Development of Displays

Past CRT → Flat Portable → Present LCD → Fast Response Low Power → Future OLED

HDTV (1920x1080)
SXGA (1280x1024)
XGA (1024x768)
SVGA (800x600)
VGA (640x480)
QVGA (320x240)
CGA (640x200)

HDTV FULL COLOR
SVGA-SXGA FULL COLOR
HDTV (CRT)
TV (TFT/Projection)
SXGA

PDP
CRT
LCD
OLED

- 1897– (~)
- 1938
- 1970
- 1980
- 1990
- 2000
- 2005
- 2010

14" B/W TV
Cellular
IMT-2000
PDA
Camcorder
CNS
E-Book
Wall TV
Roll TV

2002
2003
2004
2005
2008
2010

www.eliatech.com/img/display1.gif
Cathode Ray Tube (CRT)
Construction for Monochrome (Gray)

CRT Construction for Multichrome (Color)

Delta (a), (b)

Linear (c), (d)

The four types of shadow mask geometry in color CRTs

Merging Color

www.colorado.edu/.../tv/images/rgbScreenComp.jpg
Spectra characteristics of phosphors

P22:
(ZnS:Cu)
(ZnS:Ag)

Blue
Green
Red

Chromaticity coordinates

Arrangement of Phosphor Dots

21” TV CRT Display

17” PC CRT Display
Dots Pitch
Three common phases of liquid crystal materials

Smectic
Layer-like

Nematic
Thread-like

Cholesteric
Helical-like

Twisted Nematic LC Cell for Monochrome (Gray)

Voltage off

Voltage on

Polariser

Glass

Liquid crystal director

Glass

Polariser

Twisted Nematic LC Cell for Multichrome (Color)
How LCD Panel Can Produce Colors

Thin Film Transistor (TFT) Array

(the form of illuminant)
OLED Components

Substrate (clear plastic, glass, foil)
Anode (transparent) - removes electrons
Conductive layer - made of organic plastic molecules
Emissive layer - made of organic plastic molecules
Cathode - injects electrons

http://electronics.howstuffworks.com/oled1.htm
How do OLEDs Emit Light?

- Applied voltage across the OLED
- Electrons find electron holes
- The OLED emits light.
- The color of the light depends on the type of organic molecule in the emissive layer. Manufacturers place several types of organic films on the same OLED to make color displays.
- The intensity or brightness of the light depends on the amount of electrical current applied: the more current, the brighter the light.

http://electronics.howstuffworks.com/oled1.htm
What is Gamut?

color gamut graph of a typical CRT monitor

Comparison of Color Gamut

Lab Space
Typical LCD monitor
Typical CRT monitor
Inkjet printer

Reproduced from www.dhark.com/images/color_gamut.jpg
Gamut Mapping

- re-defining the colors of a given device
- an important problem in color management

www.people.csail.mit.edu/.../img/01-gamutplots.jpg
References

1. www.eliatech.com/img/display1.gif
4. www.computer.howstuffworks.com/monitor.htm/printable
10. www.people.csail.mit.edu/.../img/01-gamutplots.jpg
“I think you should be more explicit here in step 2.”