Impact of the Usage models on the Storage devices definition

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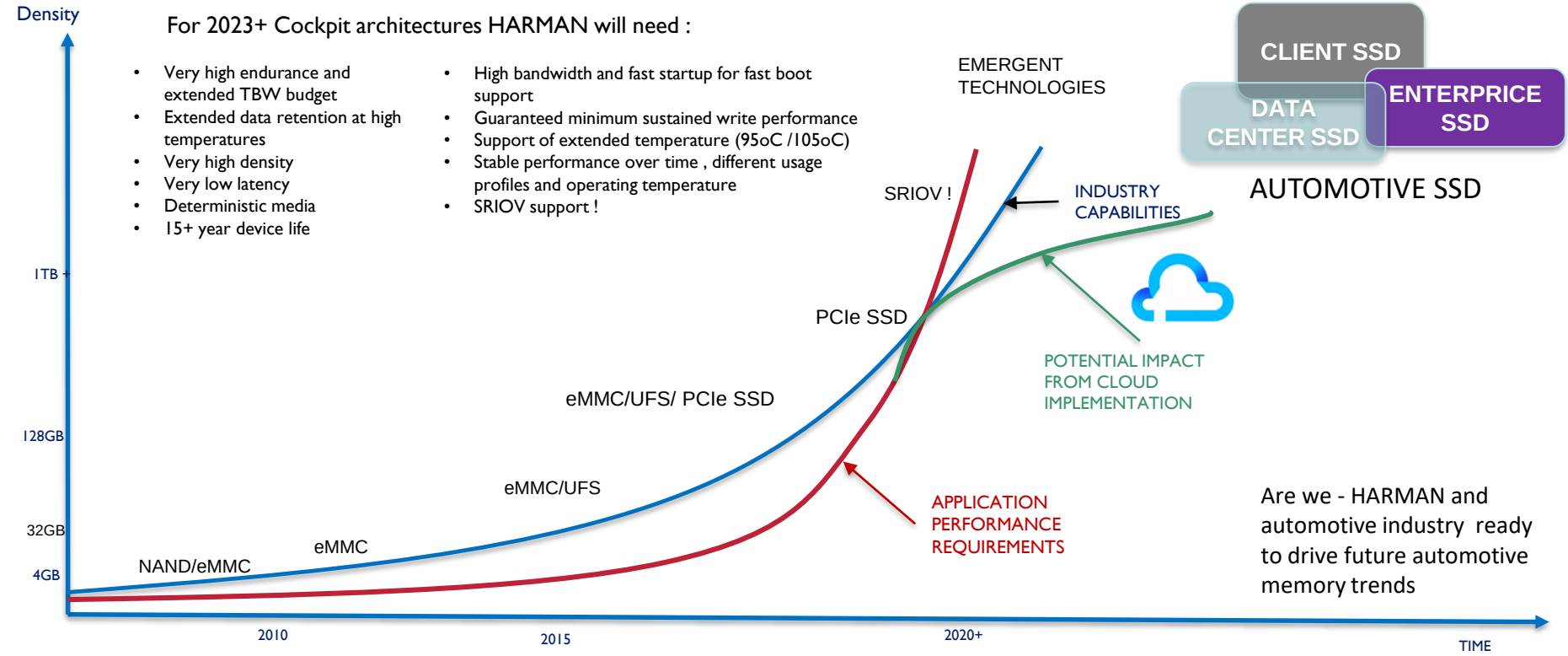
Storage Technologies Evolution
HARMAN Cockpit System & Application Requirements 2023+

Flash Memory Summit



Are we - HARMAN and automotive industry ready to drive future automotive memory trends

Picture is Not to scale and for reference only

Future COCKPIT application trends – Potential Game changers

Todays Usage models

8000 working hours
15/17 years STBY

Driving factors:
- Car Sharing, Taxi , UBER
- Autonomous Driving

Next GEN Usage models

xxxx working hours
15/17 years STBY ???

- Changes in the memory usage models → Life time - 8000h working time within 15/17 years, or STORAGE use model.
  EXAMPLES: Car sharing, UBER, Autonomous L4/L5)
  - Resulting in : Shortening the life time of memory devices -- for instance autonomous or car sharing driving may change the usage model to 24/7 operation
  - Potential Solution proposal :
    - Work with the suppliers to spec aging and wearing mechanisms
    - System notification for memory/system EOL , HW/memory changes each xx years
    - Module based HW system

- AUTOMOTIVE CLOUD utilization
  - CLOUD for data Storage may take away the big part of local STORAGE, example - NAVI Maps
  - CLOUD Computing may take away applications and system functionality

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CHALLENGES due new future USAGE models

Challenges for future automotive STORAGE devices in IVI/COCKPIT 2023+

- Floating gate cells are non deterministic → LATENCY is also not deterministic
- CLOUD may challenge the local storage latency
- PERFORMANCE: Low Sustained Write speed with no guaranteed time for background operations
- Long writes can exceed the SLC NAND Buffer size in the STORAGE devices → results in significant performance drop
  - Image sensors sending real time data without acknowledge
  - 5G downloads
  - Production → initial system image download , onboard programming
- TBW in increasing significantly
- TEMPERATURE > 105oC Tc and extended data retention ?
- SRIOV support ?
- Active and STBY POWER ?
- SER challenges

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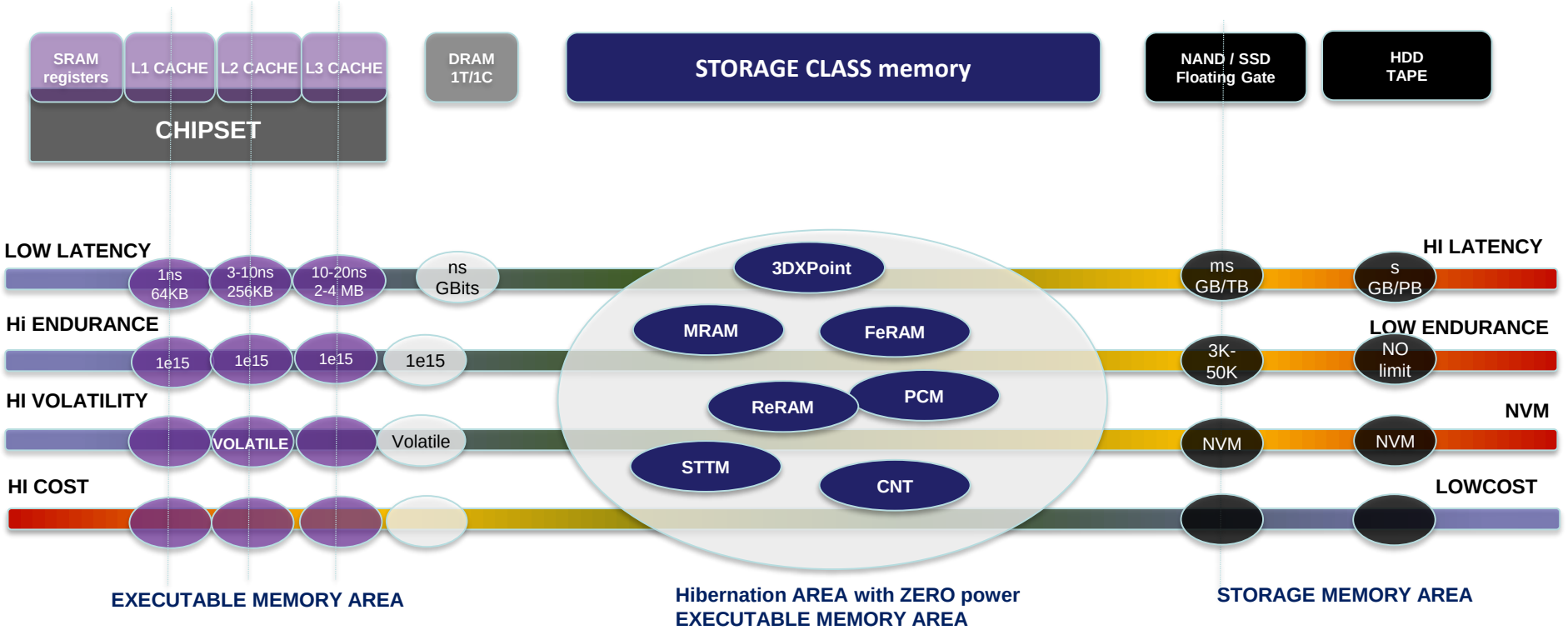
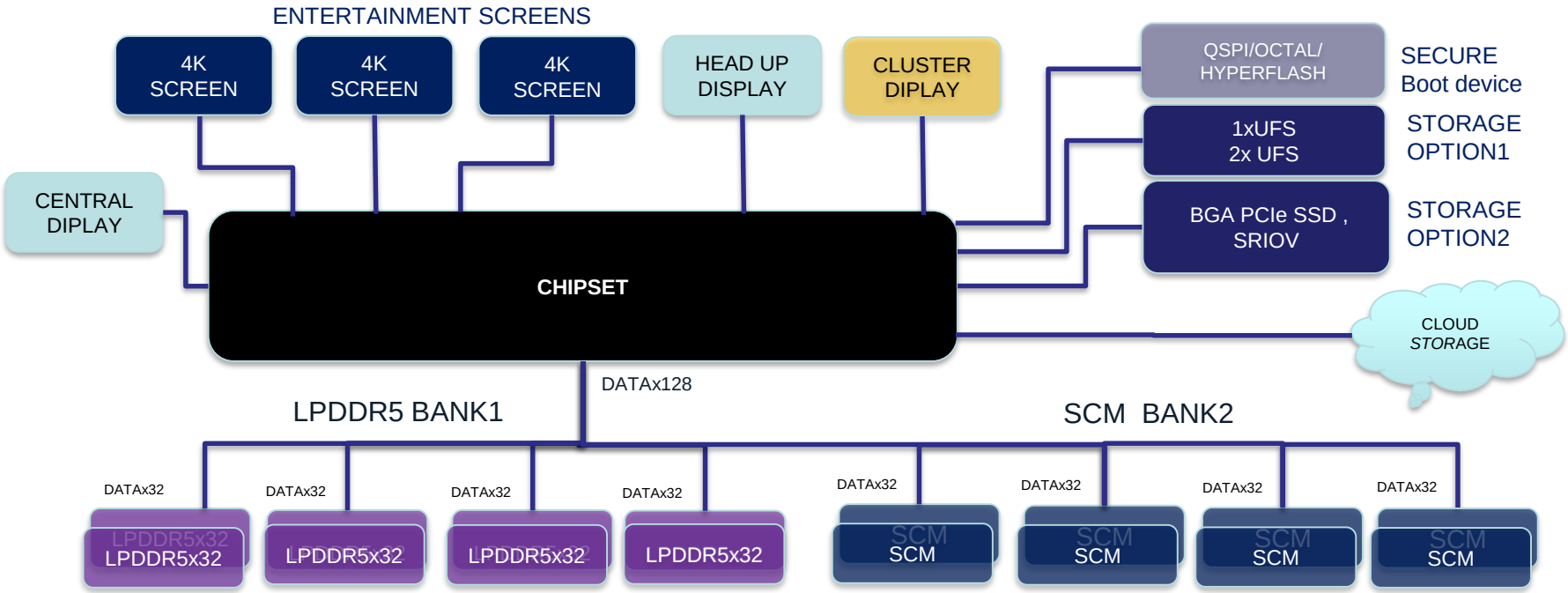
SCM STORAGE CLASS MEMORY landscape



SCM- STORAGE CLASS MEMORY example for potential 2024+ future implementation in COCKPIT



MAIN TEASKS and capabilities :
VIDEO rendering , video buffer , support multiscreen

MAIN TEASKS and capabilities :
CODE storage and XIP , ZERO STBY power , INSTANT ON , extended data retention @hi temp , ASIL B and potentially ASIL C/D support

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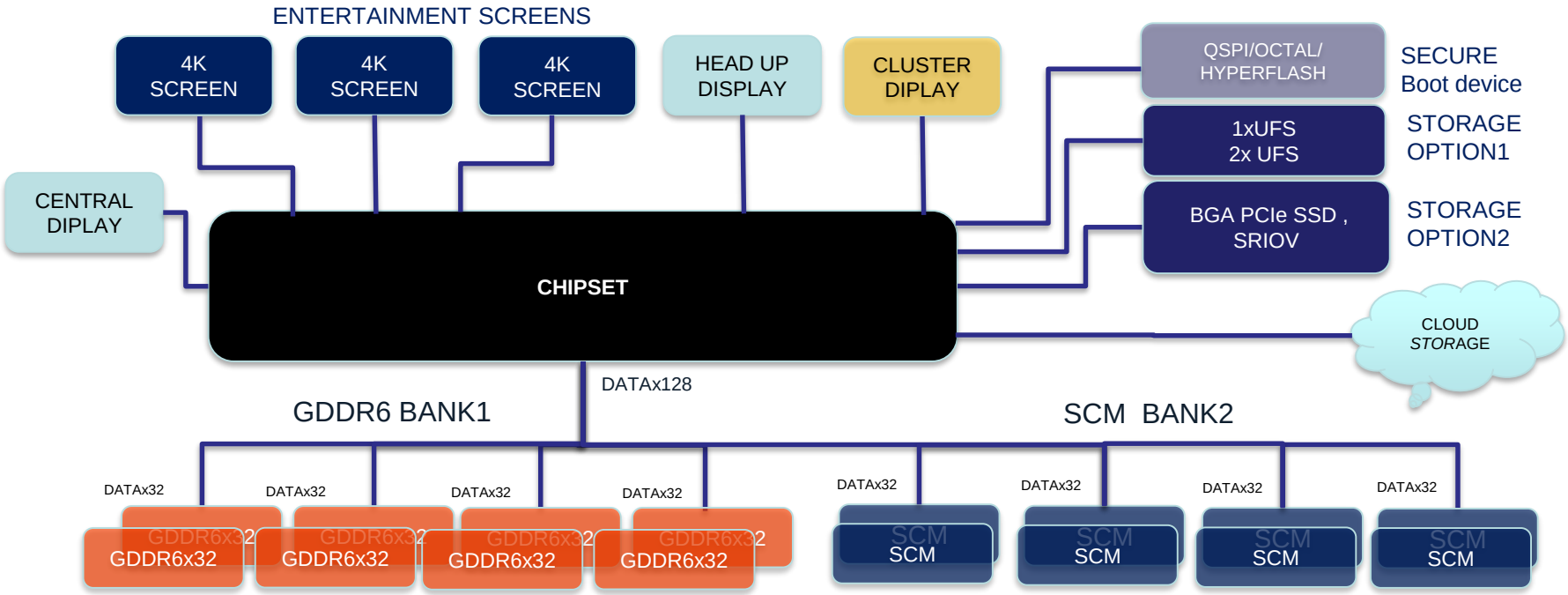

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THANK YOU

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STORAGE MEMORY SOLUTIONS for automotive application - landscape

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CLIENT SSD

DATA CENTER SSD

ENTERPRICE SSD

What is AUTOMOTIVE SSD?

Automotive CLOUD
- impact on local STORAGE

EMERGENT TECHNOLOGIES /STORAGE CLASS MEMORY

96/128L 3D TLC NAND

64L 3D TLC NAND

SSD

UFS 2.1

UFS 3.1

eMMC 5.1

SLC NAND

2017 2018 2019 2020 2021 2022 2023 2023 +

TIME

Note : timeline is related to the projects design phase

SCM STORAGE CLASS MEMORY expectations

SCM expectations/promise :

- 10+ years data retention @125oC + and xxx years data retention @85oC
- Performance as DRAM or better
- Symmetric R/W access
- Densities – match LPDDR5 , 64GBits/94 Gbits in x64 data bus packages for 2023+
- Interface – LPDDR5 ?
- NO wearing mechanism , replacement for DRAM (UBER 10 e15)
- On die ECC in flight (no added latency in read mode)
- Zero power in STBY mode , NO refresh needed
- INSTANT ON memory
- NON VOLATILE MEMORY , byte accessible
- MLC/TLC/QLC capable technology
- 3D capable technology
- Scalable technology <5 nm
- Samples availability 2020/2021
- Cost forecast → Less than DRAM