Presenter

John Geldman
Director Industry Standards
Micron Technology

John Geldman has been working on storage standards since the days of the first INCITS X3T9 versions of SCSI and ATA. John helped kick off the Mass Storage Division at Cirrus Logic in 1985. Many businesses, products patents and years later, John rejoined Cirrus Logic colleagues at Lexar Media, which was then acquired by Micron. Since then, John has been a SSD standards proponent in the CFA, IEEE 1667, JEDEC, PCI-SIG, SATA-IO, SDA ,T10, T13, TCG & USB standards communities.

John holds an MSCS from Santa Clara Univ., a BSECE from Clarkson Univ.

Useful UFS Nuts & Bolts came from ‘Strangers’

“Whoever you are, I have always depended on the kindness of strangers.”

Blance DuBois, “A Streetcar Named Desire”, 1951, Warner Brothers

Useful UFS Nuts & Bolts came from ‘Strangers’

- INCITS/T10 brought:
  - the coherent, proven SCSI architecture
- MIPI Alliance brought:
  - The high-speed, low power, UniPro link layer and M-PHY
- JEDEC brought:
  - e.MMC mobile-focused functionality (JESD84)
  - A defined modern UFSHCI (JESD223)

We all have ‘admiration’ for SCSI

Why, those were a tribute from an admirer of mine. (Blanche DuBois)

He must have had a lot of admiration. (Stanley Kowalski)

“A Streetcar Named Desire”, 1951, Warner Brothers

We all have ‘admiration’ for SCSI

- The SCSI storage model is the heart of OS’s such as Android and Microsoft’s Windows
- SCSI features a clean queuing model
  - In sequential access only one task happens at a time: not so much anymore!
  - Write blocking is bad: a 1 second write operation shouldn’t block a series of 50 uS reads for context switch
- SCSI features a clean device power model
  - SCSI: START STOP UNIT command

MIPI Alliance helps UFS: ‘bang things around’

What sign were you born under?

(Blanche DuBois)

What sign? (Stanley Kowalski)

Astrological sign. I'll bet you were born under Aries. Aries people are forceful, dynamic, they dote on noise. They love to bang things around.

(Blanche DuBois)

“A Streetcar Named Desire”, 1951, Warner Brothers

MIPI Alliance helps UFS: ‘bang things around’

- The MIPI M-PHY provides
  - differential signaling

    low noise, easy system implementation
  - high-speed interface

    UFS 2.0 supports up 580 MB/s in two M-PHY lanes, allowing interface speeds up to 1.2 GB/s
  - low-power interface

    low active power @ 200 mV signaling

    good idle protocol: Hibern8te protocol saves power throughout the device

    Voltage matters most: CMOS power is proportion to $C * V^2 * F$

Note: NAND array performance is proportional to array power: UFS’s job is to minimize interface & idle power

e.MMC called with lessons learned:

[telephone rings]

[rises out of seat] (Blanche DuBois)

That's for me, I'm sure. (Blanche DuBois)

[pushes her back down roughly] Just keep your seat, I'm not so sure. (Stanley Kowalski)

"A Streetcar Named Desire", 1951, Warner Brothers

e.MMC called with lessons learned:

- Mobile has needs:
  - Integrated boot (no separate BIOS/UEFI)
  - Multiple, independent, security conscious partitions (boot code, radio parameters, …)
  - Hardware enabled power savings
- UFS has implemented these functional requirements based on the proven experience from developing e.MMC

UFSHCI, not just another pretty face

Oh look, we have created enchantment.

Blanche DuBois, “A Streetcar Named Desire”, 1951, Warner Brothers

UFSHCI, not just another pretty face

- UFSHCI (JESD223) is a standardized modern host command interface
  - Supports system-efficient out-of-order multitasking
- e.MMC typically shares the SD Card host command interface
  - Optimized for sequential access, not random access

	e.MMC HCI (typical)	**UFSHCI**
Maximum queue depth	No (limited queuing proposed)	Command Queue; 32 entries Task Management queue; 32 entries
Out-of-order execution	No (host commanded order proposed)	Full support of SCSI model
Protocol Basis	CPU intensive	Device centric SCSI model
Interrupt aggregation	No	Yes

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- Thanks to T10
- Thanks to MIPI
- Thanks to JEDEC

Thank you!