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# Digital Television

And the Elgato EyeTV

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with input from:

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# What is Television?

- Its like Radio...
- with Moving Pictures!

# History of Television

- The first regularly scheduled television service in the United States began on July 2, 1928
- The FCC adopted NTSC television engineering standards on May 2, 1941, calling for 525 lines of vertical resolution, 30 frames per second with interlaced scanning, 60 fields per second, and sound carried by frequency modulation (FM).

# Commercial Television

- Starting in 1941 the FCC allowed stations to broadcast advertisements, but insisted on public service programming commitments as a requirement for a license
- So you can thank the FCC for all of those commercials and political ads!

# Introduction of Color

- The shadow mask color TV was patented by Werner Flechsig in Germany in 1938
- Most CRT color televisions used today are still based on this technology!
- U.S. television industry, represented by the National Television System Committee (NTSC), worked in 1950–1953 to develop a color system that was compatible with existing black and white sets and would pass FCC quality standards, with RCA developing the hardware elements

# Cost Comparison

- The cheapest of the pre-World War II American sets, a 1938 image-only model with a 3-inch screen, cost US\$ 125, the equivalent of US\$ 1,863 in 2007. The cheapest 12-inch screen was \$445 (\$6,633)
- A color model from Westinghouse (\$1,295, or \$9,934 in 2007 dollars) became available in the New York area in 1954 and is generally agreed to be the first production receiver using NTSC color system

# Digital Television

- Introduced in the late 1990s, Digital television (DTV) uses discrete (digital) signals, in contrast to the analog signals used by analog TV.
- Digital television is more flexible and efficient than analog television. When properly used by broadcasters, digital television can allow higher-quality images, sound, and more programming choices
- However, a digital signal does not necessarily carry a higher-quality image or sound than an analog signal

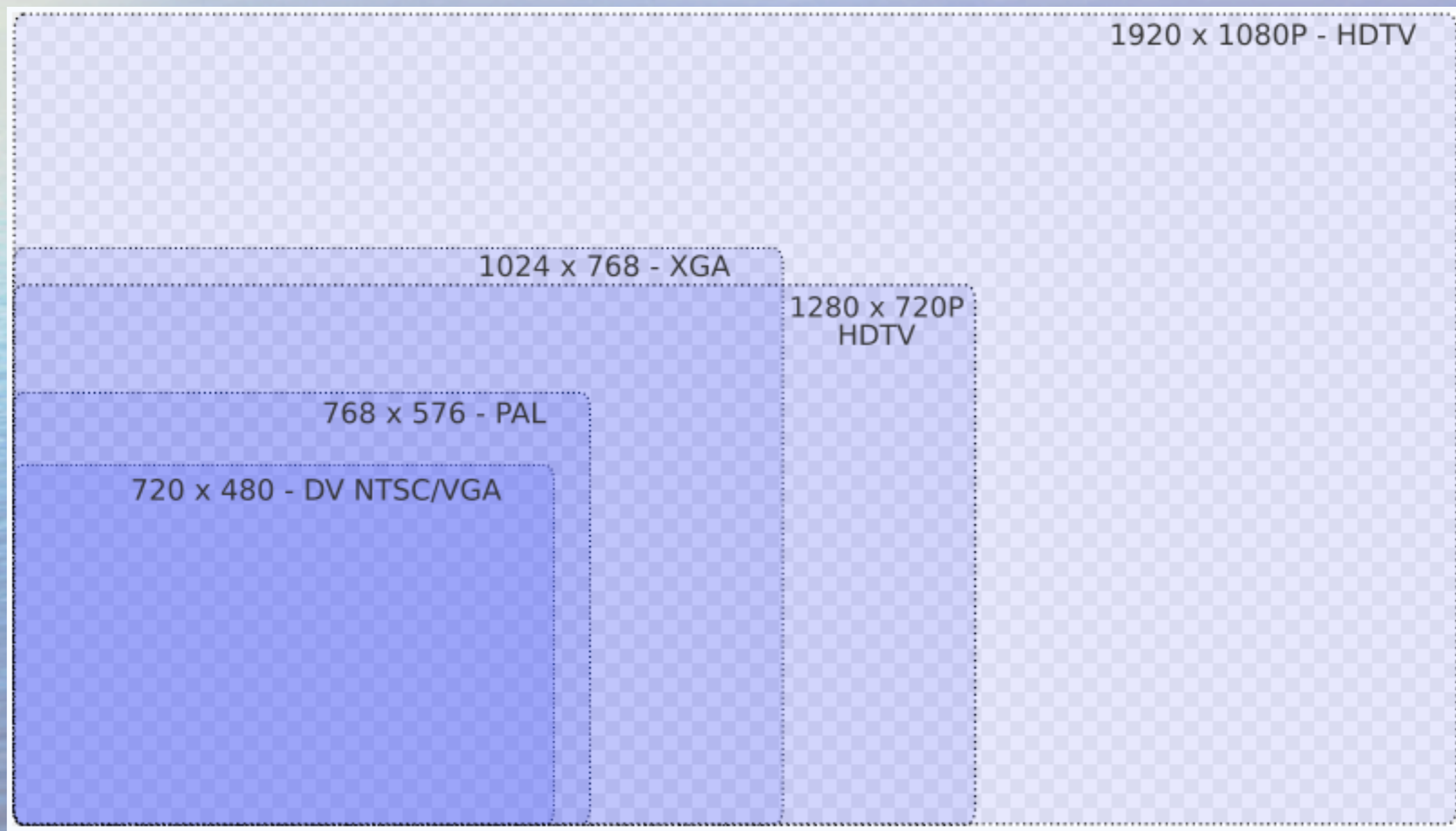
# Standard Definition TV

- Standard definition TV(SDTV) may use one of several different formats
- For 4:3 aspect-ratio broadcasts, the 640 × 480 format is used in NTSC
- For 16:9 broadcasts, the 704 × 480 (rescaled to 848 × 480) format is used in NTSC

# High Definition TV

- High-definition television (HDTV), which is usually used over DTV, uses one of two formats:
  - 1280 × 720 pixels in progressive scan mode (abbreviated 720p)
  - 1920 × 1080 pixels in interlace mode (1080i).
  - Each of these utilizes a 16:9 aspect ratio.

# Standard Resolutions



# Broadcast Formats

- National Television Systems Committee (NTSC)
  - The current format in the USA
- PAL
  - Used in most of Western Europe
- SECAM
  - Used in France and parts of Europe
- QAM
  - Used by Digital Cable TV (Usually scrambled, needs set top box or CableCARD)
- Clear QAM
  - Used by Digital Cable TV (Not scrambled)
- Advanced Television Systems Committee (ATSC)
  - The new digital TV standard in the USA

# How TV Gets to You

- Over the Air broadcast
  - Using an antenna
  - Sometime abbreviated OTA
  - Free!
- Cable TV Provider
  - Comcast
  - Can be Analog or Digital with HD
- Satellite Broadcast
  - DirecTV
  - Dish Network (Echostar)

# Radio Frequency Spectrum

- There are two major bands used for TV
  - Very High Frequency (VHF)
    - Channels 2-13
    - 40 MHz - 230 MHz
  - Ultra High Frequency (UHF)
    - Channels 14-69
    - 470 MHz - 862 MHz
- These two bands will continue to be used by Digital Television

# Antenna

- Since digital TV is broadcast using the same frequency range as conventional analog TV, the TV antenna that you use now should continue to work fine for you.
- This could be as simple as the classic “Rabbit Ears” or a large aerial on the roof or in the attic
- Digital TV does **NOT** require a new type of antenna, that’s just a marketing gimmick!

# Audio/Video Codecs

- Similar to the encoding modules in QuickTime and DVD's
- Video
  - MPEG-2
  - MPEG-4 AVC
- Audio
  - MP3
  - AC-3
  - AAC
  - HE-AAC

# Government Mandates

- For devices entering the US
  - By July 1, 2005 all TVs over 36" must include a built-in ATSC DTV tuner
  - By March 1, 2006 all TVs over 25" must include a built-in ATSC DTV tuner
  - By March 1, 2007 all TVs regardless of screen size, and all devices which include a tuner (VCR, DVD, DVR) must include a built-in ATSC DTV tuner.
- It should be noted that devices manufactured before these dates can still be sold without a built-in ATSC DTV tuner.

# Interlacing

- Interlace is a technique of improving the picture quality of a video signal primarily on CRT devices without extra bandwidth.
- Interlacing causes problems on certain display devices such as LCDs.
- It was invented by RCA engineer Randall C. Ballard in 1932, and first demonstrated in 1934, as cathode ray tube screens became brighter, increasing the level of flicker caused by progressive (sequential) scanning.

# Deinterlacing

- Deinterlacing is the process of converting interlaced video, like common analog television signals, into a non-interlaced form.
- There are various methods to deinterlace video, each producing different problems or artifacts of their own. Some methods are much cleaner in artifacts than other methods.

# Progressive Scan

- Progressive or noninterlaced scanning is a method for displaying, storing or transmitting moving images in which all the lines of each frame are drawn in sequence.
- Some TVs, and most video projectors have one or more progressive scan inputs. This allowed these displays to be used with devices which output progressive scan like progressive scan DVD players and certain video game consoles.

# Digital TV Transition

- By no later than February 17, 2009, all full-power U.S. power television will be digital, and analogue transmissions terminated, according to legislation setting this deadline signed into law in early 2006.
- The major television stations in the Wilmington, North Carolina media market have already turned off their analog signals as a rehearsal.

# Digital-analog converters

- After the switch from analog to digital broadcasts is complete, analog TVs will be incapable of receiving over-the-air broadcasts without the addition of a set-top converter box.
- Consequently, a digital converter box – an electronic device that connects to an analog television – must be used in order to allow the television to receive digital broadcasts.

# \$40 Coupon Offer

- In the United States, the government is subsidizing the purchase of such boxes via their coupon-eligible converter box program
- Plastic card with a magnetic stripe, used like a gift card
- Can be used at local retailers or selected online retailers
- Request online from:
  - <https://www.dtv2009.gov/>

# Common Connections

- RF Modulator (Antenna) connection
- Composite Video (RCA Jack)
- S-Video
- Component Video (3 RCA Jacks)
- DVI
- Mini-DVI
- HDMI
- Most convertor boxes will only offer the first two, which are the lowest quality

# Another Option

- Since the new television signals are digital...
- You can use your computer!

# Elgato EyeTV

- Software and Hardware that turn your Mac into a Television and Digital Video Recorder
- Several hardware options available, from several vendors
  - Elgato
  - Hauppauge
  - Pinnacle
- Most come bundled with EyeTV software
- May have different accessories

# Who is Elgato?

- Elgato Systems is a hardware and software manufacturer that makes television viewing and recording products specifically for the Macintosh family of personal computers, including internationally acclaimed EyeTV software.
- Founded in 1992 by Markus Fest, also known as the creator of the Toast CD-burning software for Macintosh
- Elgato is a privately held company based in Germany with US offices in San Francisco, California.

# EyeTV 3.0 Software

- Watch TV on your Mac
- Rewind, fast forward, and pause live TV
- Search the Program Guide using detailed criteria (USA only)
- Record hours of television and edit out unwanted content
- Create TV series subscriptions with Smart Guides
- Organize recordings in Smart Playlists

# More Features

- Export recordings into iTunes in one easy step & sync automatically
- Share recordings with multiple Macs in a local network
- Access recordings via Wi-Fi on an iPod®, and iPhone and selected SmartPhones
- Store your recordings on an external drive, or burn to disc using Toast Basic (included in some bundles)

# EyeTV 250 plus

- Powerful TV tuner and video converter
- Hardware compression for better quality recordings without using your CPU
- Receives free-to-air HDTV, unencrypted digital cable (Clear QAM), and analog TV
- Roxio Toast 8 Basic disc burning software
- VHS Assistant to convert videotapes to DVDs
- iPod Assistant to convert analog video to iPod/iPhone/Apple TV formats
- Works with both Analog NTSC and the new ATSC Digital TV

# EyeTV Hybrid

- Has analog and digital tuners
- Connections for external video source
- Connects via external USB 2.0 stick
- Uses your CPU to decode, so requires a faster machine
- Designed and manufactured by Hauppauge (HVR950)

# Turbo.264

- Turbo.264 is a powerful hardware encoding device that quickly converts any video to the advanced H.264 (MPEG-4) format without using your Mac's resources.
- Companion to another device
- Quickly and easily export content to iPhone, iPod, Apple TV and PSP
- Free up your Mac for other tasks while encoding
- Convert videos to high quality H.264 files
- Accelerates EyeTV's Wi-Fi Access feature

# Time to Demo!

- Elgato EyeTV Hybrid
- Elgato EyeTV 3.04 software
- MacBook Pro
  - 2.16GHz Core Duo (32-bit, not Core 2)
  - 2 Gb RAM
  - Caching on external hard drive
- Rabbit Ears (dipole) antenna