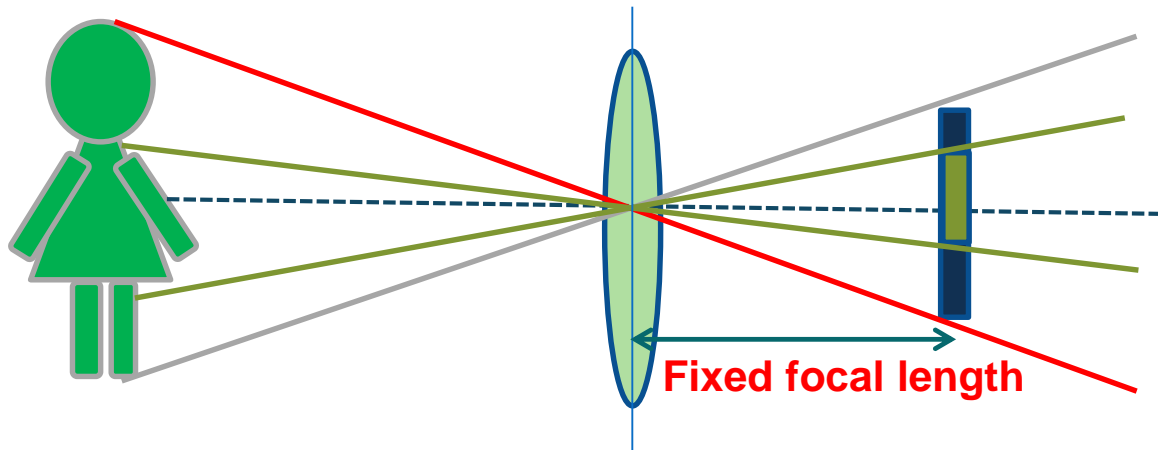
1920x1080 1/3" & 1/2.8"			
	HFOV	VFOV	DFOV
4X2X 2.8~12mm	113-33.8°	59-18.9°	137-38.8°
4X2X 8~32mm	31.2-10.16°	17.4-5.76°	36-11.58°

3MP

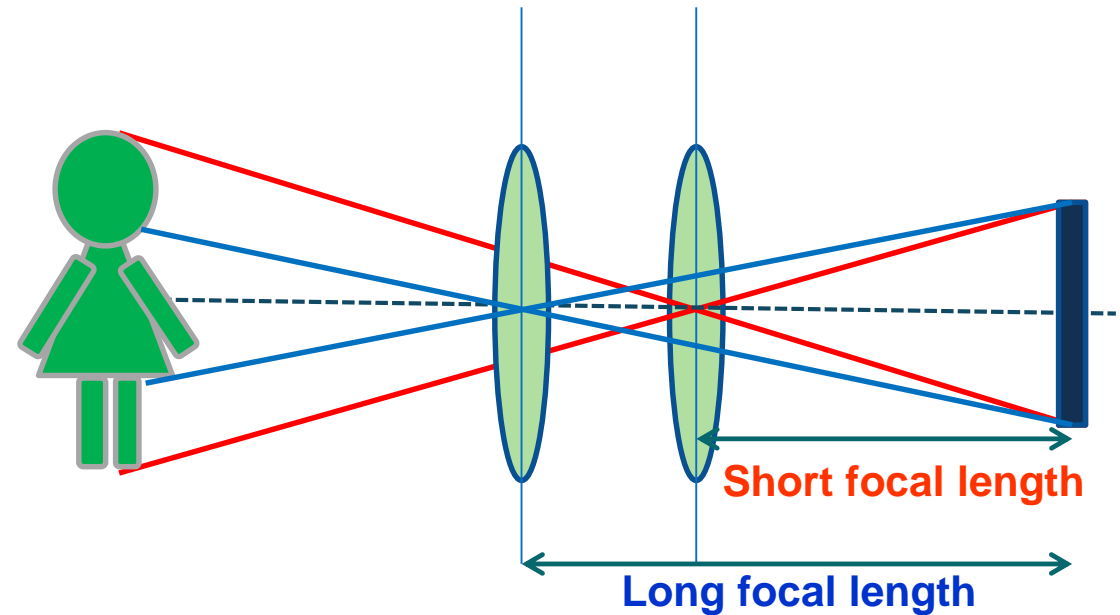
2048 × 1536 1/3" & 1/2.8"			
	HFOV	VFOV	DFOV
4X3X 2.8~12mm	91.2-28.3°	66.4-21.2°	120.2-35.4°
4X3X 8~32mm	26-8.54°	19.5-6.4°	32.8-10.6°

FOV

- Small sensor size → Small FOV
- Large sensor size → Large FOV

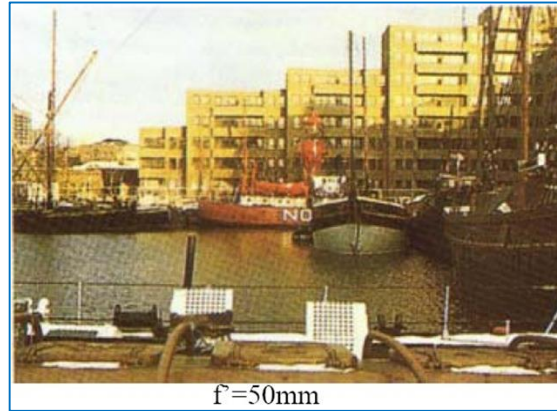


- Long focal length → Telephoto Coverage
- Short focal length → Wide Coverage

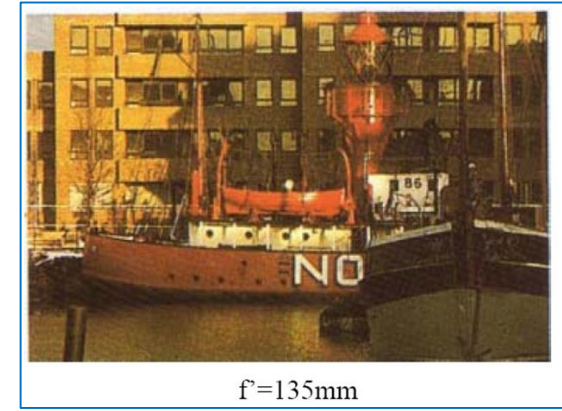


Lens with different FOV

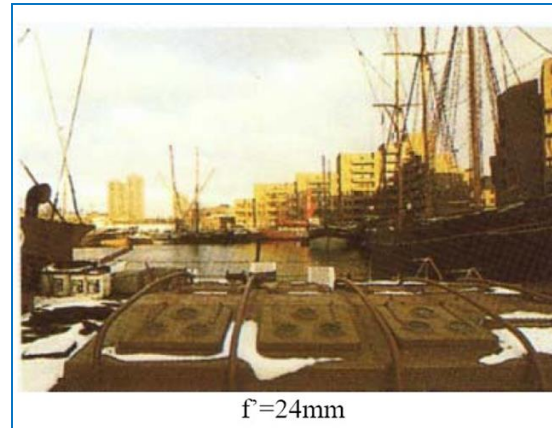
- FOV
 - ▣ Normal view
 - ▣ Telephoto
 - ▣ Wide angle
 - ▣ Panoramic



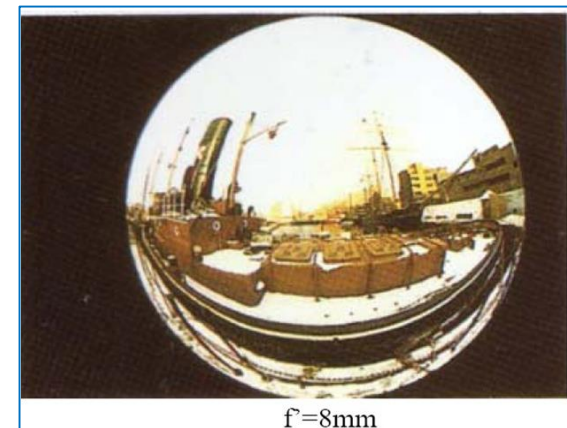
Normal view



Telephoto view



Wide angle view



Panoramic view

Iris

- **Iris**

- Iris (or aperture) is used to control the amount of light admitted through the lens.

- **F number**

- The amount of light through the lens is measured by F number.
- $F = f/D$, where f is the focal length, and D is the iris diameter.
- Each lens is labeled with the maximal F number, such as F1, F1.4, F2, F2.8, F4, etc.



F number

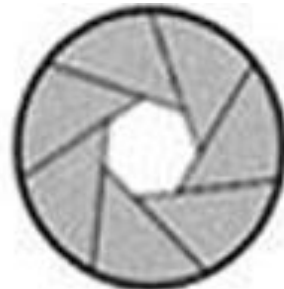
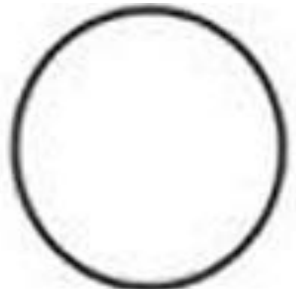
- Relationship among F number, iris size, and amount of light (with a fixed focal length)

$$D = f / 2(F)$$

f/2.8

f/4

f/5.6

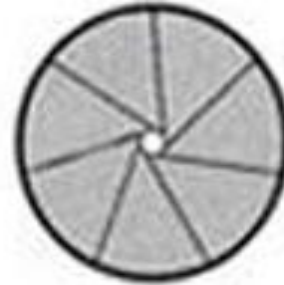
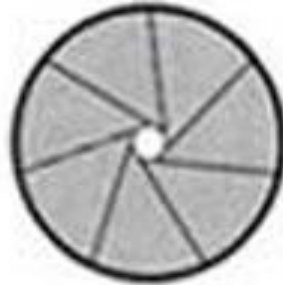
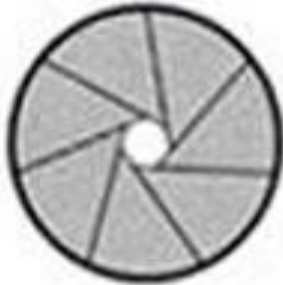
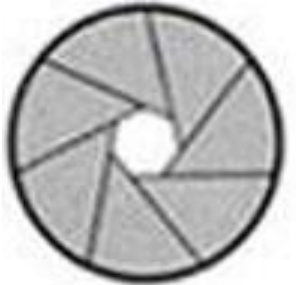


f/8

f/11

f/16

f/22



F number ↑
Iris size ↓
Amount of light ↓

F number

6mm F1.4



50mm F3.0

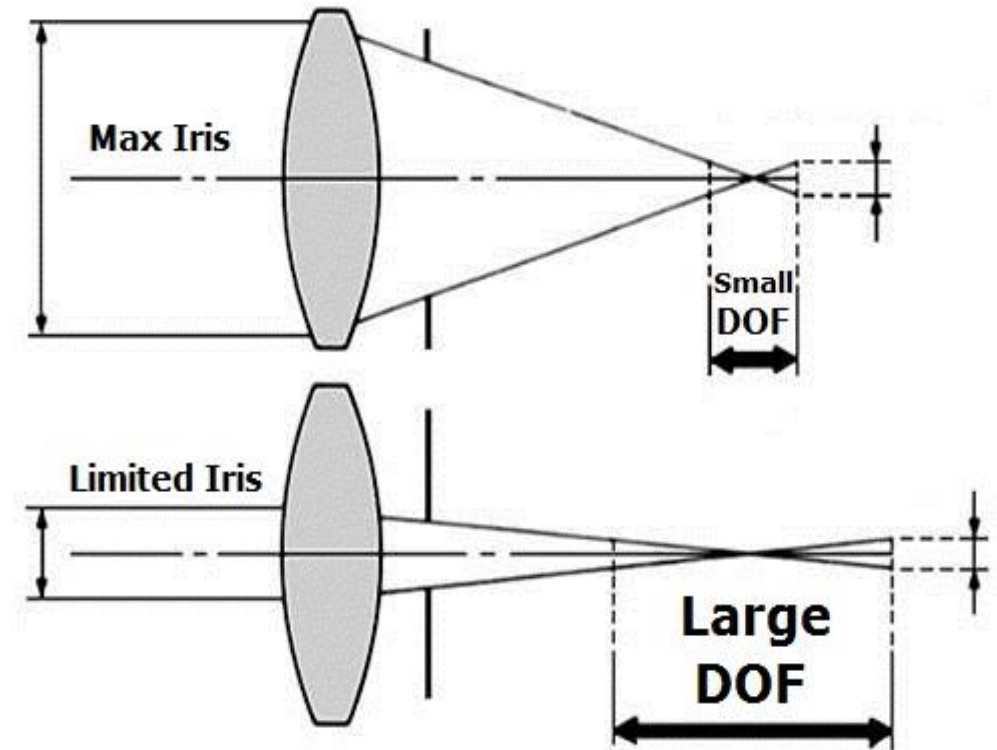
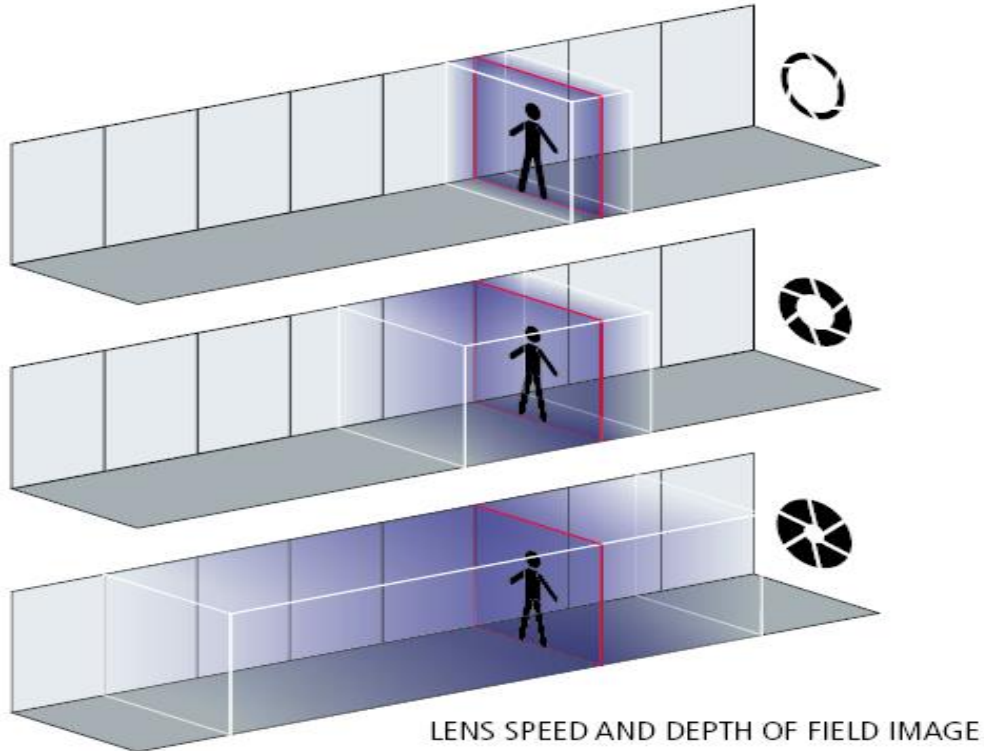


Which lens will capture a brighter image



Depth of Field

- Depth of field refers to the distance in front of and beyond the point of focus where objects appear to be sharp and clear simultaneously.
 - Bigger iris, smaller depth of field;
 - Longer focal length, smaller depth of field.



	F number	Focal length	Object distance
Depth of Field	+	-	+



Contents

- Network Basics
- Optics Basics
- **Camera Image Basics**
 - Day & Night Switch
 - Smart IR
 - EXIR
 - AGC
 - 3D DNR
 - BLC
 - WDR

Day & Night Switch

- At night or under low illumination scenes, the camera switch from color mode to B/W mode automatically, which can improve low-light performance effectively.



Day (color) mode

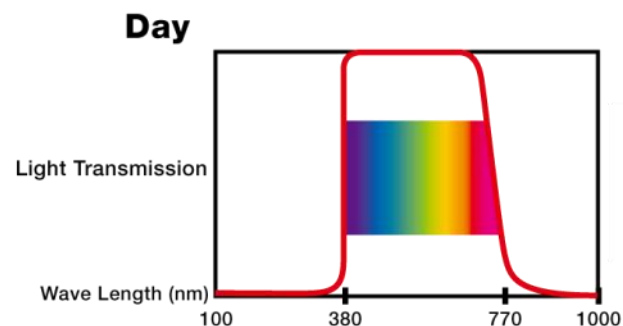
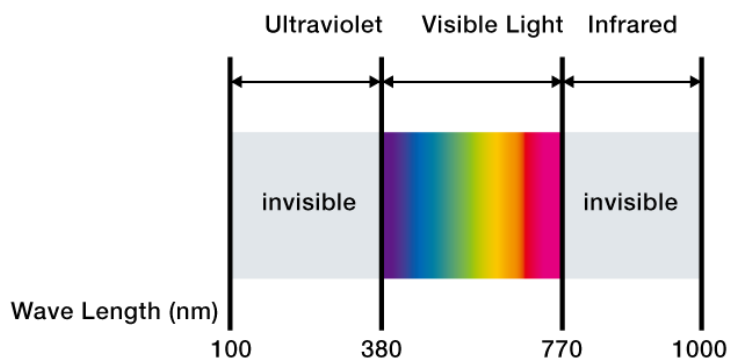


Night (black and white) mode

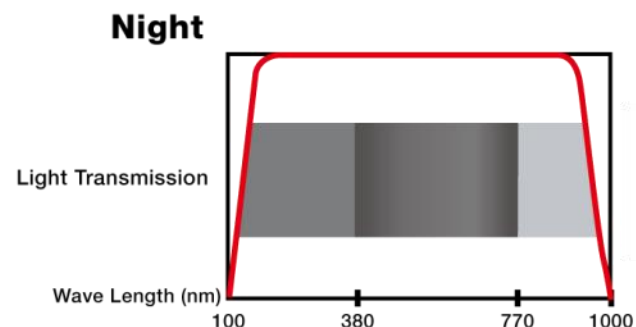
- A network camera with day/night functionality has an automatically removable infrared-cut filter. The filter is on during daytime, enabling the camera to produce colors as the human eye sees them. At night, the filter is removed to enable the camera to take advantage of near infrared light and produce good quality, black and white images. This is one way of extending a network camera's usefulness in low-light conditions.

ICR (IR-Cut Filter Removable)

- ICR sits behind a camera lens, and in front of the image sensor. The role of an IR-cut filter is to filter out infrared light to enable cameras to produce colors that the human eye sees. However, if the filter is removed under low light or nighttime conditions, the camera's sensor is able to take advantage of infrared light and deliver black and white images even when there is not enough visible light.



- An IR illuminator that provides infrared light can also be used in conjunction with a day/night camera to further enhance the camera's ability to produce high-quality video in low-light or complete darkness. Day/night cameras with built-in IR illuminators are also available.



Day & Night Switch Configuration

- Configuration > Image> Display Settings

HiLook

Live View Configuration

Display Settings OSD Settings Privacy Mask

Local System Network Video/Audio Image Event Storage

Scheduled Image Settings Auto-Switch

Image Adjustment

Exposure Settings

Day/Night Switch

Day/Night Switch Auto

Sensitivity 4

Filtering Time 40

Smart Supplement Light OFF

Backlight Settings

White Balance

Image Enhancement

Video Adjustment

Day/Night Switch

Day/Night Switch

Day
Night
Auto
Scheduled-Switch

NOTE

Day, Night, Auto, and Scheduled-Switch are selectable for day/night switch.

Day & Night Switch


Color & B/W Switch	Day, Night, Auto, Scheduled-Switch	Multiple mode
Sensitivity	0~7	Judged by photoresistance
Filtering Time (s)	5~120	After this period of time, the color & B/W mode switch
Smart IR	ON/OFF	Prevent overexposure


Day: the camera stays at day mode.


Night: the camera stays at night mode.

Auto: the camera switches between the day mode and the night mode according to the illumination automatically. The sensitivity ranges from 0~7, the higher the value is, the easier the mode switches. The filtering time refers to the interval time between the day/night switch. You can set it from 5s to 120s.

Schedule: Set the start time and the end time to define the duration for day/night mode.

Scheduled Image Settings Scheduled-Switch 

Start Time 06:00:00 

End Time 18:00:00 

Common Day Night

Smart IR

- Smart IR function gives user an option to adjust the power of the IR LED, thus providing a clear image that is not overexposed or too dark.

Anti Over Exposure



Smart IR OFF

Smart IR ON

^ Day/Night Switch

Day/Night Switch	Auto
Sensitivity	4
Filtering Time	<input type="range"/> 120
Smart Supplement Light	ON
Mode	Auto

Manual mode: Configure the distance by control the current intensity of the led.

Auto mode: Auto-adjust the current intensity of the IR led.

EXIR

Traditional IR



Traditional IR LEDS focus all their energy at the center of the image in a circular pattern, leaving the periphery dark.

EXIR



EXIR, with an integral lens that distributes the IR energy uniformly across the rectangular field of view.

AGC

- AGC(Auto Gain Control) amplify the signal from CCD to make it brighter during night time. This amplification is called gain. The camera can auto adjust the gain control according to signal level.
- Advance: increase dynamic range;
- Disadvantage: amplify noise as well.



AGC OFF



AGC ON

3D DNR

- Through DNR function we can reduce the noise to get a better quality image during **night**.
- HiLook cameras adopt 3D digital noise reduction to provide images with less noise in low-light surveillance scenes compared to conventional cameras. 3D DNR can be used to enhance image quality and save bandwidth.



DNR Disabled



DNR Enabled

3D DNR Configuration

^Image Enhancement

Digital Noise Reduction

Noise Reduction Level

^Image Enhancement

Digital Noise Reduction

Space DNR Level

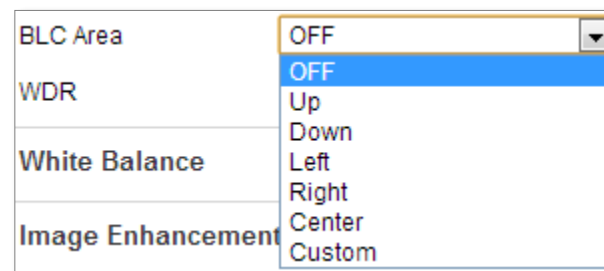
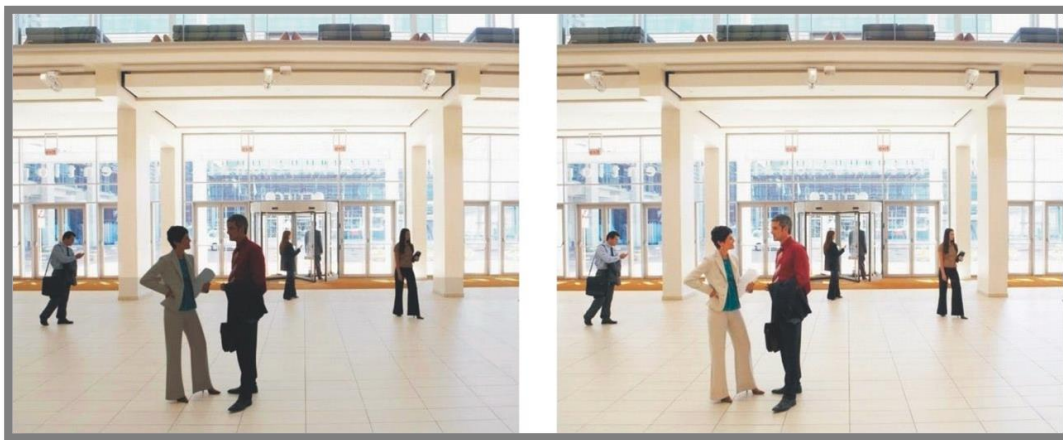
Time DNR Level

3D DNR (Expert Mode)

- Space domain
 - > intra-frame noise reduction, static noise
- Time domain
 - > inter-frame noise reduction - dynamic noise, moving image tailing

BLC (Back Light Compensation)

- **BLC:** If you focus on an object against strong backlight, the object is usually too dark to be seen clearly. BLC compensates light to the object in the front to make it clear.
- It enables objects in the foreground to be seen clearly, although the background areas will be changed.



NOTE

OFF, Up, Down, Left, Right, Center and customize are selectable.

WDR (Wide Dynamic Range)

- **D-WDR:** Digital WDR is a software-based technique that optimizes image quality by adjusting the gamma (γ) value to enhance dark areas. The D-WDR level should be carefully adjusted according to the lighting conditions in order to minimize possible image deterioration (i.e. the image being washed out).
- **True WDR:** WDR cameras incorporate an image sensor that takes different exposures of a scene (e.g., a short exposure for very bright areas and long exposure for dark areas) and combine them into one image, enabling objects in both bright and dark areas of a scene to be visible.

120dB WDR



Enable **WDR** may reduce the image quality (image looks grey) in normal situation.

Backlight Settings

WDR

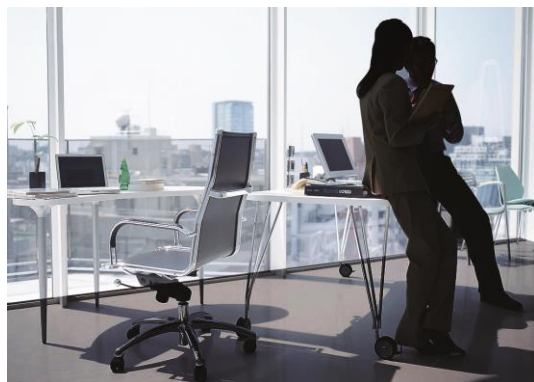
ON

Wide Dynamic Level



D-WDR vs. WDR vs. BLC

Items	D-WDR	True WDR	BLC
Core technology	Algorithm	Circuit module & algorithm	Algorithm
Advantage	Easy to realize	Twice or triple exposures	Areas are selectable
Disadvantage	Image may be slightly washed out	Consume camera CPU	Background may be overexposed



Original



BLC



WDR

NOTE

✓ Users should choose the mode appropriately according to the real scene to form the optimal image.



Thanks