

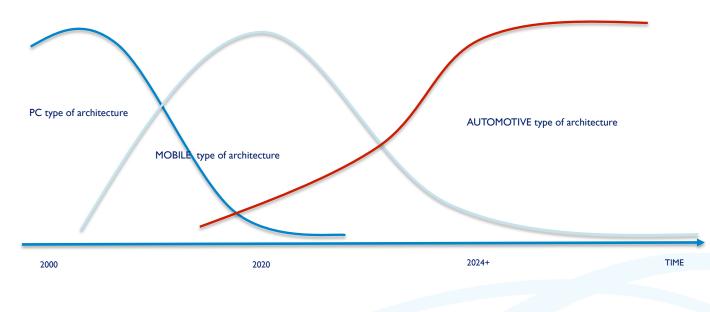


IVAN IVANOV JULY 2018

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## INDUSTRIES DRIVING MEMORY SYSTEM ARCHITECTURE INNOVATIONS





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## STORAGE TECHNOLOGIES EVOLUTION HARMAN COCKPIT SYSTEM APPLICATION REQUIREMENTS

Density For 2023+ Cockpit architectures HARMAN will need : EMERGENT High bandwidth and fast startup ٠ Very high endurance and TECHNOLOGIES for fast boot support extended TBW budget Guaranteed minimum sustained Extended data retention at high write performance temperatures Support of extended Very high density temperature (105C/125C) Very low latency SRIOV Stable performance over time, Deterministic media different usage profiles and 15+ year device life operating temperature SRIOV support ! • ITB -INDUSTRY CAPABILITIES PCIe SSD APPLICATION eMMC/UFS/ PCIe SSD PERFORMANCE 128GB REQUIREMENTS eMMC/UFS 32GB eMMC NAND/eMMC 4G В COPYRIGHT HARMAN ON TERNATIONAL, 2018 2020+ TIME 2015 Picture is Not to scale and for reference only

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## AUTOMOTIVE KEY TECHNOLOGY TRANSITIONS HARMAN NEEDS AT PLATFORM LEVEL (FOR REFERENCE ONLY)



LPDDR5 **VOLATILE MEMORY** LPDDR4x LPDDR4 **MULTI-DOMAIN SYSTE** SINGLE-DOMAIN SYSTEM PCIe 3.0/4.0 SSD (option) BGA PCIe 3.0 SSD (optio STORAGE MEMORY **UFS 2.1** eMMC 5.x STORAGE CLASS MEMORY **EMERGENT TECH** TIME 2023 2017 2018 2019 HARMAN International. Confidential. COPYRIGHT HARMAN INTERNATIONAL, 2018 2019 2020 Picture is Not to scale and for reference only

## SCM STORAGE CLASS MEMORY ARCHITECTURE HARMAN HIGH-LEVEL REQUIREMENTS



- ✓ Extended data retention → 15 years+ at temperature >> 95C Tc
- ✓ Very high Read/Write speed (DRAM like), symmetric access
- ✓ Byte-accessible
- ✓ NO wearing mechanism
- ✓ BER (Bit Error Rate ) → Potential Replacement for DRAM (UBER 10e15)
- ✓ On die ECC in flight ( no added latency in read mode)
- ✓ Zero power in standby mode
- ✓ NO refresh needed
- ✓ Instant-on support
- ✓ Non-volatile
- ✓ MLC/TLC/QLC.. capable technology
- ✓ 3D-capable
- $\checkmark$  Scalable (for reference  $\rightarrow$  below 5 nm)
- ✓ Samples 8/16 Gbits per die and more in 2023+

✓ Cost infrastructure → better (less) than DRAM HARMAN International. Confidential. Copyright 2015.

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