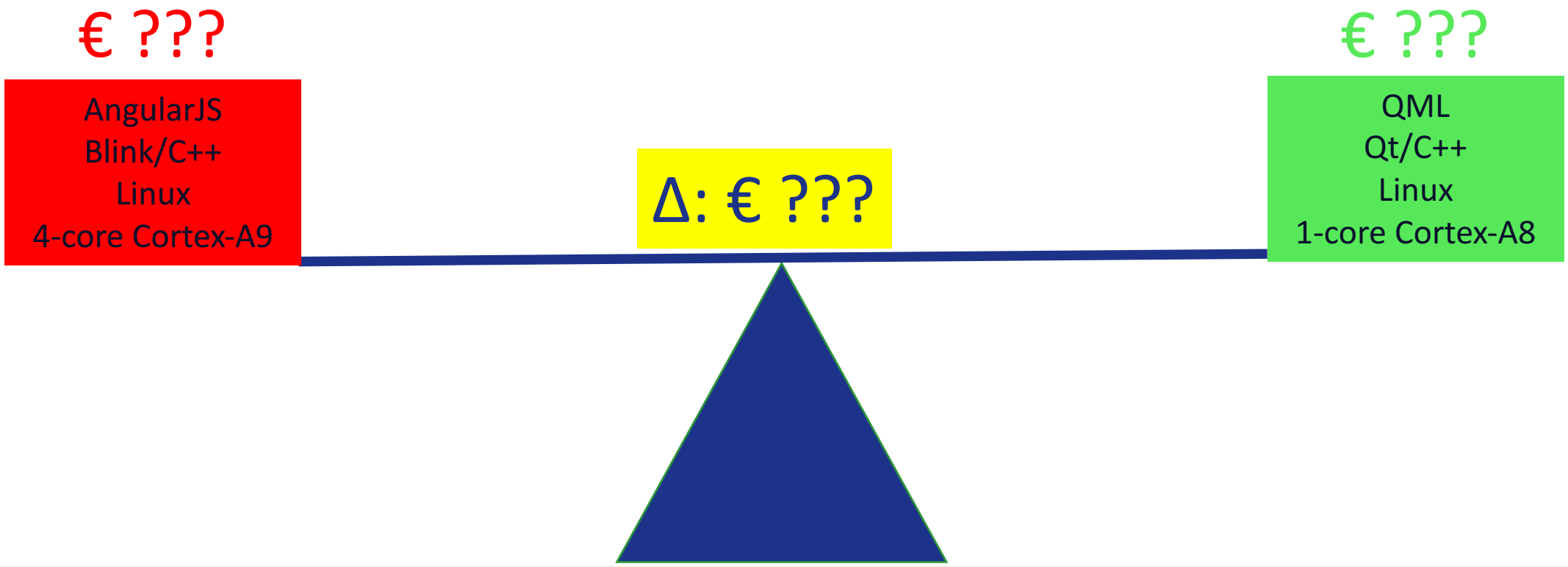
Qt or HTML5?
A Million Dollar Question

Burkhard Stubert – Solopreneur, Embedded Use

SoC Costs: Web vs. Qt

Same Application

(e.g., appliance, printer, STB, TV, IFE, terminals)



Outline – Why Web is More Expensive than Qt

- Recap of ARM SoCs: Devices and Costs
- For good UX: Web requires at least quad-core ARM Cortex-A9
  - Few high-profile Web applications on embedded systems
  - Two cautionary stories: Facebook and Netflix
- Qt achieves same or better UX on single-core ARM Cortex-A8 and ARM11
  - Many high-profile Qt applications on embedded systems
- Nothing will change any time soon
  - Web requires more RAM, flash memory and power
  - Web's JIT compilation no match for QML's native compilation
  - Web rendering flow badly suited for graphics acceleration
- Conclusion

Outline – Why Qt is Cheaper than Web

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Recap of ARM SoCs – Example Devices

Architecture	Example Devices
Cortex-A57/53	IVI in premium cars (2015), Samsung GS6, Raspberry Pi 3
Cortex-A15	IVI in middle-class cars (2017), Samsung GS4
Cortex-A9	**iPhone 4S, IVI in middle-class cars (2013), agricultural terminals (2017)**
Cortex-A8	**Premium ovens (2013), Nest thermostat, iPhone 4, In-flight entertainment (2014), agricultural terminals (2013), Nokia N9**
ARM11	Raspberry Pi 1, iPhone 3G, Nokia N8
ARM9	Nintendo DSi, Lego Mindstorm EV3, VoIP phones (2007)

Recap of ARM SoCs – Unit Costs in €

SoC	Architecture	Cores	1	100	10K	1M
R-CAR M3	Cortex-A57/53	4/4	202.50	135.00	90.00	60.00
TI AM5728	Cortex-A15	2	124.00	82.65	55.10	36.75
NXP i.MX6	**Cortex-A9**	**4**	**71.35**	**45.55**	**31.70**	**21.15**
NXP i.MX53	**Cortex-A8**	**1**	**33.05**	**22.05**	**14.70**	**9.80**
NXP i.MX35	ARM11	1	16.00	10.65	7.10	4.75
NXP i.MX25	ARM9	1	11.30	7.55	5.05	3.35

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Few Embedded Web Applications

- No surprise: JavaScript frameworks target mobile and desktop

Angular JS:
One framework. Mobile & desktop.

React Native:
Learn once, write anywhere:
Build mobile apps with React

Facebook: Abandoning Web for Native

Mark Zuckerberg

The biggest mistake that we made as a company is betting too much on HTML5 as opposed to native.
We burned two years.

The mobile user experience is so good that good enough is not good enough. The only way we are going to get to the highest quality level is by **going native**.

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- **iPhone 4S not good enough**
  - **Dual-core Cortex-A9, 512MB RAM, 800 MHz, GPU**
- Issues
  - High memory consumption
  - Inconsistent framerates: stuttering during scrolling and animations
  - Sluggish touch tracking
  - Hard to find reasons because debuggers and profilers missing or wanting

Netflix: Going All In with Web

Huge Fragmentation problem:
Wide-range of SoCs for TVs, STBs, DB/DVD players, smartphones, tablets, PCs

2009 – 2014:
Mediocre UX with hybrid QtWebkit approach

From 2014 – Proprietary solution:

- Gibbon rendering engine in JS
- HMI in JS similar to ReactNative (highly optimised for domain)

Results on SoCs >= Cortex-A8:

- 30fps refresh rate
- 110ms response time
- **Not quite a good UX!**

Netflix spent
millions of dollars!

With Qt: Better UX
for less dollars!

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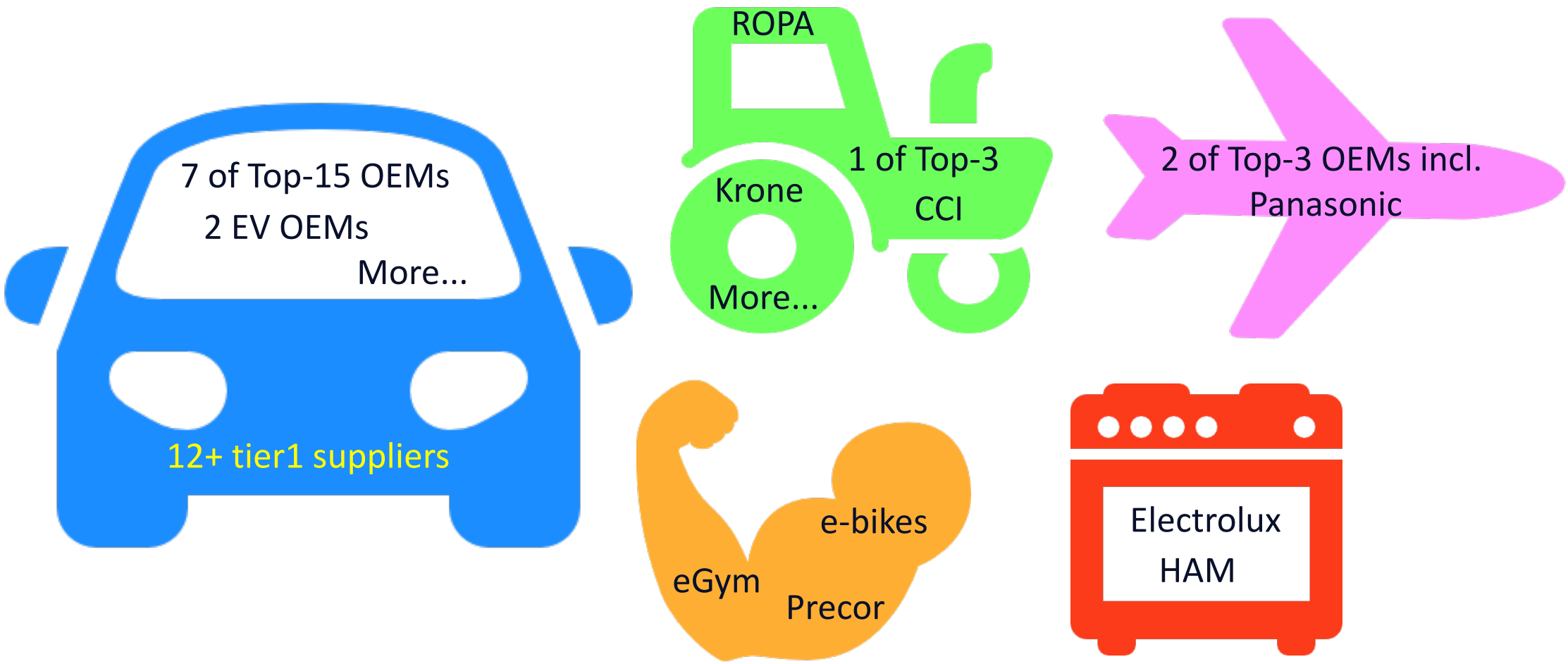
Many Embedded Qt Applications



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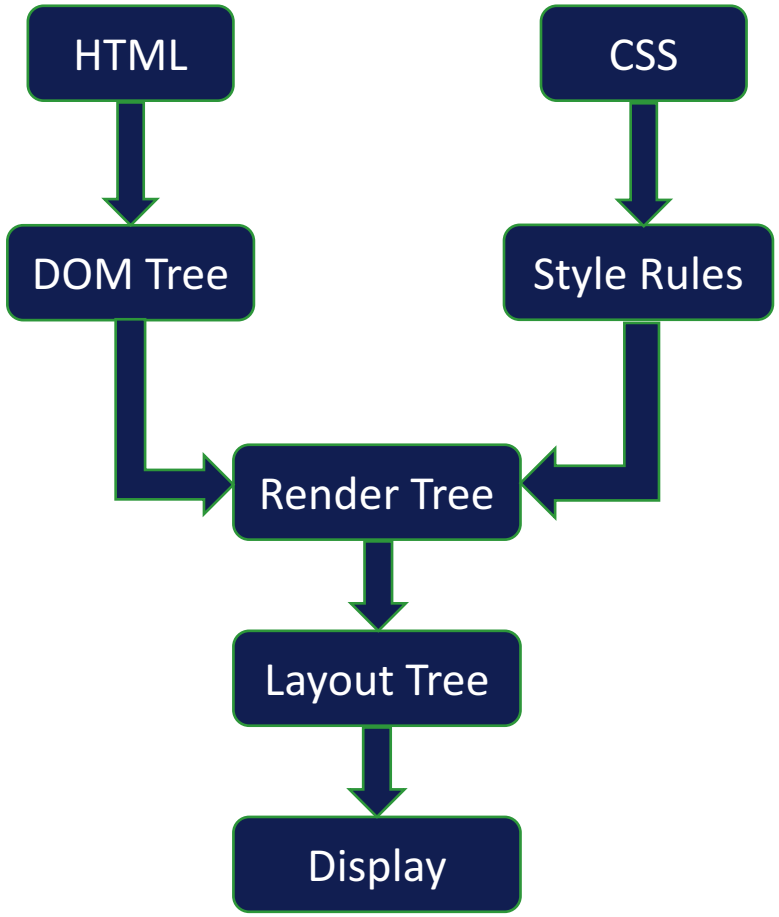
No Changes Soon: RAM, Flash, Power, Startup

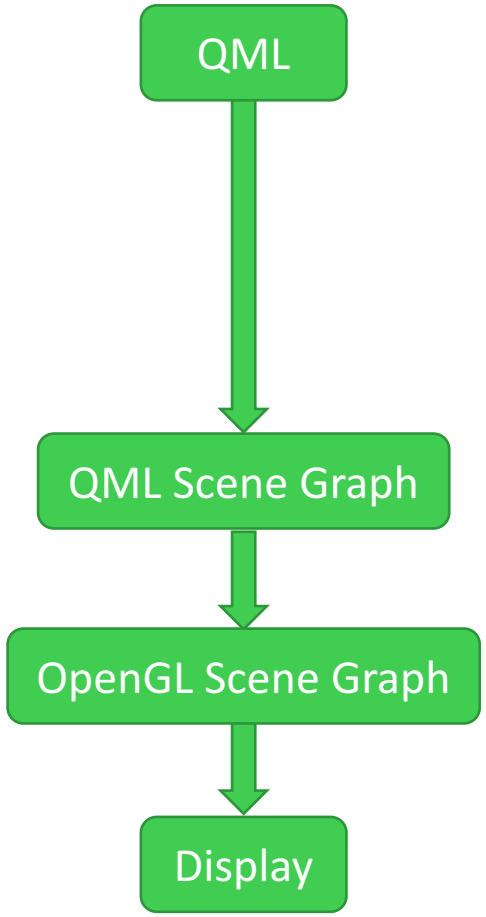
- Size of Qt5WebEngineCore: 103MB
- Size of Chromium browser: 42 MB
- Startup time of Chromium browser on Raspberry Pi 3: 6 seconds
- Power consumption on Macbook Pro. Time battery lasts when reading Web pages:
  - Safari: 5:30h
  - Chrome: 3:40h
- Size of Q5Quick and Qt5Qml: 8MB
- Startup time of Linux and QML application on iMX6: 1.25s

No Changes Soon: Compilation

- Web
  - Just-in-time compilation saw huge speed-ups over last years
- Qt Commercial
  - QML compiled into C++ and then into machine code
  - For example: 30% faster startup times of QML application
- Qt LGPLv3
  - Cache compilation of QML/JS in one run and use in next run

No Changes Soon: Rendering Flows





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SoC Costs: Qt Much Cheaper than Web

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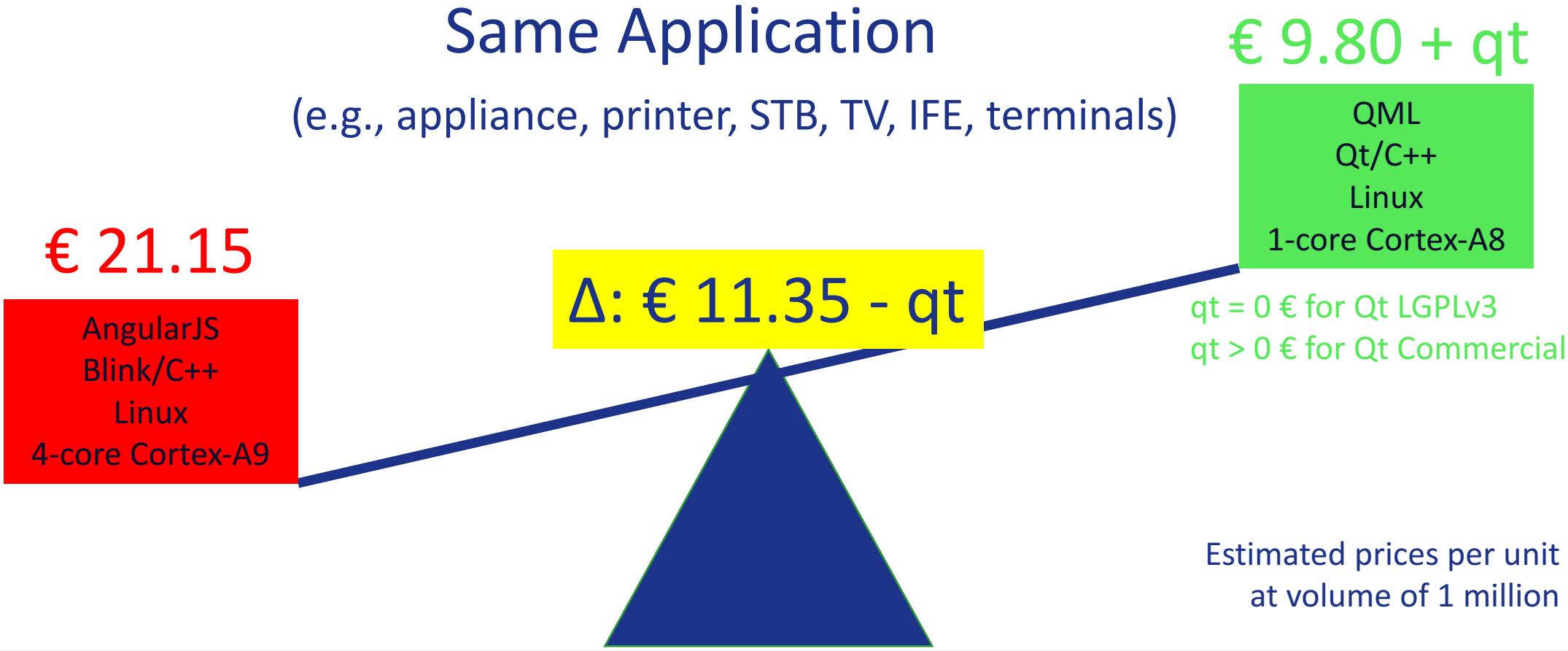

Estimated prices per unit
at volume of 1 million

Whitepaper: https://www.qt.io/html5
Thank you ☺

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