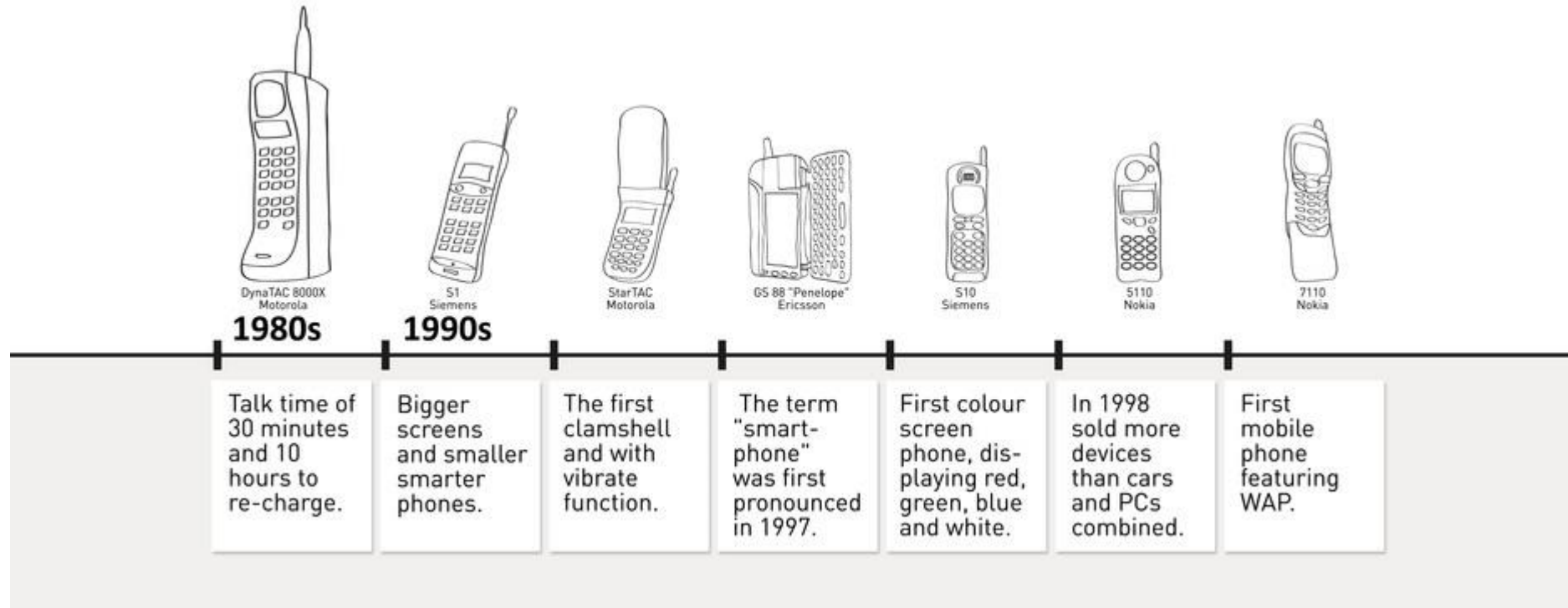


Part 1

Evolution of the mobile graphics world

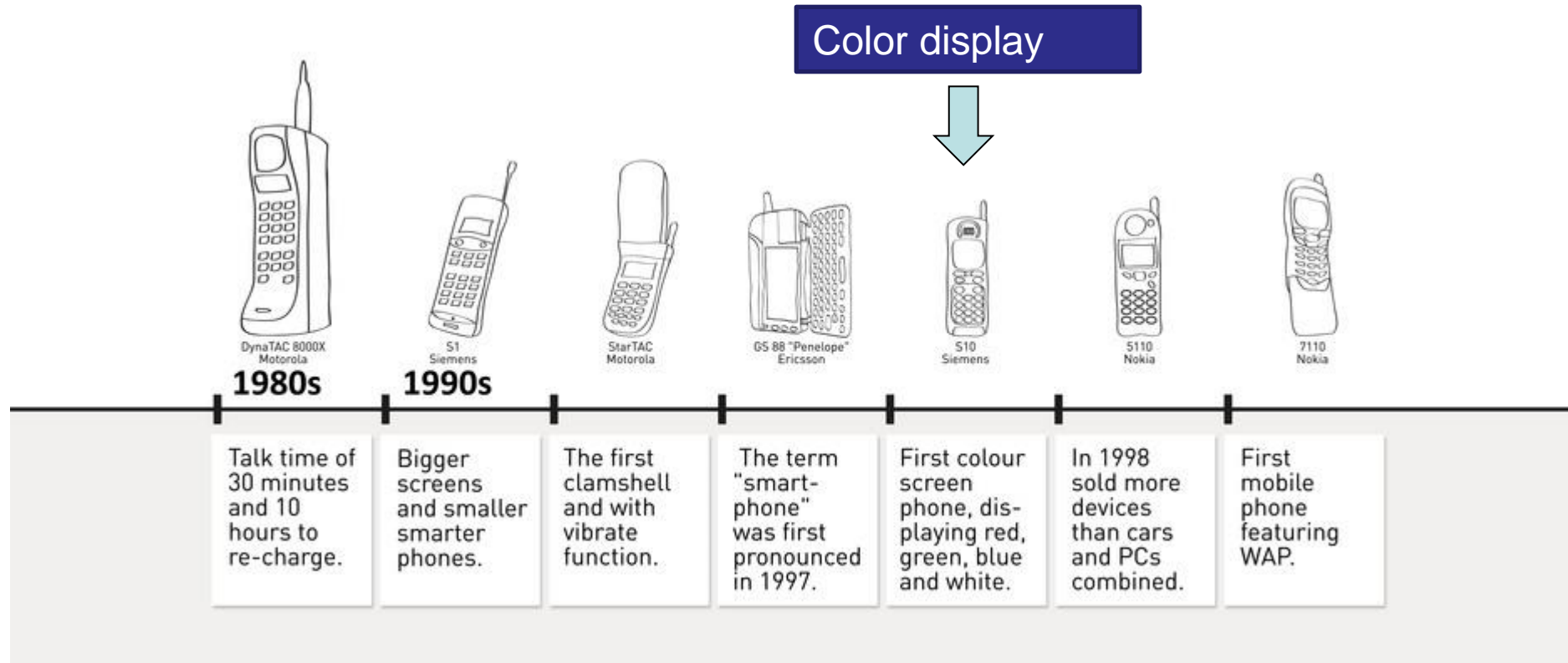
Marco Agus, KAUST & CRS4

Mobile evolution (1/3)



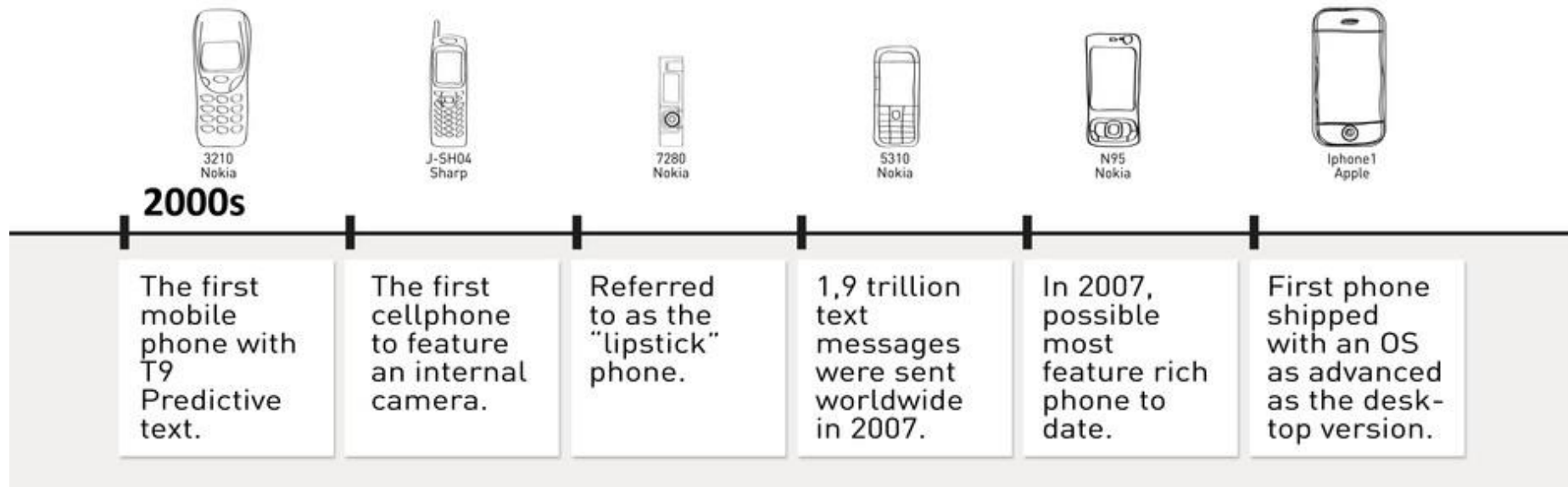
Infographic designed by LEWIS PR for Mobile World Barcelona

Mobile evolution (1/3)



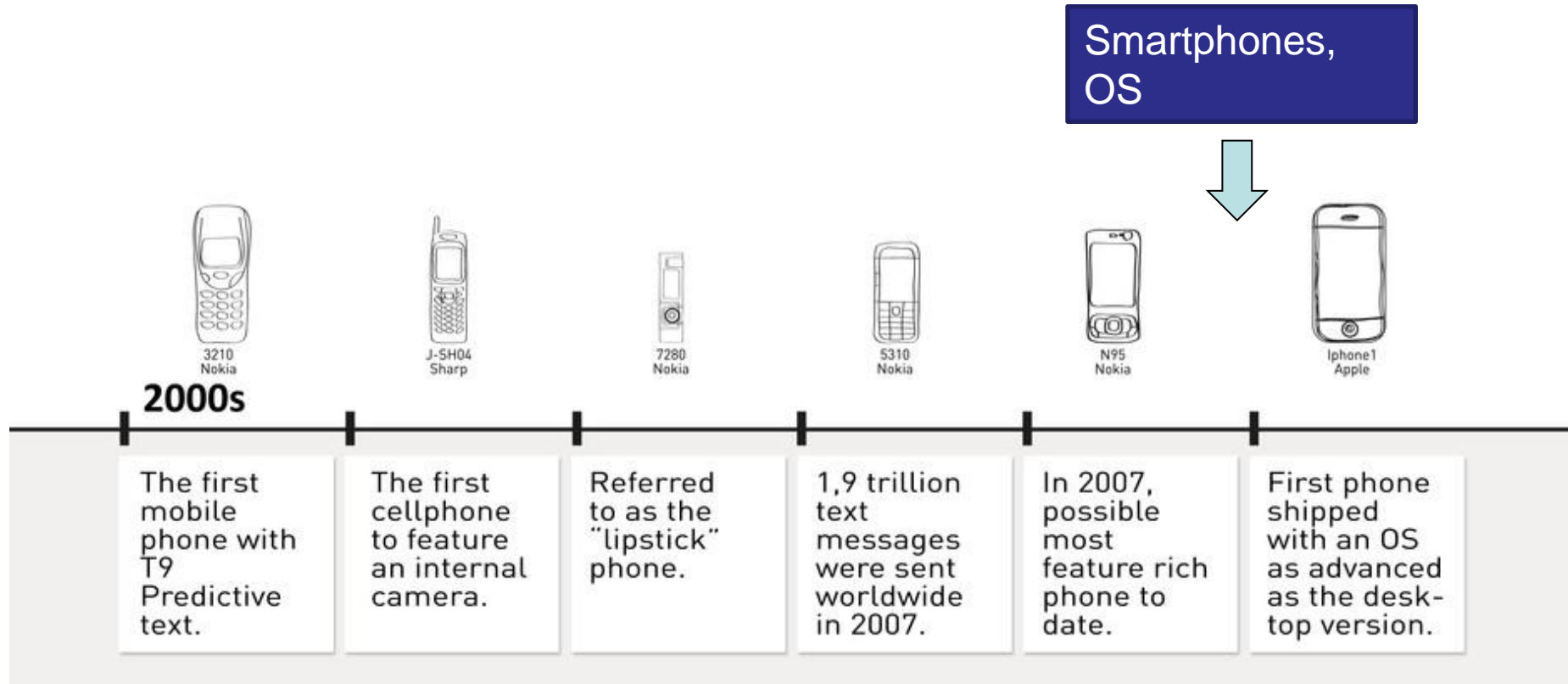
Infographic designed by LEWIS PR for Mobile World Barcelona

Mobile evolution (2/3)



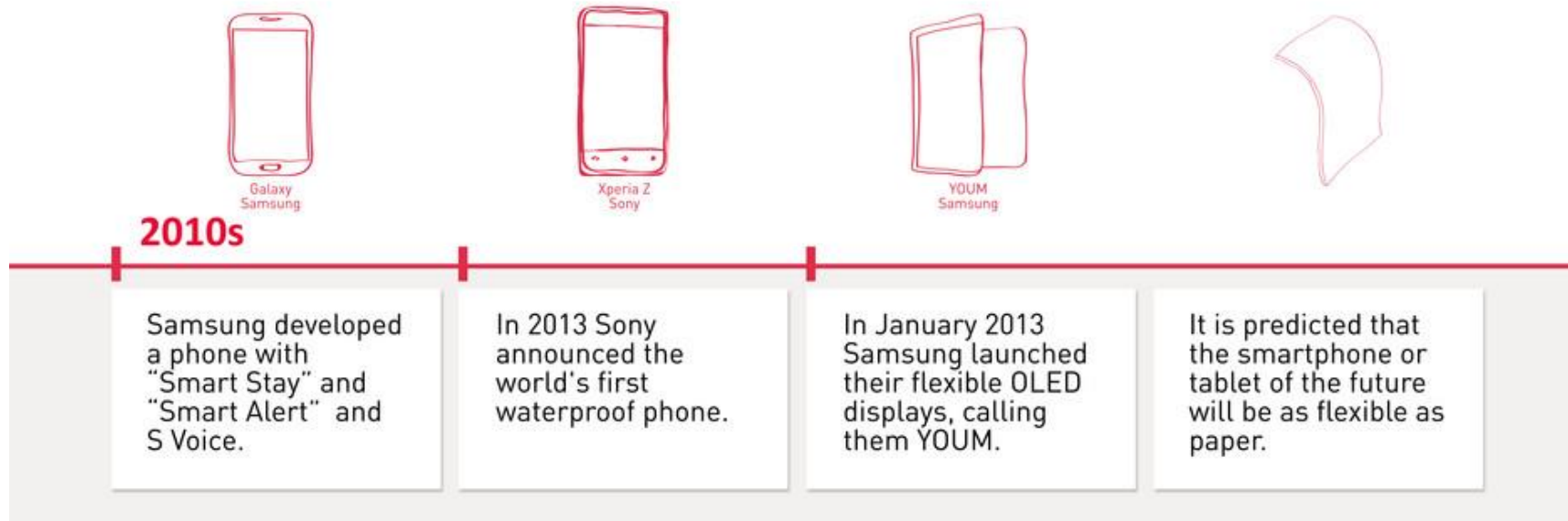
Infographic designed by LEWIS PR for Mobile World Barcelona

Mobile evolution (2/3)



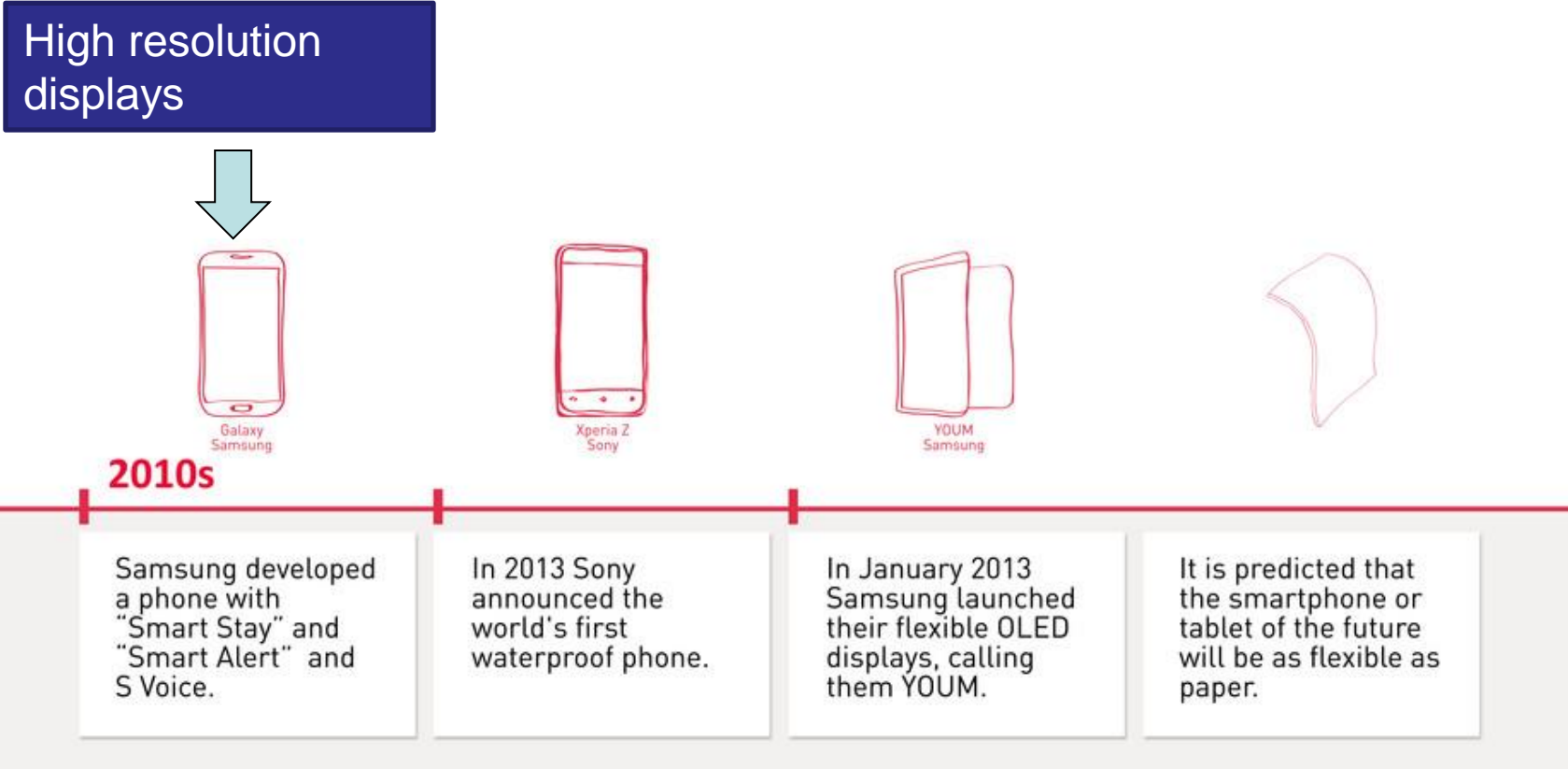
Infographic designed by LEWIS PR for Mobile World Barcelona

Mobile evolution (3/3)



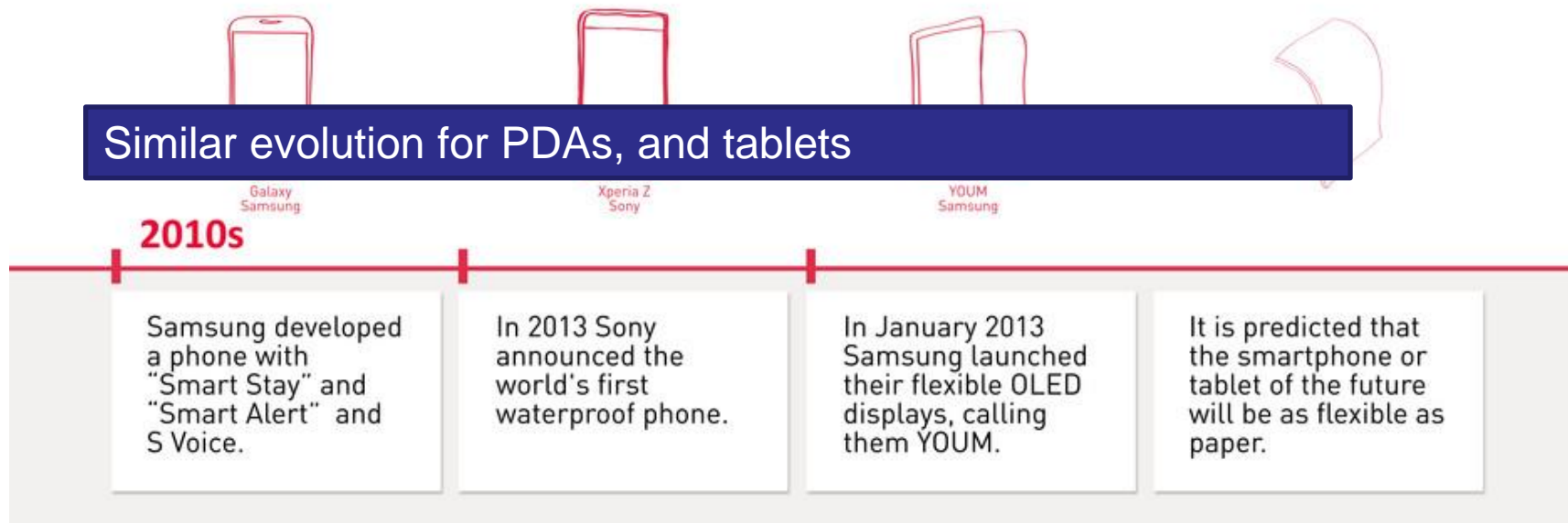
Infographic designed by LEWIS PR for Mobile World Barcelona

Mobile evolution (3/3)



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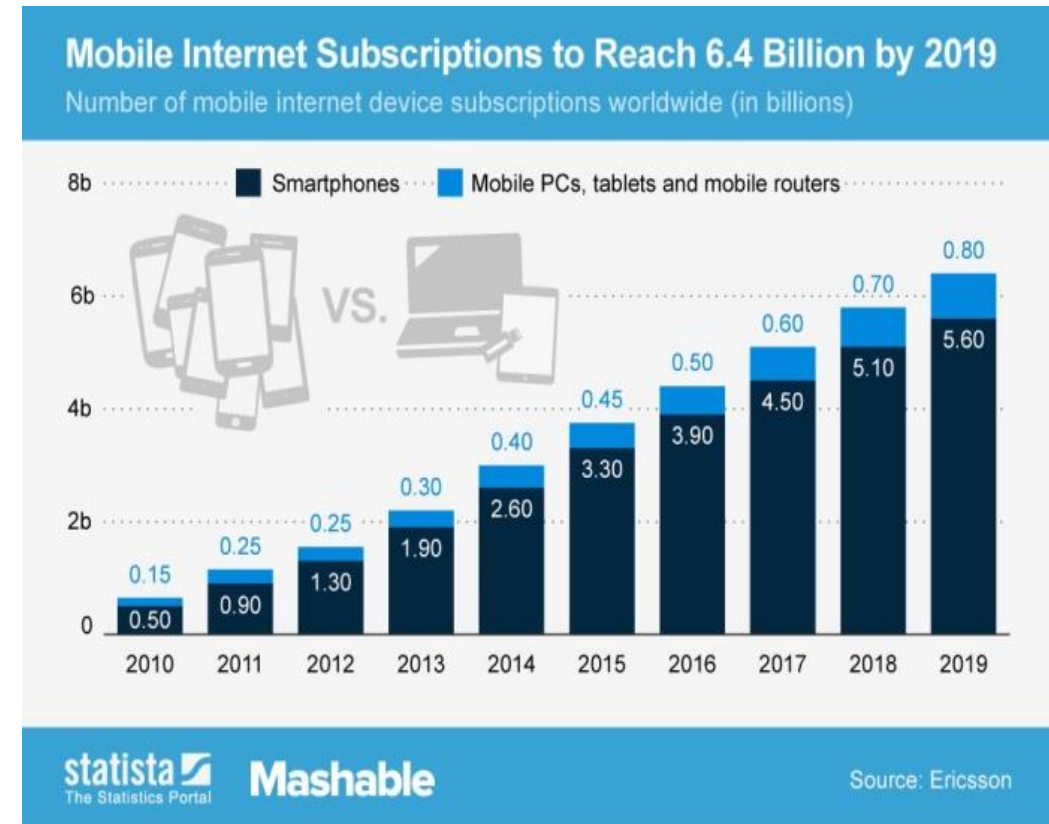
Mobile evolution (3/3)



Infographic designed by LEWIS PR for Mobile World Barcelona

Mobile connectivity evolution

- Bandwidth is doubling every 18 months
- Mobile internet users overcame desktop internet users
- 2017 smartphone traffic expected at 2.7 GB per person per month



© www.statista.com

Displays and User Interface

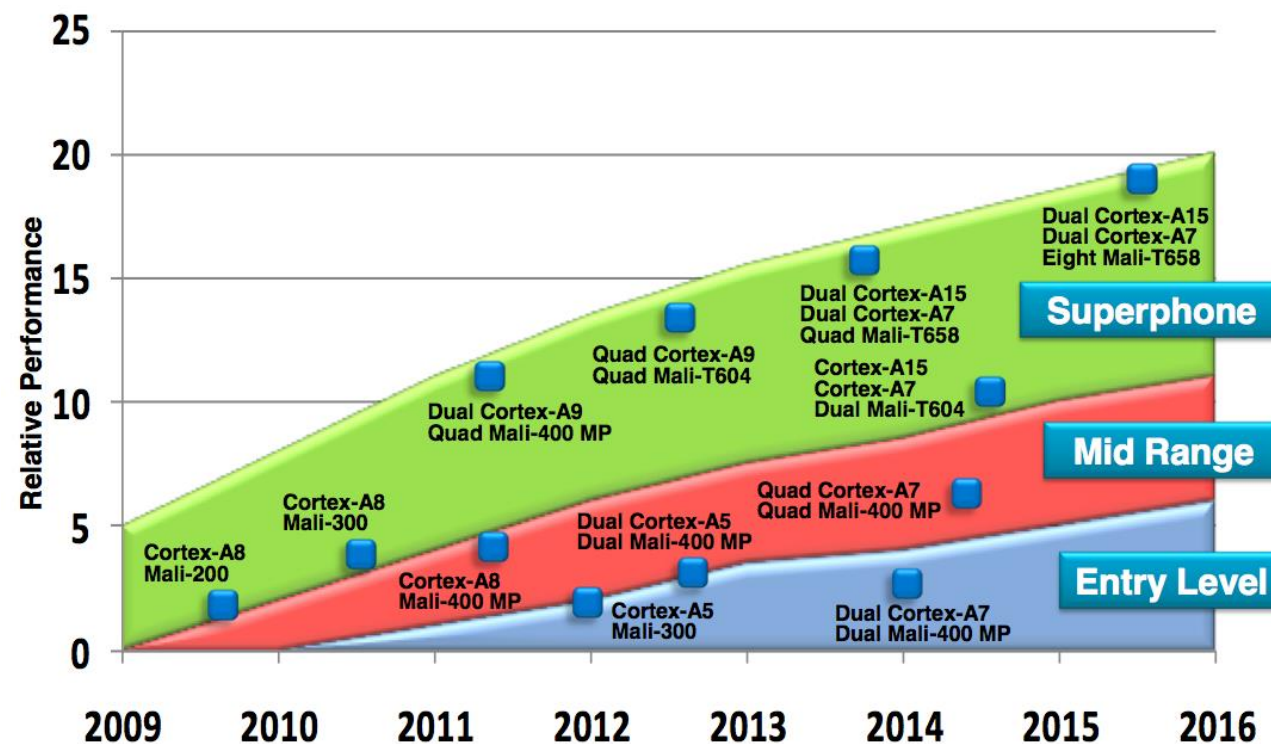
- **Before 2007 – old days**
 - PDA → Palm OS/ Windows Pocket / Windows CE
 - Stylus interaction (touch screens at early stages)
- **Touch era**
 - 2007 – iOS /iPhone
 - 2008 – Android / HTC Dream or G1
 - Touch-enabled devices (no stylus required)
- **Nowadays**
 - Wearables → <2”
 - Smartphones → 3-6”
 - Tablets → >7-10”
 - DLP projectors integrated

Display characteristics

	Application	100 PPI	150 PPI	200 PPI	250 PPI	300 PPI	400 PPI	500 ppi
20 cm	Smart Phone	3.5" 400 × 234 (132 PPI)	3.5" 480 × 320 (164 PPI)	→	3.5" 800 × 480 (266 PPI)	3.5" 960 × 640 (326 PPI)	3.5"/3.7" 1280 × 800 (400+ PPI)	5.1"/5.5" 2560x1440 (>500 PPI)
30 cm	Tablet PC	7" 800 × 480 (133 PPI) →	7" 1024 × 600 (169 PPI) →	7" 1280 × 800 1366 × 768 (215 PPI)				
		9.7" 1024 × 768 (132 PPI) →		9.7" 1600 × 1200 (206 PPI)	9.7" 2048 × 1536 (264 PPI)			
		10.1" 1024 × 600 (118 PPI) →	10.1" 1280 × 800 1366 × 768 (150 PPI)	10.1" 1920 × 1080 1920 × 1200 (210 PPI)	→	10.1" 2560 × 1600 (300 PPI)	10.1" 3840x2160 (438 PPI)	
40 cm	Mini-Note	10.1" 1024 × 600 (118 PPI)						
50 cm	Notebook PC	15.6" 1366 × 768 14.0" 1366 × 768 (110 PPI)						
60 cm	LCD MNT	21.5" 1920 × 1080 (100 PPI)						

Chip evolution (1/2)

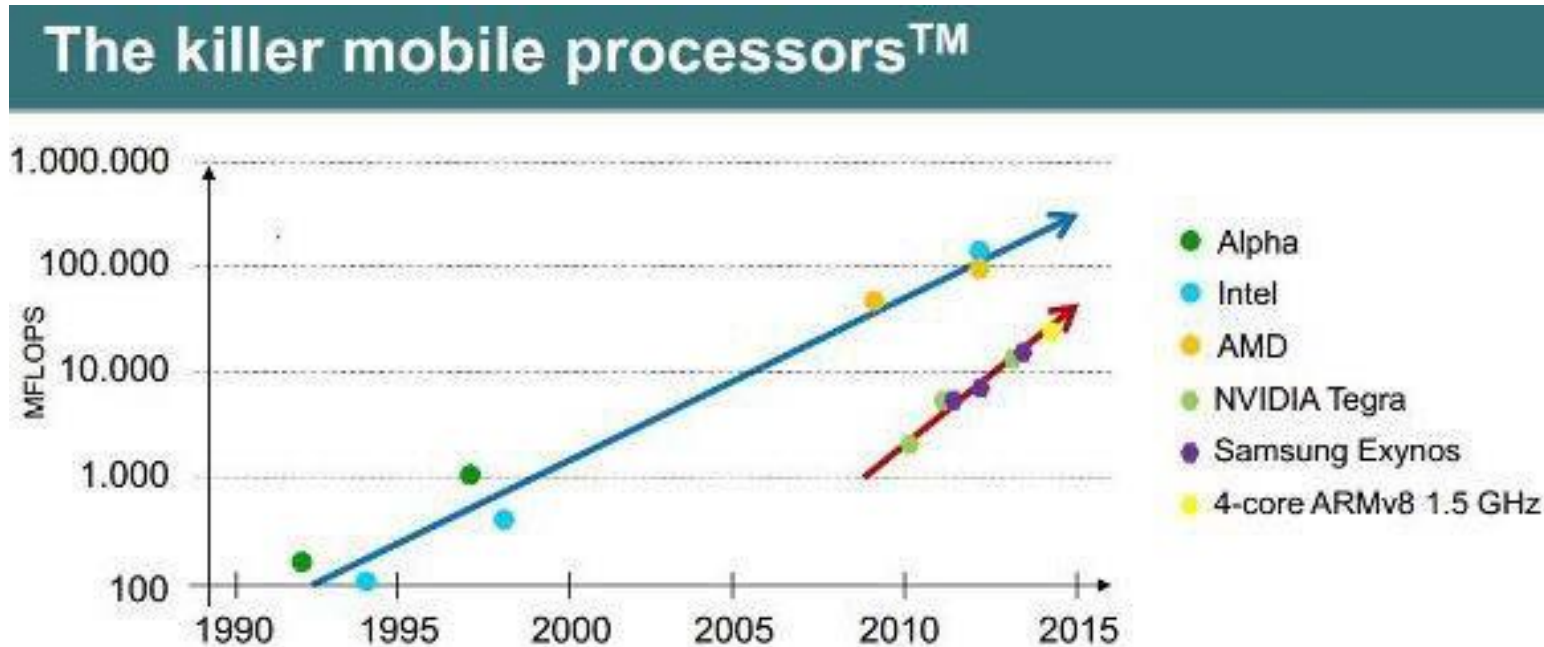
Scalable Mobile Processor Evolution



© ARM



Chip evolution (2/2)



- Microprocessors killed the Vector supercomputers
 - They were not faster ...
 - ... but they were significantly cheaper and greener
- History may be about to repeat itself ...
 - Mobile processor are not faster ...
 - ... but they are significantly cheaper

© Rajovic, N., Carpenter, P., Gelado, I., Puzovic, N., & Ramirez, A. (2013). Are mobile processors ready for HPC?. In Supercomput.

Scenario

- **Modern smartphones (tablets) are compact visual computing powerhouses**
- **DIFFUSION: more than 4.6 billion mobile phone subscriptions**
 - [Ellison 2010]
- **NETWORKING: High speed internet connection (typical 1GB/month plan)**
 - 3G - < 0.6-3Mbps ~ 100KB/s - 400KB/s (latency ~ 100-125ms)
 - 4G – < 3-10Mbps ~ 400KB/s - 1MB/s (latency ~ 60-70ms)
 - 5G - 1Gbps (from 2016?)
- **MEMORY: Increasing RAM and storage space**
 - RAM 1-3GB
 - Storage 8-64GB
- **COMPUTING: Increasing processing power**
 - CPU 4-8 core @ 2.5Ghz
 - GPU 72-192 cores (~ALUs)

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Where are we going?

- **Powerful devices for acquiring, processing and visualizing information**
- **Accessibility of information (anybody, any time, anywhere)**
- **Immense potential (integration of acquisition, processing, visualization, cloud computing, and collaborative tasks)**

Next Session

MOBILE GRAPHICS TRENDS: HARDWARE ARCHITECTURES & APPLICATIONS