Universal Flash Storage Compliance Test

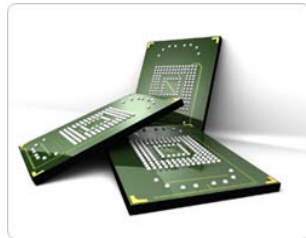## A New Approach For a New Technology

Perry Keller

Compliance and Enablement Chair

Board of Directors
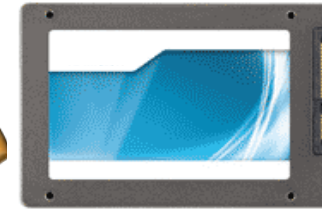
Universal Flash Storage Association

Memory Program Manager - Agilent Technologies

Universal Flash Storage (UFS) The Next Generation Mobile Storage

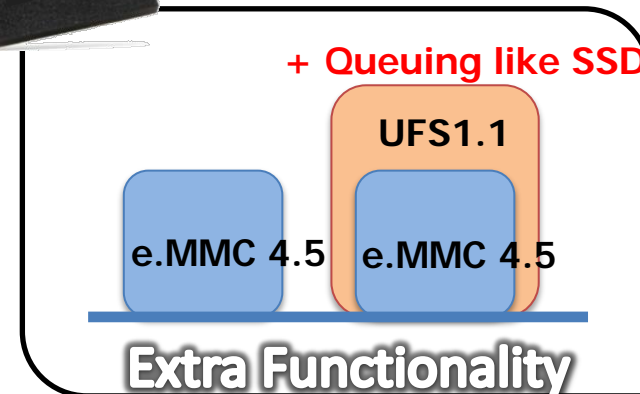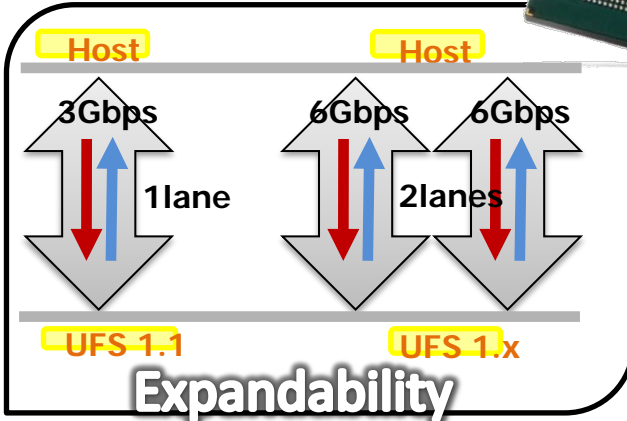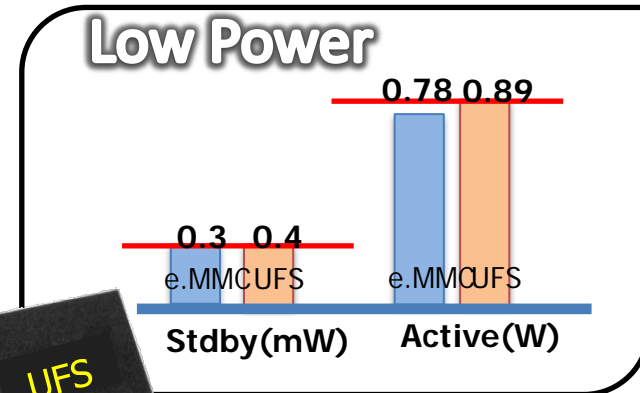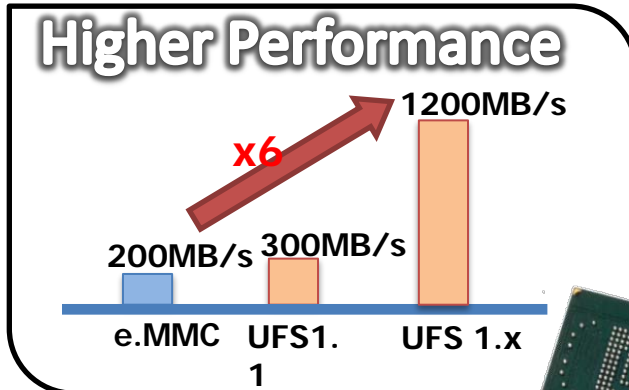Reliability & Low Power

e.MMC

SSD Technology

Proven & Robust CMD Set

Built on e.MMC heritage

- Incorporate e.MMC features adopted by mobile systems for a smooth transition in mobile applications

UFSA
Universal Flash Storage Association

What Makes UFS Different?

- **Smartphones and tablets being asked to do desktop PC work**
- **UFS provides SSD performance for low power battery operated systems**

Higher Performance

x6

1200MB/s

200MB/s · 300MB/s

| e.MMC | UFS1.1 | UFS 1.x |

Low Power

0.78 0.89

0.3 0.4

e.MMC UFS · e.MMC UFS

Stdby(mW) · Active(W)

Expandability

Host · Host

3Gbps · 6Gbps · 6Gbps

1lane · 2lanes

UFS 1.1 · UFS 1.x

UFS

Extra Functionality

+ Queuing like SSD

UFS1.1

e.MMC 4.5 · e.MMC 4.5

- **Reliability and interoperability demand rigorous compliance certification**

UFSA
Universal Flash Storage Association

Principles of Certification

- **Assure Devices and Hosts operate reliably per the UFS specification**
    - Test procedures developed by the experts who wrote the spec itself
    - Uniform positive customer experience
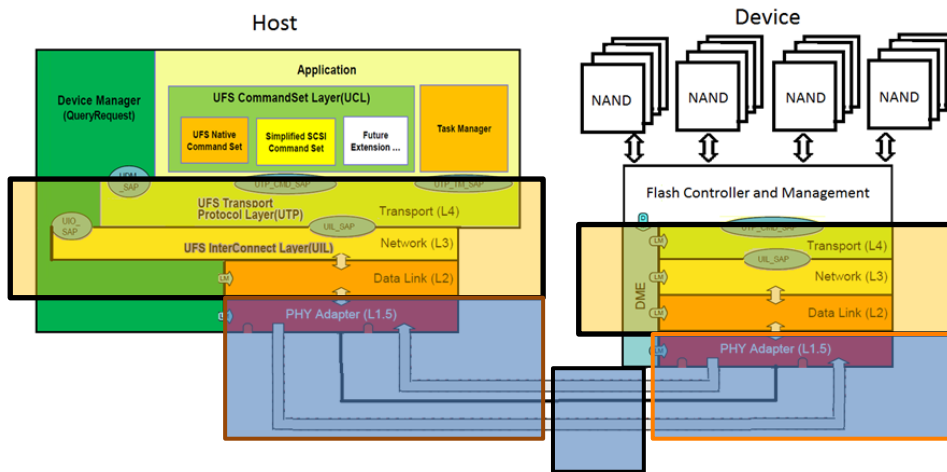   - No hidden design requirements

- **Maximize benefits to developers at minimum cost**
    - Mix of interface and interop tests provides maximum coverage with least effort
    - "Type" certification supports product enhancement without recertification
    - Plugfests provide for pre-compliance test of prototypes while protecting IP

- **Promote completeness and advancement of the specifications**
    - Real-time, real life input to specification developers

- **Assure ultimate integrity of UFS brand**
    - UFSA certified independent 3rd party testing provides proof of compliance
    - Prerequisite for UFS logo increases developer AND end user confidence

High Test Coverage, Efficiently

Direct Specification Test

- Verifies key UFS function points
- Covers protocol, electrical and interconnect compliance
- Reliably checks hard to reproduce corner cases
- May not detect inconsistencies
- Uses test equipment to generate stimulus and analyze responses

Interoperability Test

- Confirms hosts and devices actually work as a system
- Finds ambiguities and inconsistencies in the specification that may break a real UFS system
- Uses "golden" devices and hosts

Only combining approaches can verify compliance

The Bottom Line

- **UFS' high speed, functionality and multi-organization specification linkage require a new approach to compliance test**

- **UFSA compliance program is based on best practices of existing consumer interfaces like USB, SATA, PCI**
  - **Independent , managed 3rd party certification**
  - **Combining specification and interop test maximizes confidence at minimum cost**

- **End user and developer confidence in UFS assured**