# Video over IP

Stick all the *bits* together to make a picture

A *bit* of a break so *nibble* at it or take it in *byte* size chunks and find the *words* for it.

# Acronyms & Terms

- Bit — BInary digiT uses 1s & 0s
- Byte — 8 bits as a group
- Protocol — An agreed-upon communication format
- IP — Internet Protocol. IP specifies the format of packets, also called *datagrams,* and the addressing scheme.

# Acronyms & Terms

- TCP/IP Transmission Control Protocol/ Internet Protocol
- UDP User Datagram Protocol
- ATM Asynchronous Transmission Mode.
- IP Address 192.168.10.2 (IP4 4 groups of 8 bits) soon to change to IPv6 (8 groups of 16 bits) to give 3.4x $10^{38}$ addresses.

# Acronyms & Terms

- MAC address Media Access Control
  an unique hardware address
- **O**pen **S**ystem **I**nterconnection an ISO standard for networking, a 7 layer model.

# What's IP

- Having defined Internet Protocol, please note:-

It does not mean the Internet!

- It's the way you speak on the Internet and networks usually TCP/IP.

# TCP/IP

The TCP packet header tells the system

- Where I'm from
- Where I'm going
- My number
- The next number coming
- How much is coming
- Control bits
- Checksum for error correction
- The urgency
- Options

- A total of 128 bits before you send any information and then you get a similar reply!!

# TCP/IP

Greedy of data transmission & time

# UDP(/IP)

- Called a broadcast protocol
- The UDP packet header tells the system
  - Where I'm from
  - Where I'm going
  - How much is coming
  - Checksum for error correction (internal use only)
- A total of 72 bits before you send any information
- There is no reply
- More economic of data & time

# What's in a picture

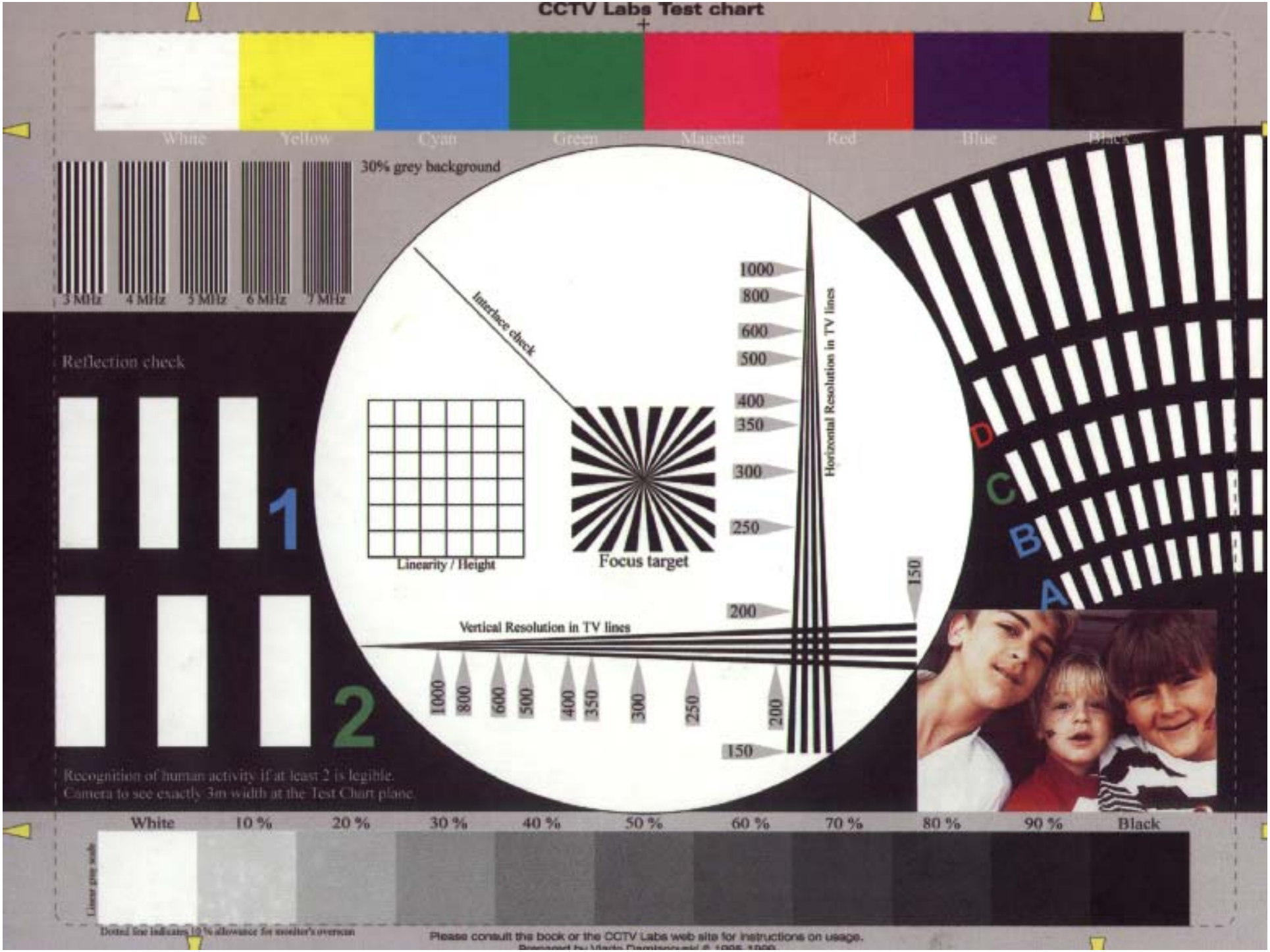
A picture paints a thousand words

At 2 bytes to a word = 2k Bytes

# WRONG!

# What's in a picture?

- PAL images are 625 lines
- Sampled video is 768 x 576
  - Based on CCD chip size
- Why stay with PAL!!!!
- Stay digital all the way.


CCTV Labs Test chart
White
Yellow
Cyan
Green
Magenta
Red
Blue
Black
30% grey background
3 MHz
4 MHz
5 MHz
6 MHz
7 MHz
Reflection check
1
2
Recognition of human activity if at least 2 is legible.
Camera to see exactly 3m width at the Test Chart plane
Interlace check
Linearity / Height
Focus target
Horizontal Resolution in TV lines
1000
800
600
500
400
350
300
250
200
150
Vertical Resolution in TV lines
D
C
B
A
White
10 %
20 %
30 %
40 %
50 %
60 %
70 %
80 %
90 %
Black
Please consult the book or the CCTV Labs web site for instructions on usage.

# What's in a picture?

Say an image is

1280 x 1024 pixels

That is a total of 1,310,720 pixels

With 24 bits of colour info per pixel

# Loads of DATA!!

# What's in a picture?

Over 1.5 G bits per second

(broadcast up to 4.7Gbps)

1 Giga bit = 1024 Mega bits

1 Mega bit = 1024 kilo bits

= 1024 x 1024 bits = 1,048,576 bits

So a Giga bit is 1,073,741,824 bits.

What limits us?

BANDWIDTH

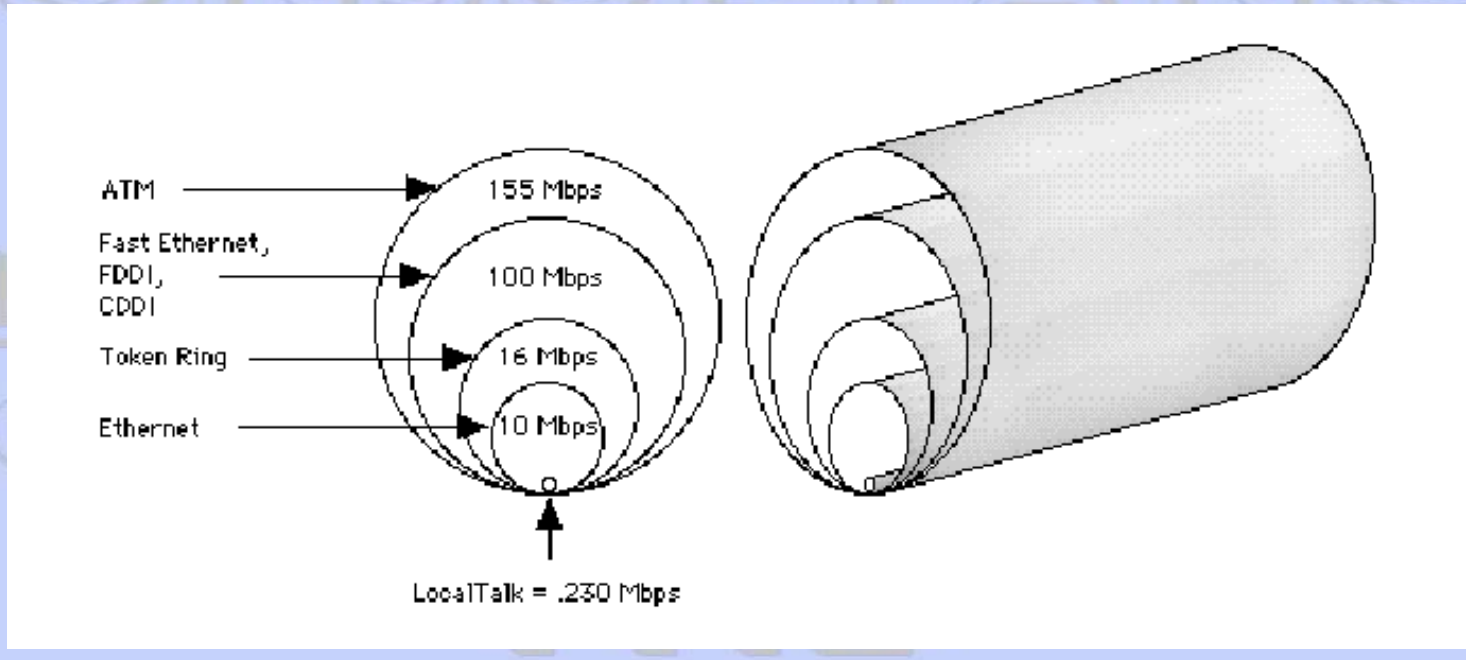
BANDWIDTH

BANDWIDTH.

# What's a network?

- Types
  - Coaxial – LAN as a ring
  - Twisted Pair – LANs WANs MANs
- Size
  - Many users
  - Can have very large LANs, up to 90m between hubs or switches
- Speed
  - 10BaseT 10 M bits/sec
  - 100BaseT 100M bits/sec
  - 1000BaseT 1000M bits/sec.

# What's a network?




- capacity argued from 40% to 60% (dependent upon server utilisation).

# What's a network?

- 40% – 60% of 100Mbps = say 50Mbps
- Video is 1.5Gbps
- 1 image of un-compressed/un-processed data every 30 seconds
- Does that frighten you?

# How can we improve on update rates?

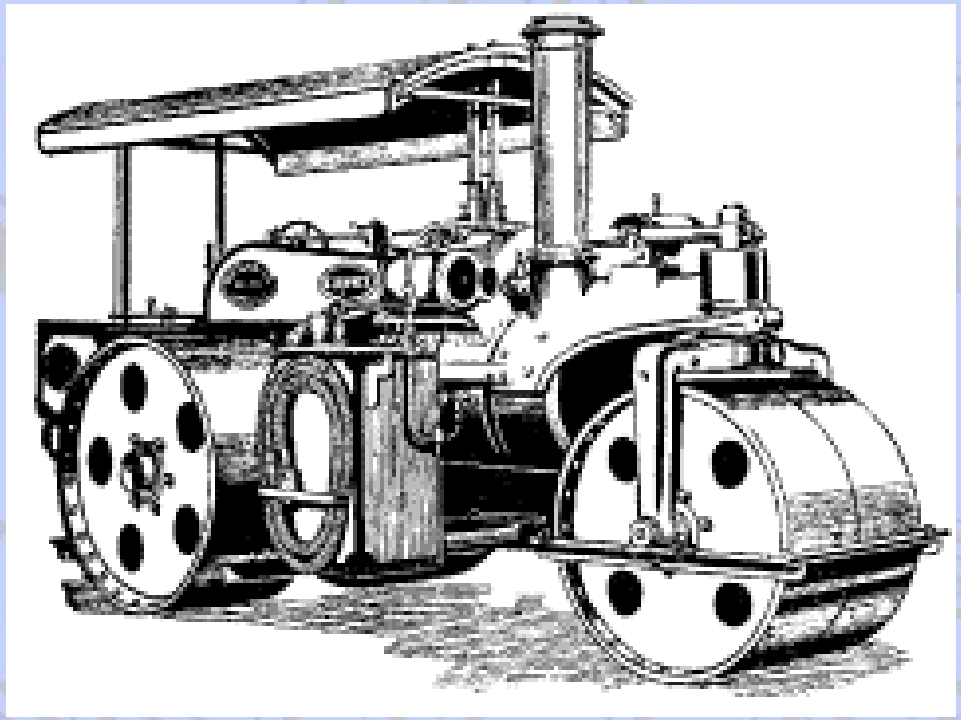
## Send less data!!!

# How can we improve on update rates?

- How can we do that?
  - Compression
  - Conditional refresh
  - Smaller images.

# What about compression?

It depends upon the data compression used



This is the TLC advanced compression tool.

# What about compression?

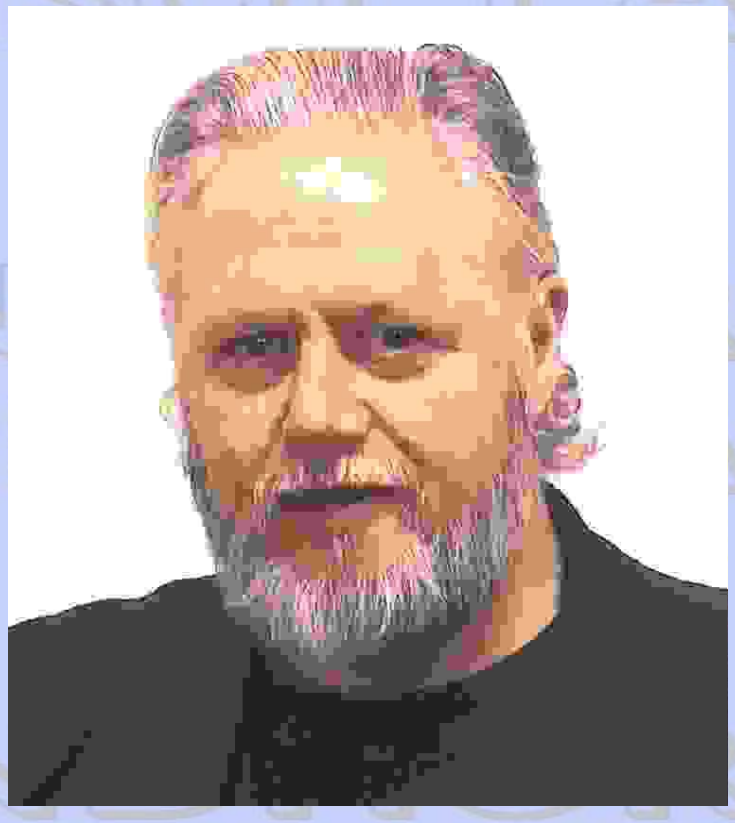
- JPEG (1MB/sec)
- JPEG 2000
- Wavelet (1.5MB/sec)

Stills

- MPEG 1 (70kB/sec)
- AVI (3.6MB/sec)
- WMV (87kB/sec)

Moving images

# What about compression?



It can ruin your IMAGE.

# What's Conditional Refresh?

- It's not a CODEC, it uses a CODEC (CODer/DECoder)
- Don't send the whole picture only send the changes
- H261
- H263.

# Smaller pictures mean smaller files

- But beware a smaller picture also means less detail
- CIF (Common Intermediate Format) is only 352 pixels wide by 288 high.

# Expand the picture to full screen

# Image size

| Format | Vertical pixels | Horizontal pixels |
|---|---|---|
| QCIF | 176 | 144 |
| CIF | 352 | 288 |
| 4CIF | 704 | 576 |
| 16CIF | 1408 | 1152 |
| MPEG-1 | 320 | 240 |
| MPEG-2 | 720 | 576 |
| MPEG-4 | 720 | 576 |

# How can we use it?

- First carry out the

# Operational Requirement

# How can we use it?

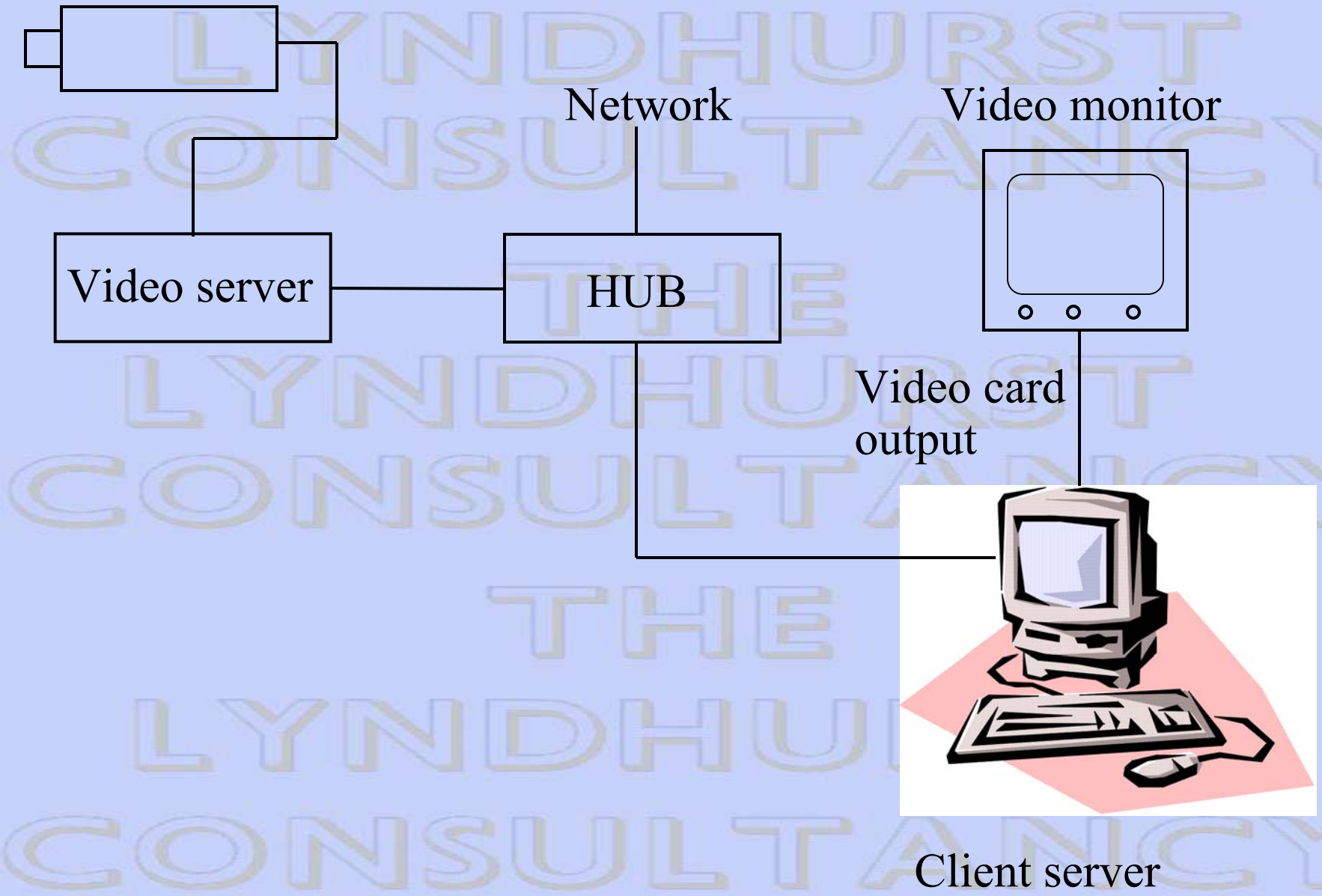
- Next -

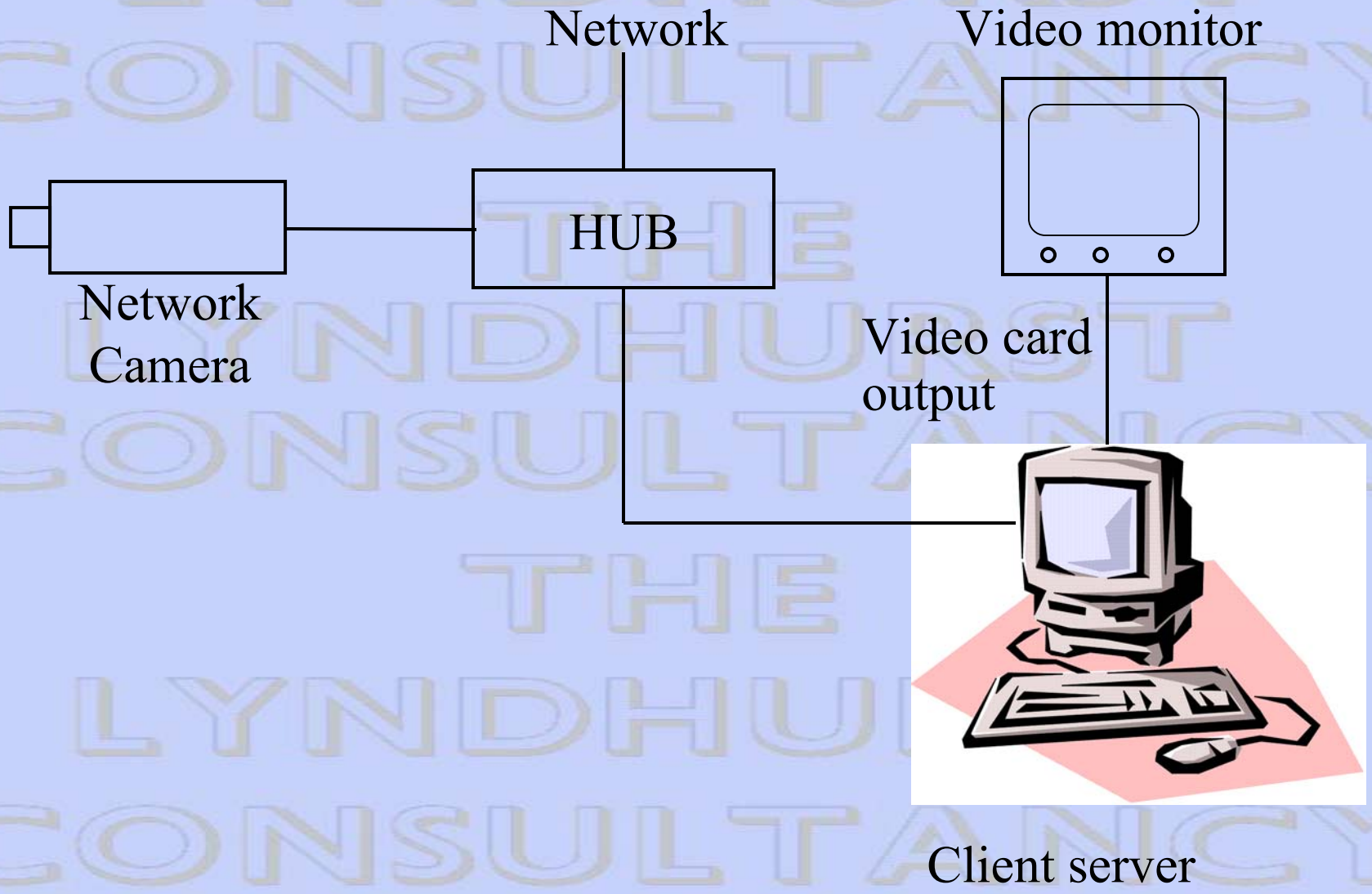
Get the IT Manager involved!!

# How can we use it?

- Use digital cameras
- Use existing cameras (using a video server)

- Hybrids systems are OK
  - Have the managers output on the network but analogue in the control room
- Be cautious about camera quantities.


Network
Video monitor
Video server
HUB
Video card
output
Client server


Network
Video monitor
HUB
Network
Camera
Video card
output
Client server

# What can we use it for?

Anything your heart desires,
if it meets the O.R.

# What else?

- Use the network for recording
  - Choose the type carefully (RAID)
  - Add new file servers
- Integration with other computer based systems

Such as…..

# Facial Recognition

- Against HRA
- For Can you find my little boy, here's his picture

How many cameras help find him?

# ANPR

Automatic Number Plate Recognition

- Lost or Stolen?
- Persistent PCN evaders
- Congestion charging
- Decriminalisation of Traffic Enforcement (DTE)
- Toll roads?

# Why use it?

- We *will* be able to get better resolution
- There *will* be cost savings for cabling
- There *will* need to be an upgrade on many intranets
- There *will* be more flexibility
- There *will* be more IT technicians than CCTV technicians.

# Cautions!

If using the www

- Get fixed IP addresses
- Use firewall technology
- Set up a Virtual Private Network (VPN)
  - Uses tunnelling and encryption
- Use Proxy Servers.

# Cautions!

If using the Intranet

- Keep access limited
- Look for systems with security access
- Think carefully about data storage, it will be massive
  - (don't need 31 days).

# Data Protection

- CCTV images can be personal data and video over IP is no exception
  - Bear in mind the Durant v FSA judgement
  - Do we need to de-gauss?

- CoP does not cover digital Tx specifically – yet……

# Mystic Jon predicts

- 3G mobile telephony will be a major philosophy change!!!
  - Its already starting, up to 220kbps on Vodafone
- Faster networks will increase the opportunities
- We have to become more IT aware.

# Summary

- Get knowledge
- Carry out the O.R.
- Talk to the IT manager
- Select the camera equipment
- Select the recording storage size
- Integrate with other bits
- Sit back relax and watch the telly!!!

# Thanks for listening &