Emerging Technologies of ITS
The Evolution of CCTV

Areas of Discussion...

• IP Cameras
  Internal vs External Encoding

• High Definition Video
  What’s all the hype?

• H.264 Encoding
  How is it Different?
In the Beginning...

- It was analog ...
- And it was good!
- It was also difficult to share
- Required high bandwidth rates
- Difficult to store
- Not easily scalable
- Not easy to integrate
- Not ‘Web’ enabled
• Internally encoded analog video
  Digitized, IP Ethernet Format, Compressed

• Getting over the Hurdle
  Power, 10/100, serial, USB, Audio, Video, LED’s

• Holding to Standards & Spec’s
  TS-2, Pressurized, Sealed

• Simplicity
  Cable and Cabinet requirements
Experience high definition video for yourself
Exploring HiDef Video

- HiDef is a Video Compliance Standard
  720p, 1080p, 16:9 Aspect Ratio
- Difference Between HiDef & Megapixel cameras
  Resolution equivalence
- Integration Into Existing Platforms
- Visible Contrasts
# HiDef Video vs Megapixel Video

<table>
<thead>
<tr>
<th>Camera Type</th>
<th>3960(^{HD}) 720p</th>
<th>5MP</th>
<th>3MP</th>
<th>2.1MP</th>
<th>1.3MP</th>
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<tr>
<td>Zoom Factor</td>
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<td>DIGITAL</td>
<td>DIGITAL</td>
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<td>2560 1920</td>
<td>2048 1536</td>
<td>1600 1200</td>
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<td>160 120</td>
<td>128 96</td>
<td>100 75</td>
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<tr>
<td>x18</td>
<td>1280 720</td>
<td>142 107</td>
<td>114 85</td>
<td>89 67</td>
<td>71  57</td>
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</tbody>
</table>

- **Resolution Advantage**
- **Resolution Equivalence**
- **Resolution Disadvantage**

*High Definition Advantage*
HiDef Comparison to Standard Definition

**HD Image**
- Camera = 3960HD
- Image Res. = 1280 x 720
- Camera Zoom Depth = 16x
- HAFOV = 3.25 deg
- HFOV = 30 ft (9.14 M)
- VFOV = 17 ft (5.2 M)
- Object = Car
- Distance = 528 ft (161 M)
- Approx Object Size = Approx Object Size = 6 ft (1.8M) W x 5 ft (1.5 M) H
- Horiz. Pixels on Target = 256
- Vert. Pixels on Target = 214
- Total Pixels on Target = 54784

**SD Image**
- Camera = 3940
- Image Res. = 640 x 480
- Camera Zoom Depth = 35x
- HAFOV = 1.73 deg
- HFOV = 16 ft (4.9 M)
- VFOV = 12 ft (3.7 M)
- Object = Car
- Distance = 528 ft (161 M)
- Approx Object Size = 6 ft (1.8M) W x 5 ft (1.5 M) H
- Horiz. Pixels on Target = 241
- Vert. Pixels on Target = 200
- Total Pixels on Target = 48200

**Comparisons**
- HD image: 1280 pixels, 528 ft (161 M) from camera, 17 ft (5.2 M) high, 30 ft (9.14 M) wide
- SD image: 480 pixels, 528 ft (161 M) from camera, 12 ft (3.7 M) high, 18 ft (4.2 M) wide

**Calculations**
- Vert. Pixels on Target = (Image Vert. Res / VFOV) * Object Height
- Total Pixels on Target = Vert. Pixels on Target * Horiz. Pixels on Target
HiDef Comparison to Standard Definition Video
A Look at the Network

I asked my dad where the children came from, he said people download them from the internet!
The Holy Grail.....

Better Image Quality w/Less Bandwidth
Effects on Networks

- Frame Rates
- Resolution
- Bandwidth
Encoding Video
The Physics of Encoding – Doing the Math…

• NTSC analog video is 640 x 480 pixels per frame
• Total pixels per frame = 300,000
• Times 30 frames p/sec = 9,000,000 pixels p/sec
• Times 24 bits per pixel = 221,000,000 Mbits
• Divide by 8 bits per byte = 27 MB (uncompressed)

• HDTV (720p) is 1280 x 720
• 83 MB (uncompressed)
H.264 Video Compression

• Video Compression is Really Motion Compensation
  The difference between consecutive frames in terms of where the previous frame has moved to. Subsequent frames have a lot of redundancy. The goal is to remove the redundancy.

• Effects on Bandwidth
  Frame Rate, Resolution, Traffic Shaping

• What is H.264?

• A Truly Open Format
  Windows Browser, VLC, QuickTime

• Universal Usage
  YouTube, Skype, Blu-ray, iPhone, iTunes Store,
With the MJPEG format, the three images in the above sequence are coded and sent as separate unique images.

With H.264 difference coding, only the first image is coded in its entirety. In the two following images references are made to the first picture for the static elements. Only the portions of the frame which have changed are re-coded.
What is H.264?

- MPEG4 Part 10 or AVC
- Covers low bit-rate Internet Streaming, to HDTV Broadcast and Digital Cinema
- Contains new features that allow it to compress video more effectively
Cross Road

• (n): The point at which a choice has to be made

• The Challenge is to Plan, Some Distance Into the Future

• Questions That Will Have Impact Decades From Now
  * HD or SD
  * IP or Analog
  * Video Walls
  * Decoding Video
  * Supporting Infrastructure
  * Costs $$$
The Surveillance System Sales Cycle...

• The original architecture selected at the beginning of the cycle, shapes what is purchased for nearly a decade.

  EXAMPLE...

  Classic DVR’s are only compatible w/analog cameras... Once you select a classic DVR, all you could use (w/o major structural changes) was analog cameras.
So.....
What to look for in a camera

- Analog or IP Camera
- Standard versus High Definition
- Easily integrated in existing architecture
- Sealed / Pressurized
- Fixed position or PTZ camera
- Dome camera or Barrel camera

- Pan/Tilt
- Multi Focal
- Auto Focus
- Auto Iris
Combining Technologies

**H.264 & HDTV**

- Made available with increase in processing power
- Until Recently, HD Video Over IP Performed Poorly Over Most LAN/WAN Networks
- H.264 & HiDef TV are Found in Nearly Every New Video Product in the Market Today
- ONVIF Makes it Compatible
  - Consortium camera manufacturers
  - For standardizing interoperability
  - Defines a common protocol how network video devices should exchange information
Advanced Functionalities...

- Traffic Analytics
  - Speed / Occupancy
- Internal Web Server
  - Admin, Control, View
- Multiple Outputs
- Motion Detection
- NTCIP
- Tracking
- PoE
Traffic Analytics – Speed & Occupancy
Internal Web Server User Interface
Thank You
Questions