

# THE BROADBAND DESKTOP

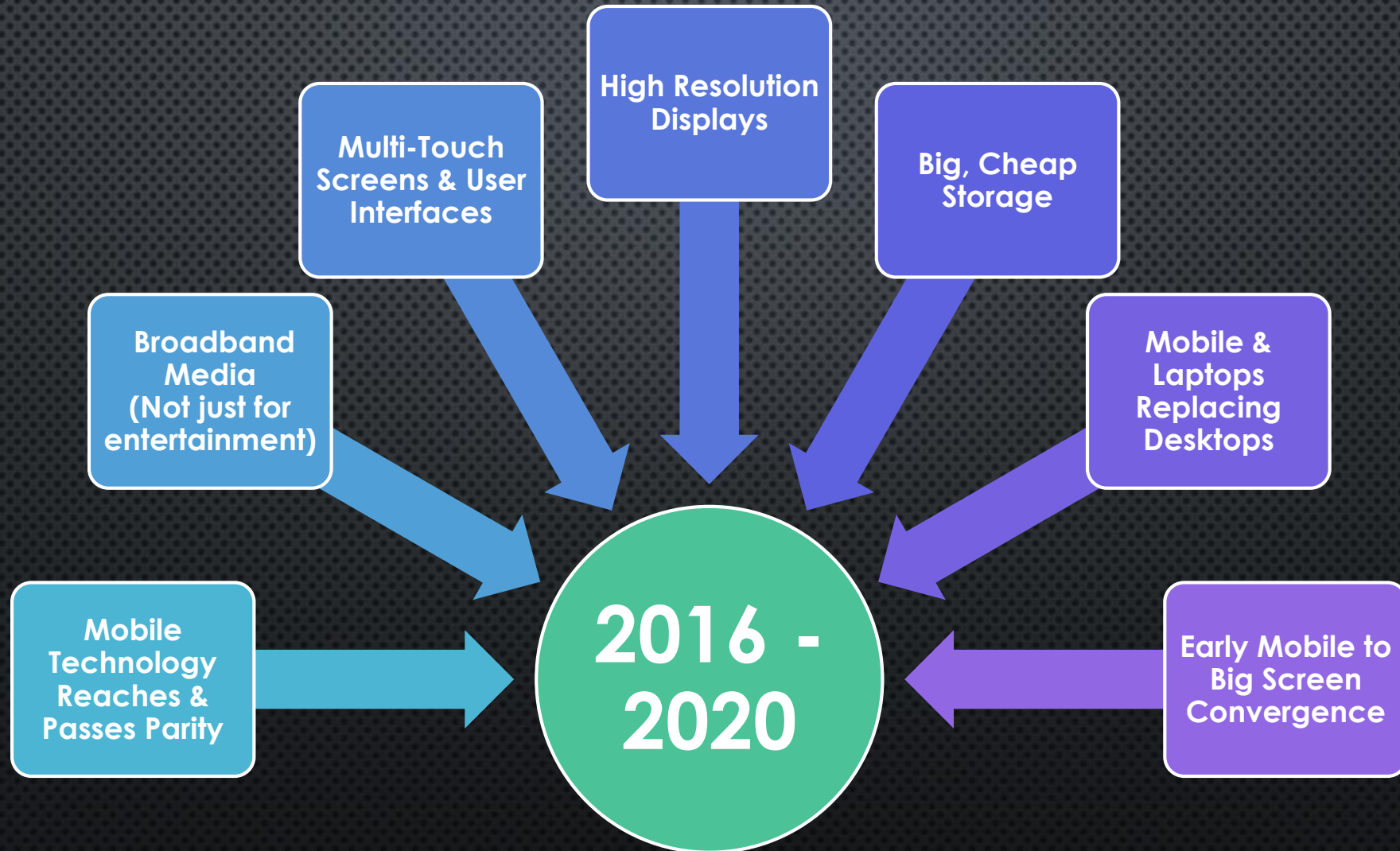
## RISE OF THE BIGSCREEN

(AND IT'S ABOUT TIME...)

DUB DUBLIN

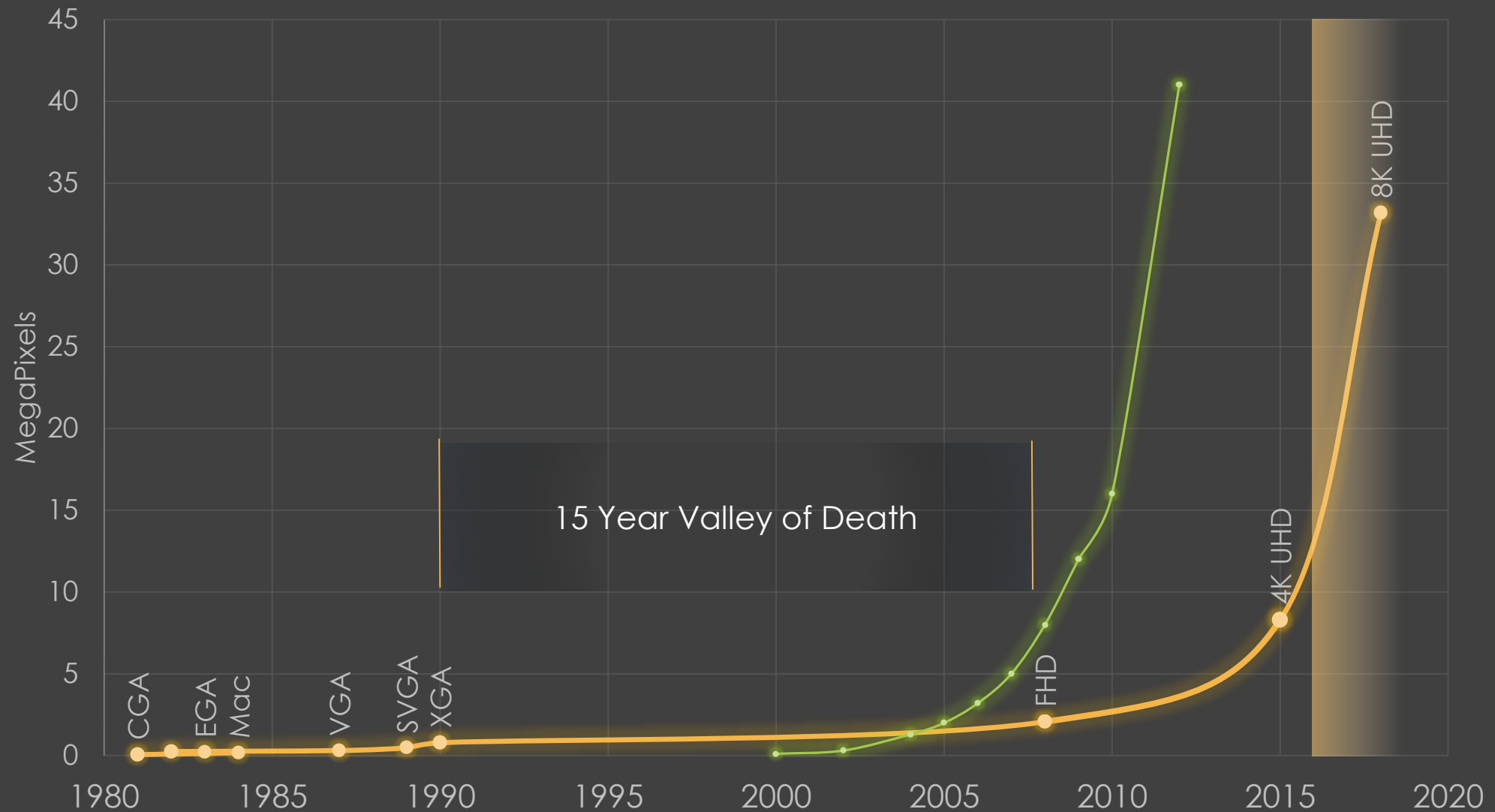
DUBLINVENTION / BRILLIANT DEVICES

# TOP TRENDS DRIVING NEW HARDWARE IN 2016





# EVOLUTION OF RESOLUTION



# COMPUTERS (INFO), NOT TV (ENTERTAINMENT), WILL DRIVE HIGH-RES SCREENS

- CAMERA IMAGES (EVEN FROM PHONES!) ARE TOO BIG TO DISPLAY
  - CURRENT FLAGSHIP PHONES ARE ~ 16-20 MEGAPIXELS
- NOT AS BIG A CHALLENGE WITH VIDEO
  - 4K VIDEO CONTENT IS STILL RARE & HARD TO DELIVER
  - 8K IS ONLY A DREAM... (AND WHO REALLY WANTS IT?)
- TV MAKERS (WRONGLY) THINK 4K/8K CONTENT WILL DRIVE BIGGER SCREENS



# THE REAL DRIVER IS MORE INFORMATION BANDWIDTH TO THE USER

- “PIXELS ARE THE MOST PRECIOUS RESOURCE OF YOUR USER INTERFACE”
- WE’VE NEEDED MORE PIXELS FOR OVER 20 YEARS
- THERE’S NO SUBSTITUTE FOR BEING ABLE TO SEE A LOT ALL AT ONCE
  - LETS US MORE OPTIMALLY USE OUR MOST SOPHISTICATED AND HIGHEST BANDWITH SENSORS – THE HUMAN EYE
- TOUCH ALLOWS DIRECT INTERACTION WITH DATA
  - (WE’RE REALLY JUST STARTING TO FIGURE THIS OUT...)

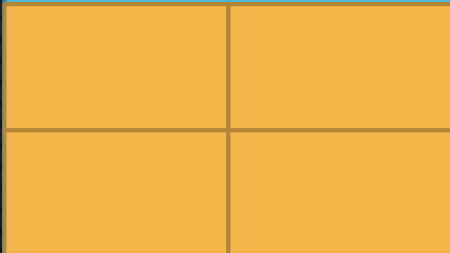
# RESOLUTIONS IN PIXELS



Full HD (1920 x 1080)

# RESOLUTIONS IN PIXELS

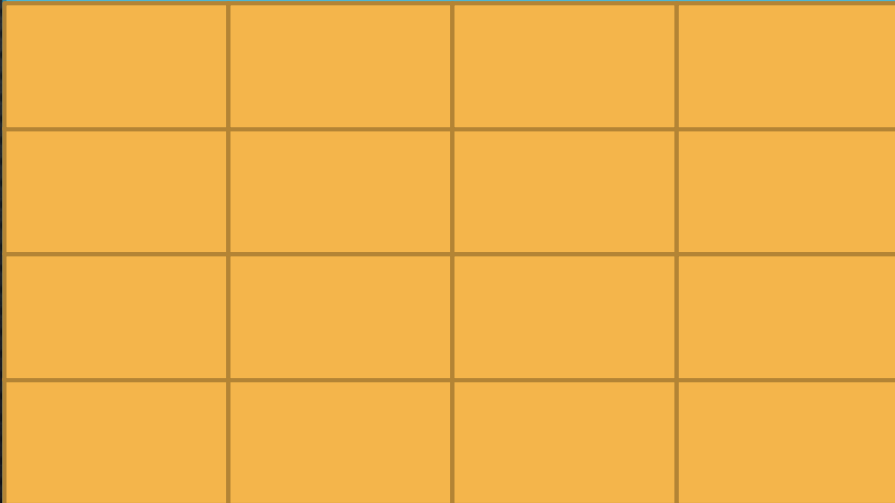
4K (3840 x 2160) = 4 x Full HD





# RESOLUTIONS IN PIXELS

8K (7680 x 4320) = 16 x Full HD



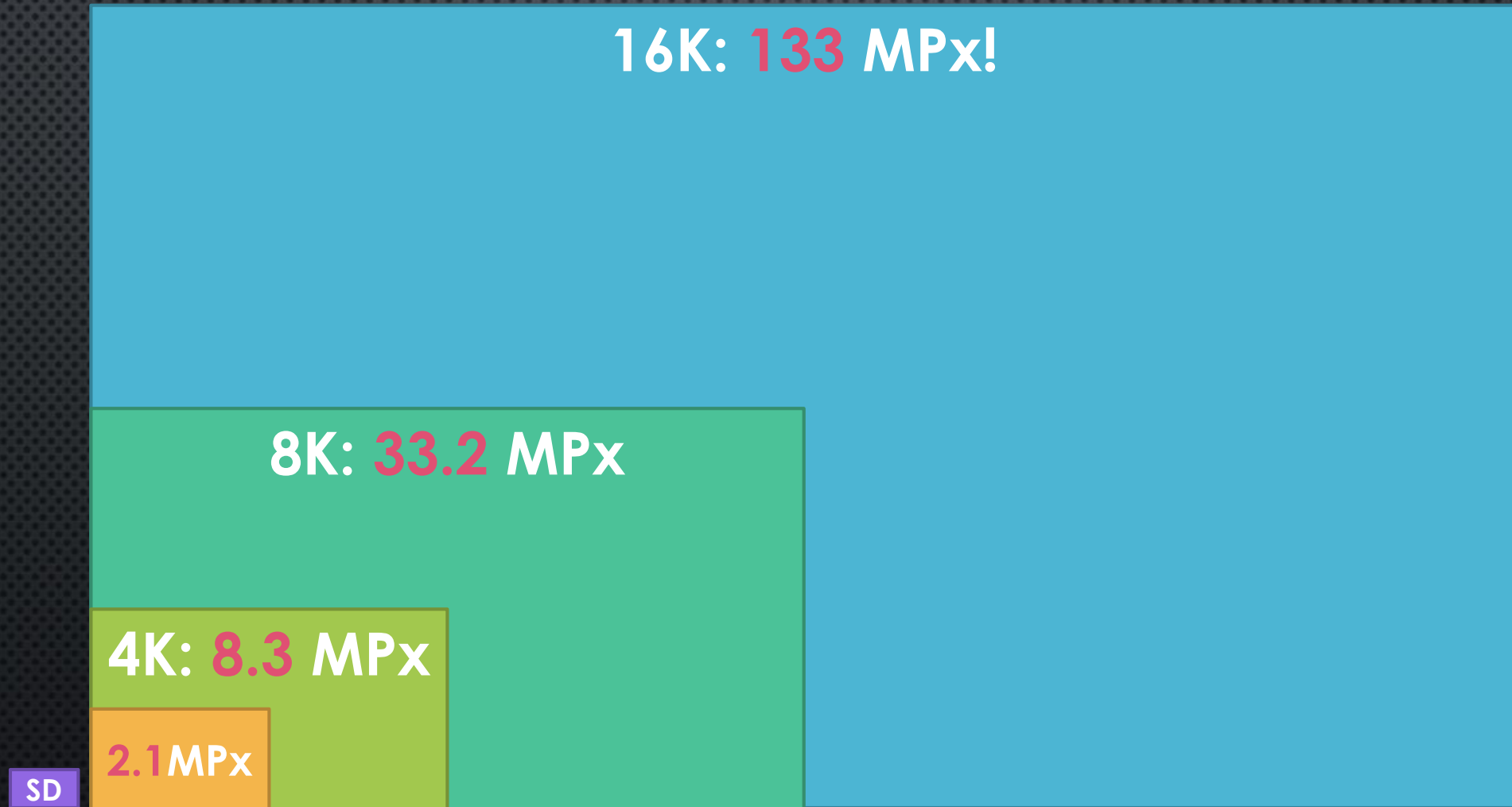


# RESOLUTIONS IN PIXELS



16K (15360 x 8640)  
= 64 x Full HD

# RESOLUTIONS IN PIXELS





# RESOLUTION: WHAT IS “RETINA”?

- APPLE’S DEFINITION OF “RETINA” IS FAR BELOW ACTUAL RETINA RESOLUTION (BY AT LEAST 4X) , BUT A GREAT TARGET FOR HIGH-PERFORMANCE DISPLAYS
- RETINA DISTANCE FOR A 50” SCREEN (APPROX. 2 ½ X 4 FOOT “DESKTOP” DISPLAY):
  - 4K – RETINA AT 39 INCHES (OR MORE)
  - 8K – RETINA AT 20 INCHES (20-24 IN IS IDEAL TOUCHSCREEN DISTANCE)
  - 16K – RETINA AT 10 INCHES (OR CAN BE 100-INCH DISPLAY AT IDEAL 20” TOUCH DISTANCE)

# SO HOW MUCH RESOLUTION DO WE REALLY NEED?

- HOW MUCH DO WE HAVE AVAILABLE TODAY (NOT THROUGH OUR COMPUTERS)?
- HOW MUCH CAN WE REALLY USE?
- IN BOTH CASES, MUCH MORE THAN YOU MIGHT THINK...



## A BACK-OF-THE-ENVELOPE INFORMATION BANDWIDTH ANALYSIS...

How much INFORMATION is on a STD PAGE?

ANSI A-SIZE =  $8\frac{1}{2} \times 11$  - Assume  $\frac{1}{4}$ " BORDER

$$\text{so } 8 \times 10\frac{1}{2} = \underline{84 \text{ in}^2}$$

$$@ 300 \text{ DPI} = \underline{7.56 \text{ MP}}$$

$$@ 600 \text{ DPI} = \underline{\underline{30.2 \text{ MP}}}$$

## WHAT THIS MEANS (TO SCALE):

A SINGLE  
SHEET HOLDS  
MUCH  
MORE INFO  
THAN YOUR  
SCREEN

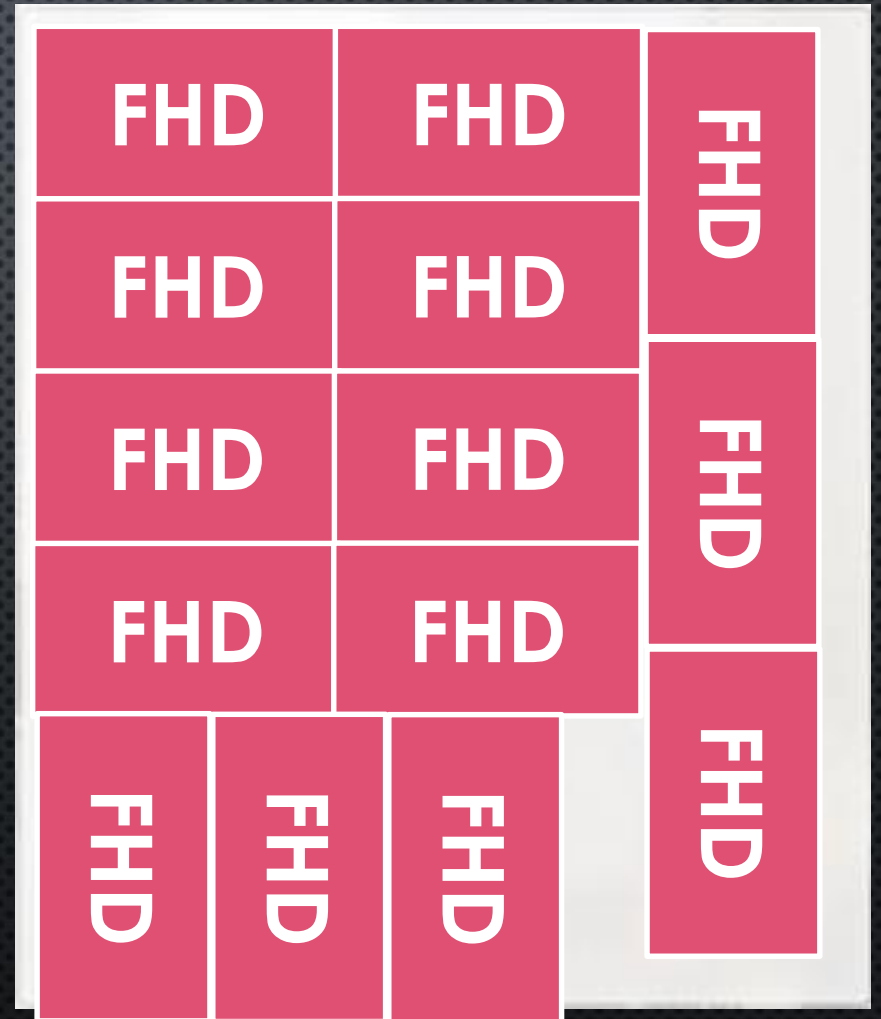
~ 14.5 X

@600DPI

OR

~3.6 X

@300DPI





## WHAT THIS MEANS (TO SCALE):

A SINGLE  
SHEET HOLDS  
MUCH  
MORE INFO  
THAN YOUR  
SCREEN

~ 3.6 X  
@600DPI  
OR  
~1 X  
@300DPI

4K UHD

4K UHD

4K UHD

# HOW MANY SHEETS OF PAPER CAN YOU SPREAD OUT AND EASILY READ ON YOUR DESK?

- EVEN A SMALL DESK HAS ROOM FOR 5-10 SHEETS
- A LARGER DESK (ESPECIALLY WITHOUT A COMPUTER IN THE MIDDLE OF IT!) HAS ROOM FOR EVEN MORE
- SO YOU REALLY CAN USE A LOT OF PIXELS!
- PLUS, THE “DESKTOP” METAPHOR REALLY STARTS TO WORK AT REAL DESKTOP SIZES. (IMAGINE THAT!)

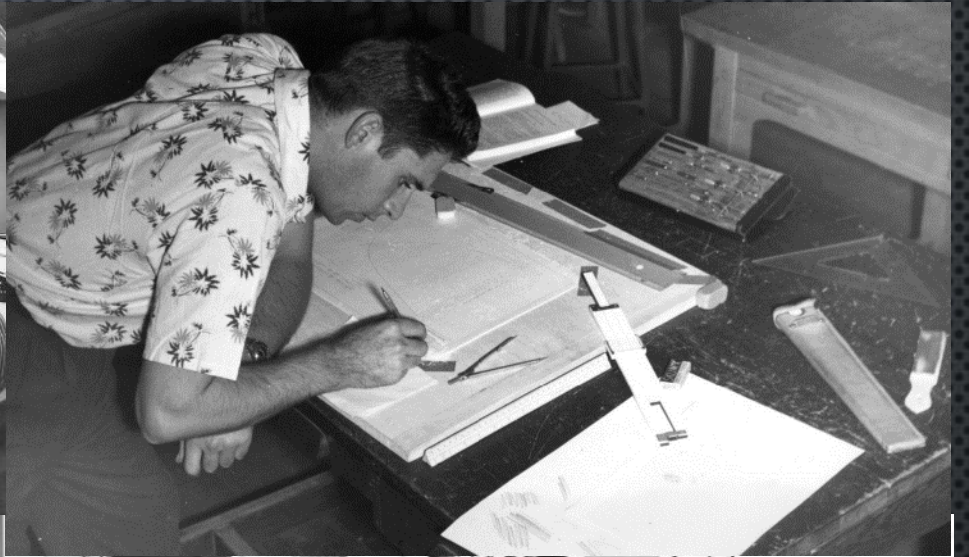
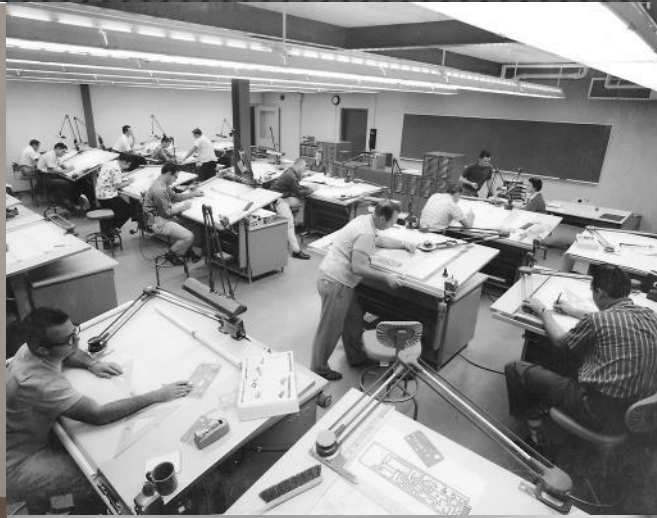


SO WHAT DOES THE IDEAL NEXT-GEN BIGSCREEN  
WORKSTATION LOOK LIKE?

HINT:

IT LOOKS A LOT LIKE A STATE-OF-THE-ART WORKSTATION  
LOOKED 50 (OR EVEN 100) YEARS AGO!







# FUTURE VISIONS – SUNFIRE – BRUCE TOGNAZZINI



A view from 1994 (!)

- Large, High-res screen
- Full Touchscreen
- Wraps around and up
- “Fling” documents from desk surface to vertical workspace
- Integrated cameras, scanners & video/phone



# FUTURE VISIONS – SCI FI - CAPRICA





# FUTURE VISIONS – SCI FI - CAPRICA





# FUTURE VISIONS - SMART DESK CONCEPTS





# REALITY - TODAY

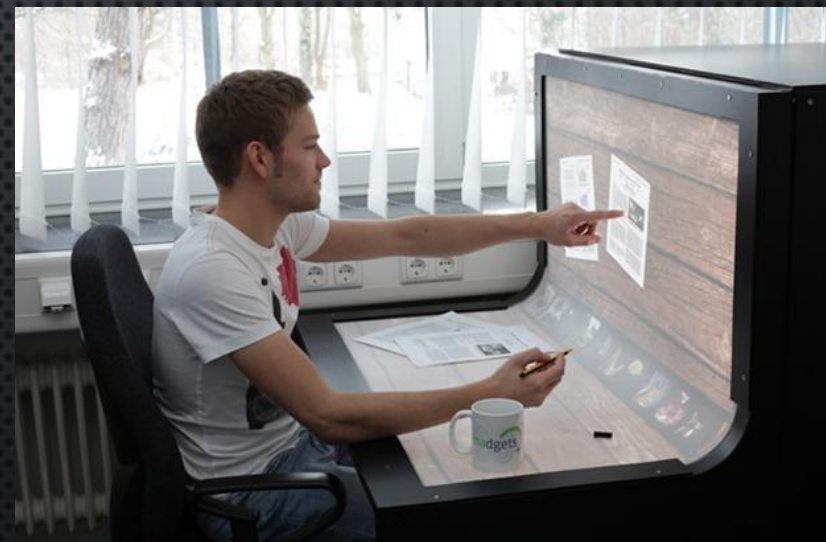


IDEUM 65"  
DRAFTING  
TABLE

EURO  
RESEARCH  
PROTOTYPE



HP ENVY  
RECLINE





# REALITY - TODAY

MICROSOFT  
SURFACE HUB





# REALITY - TODAY



INTEL WIDI

WIRELESS DISPLAY LINK

SUPPORTS 4K &  
DX9/DX11



# NEAR TERM PREDICTIONS

- 8K WILL BE THE SWEET SPOT FOR THE NEXT FEW YEARS
  - GIVES RETINA RESOLUTION FOR A DESKTOP SIZED DISPLAY
  - MUCH EASIER TO BUILD 8K THAN 16K SCREENS
  - BIG TOUCHSCREENS (ESP. PRECISION MULTI-TOUCH W/PEN), ARE (CURRENTLY) EVEN HARDER THAN BIG DISPLAYS
- NOT MUCH REASON TO GO BEYOND 16K FOR THE NEAR-MID FUTURE
  - EVEN 16K IS OVERKILL FOR MANY APPLICATIONS
  - 16K GRAPHICS CHIPS/CARDS WILL TAKE A WHILE TO GET SORTED



# CURRENT GRAPHICS PROCESSING TRENDS

- MOBILE CPUs AND GPUS MAY SOON PASS COMMODITY DESKTOP PARTS
- FINFET GPUS:
  - MUCH IMPROVED PERFORMANCE
  - MUCH LOWER POWER CONSUMPTION
- VR TYPICALLY REQUIRES  $\sim 7$  X THE PERFORMANCE OF STANDARD DISPLAY
- AMD: 16K x 16K @ 120 Hz EQUATES TO 6 GPIXELS/SECOND (!)
  - RESULTS IN "MIRROR-LIKE" IMAGE QUALITY AND REALISM
  - MAY BE MORE APPLICABLE TO VR THAN LARGE DISPLAYS
  - AIMING FOR 200-240 Hz UPDATE RATES FOR VR



# INFORMATION BANDWIDTH NEEDS DATA BANDWIDTH, TOO!

## NETFLIX:

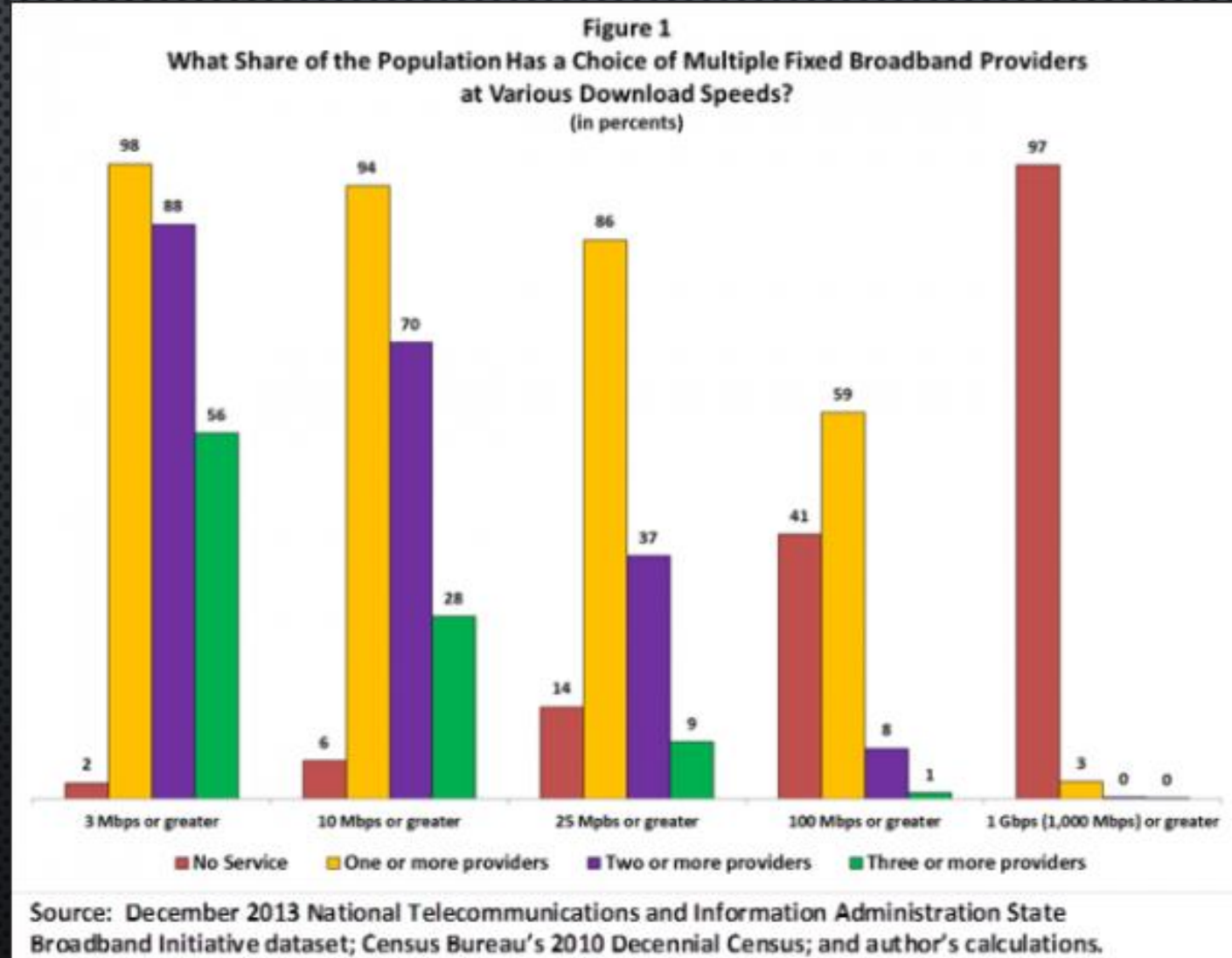
- 4K STREAMING REQUIRES MINIMUM 15 MBPS (18 MBPS MORE TYPICAL)
- (OTHER SOURCES SAY UP TO 25 MBPS)

## NHK:

- 8K @ 120 FPS REQUIRES 48 GBPS ← PROBLEM!
- (UHD ALLOWS 24, 25, 50, 60, & 120 FPS)
- NHK SUPER H1VISION CODEC COMPRESSES 8K@120 Hz TO 500 MBPS
- 85 MBPS IS THE MINIMUM REQUIRED FOR 8K ← THIS, IS DO-ABLE, THOUGH!



# CURRENT NETWORKS NOT READY FOR UHD



# BUT WILL THAT BIG SCREEN BE A COMPUTER, OR JUST A PERIPHERAL?

- WHAT HAPPENS WHEN YOUR PHONE HAS THE POWER TO REPLACE YOUR DESKTOP?
  - COMPUTE/GRAPHICS POWER
    - ARM PHONES/TABLETS ALREADY USE MULTIPLE CORES MORE EFFECTIVELY THAN PCs
    - MOBILE GPUS ARE ADVANCING RAPIDLY, & OFTEN SCALE WELL HORIZONTALLY
  - STORAGE
    - APPROACHING 1 TB TIPPING POINT
    - ALLOWS CARRYING “EVERYTHING THAT MATTERS” WITH YOU EVERYWHERE
  - LOW-POWER MULTI-GIGABIT WIRELESS (LI-FI, MMWAVE) CONNECTS DATA TO DISPLAY



# WE'RE ALREADY SEEING THIS TREND...



MICROSOFT LUMIA & DOCK



ACER  
JADE PRIMO  
WIN10  
POCKET PC



LUMIA  
DISPLAY  
DOCK



MOTOROLA  
ATRIX 4G



# BIG SCREENS ARE COMING TO CREATE THE BROADBAND DESKTOP – WILL YOU BE READY?

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