HCSA

HIKVISION

Fundamental of Video Surveillance and Security

——HIKVISION Certified Security Associate Training

V1.1 , 2015.5

Content

1. **Security and CCTV**
2. Glossary and Concepts
3. Function of Cameras

CCTV

- Definition:

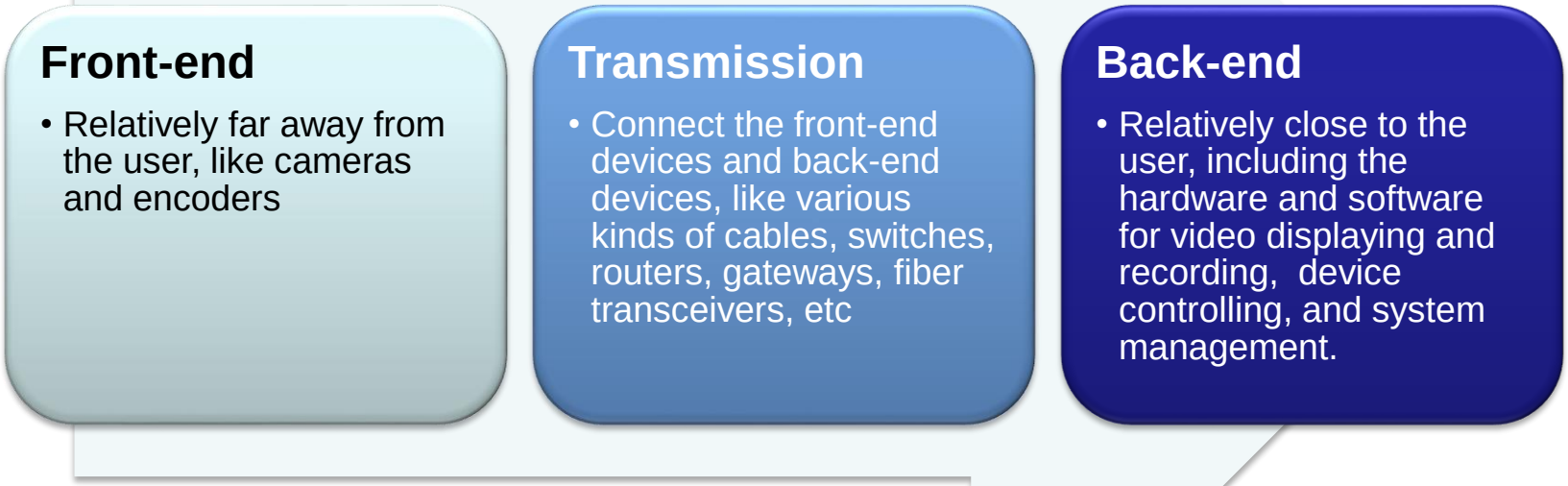
  Electronic system or network system that uses video technique to detect & view selected area, synchronously display & record live image, retrieve & play back of recorded data.

- Basic Functions:

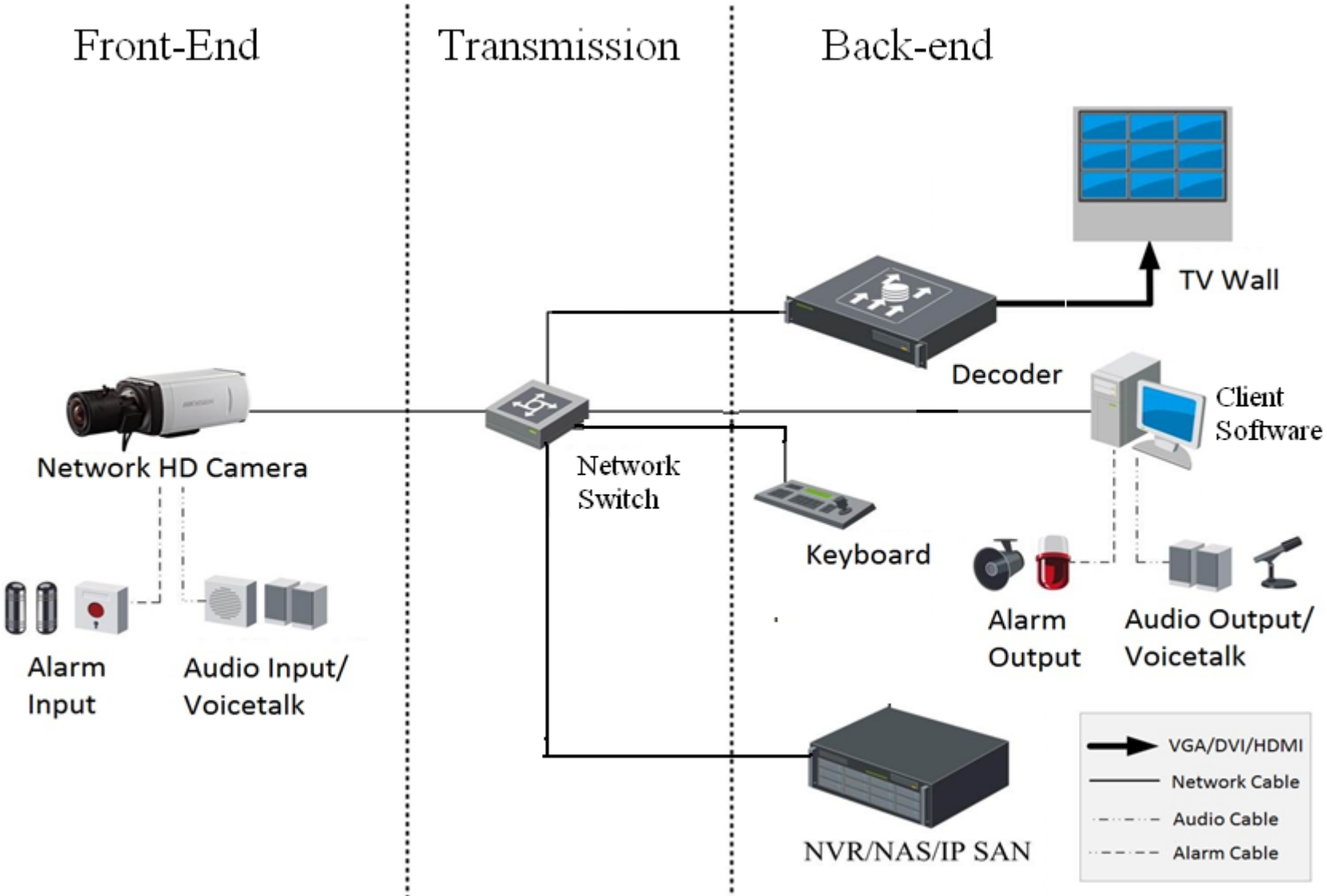
Functions	Requirements
Monitoring	The video should be real-time and clear.
Controlling	Alarm handling should be in time, PTZ operations should be smooth, etc.
Management	The management functions should be powerful and useful, like storage, retrieve, playback, user permission and maintenance.

CCTV System Components

- A CCTV system, no matter big or small, IP or analog, is consisted of three parts:

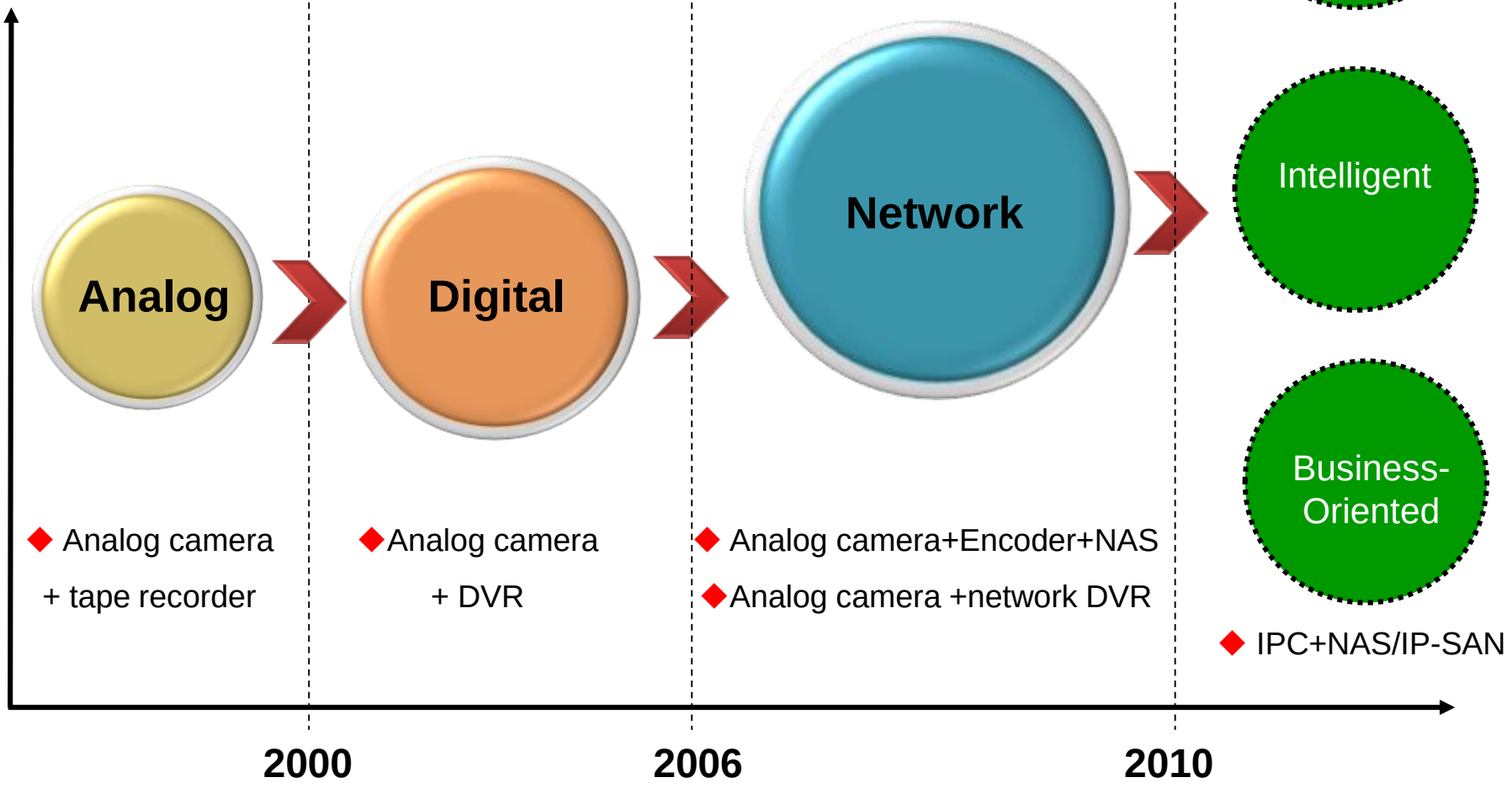


An Example of IP System



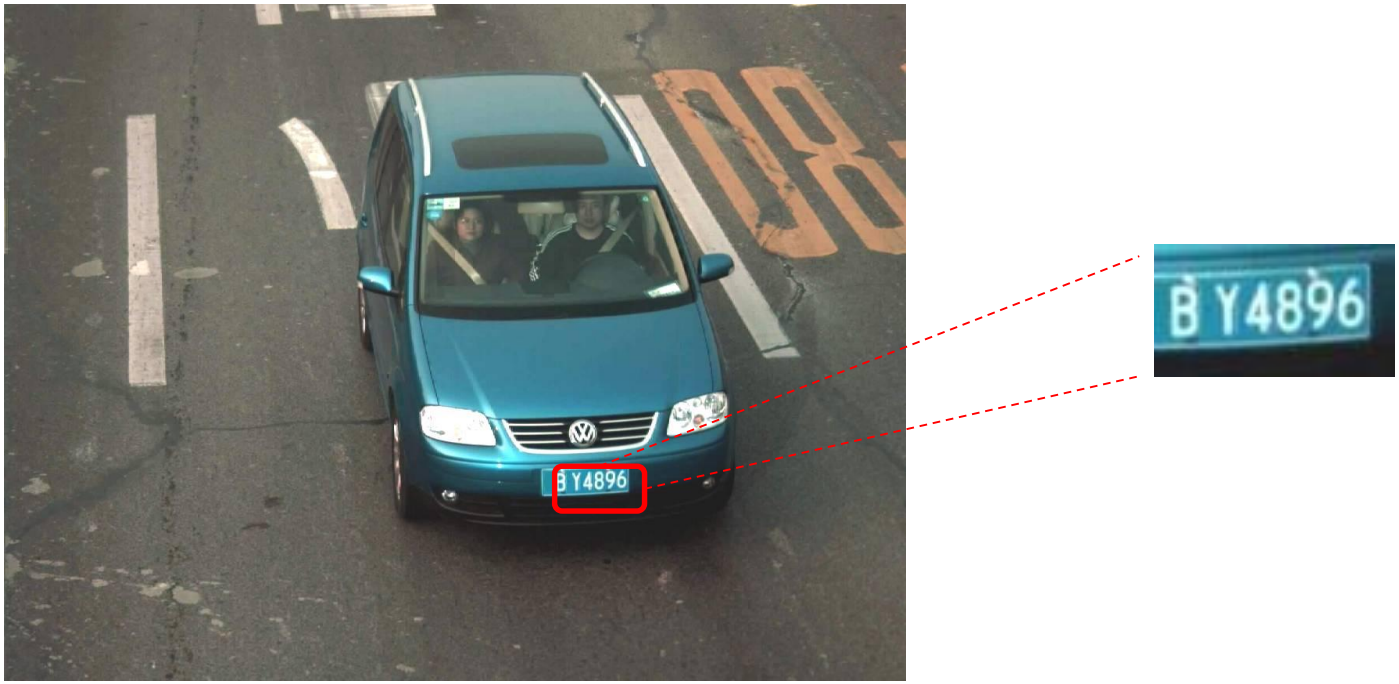
Trend in CCTV

- Currently the industry is moving to IP solutions. These solutions will include cameras with increased megapixels and additional video analytics.



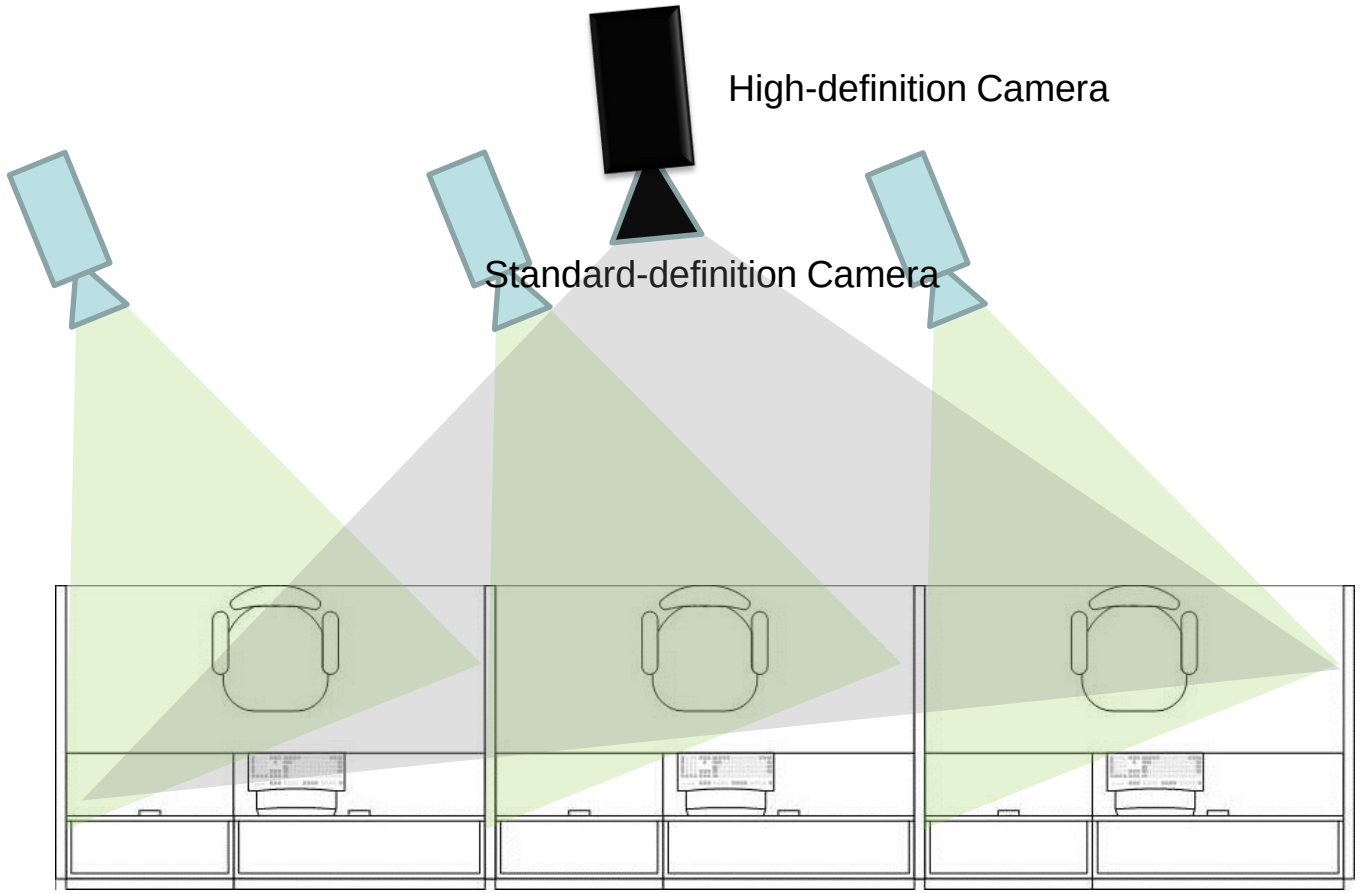
Advantages of HD Surveillance (1)

- Higher definition, providing more details



Advantages of HD Surveillance (2)

- Reduce the number of cameras.



Various of Video Content Analytics

Traverse Plane Detection

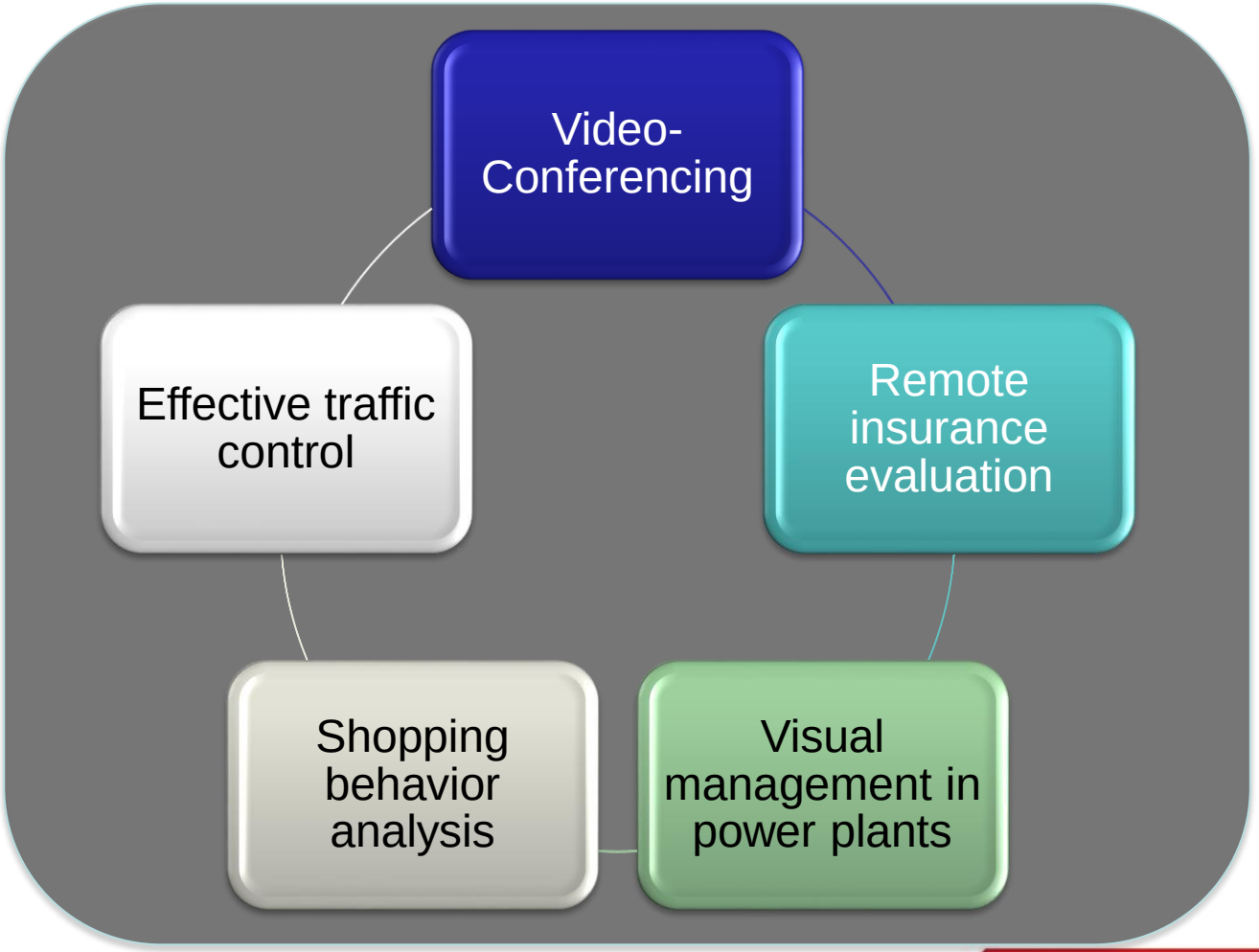
Traffic Jam Detection

Auto Tracking

and many others...

Business-Oriented System Solutions

- Besides traditional Security purposes, CCTV can serve more now. For example:



and many others...

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Worldwide Television Standards

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PAL(Phase Alternating Line)

1. Line frequency: **50Hz**; field frequency: 50 fields; frame frequency: **25 fps**; scan line: **625 lines.** Low image color error rate, and with good compatibility with B&W TV.
2. Used in China, Germany, etc.

NTSC(National Television System Committee:)

1. Line frequency: **60Hz**; field frequency: 60 fields; frame frequency: **30 fps**(actually 29.97fps); scan line: **525 lines**
2. USA, Japan

SECAM(Sequential Couleur avec Memoire)

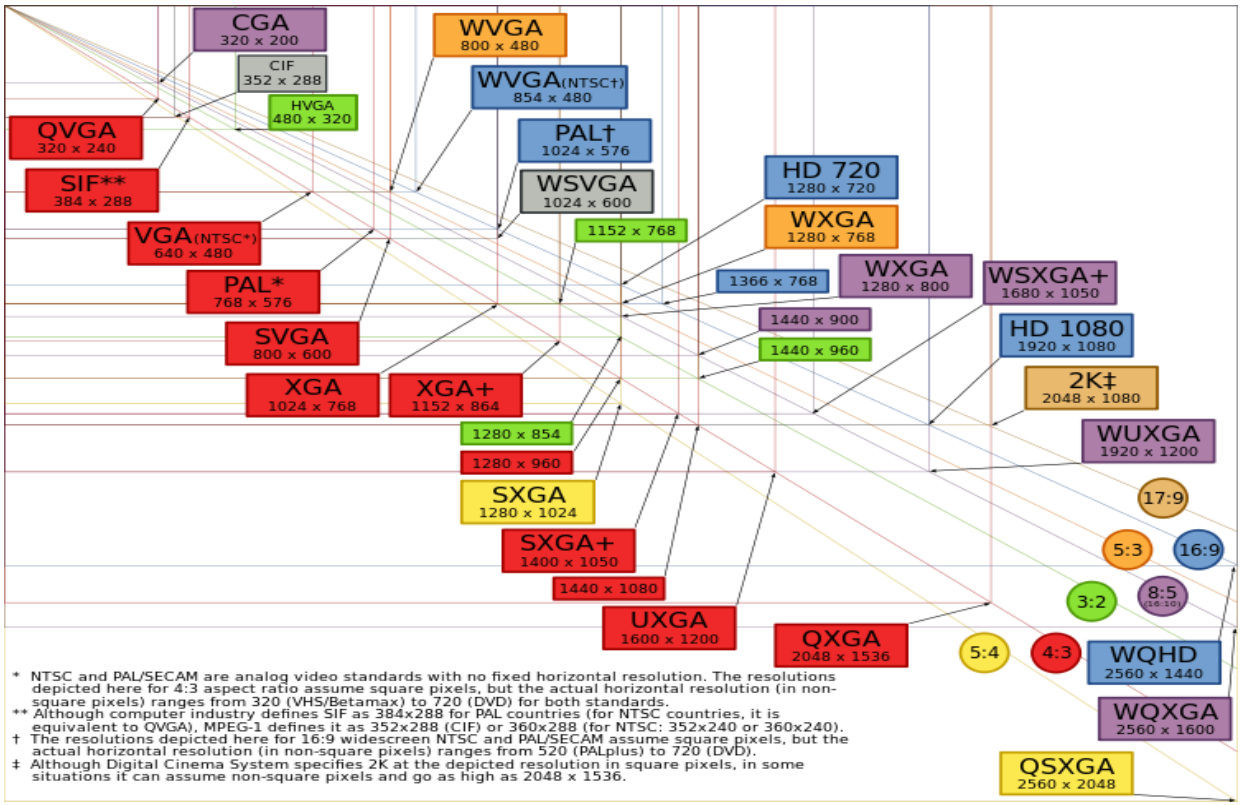
1. Transmit color and memory by sequence. **25fps, 625 lines**.
2. Russia, France, Egypt

Resolution

- Pixel
  - Rectangular dots which form an image. All images, video or static, are measured in pixels. In analog word, each pixel is composed of three color dots of red, green, and blue.

- Resolution
  - It is used to describe the size of an image and usually quoted as width * height, with the units in pixels.

Popular resolution are shown on the right.



Standard Resolution

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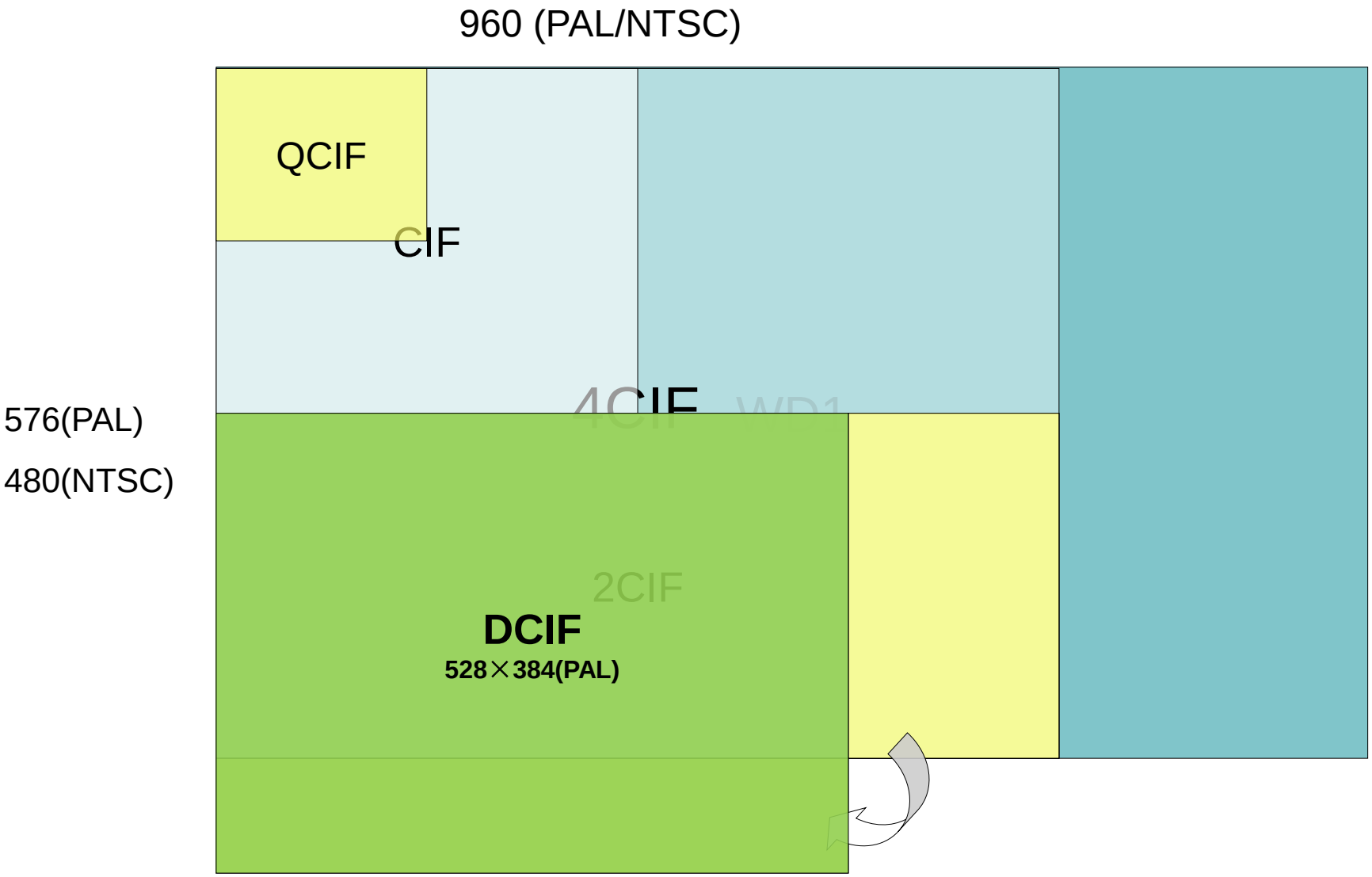
Resolution / Standard	WD1	D1	4CIF 1×1	2CIF 1×1/2	DCIF 3/4×2/3	CIF 1/2×1/2	QCIF 1/4×1/4
PAL	960 × 576	720 × 576	704 × 576	704 × 288	528 × 384	352 × 288	176 × 144
NTSC	960 × 480	720 × 480	704 × 480	704 × 240	528 × 320	352 × 240	176 × 120

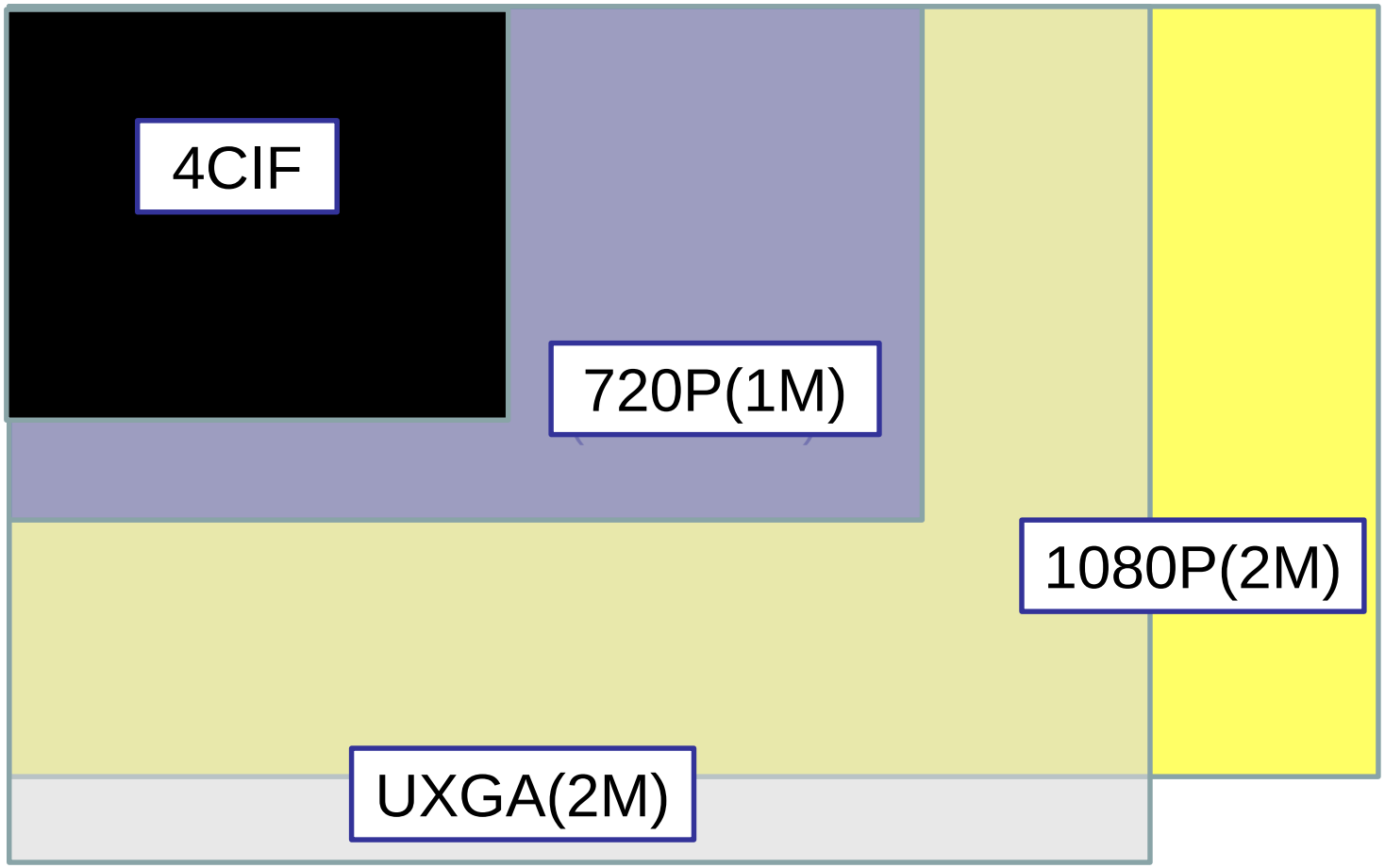
High-definition Resolution

Resolution / Standard	720P	960P	UXGA	1080P	QXGA	4MP	6MP	4K/8MP
	1280 × 720	1280 × 960	1600 × 1200	1920 × 1080	2048 × 1536	2560 × 1440	3072 × 2048	4096 × 2160

Frequently Used Standard Resolution in CCTV



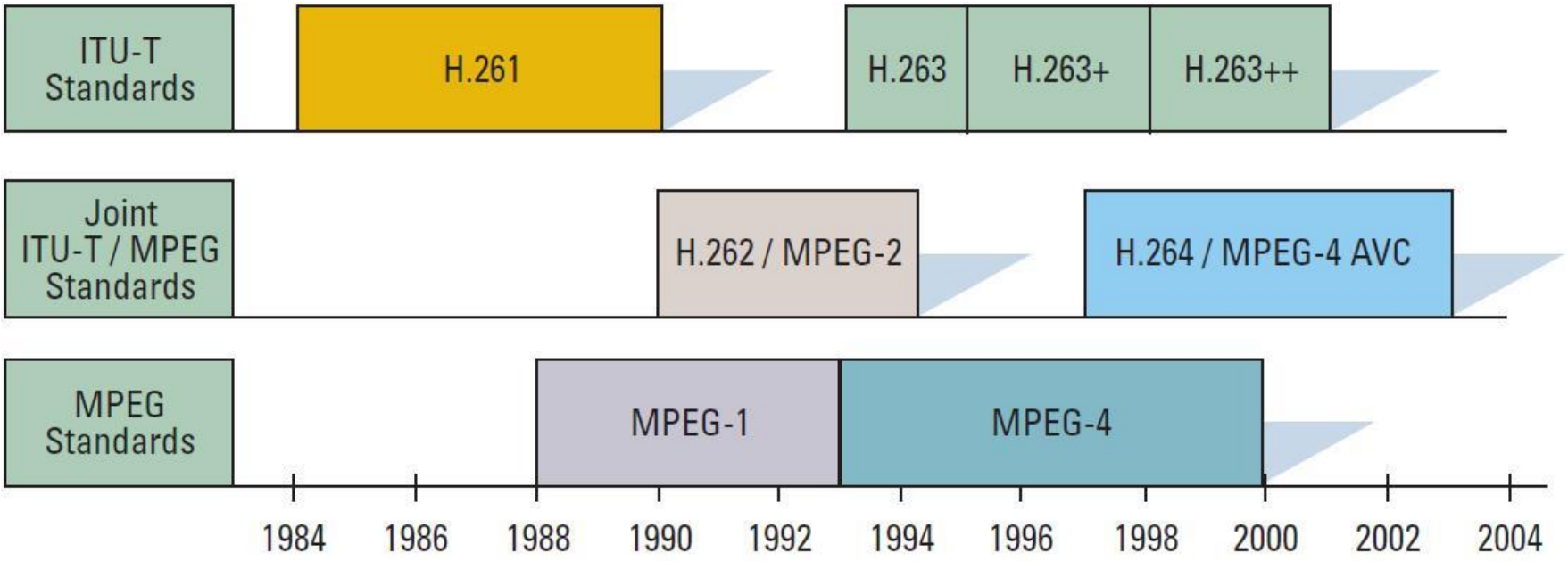
Frequently Used High-definition Resolution in CCTV



Video, frame rate and Stream

- Video
  - Video is made up of a series of continuous images
  - Each image in the video is named as a ***Frame***
- Frame Rate
  - Quantity of frames per second, measured by fps(frames per second).
- Stream
  - After the video is compressed, a stream is generated.
  - BitRate (bps): quantity of bit stream per second.
  - BitRate type : Constant BitRate**(CBR)**, Variable BitRate**(VBR)**
  - Stream type: video, audio, video & audio complex stream

Video Compression Standards



Chronological Progression of ITU and MPEG Standard

Video compression technologies are known as "**codecs**", a term derived from the compression and decompression methodology.

M-JPEG

MJPEG(Motion JPEG), is the digital video version of the JPEG compression family and follows the JPEG compression algorithm

MJPEG is a higher quality video codec, because it forces the use of all required frames per second. MJPEG uses every frame as if it were an animation.

Because every frame is a key frame, so the file sizes for MJPEG are much larger and the required bandwidth is bigger than a comparable MPEG-4 file

MJPEG frame rate and resolution can be adjusted momentarily. And MJPEG is the best choice for Video Analytics

MPEG-4

1

MPEG-4 includes a specific formula of I-, P- and B- frames to create motion.

2

MPEG-4 has become the standard for streaming digital video, because it provides flexibility and cut down the bandwidth and storage space down to one-quarter that of M-JPEG.

H.264

H.264(also known as MPEG-4 AVC in ISO/IEC) is a new, very important breakthrough in digital video surveillance.

H.264 can encode and decode video at a higher quality, using half the bandwidth of any of its codec predecessors. It can provide better quality video for video analytics and use less storage space.

H.264 creates some new compressed technology such as multi-reference frame, multi-block type, integer transform, intra prediction, etc. It uses more refined Divided Pixel Motion Vector (1/4, 1/8) and loop filter improved compressed performance.

H.265

- H.265 is set and approved by **ITU**. It is also called **HEVC**.
- H.265 is a more efficient video coding way to realize a high definition transmission under a comparatively low bandwidth. It is a upgrade version of H.264.
- H.265 also support **4K**(4096*2160) and **8K**(8192*4320) ultra high definition video coding.

Bit rate

- Bit rate is the measurement of the size of a video stream. It depends on the resolution and frame rate of the video, compression codecs, and how much motion are there in the video.

Resolution	VGA	4CIF	720P(1280*720)	1280*960	1080P(1920*1080)	4MP	6MP	4K/8MP(4096*2160)
Bit rate	0.75Mbps	1Mbps	2Mbps	2Mbps	4Mbps	6.5Mbps	11Mbps	16Mbps

Note: Frame rate is set to 25 fps.

- Bitrate decides the ***storage*** and ***bandwidth requirements***.
- If Bit rate is not enough, the video quality will be bad. If too much Bit rate is used, unnecessary waste of bandwidth and storage will occur.

Bit rate and Record File Size

- After figuring out what is the bit rate, size of record file could be calculated accordingly.

1.Size of Record file per hour (unit: MB/hour) ＝biterate (Kbps)*3600/8/1024

2.Then, multiply this number with how many hours you need to need the recording files.

3.If the number is huge, you can divide the number by 1024 or 1024*1204 to convert it to GB or TB.

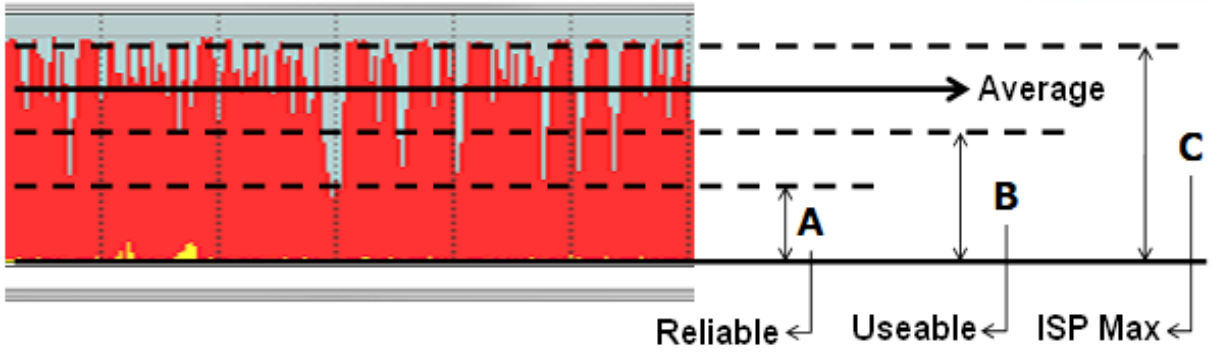
Bitrate	File size		Bitrate	File size
512kb	225MB		1.50Mb	675MB
640kb	281MB		1.75Mb	787MB
768kb	337MB		2.00Mb	900MB
896kb	393MB		3.00Mb	1350MB
1.00Mb	450MB		4.00Mb	1800MB
1.25Mb	562MB		5.00Mb	2250MB

The table shows the size of recording files under common used bit rate

(one channel, one hour)

Bit rate and Bandwidth

Required Bandwidth(K) = Bitrate*E. (1.2 < E < 1.4)



Note

When ISP gives you a 10Mbps network, you can never transmit a 10Mbps video stream on it.

Required Bandwidth	K<=A	A<K<=B	B<K<=C
Result	Transmission is smooth and real-time	Transmission is OK most of the time. Enlarging the butter could make it smooth, but delay will become worse as well.	Transmission is slow. A lot of packets will lost. The video will be jerking and broken.

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S/N

- Use S/N to indicate the ratio between camera output signal and noise, unit is dB.
- Formula: $S/N=20log(V_S / V_N)$
- S/N represents the image performance of camera under low illumination.

During day time, picture quality is very good.

During night, low S/N camera tend to create many white dots(noise) on the picture.

DNR

- Through DNR function we can reduce the noise to get a better quality image during **night**.

- Compared to traditional DNR, **3D-DNR** not only process the Y signal and C signal, but also process the original signal from sensor.

DNR Disabled

DNR Enabled

AGC

- AGC(Auto Gain Control) amplify the signal from CCD to make it more bright 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

White Balance

- For color camera, ensure the right color display in different color temperature(CT) environment.
- Classified into manual WB and auto WB
  - Manual WB
  - Auto WB
    - Auto White Balance(AWB)
    - Auto Tracking White Balance (ATB)

Fluorescent Lamp CT

Standard CT

Tungsten Filament Lamp CT

Backlight Compensation

- Camera can determine the AGC level based on the average brightness of the entire field of view, for example: when the brightness of foreground is greatly different with the background, it will lead the foreground to lack of exposal.
- Camera enable the BLC function, which can determine the AGC level singly based on one of the sub area in the entire field of view. It can ensure the normal exposal of foreground but will cause overexposure of background.

Wide Dynamic Range

- Adopt special CCD and DSP circuit, exposure separately to the brighter and darker areas, and then compose these two images together to form a image, whose foreground and background are clear.
- WDR is widely used in backlight environment now, like the lobbies and counters.

Day/Night

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

Day (color) mode

Night (black and white) mode

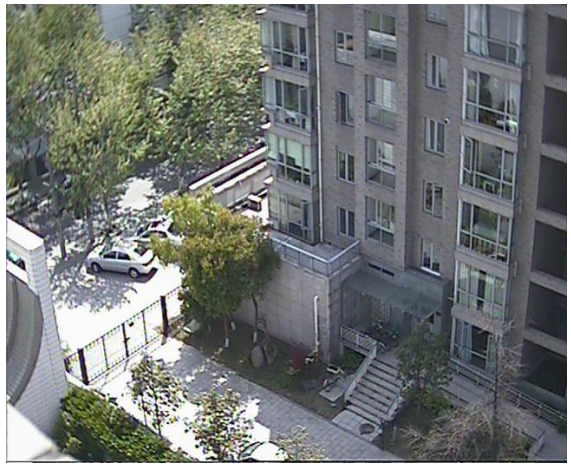
Too dark to form a good color image.

ICR

Two D/N switch modes

- Digital D/N mode——Adopt fixed bimodal filters, which support pass the visible and infrared light simultaneity.
- **ICR** D/N mode——Adopt mechanical IR filter, filter out infrared light during the day to ensure the image effect; remove IR filter at night, to ensure the full spectrum light can reach the sensor

Digital D/N mode---IR light reaches the image sensor and makes the quality worse



ICR D/N mode---IR light are blocked by IR filter during day time.

High Light Compensation

- Compensate the strong light in the picture, so that the surrounding area wouldn't be over-exposed and still could be seen.
- Widely used in traffic monitoring, where license plates must be recognized.

Camera without HLC

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Thanks!

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