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

IP Cameras

- 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

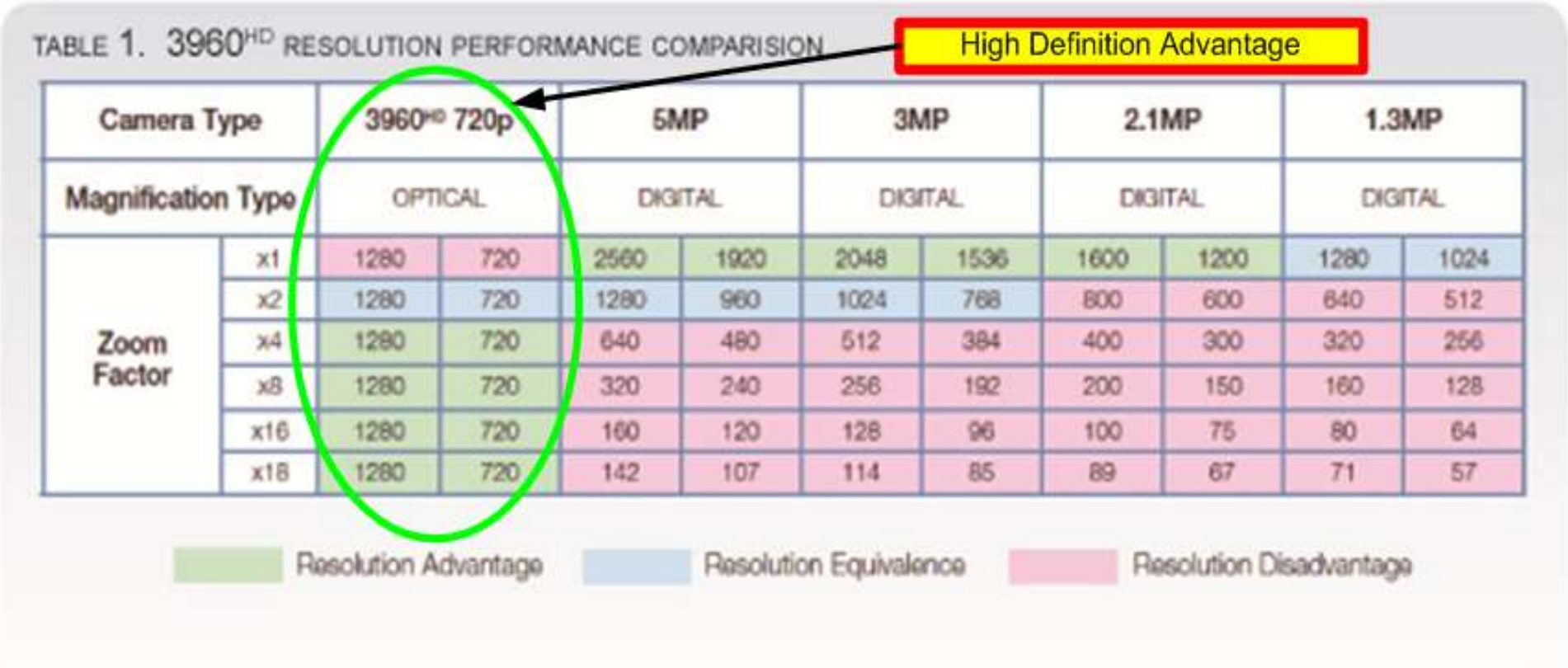


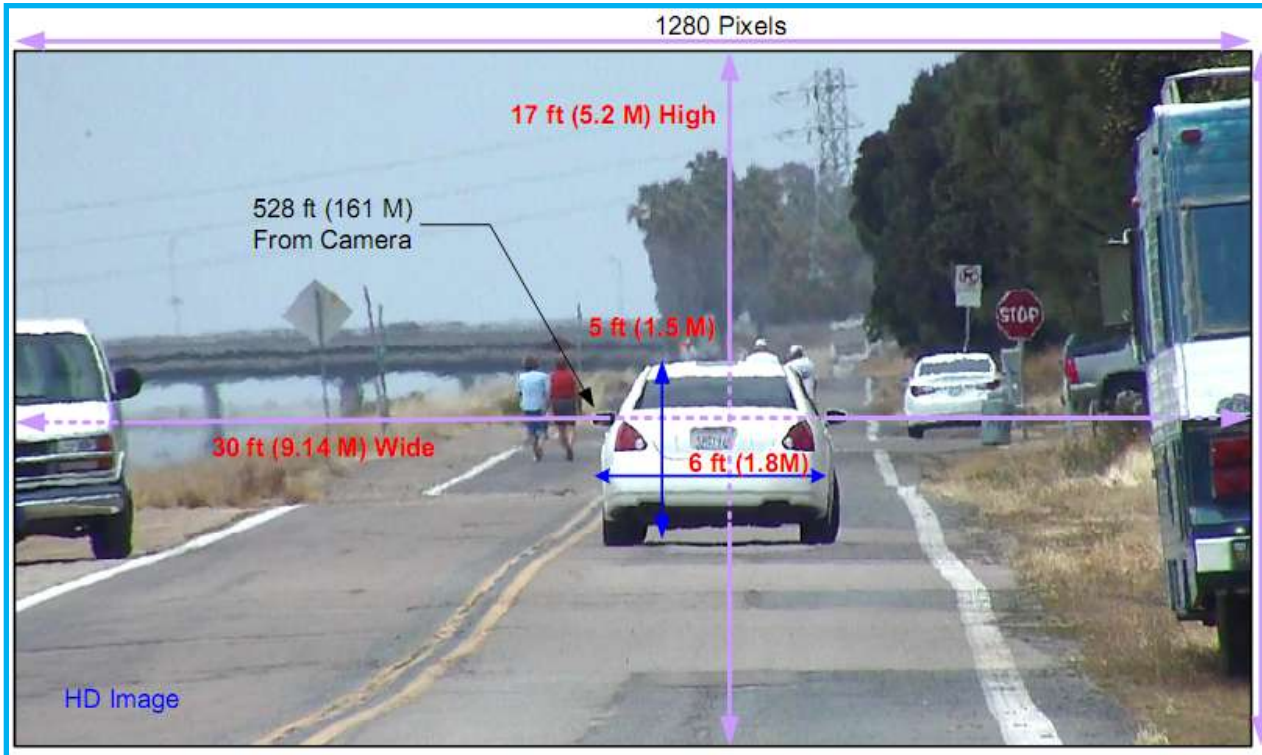
TABLE 1. 3960HD RESOLUTION PERFORMANCE COMPARISION

High Definition Advantage

Camera Type		3960HD 720p		5MP		3MP		2.1MP		1.3MP	
Magnification Type		OPTICAL		DIGITAL		DIGITAL		DIGITAL		DIGITAL	
Zoom Factor	x1	1280	720	2560	1920	2048	1536	1600	1200	1280	1024
	x2	1280	720	1280	960	1024	768	800	600	640	512
	x4	1280	720	640	480	512	384	400	300	320	256
	x8	1280	720	320	240	256	192	200	150	160	128
	x16	1280	720	160	120	128	96	100	75	80	64
	x18	1280	720	142	107	114	85	89	67	71	57

Resolution Advantage Resolution Equivalence Resolution Disadvantage

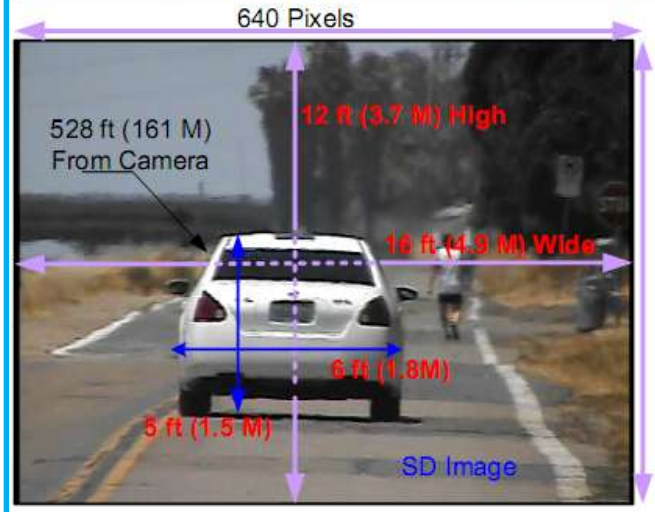
HiDef Comparison to Standard Definition



Camera = 3960HD
Image Res. = 1280 x 720
Camera Zoom Depth = 18x
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



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

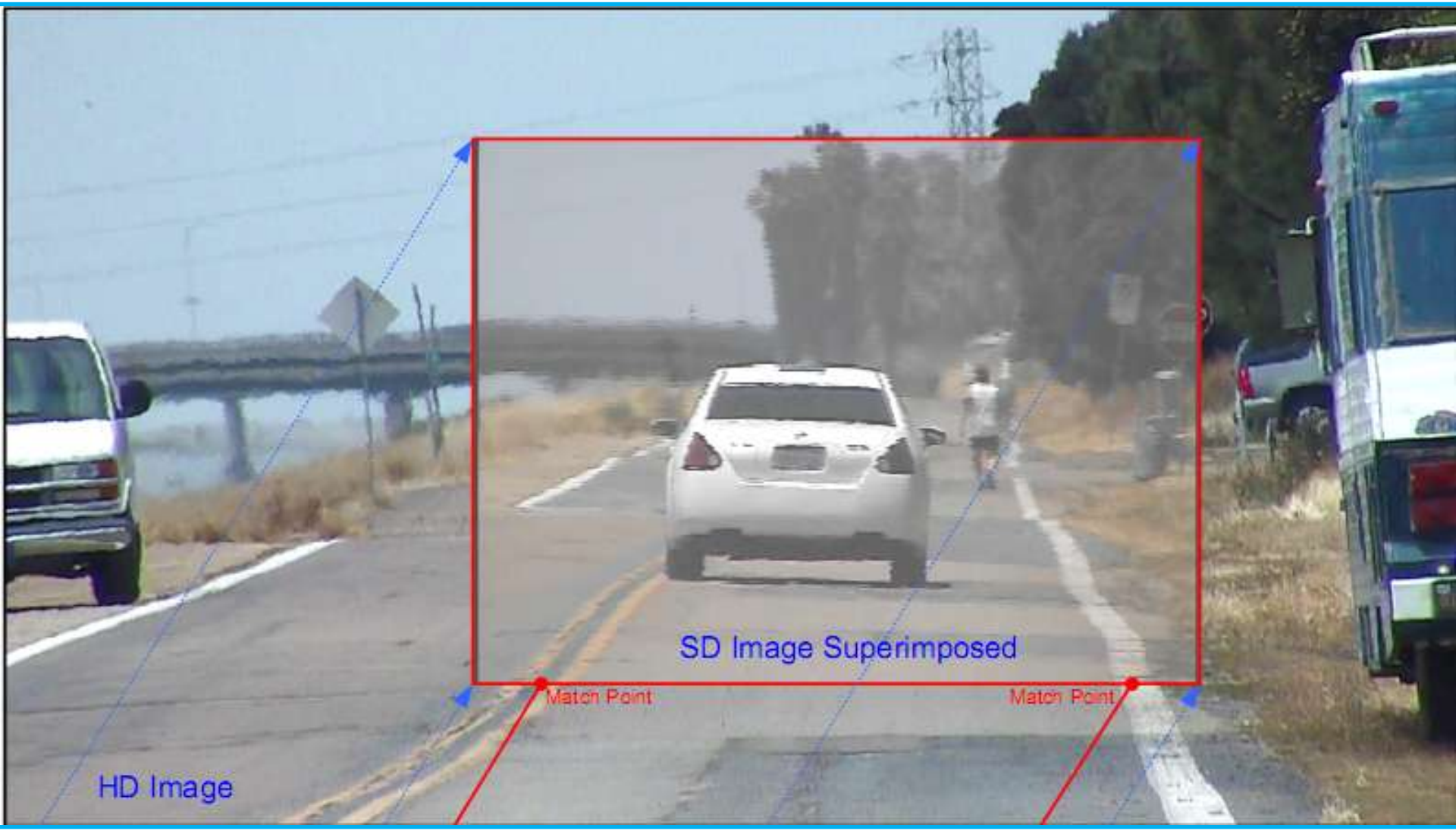
Horz Pixels on Target = (Image Horz. Res / HFOV) * Object Width

Vert Pixels on Target = (Image Vert. Res / VFOV) * Object Height

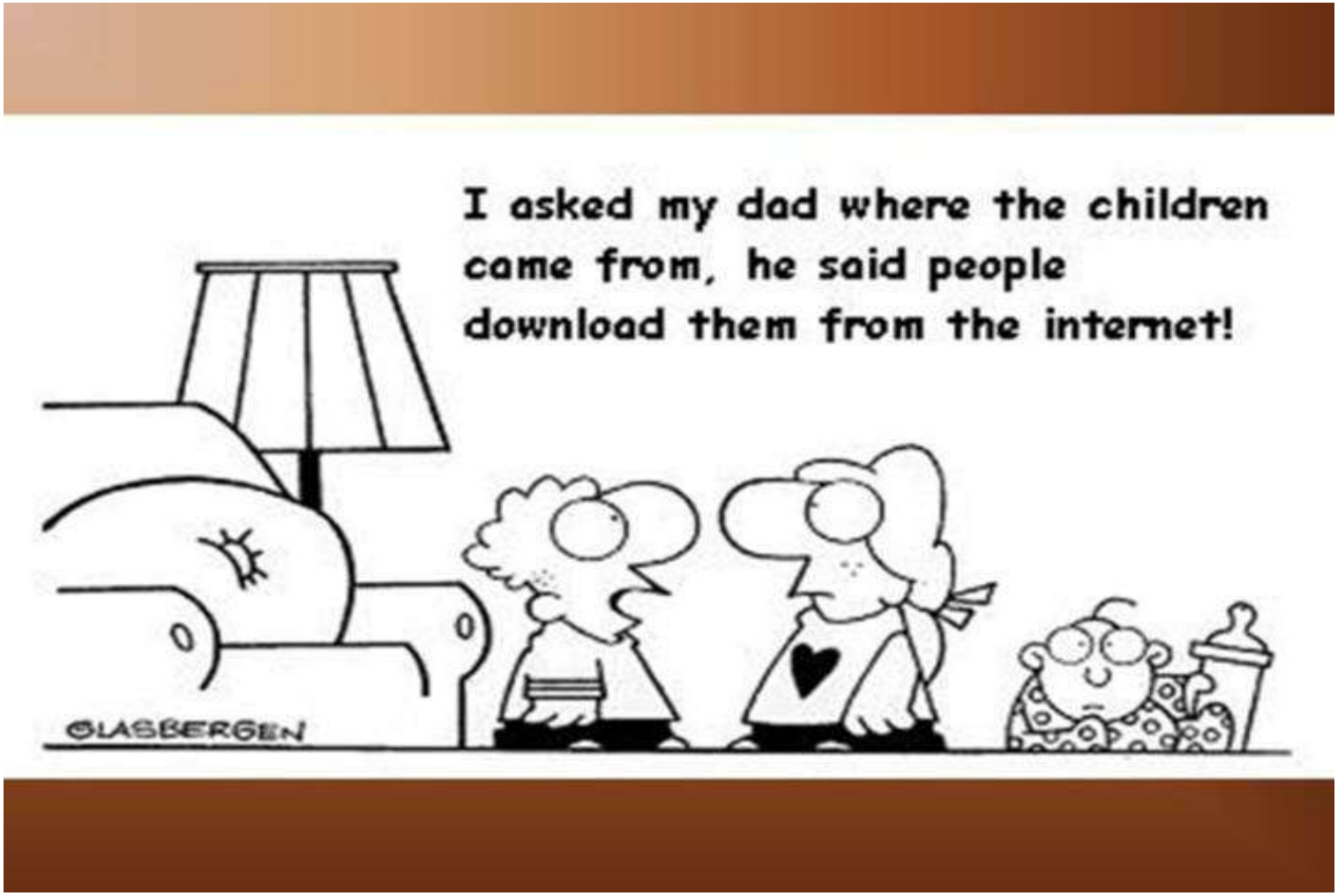
Total Pixels on Target = Vert Pixels on Target * Horz Pixels on Target

Apendix B

HiDef Comparison to Standard Definition Video

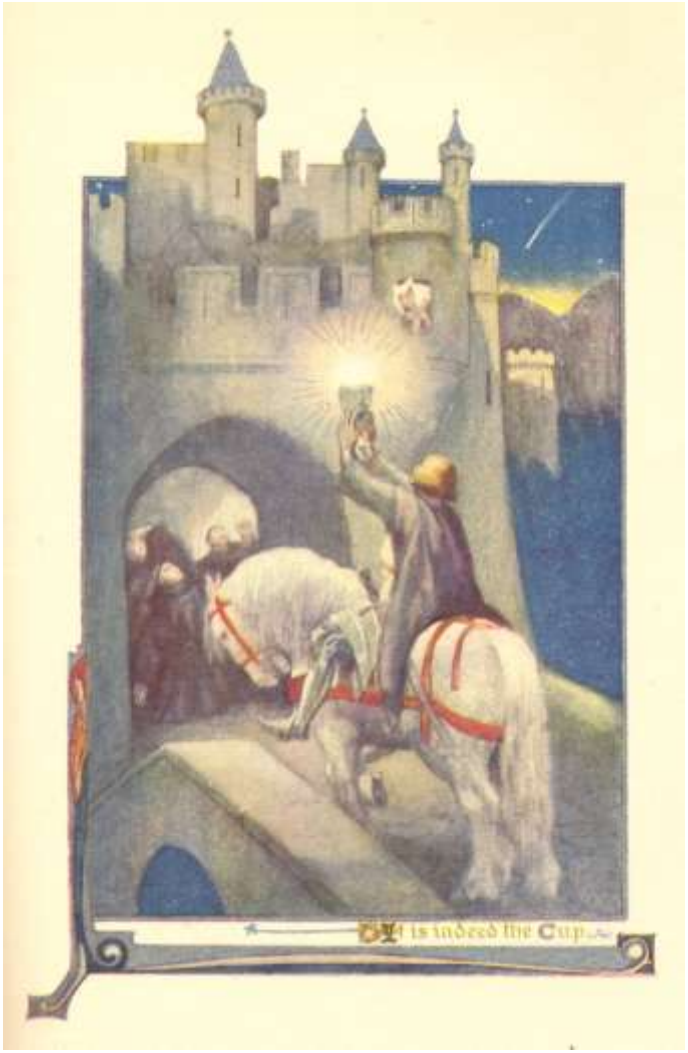


A Look at the Network



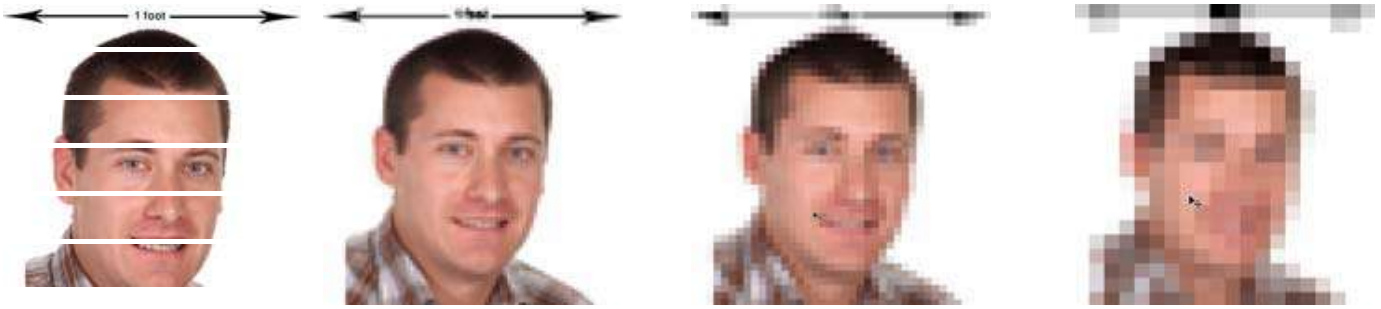
The Holy Grail…..

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

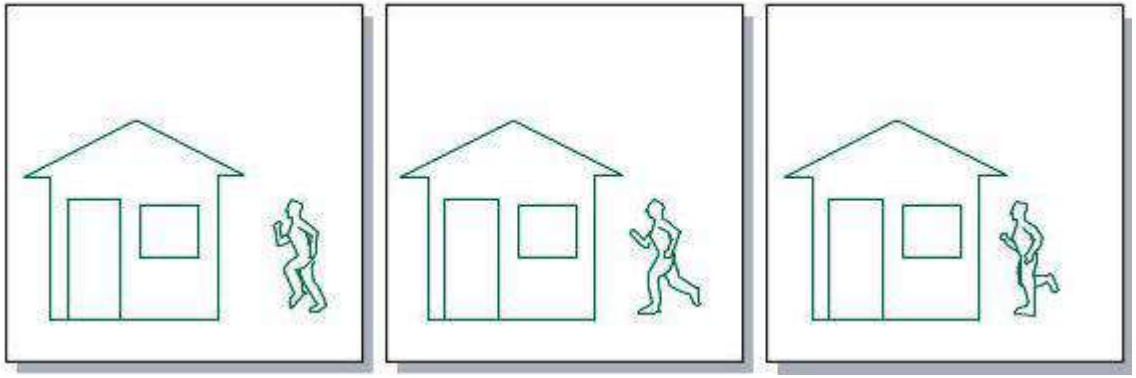
- What is H.264 ?
- A Truly Open Format

  Windows Browser, VLC, QuickTime

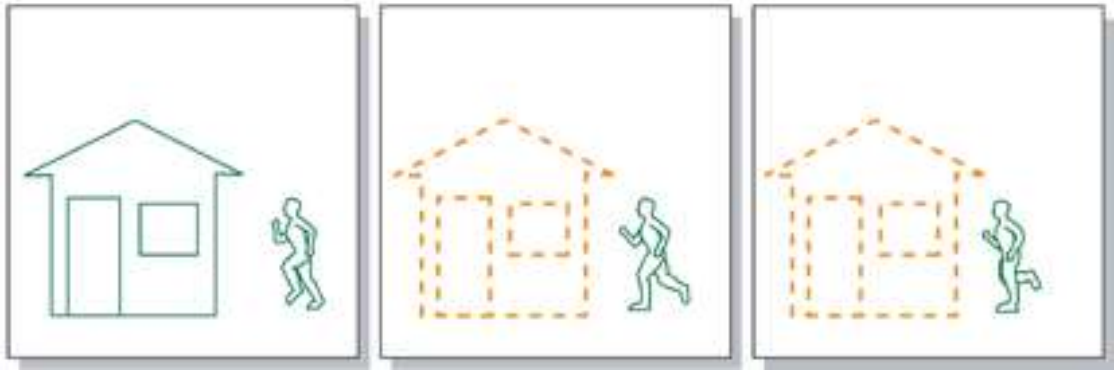
- Universal Usage

  YouTube, Skype, Blu-ray, iPhone, iTunes Store,

VIDEO COMPRESSION



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

VideoLAN

YouTube

Blu-ray Disc™

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.

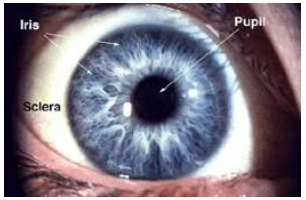
- EXAMPLE…

  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

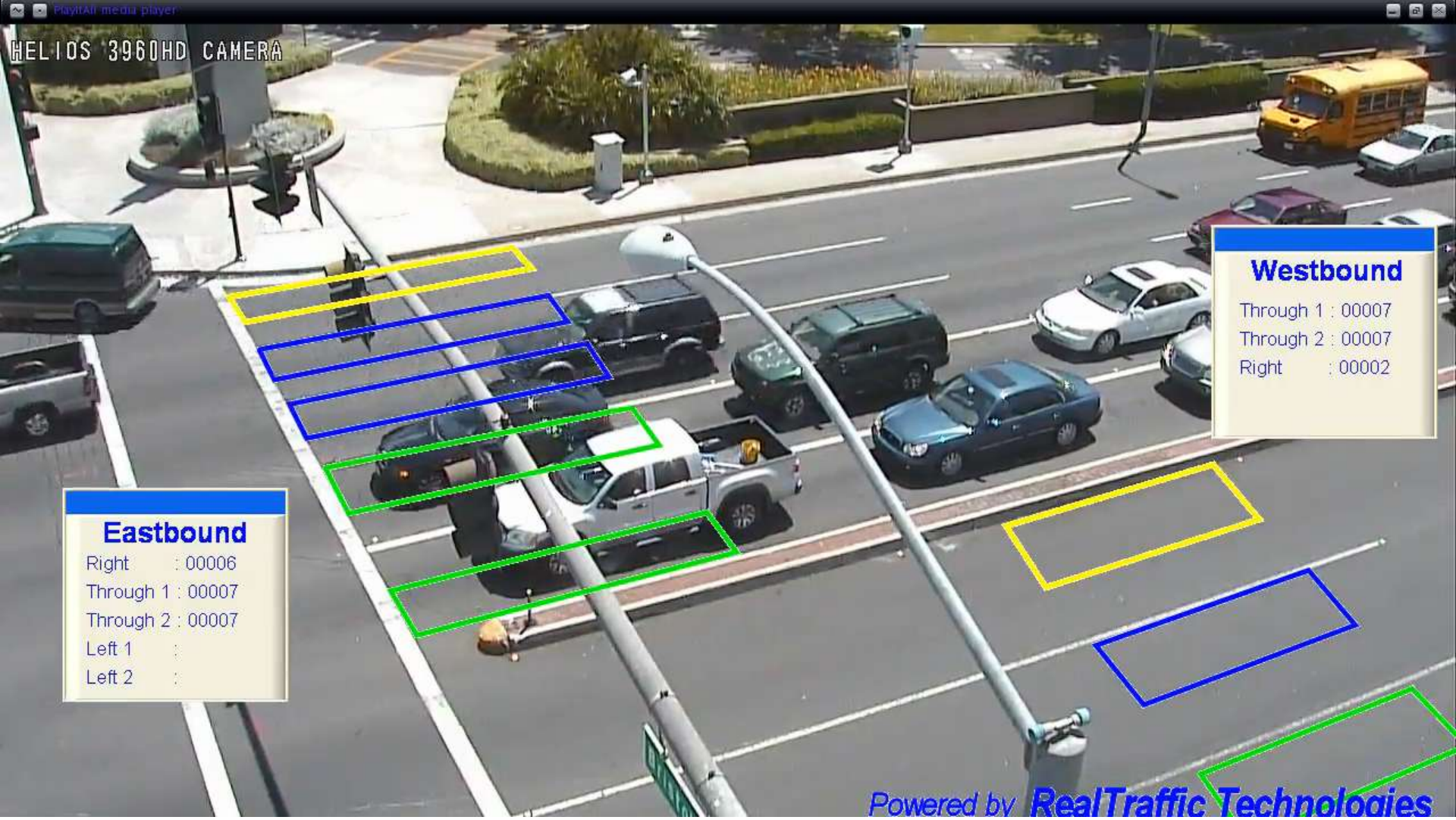
H.264 & HDTV

- Made available w/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 manufactures**
  - **For standardizing interoperability**
  - **Defines a common protocol how network video devices should exchange information**

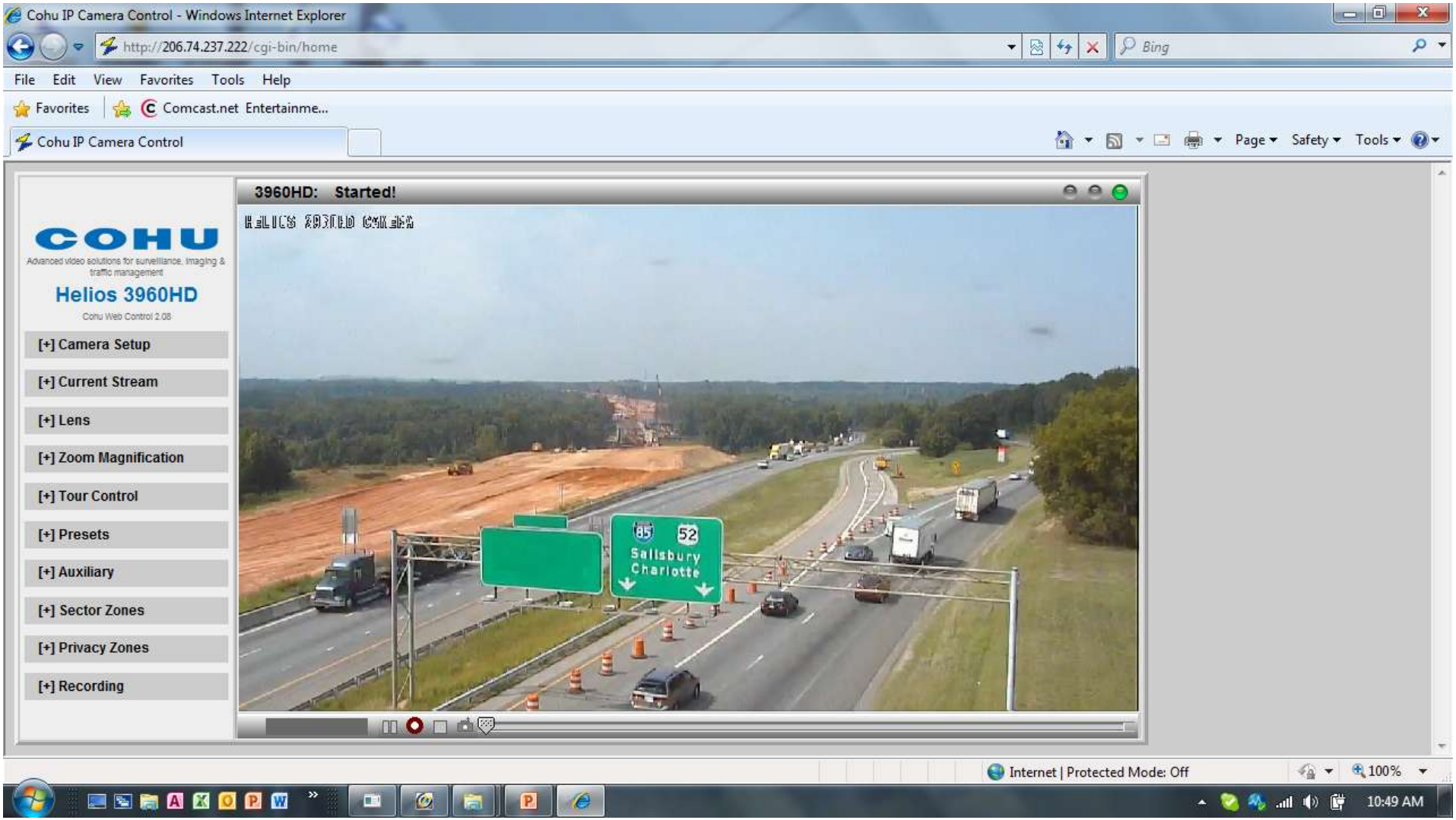
ONVIF

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