HDTV Decisions

Gary Sasaki
www.digdia.com

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Outline

Confused by all the HDTV Choices?
By the end of the presentation
you won't be any less confused,
but at least you may know why.

- Some buzz from CES 2006
- Issues to consider for HDTV
  - The Obvious
  - The Less Obvious
  - The Obscure

Displays – Does Size Matter?

Panasonic, a leader in plasma, couldn't sit silent as Samsung & LG played the size game.

Meantime, Sony, Samsung and LG turned their attention to big LCD displays.

Sony 82" LCD Prototype

Big Glass

Gen 7 LCD Glass holds
Eight 40" displays comfortably.

Some sizes can waste glass.
(Twelve 32" and six 46" possible, too)

A Gen 8 plant is now being constructed.

Samsung display

Backlights Advance

Several showed LED backlit LCD panels to get wider color range.

Sanyo's demo –
LED version on left.

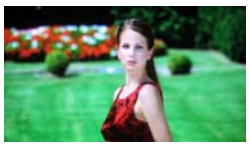
Samsung's Flat Fluorescent Lamp, for thinner more efficient LCD backlighting.

The more exotic displays

Sony also showed a future 55" slim SXRD (LCoS) television.

Current models are 1080i. Expect 1080p soon.

Toshiba & Canon finally gave a public showing of their SED display. This was only 720p, but production units will be 1080p.



SED – Surface-conduction Electron-emitter Display

Big Displays = Quality Matters

Interlacing, Judder, Mosquito Noise, etc. are easier to see

Everyone was sporting their 1080p displays.

Broadcast content is 1080i, but people are hoping for Blu-ray for 1080p content.

LG showed off "Single Scan" (vs. Dual) Plasma for better picture quality, particularly in the middle of the display.

Photo shows complex circuitry used.

Projectors – Big and Little

Small LED lit DLP projectors were shown by several companies. This ViewSonic unit is 25 lumens. Good for a 40" screen.

LG's Wall mounted Projector

Sanyo showed the first "2K" LCD projector for digital cinema.

"2K" = 2,048 x 1,080

Display Tricks

Philips showed off their Ambilight, this time with a 3-sided and a 4-sided version.

Painting rolls down when TV is not being viewed.

Huge, Man, Huge

LG's VGA display for phones (see through magnifying glass)

Plays video (MPEG4) and audio (MPEG3) for 8 hours on a charge – from IOPS

HDTV Factors

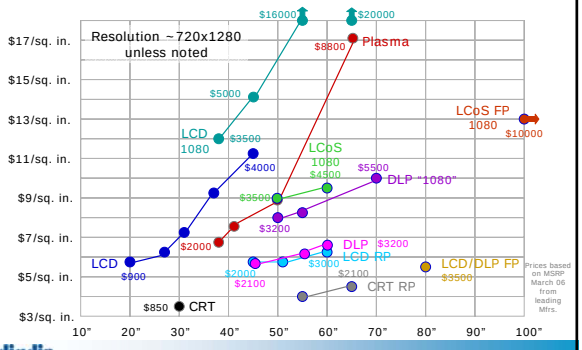
The Obvious
- Budget
- Size
- Form Factor

The Less Obvious
- Resolution
- Image Engine
- Contrast Ratio
- Color
- Total Cost of Ownership
- Video Engine
- Connectivity
- Audio
- Control
- Content

The Obscure
- DCR
- OCAP, ACAP & MHP
- DLNA & HANA

Budget

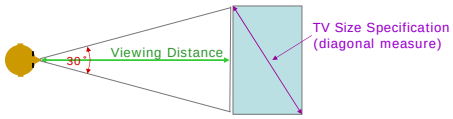
Most people buy the biggest TV that fits their budget



Size

Optimum size is determined by:

- Minimum 30 degree viewing angle (immersive viewing)
- 1/60th degree visual acuity (seeing details)
- Ego



Rough Rule of Thumb:

- For 1080 HDTV: Viewing distance = 1.6 x TV size
- For 720 HDTV: Viewing distance = 2.4 x TV size (for acuity)

Example: 1080 50" TV = 6 feet 8 inches

Form Factor

Everyone likes flat panels, but:

- Will you really mount it on a wall?
- If so:
  - Can the wall hold 70 – 120 pounds?
  - Can you get video signals to it?
- Do you want to pay 2X to 5X more?

Note: product to the left is a Sony rear projection SXRD set

Resolution

Most sets today are around 720 x 1280 (a standard HDTV)

Many are 720 x 1024 or 768 x 1366

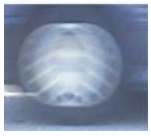
This number (horizontal lines) need only be 720 or more to be called "HDTV" – a hold over from analog days.

Standard

Non-standard resolutions mean pixel morphing is needed

Non-Standard

Best is 1080 x 1920 (a "Full" HDTV)



"i" = Interlaced "p" = Progressive

- Standard HDTV levels are 720p and 1080i
- 1080p is coming out, but content is rare

Interlaced video of moving wheel

Image Engine (Consumer Grade)

- CRT – Cathode Ray Tube
- Plasma – AKA PDP for Plasma Display Panel
- LCD – Liquid Crystal Display
- LCD RP or FP – LCD Rear or Front Projection
- DLP RP or FP – Digital Light Processor, Rear or Front Projection
- DLP RP "Smooth/Wobulator" – DLP w/extra mirror (2x resolution)
- LCoS RP or FP – Liquid Crystal on Silicon
- SED – Surface-conduction Electron-emitter Display

CRT

Samsung and LG are giving CRTs one last chance

Many CRT plants have been closing.

CRTs are not yet dead, nor do they need to be really deep.

- ✓ Good Contrast Ratio
- ✓ Great Color Reproduction
- ✓ Very Good Side Viewing Angle
- ✓ Relatively cheap
- o Analog technology (drift, distortion)
- o Heavy
- o Visible raster
- o Phosphor burn

CRT = Cathode Ray Tube

Plasma

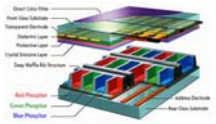
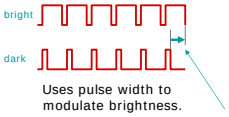


Illustration from Array Electronics



Uses pulse width to modulate brightness.

People like the big flat panel with bright definition

- ✓ Can get in big sizes, yet thin
- ✓ Good Contrast
- ✓ "Direct View" for high definition
- ✓ Very Good Side Viewing Angle
- ▪ Life has improved to 50-60K hours
- o 1080 resolution is rare
- o "big pixels" and fair Aperature
- o Fair dark scenes
- o Temporal Dithering

Difference in time can cause Temporal Dithering in moving high contrast scenes

LCD Panel

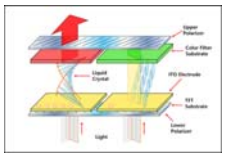


Illustration from AUO

Sexy flat panel for small to moderately large screens.

- ✓ Good life (60k hours backlight)
- ✓ Very thin
- ✓ Cool, not too heavy
- ▪ 1080 getting more available
- o Fair contrast ratio
- o Fair dark scene definition
- o Fair Aperture for “screen door”
- o Can smear fast action

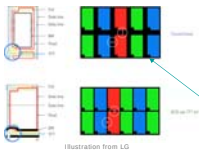


Illustration from LG

Area for transistors are opaque, potentially causing a screen door effect.

LCD Projection

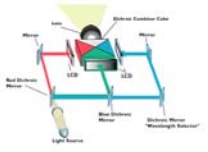


Illustration from ProjectorPoint

Fairly affordable way to get a big picture

- ✓ Relatively affordable
- ✓ Good color
- o Bulb warm-up & replacement
- o Fair side viewing angle
- o Poor black levels
- o Fair contrast ratio
- o Fair Aperture for “screen door”

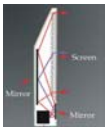


Illustration from ProjectorPros

Rear projection mirrors “air is free”

Marketing campaign to emphasize a key difference LCD has over DLP

DLP Projection

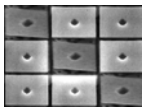


Photo from Texas Instruments

Micro-mirrors

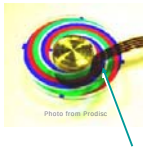
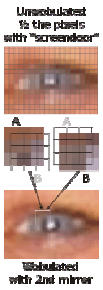


Photo from Prodisc

Produces a very good picture with very good contrast ratio, yet relatively affordable.

- ✓ High contrast ratio
- ✓ Good color
- ▪ “1080” w/wobulation
- ▪ Native 1080 emerging
- ▪ OK black levels
- ▪ 3 chip DLP exists (expensive)
- o Rainbow effect
- o Bulb warm-up & replacement
- o Fair side viewing angle
- o Temporal Dithering

Note: “business” projectors add a white segment to produce higher contrasts for slides



LCoS Projection

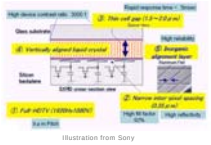


Illustration from Sony

Known as:
SXRD – Sony
HD-ILA – JVC
LCoS - Brillian

Newest image engine that only a few have mastered, but it provides a great picture.

- ✓ Only in 1080 Resolution
- ✓ High Contrast Ratio
- ✓ Very Good Color
- ✓ Very Good Grey Scaling
- ✓ Good Response for Motion
- ▪ A bit of a premium price
- ▪ Sony offers a Xenon Lamp version
- o Bulb warm-up & replacement
- o Fair side viewing angle

Front Projectors

Ambient light can ruin the contrast in a front projection system.

This screen from Screen Innovations attenuates side angle light.

A Sony screen uses films to attenuate unwanted colors.

Viewing Angle

Illustration from Stewart Filmscreen

High Gain screens direct reflections to the front,
but give up side angle viewing.

Grey screens attenuate all light.

SED

Photo taken of SED

Not expected until end of 2007 (delayed because of cost issues), but supposed to deliver best picture.

- ✓ Direct view for high contrast
- ✓ Very good color and black levels
- ✓ Less expensive than plasma in theory
- ✓ Very good side angle viewing
- o Not available yet
- o Phosphor based, so subject to burn

Nano-technology and ink jet technology are used to keep costs down

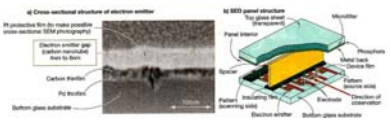


Illustration from Nikkei Electronics Asia

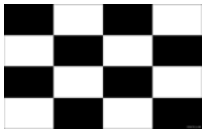
Technology Matrix

Each has strengths and weaknesses

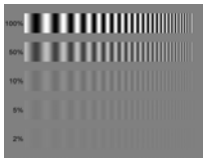
	CRT	Plasma	LCD Panel	SED	LCD RP	DLP RP	LCoS RP
Practical Size	<40"	40 - 70"	20 - 60"	50 - 70"	45 - 65"	45 - 70"	50 - 70"
Budget	$0.8K	$2 - 9K	$1 - 20K	N/A	$2 - 4K	$2 - 6K	$3 - 5K
Depth	>14"	~4"	4" or less	~4"	8 - 19"	8 - 19"	8 - 19"
1080?	Yes	Few	Some	All	Few	w/2X	Yes
Contrast	★★★	★★★	★	★★★	★	★★	★★★
Black Level	★★★	★★	★	★★★	★	★★	★★★
Motion	★★★	★★★	★★	★★★	★★	★★★	★★★
Color	★★★	★★	★★	★★★	★★	★★★	★★★
Screen Burn	★	★	★★★	★	★★★	★★★	★★★
Side Viewing	★★★	★★★	★★	★★★	★	★	★
	Analog	Temporal Dithering	LED backlight	Not yet Available	Bulb	Rainbow, Bulb	Bulb

What color is this screen? This slide is meant for display on a screen. The point being that "black" is relative. A screen is usually white – yet when a picture is displayed on it the unlit parts look black. Good contrast and good black levels are necessary to make pictures pop out and look life like.

Contrast Ratio



ANSI Contrast Pattern



Modulation Transfer Function

Contrast Ratio should be specified as ANSI Contrast, not "Full On"/"Full Off".

Contrast is affected by many things:
- Ambient lighting
- Reflections
- Optics
- Leakage

Not usually specified is Modulation Transfer Function (MTF).
MTF measures the system's ability to reproduce good contrast at higher spacial frequencies of change.

Color

Most vendors "crank up the color" to stand out in the stores.
- Check manual to see if you can set the color back to normal.
- Optionally, buy a color calibrator and get it perfect (SpyderTV shown is $269)

Regular LED

Illustration from Lumileds

Technology can make a difference
- Phosphor "defines" television color
- LCD panels are trying LED backlighting to go "beyond phosphor"
- Xenon is better than Mercury lamps

Total Cost of Ownership

A few factors that affect TCO:
- Plasma, SED and CRT use phosphors that fade & burn (Half life of 50K – 60K hours)
- LCD panels need backlight replacement (They last about 60K hours)
- Projection systems need bulb replacement (2K to 6K hours, bulb costs $200 to $400, more if Xenon)
- Some set, like Plasma, can draw more than 500 Watts ($100/year)

200W UHP (Ultra High Pressure) Mercury Lamp for projector - $350

Video Engine

Photo from Genesis

Film is 24fps, Television is 30 or 60fps (U.S.) – Therefore 3-2 Pulldown

All kinds of image massaging takes place inside a good HDTV set.
- Making Standard Definition (e.g. DVD) look good on an HDTV display
- Making Movies look good with 3-2 Pulldown
- Making sure the proper aspect ratio is used
- Smoothing Aliasing ("Jaggies")
- Deinterlacing for better image motion
- Removing compression artifacts
- Newer sets can handle 1080p (progressive)

Aliasing

Connectivity

First rule: the set must have HDMI inputs (or you risk "down-rez")

- HDMI carries encrypted video, audio and control.
- Nice to have at least 2 HDMI inputs.
- Can be expensive (e.g. 50' cable is $220)

Analog inputs are still needed:

- Existing DVD players
- Game boxes
- Cameras and Camcorders

New HDTV sets have it all

Coax for antenna

- If you use the HDTV tuner, get a good antenna

Optional memory card slots.
Optional DVI inputs for Computers.
Ethernet is rare (more on this later)

*HDMI – High Definition Multimedia Interface

Audio

Photo from California Audio Technology

Great sound can make the image look better.

- Put surround speakers at eye level and don't crank up rear speakers
- Avoid subwoofer in corner and look for "nulls" (AKA "standing waves")

Denon AVR4806 ($3500)

AV Receivers are optional

- Useful for Big Sound
- May have lip sync adjustments
- They can take over connectivity
- May provide additional HDMI inputs

Control

Philips Pronto NG ($300)

Universal Remote URC-300 ($200)

Panasonic Viera Link

Photo from Engadget

Sometimes control can get so complex only the Geek in the house can watch TV.

- A programmable universal remote can help eliminate multiple remotes, but are complex to setup
- Panasonic has come out with the first remote to take advantage of HDMI

Content

Weight Watchers rebel

Proper letterbox

Toshiba HD-DVD Player

Sadly, many people stretch SDTV to fill HDTV screens.

- Be mindful of proper aspect ratios
- Many widescreen DVD movies are 2.35:1, not 1.78:1 (16:9 widescreen)
- Automatic aspect ratio in future

DTV is Not HDTV

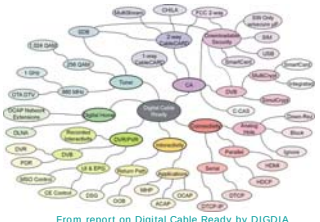
- You need either HDTV antenna or
- Pay for HDTV service
- Make sure DVR is HDTV capable

Blu-ray and HD-DVD have not yet merged

- Samsung & LG working on dual drive
- Movies will cost $25 to $40

Digital Cable Ready

CableCARD



From report on Digital Cable Ready by DIGDIA

Digital Cable Ready is not yet Digital Cable Ready.

- There are many elements to DCR
- Today's DCR is "one way"
  - No VOD
  - No IPG
- Two-way DCR will likely Not use CableCARDs, but will use Downloadable Conditional Access System (DCAS)

VOD = Video On Demand, IPG = Interactive Program Guide

OCAP, ACAP & MHP

OpenCable Application Platform (OCAP) is a standard for interactive cable television

Based on Europe's Multimedia Home Platform (MHP), part of Digital Video Broadcast (DVB)

Advanced Common Application Platform (ACAP) is based on OCAP, and is for broadcast

- OCAP is not available, but will be soon
- Panasonic and Comcast have been early supporters.

DLNA & HANA

HANA

Digital Living Network Alliance (DLNA)
and
High-Definition Audio-Video Network Alliance (HANA)
are two competing ways to
digitally connect televisions, DVRs, PCs, etc.

- DLNA is based on Ethernet
- HANA is based on IEEE1394
- Both have a vision of sending AV around the home and controlling it from anywhere
- Simple DLNA is here now
- The market is still years away

Summary

- 2006 is the first year that it might be "safe" to buy an HDTV set.
- Try to get 1080i, if not 1080p (look at native resolution)
- Make sure it has HDMI
- Technology?
  - Biggest screen – LCoS or DLP projection (special room)
  - Big screen not on the wall – LCoS (DLP & LCD OK, too)
  - Big screen on the wall – Plasma
  - Medium to big screen on the wall or tight spots – LCD
- Make sure you have HDTV content sources & services
- Watch Content in proper aspect ratio
- Don't worry about Digital Cable Ready yet

Thank You

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for companies in the digital living value chain.
We help find growth opportunities.

Gary Sasaki
gary.sasaki@digdia.com

www.digdia.com

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