SECTION 1
ELECTRONIC INFORMATION DISPLAYS - AN OVERVIEW

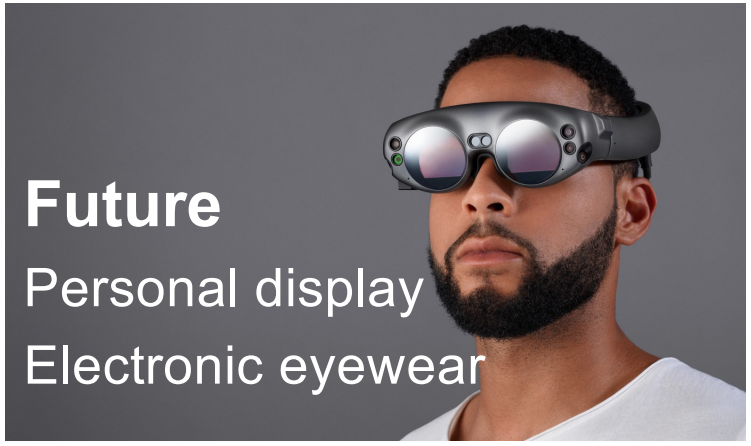
Electronic Display - Definition

Wikipedia. An electronic **display device** is an output device for presentation of information for visual or tactile reception, acquired, stored, or transmitted in various forms. When the input information is supplied as an electrical signal, the display is called *electronic display*.

www.answers.com

An electronic **display device** is an electronic component used to convert electric signals into visual imagery in real time suitable for direct interpretation by a human operator

Display paradigms



Three questions for you …

My assertions

Today, in 2022, electronic displays are everywhere

They have permeated all parts of our lives

We could not function (so well / at all*) without them

My questions

Since waking up this morning

How many electronic display screens have you looked at ?

How many times have you looked at an electronic display ?

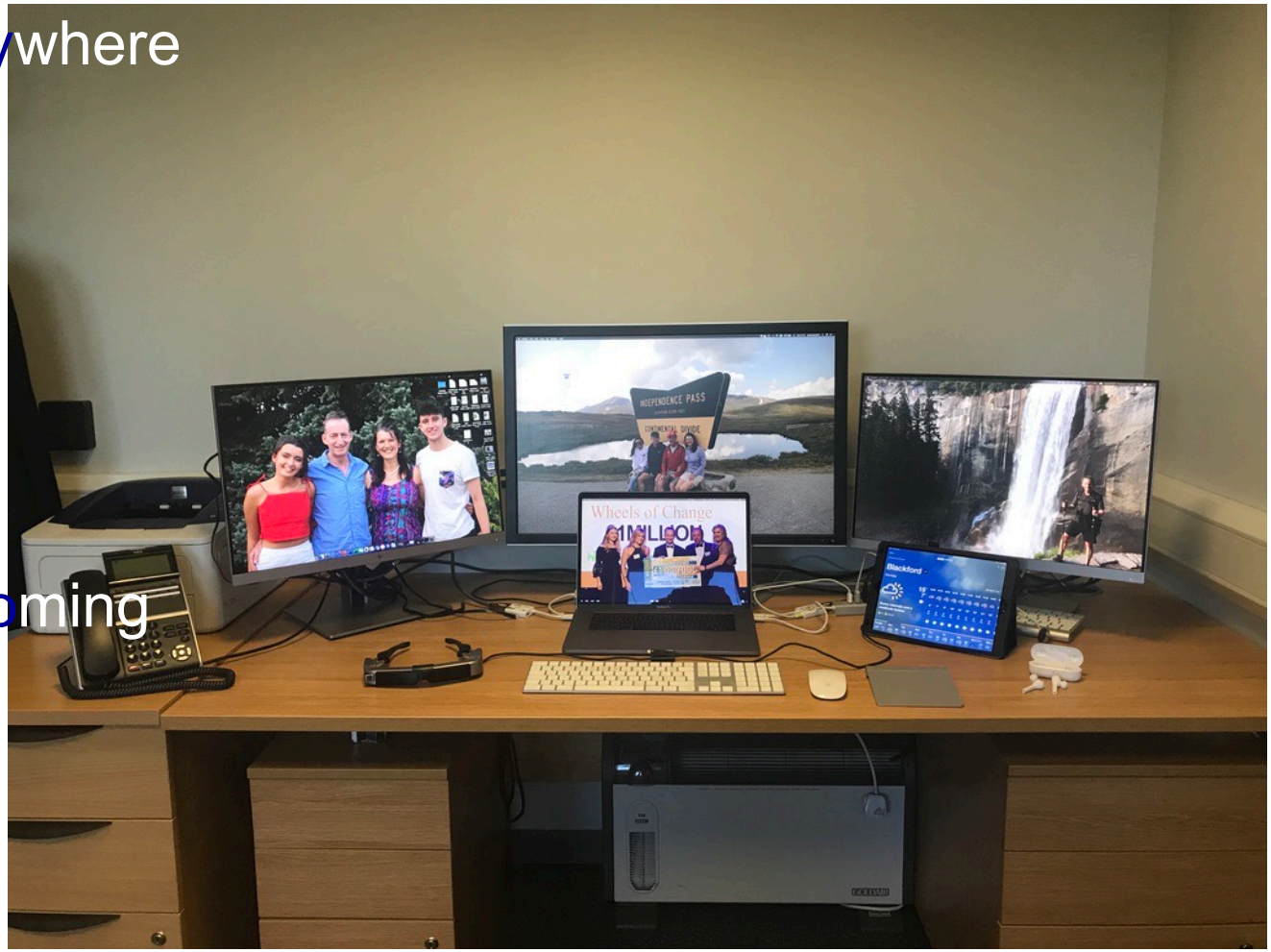
How many minutes have you spent looking ?

* Delete as appropriate

Ubiquity of Electronic Displays

Electronic displays are everywhere

- Home
- Office
- Car, bus
- Person
- Pub
- Railway station, airport



Content is continuously becoming more

- Complex
- Colourful
- Video-oriented
- Engaging

Goal of advanced electronic displays

Definition of the ideal electronic display

– An electronic display on which a viewed image is indistinguishable from reality

Not possible!

Goal of today's advanced displays

– To come a close as possible to the ideal display given practical restrictions

– Size, weight, power consumption, cost etc

Thought Experiment!

A fundamental issue

The real world is
3-DIMENSIONAL

CONTINUOUS &
UNLIMITED in

SPACE
TIME
COLOR
BRIGHTNESS

Look around you!

Almost all
Electronic Displays are
PLANAR (2-D)

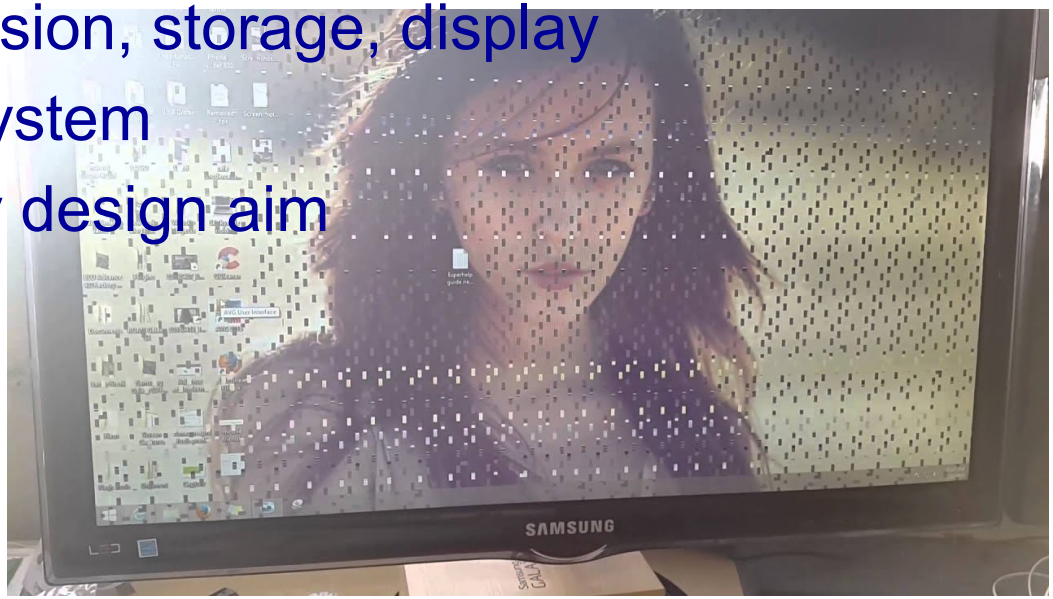
DISCRETE &
LIMITED in

SPACE (pixels)
TIME (frames)
COLOR (shades)
BRIGHTNESS (grey levels)

Visual artifacts

Definition - artefacts are unwanted visible effects that distort faithful reproduction, reduce realism or otherwise detract from the users enjoyment of the content being viewed

- **artefacts** can derive from any part (or combination of parts) of the system – capture, transmission, storage, display
- **artefacts** exist in every display system
- Minimization of **artefacts** is a key design aim



Display System Functional Blocks

Generate / receive Image Data

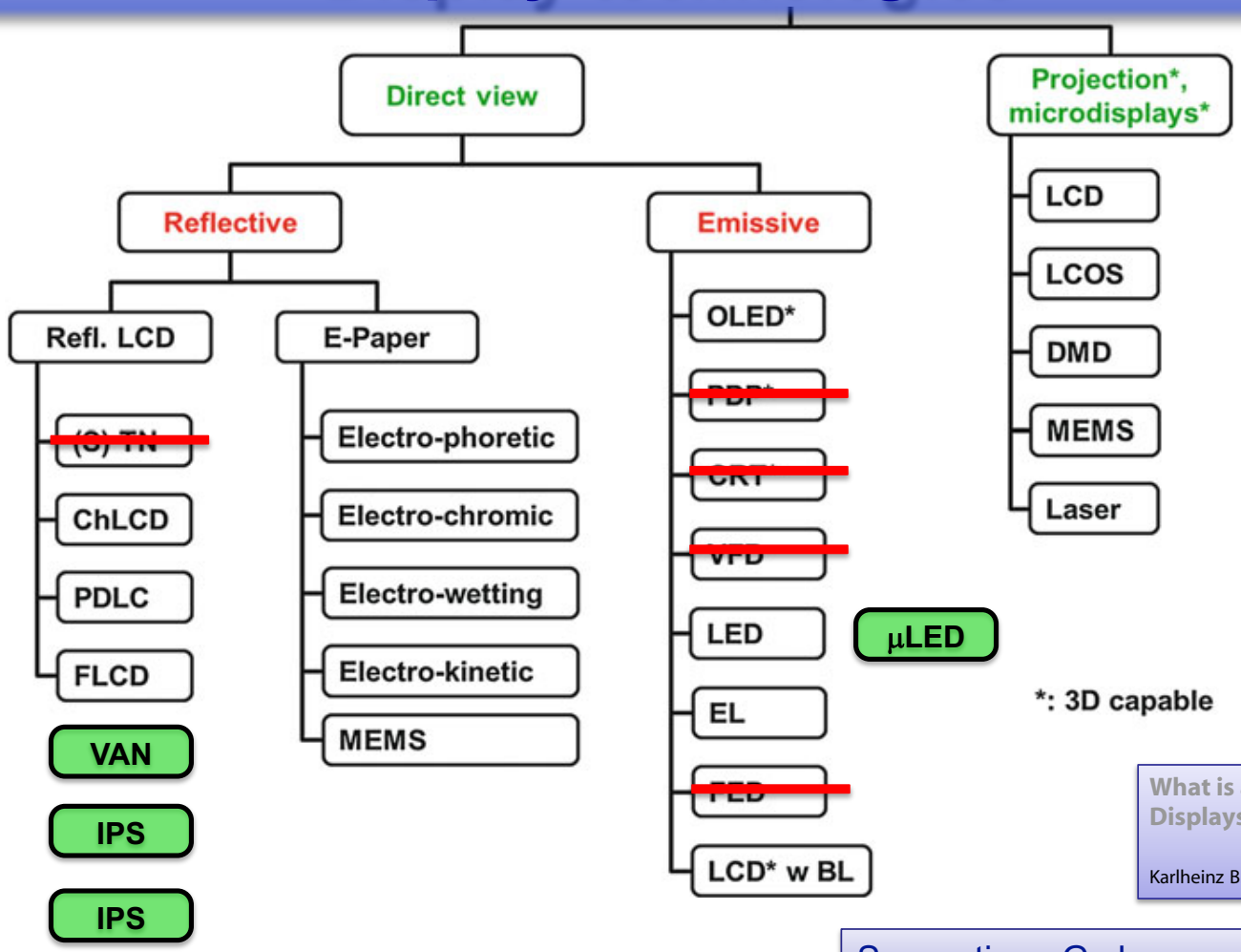
Store Image Data

Transmit Image Signal

Convert Image Signal

Display Image Signal

Display technologies



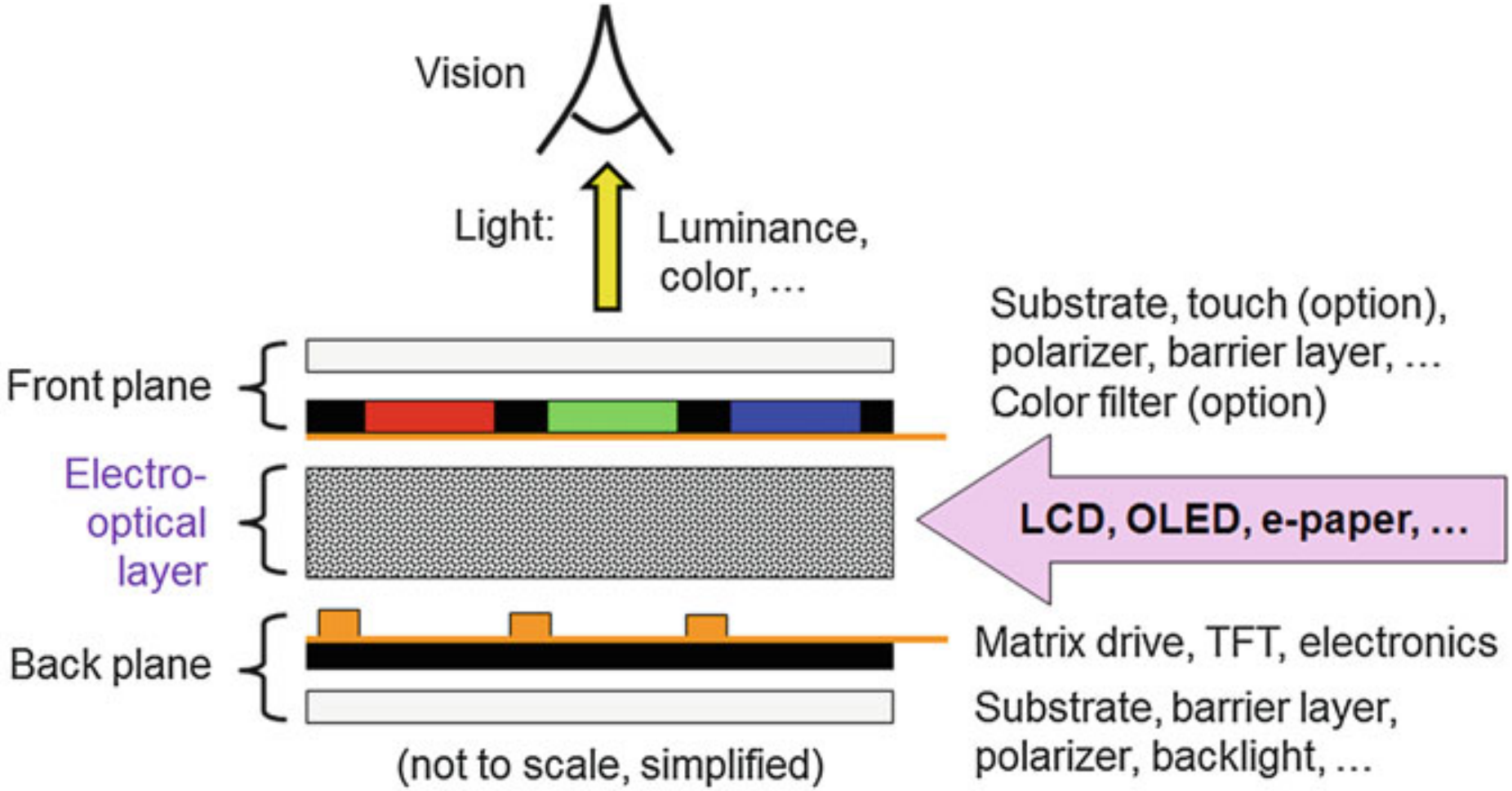
*: 3D capable

What is a Display? An Introduction to Visual Displays and Display Systems

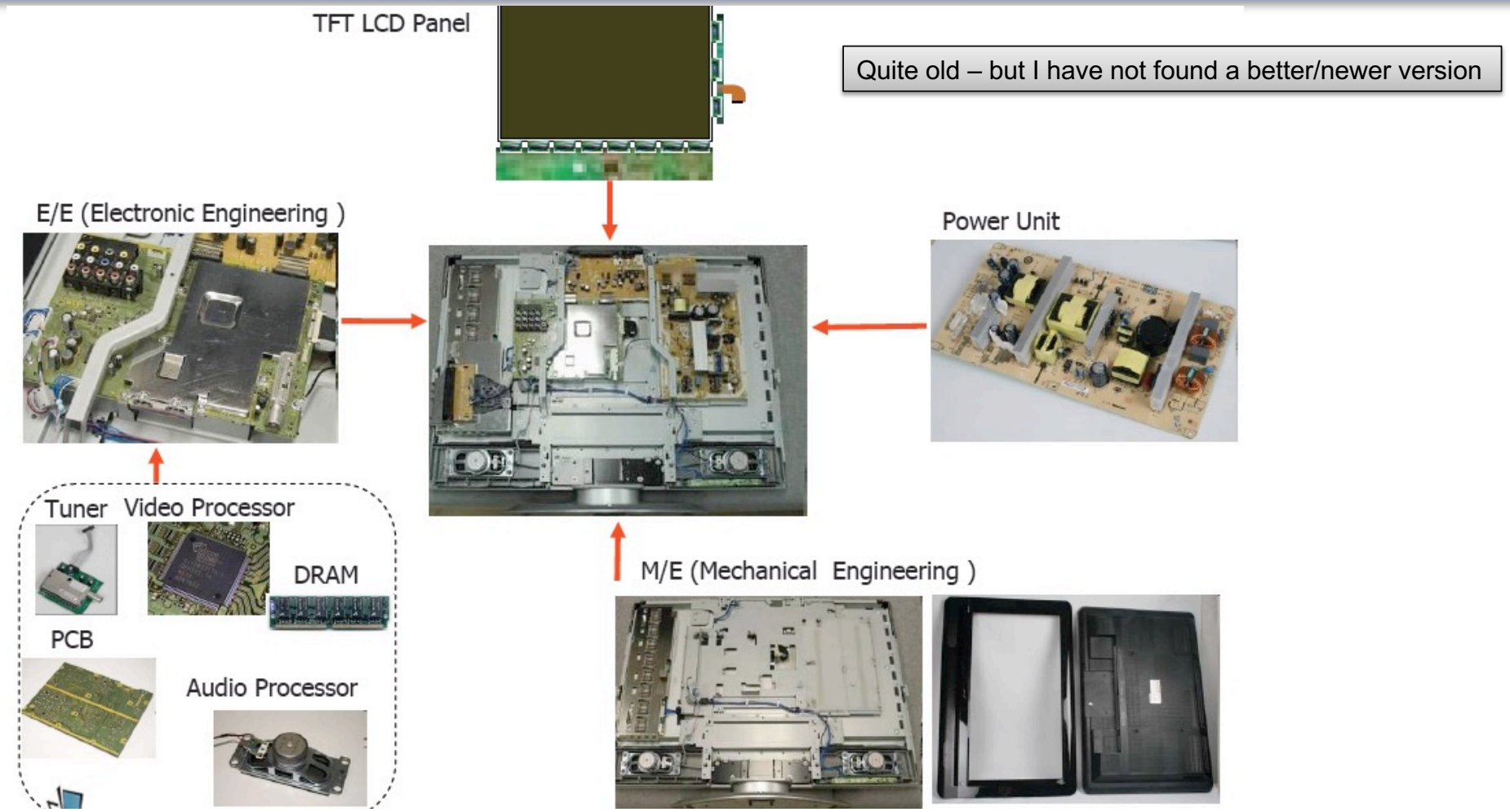
Karlheinz Blankenbach

Suggestion - Go home and look up all the acronyms

Display Panel - Component Parts



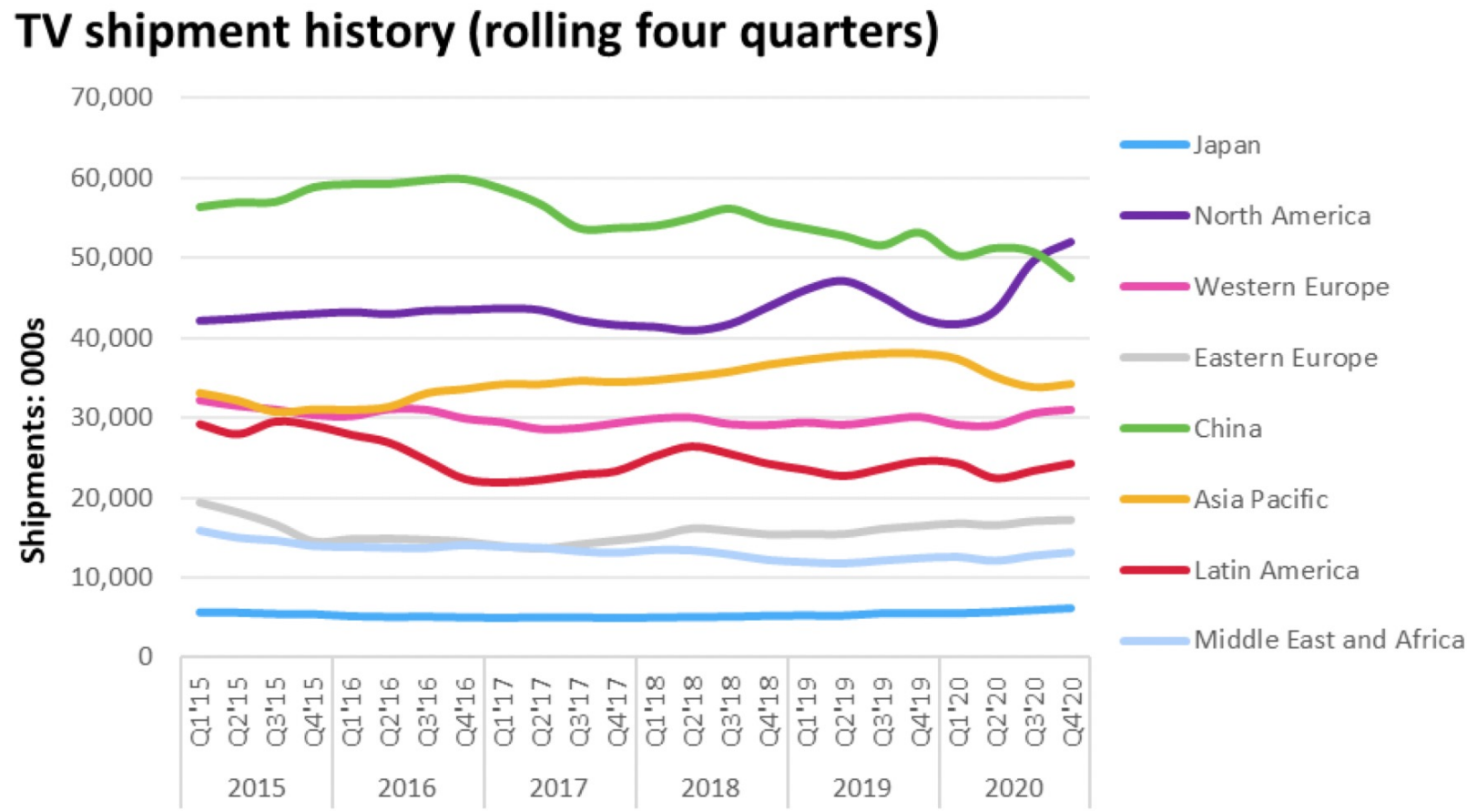
TFT LCD TV breakdown



Domestic flat panel tv

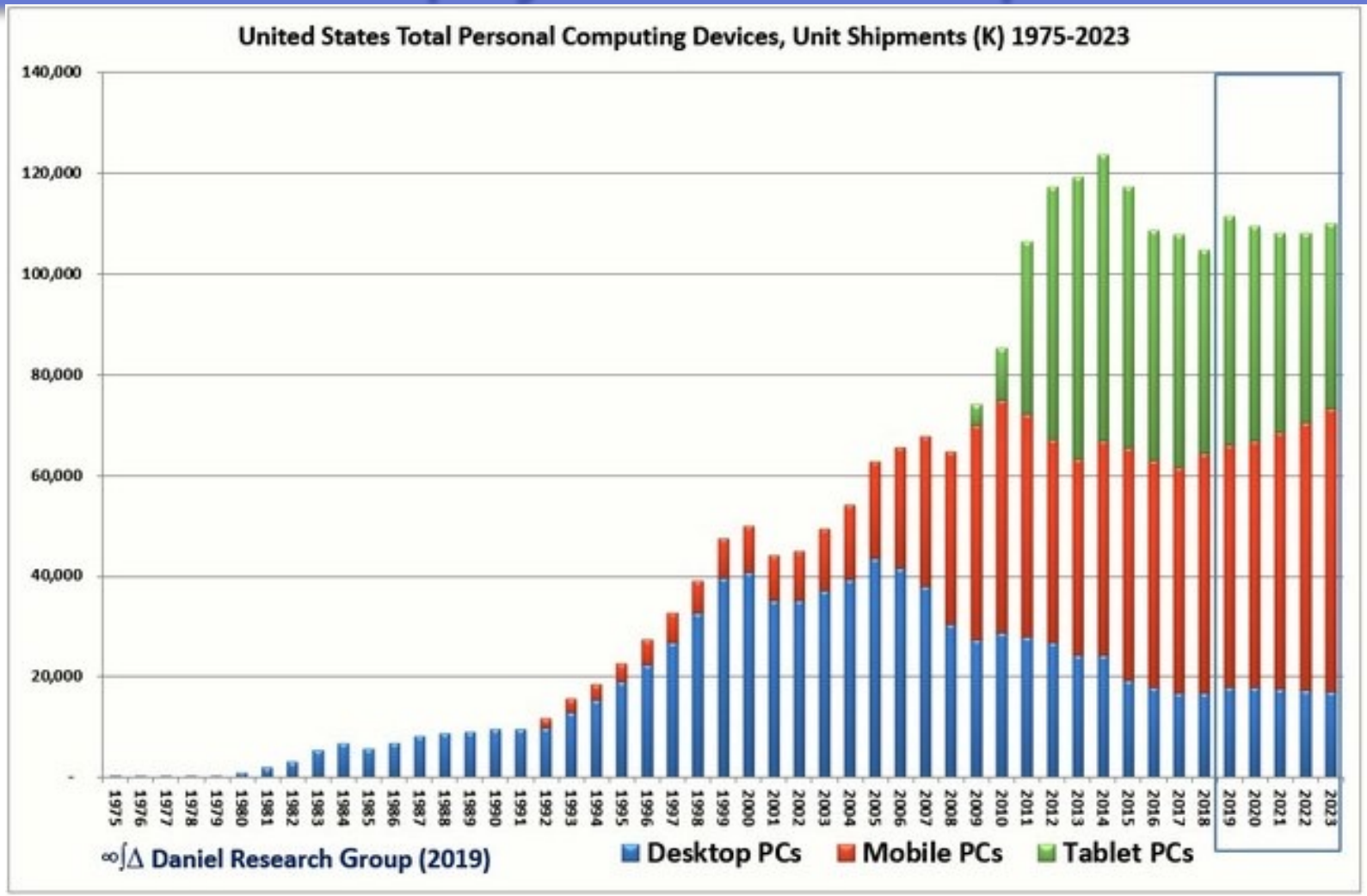
LCD and OLED!
LED?

Domestic Flat Panel tv Market

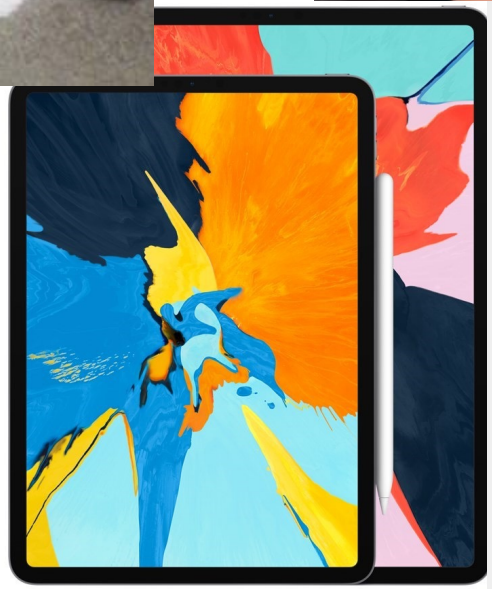


Source: Omdia

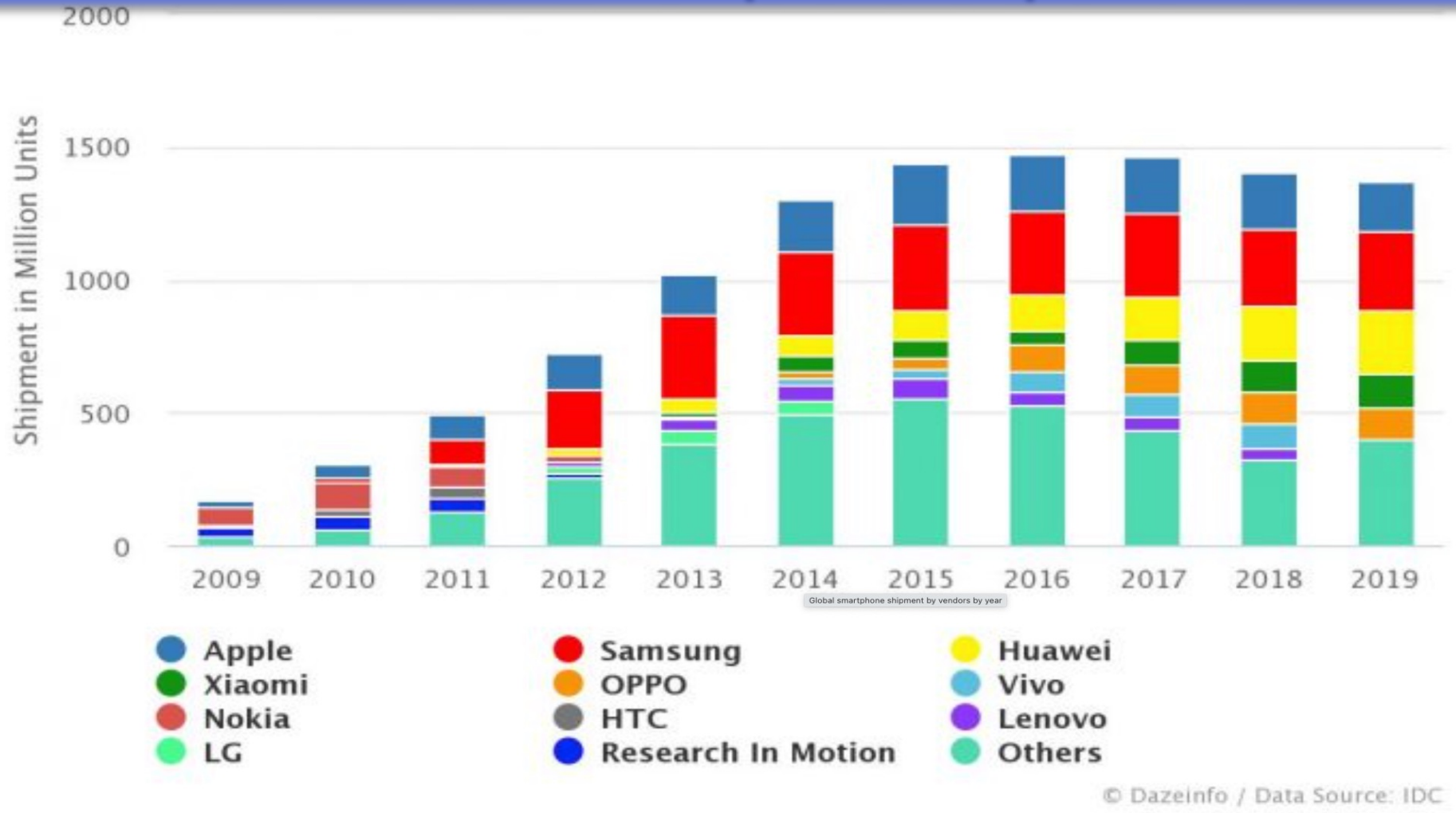
Display Markets - Computer



Mobile phones, GPS, Games



Worldwide Smartphone Shipments



WW SM TFT LCD ASP Trend

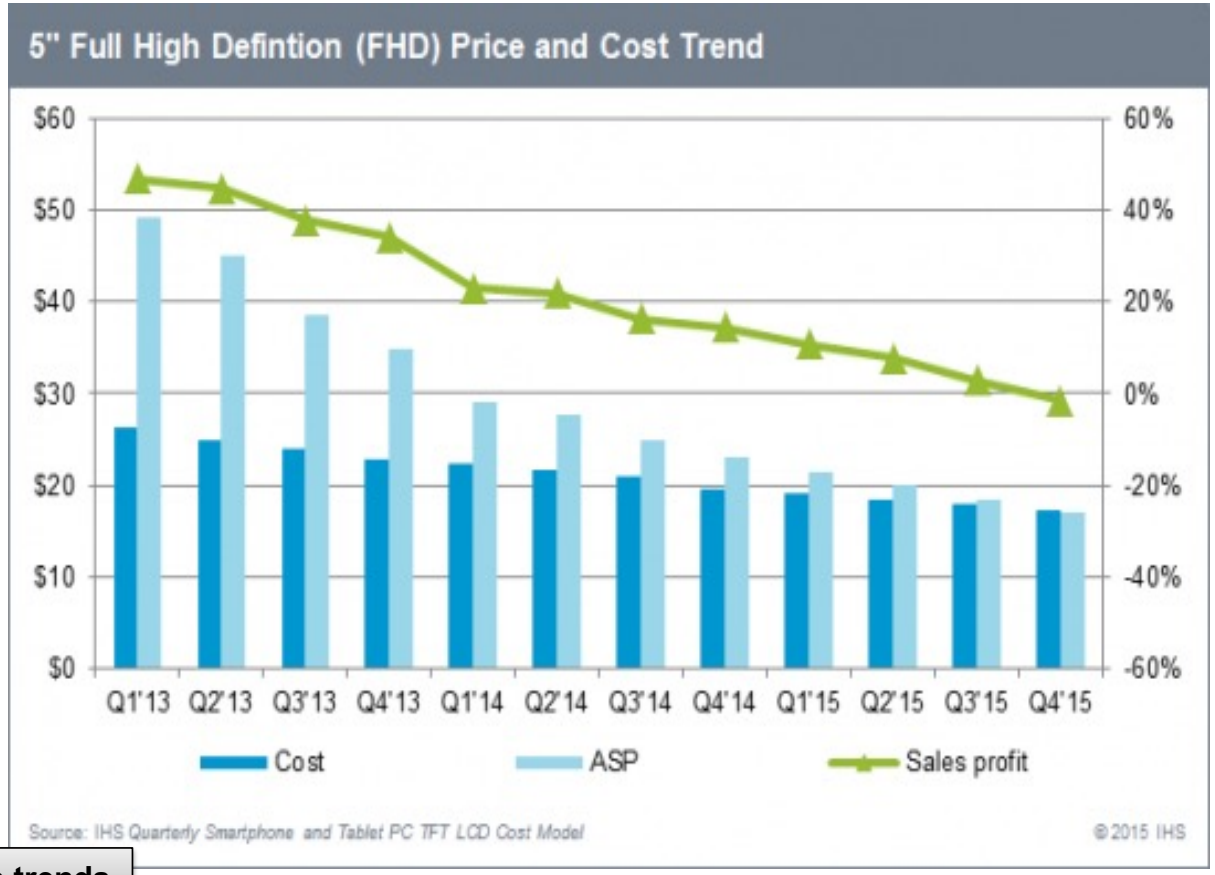
Underlying reason is

- Price erosion
- Like most consumer electronics

Manufacturers must constantly

- Grow volume
- Increase yield
- Reduce overheads

to thrive / survive

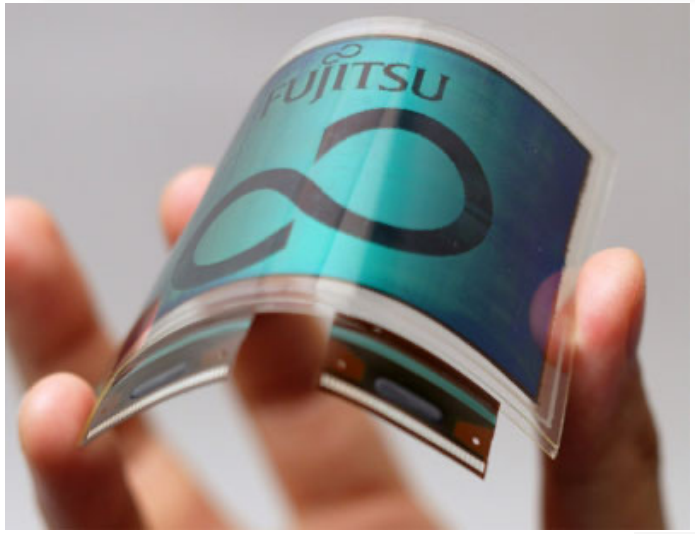


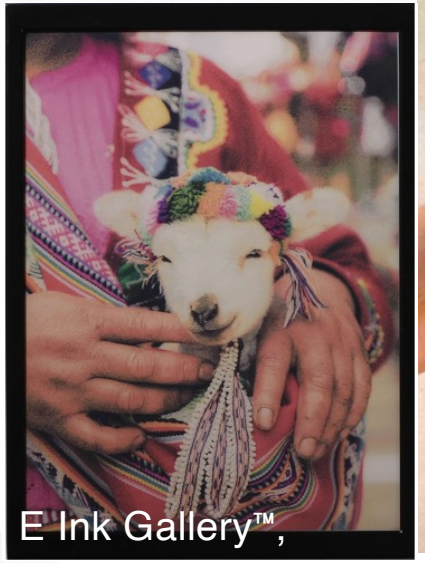
Historical figures that indicate **trends**

AR/VR HMD – Emerging Market

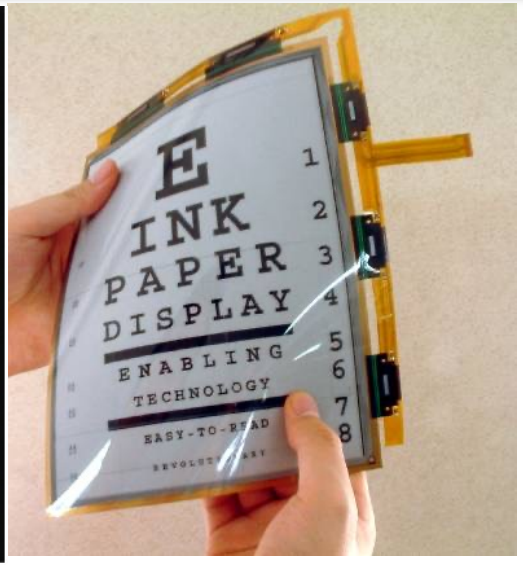
VARJO XR-3

Flexible & Organic

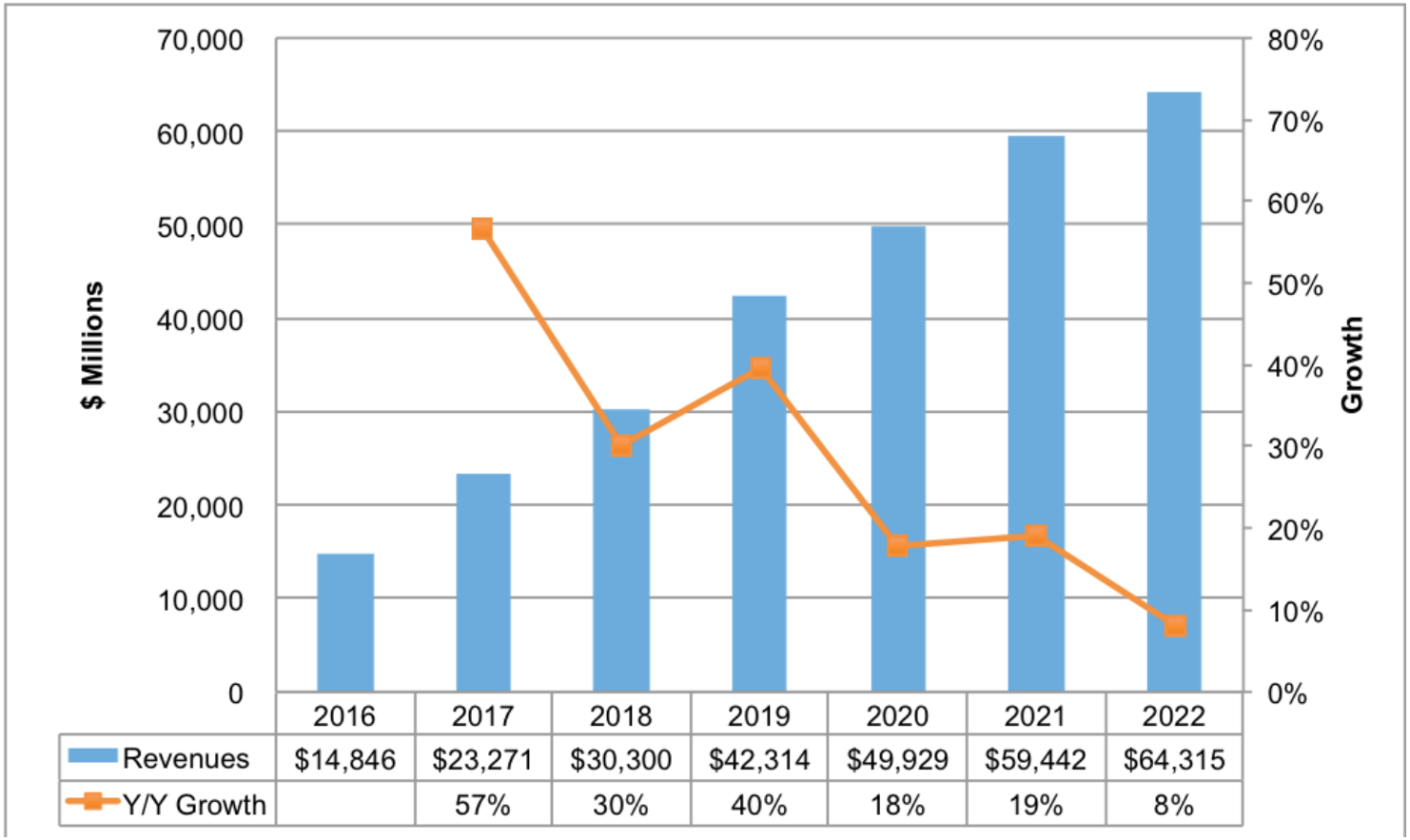




E Ink Gallery™, based on the Advanced Color ePaper (ACeP™) is a high quality, full color reflective display. In the ACeP™ system, the ink can produce full color at every pixel, without the use of a color filter array (CFA).



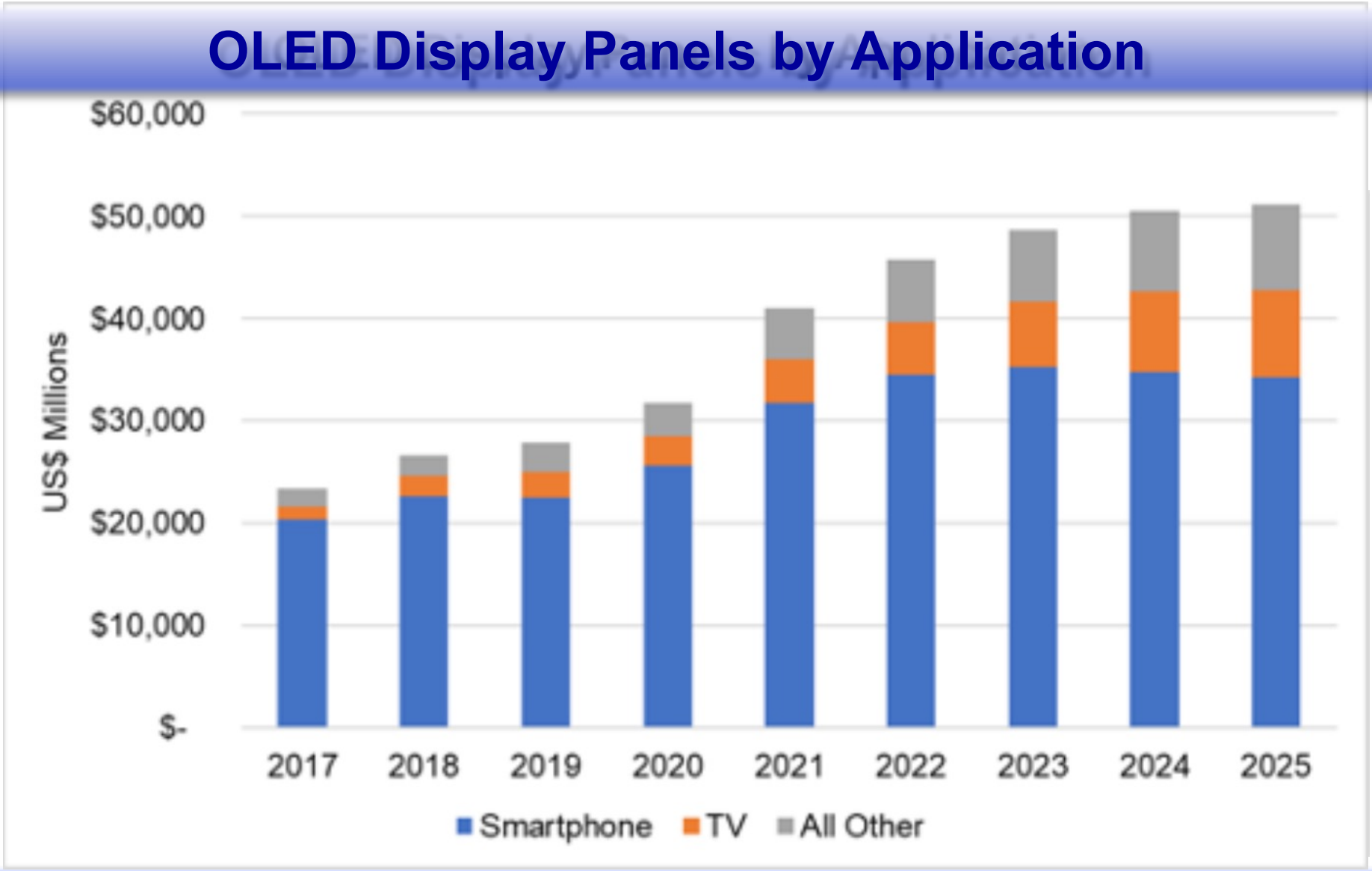
OLED Display Market Forecast



	2016	2017	2018	2019	2020	2021	2022
Revenues	$14,846	$23,271	$30,300	$42,314	$49,929	$59,442	$64,315
Y/Y Growth		57%	30%	40%	18%	19%	8%

Source – DSCC via Display Daily

OLED Display Panels by Application



Comparing display pixels and sensor array pixels

The main reason that electronic display pixels
are completely unlike image sensor pixels
is because …

Display System Design

The greatest challenge of display **system** design derives from the fact that…

… no matter how faithful, repeatable and reliable the electronics, electro-optics, backlighting etc is …