Impact of the Usage models on the Storage devices definition

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For 2023+ Cockpit architectures HARMAN will need:

- Very high endurance and extended TBW budget
- Extended data retention at high temperatures
- Very high density
- Very low latency
- Deterministic media
- 15+ year device life

- High bandwidth and fast startup for fast boot support
- Guaranteed minimum sustained write performance
- Support of extended temperature (95°C /105°C)
- Stable performance over time, different usage profiles and operating temperature
- SRIOV support!

Are we - HARMAN and automotive industry ready to drive future automotive memory trends
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
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 > 105°C Tc and extended data retention?
• SRIOV support?
• Active and STBY POWER?
• SER challenges
SCM STORAGE CLASS MEMORY landscape

CHIPSET
- SRAM registers
- L1 CACHE
- L2 CACHE
- L3 CACHE
- DRAM 1T/1C

STORAGE CLASS memory
- NAND / SSD Floating Gate
- HDD TAPE

LOW LATENCY
- 1ns 64KB
- 3-10ns 256KB
- 10-20ns 2-4 MB

Hi ENDURANCE
- 1e15

Hi VOLATILITY
- Volatile
- Volatile

HI COST
- EXECUTABLE MEMORY AREA
- STTMRAM
- STTM
- CNT

VOLATILE
- EXECUTABLE MEMORY AREA
- STORAGE MEMORY AREA

Hibernation AREA with ZERO power
- EXECUTABLE MEMORY AREA
- STORAGE MEMORY AREA

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

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

MAIN TASKS 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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THANK YOU

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STORAGE MEMORY SOLUTIONS for automotive application - landscape

What is AUTOMOTIVE SSD?

Automotive CLOUD - impact on local STORAGE

64L 3D TLC NAND

UFS 2.1

eMMC 5.1

96/128L 3D TLC NAND

SSD

Note: timeline is related to the projects design phase

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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