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Synopsys

**Power, Performance and Security  
Advantages of UFS Leveraging  
MIPI Specifications**

**HSINCHU CITY, TAIWAN**

**MIPI.ORG/DEVCON**

**2017**

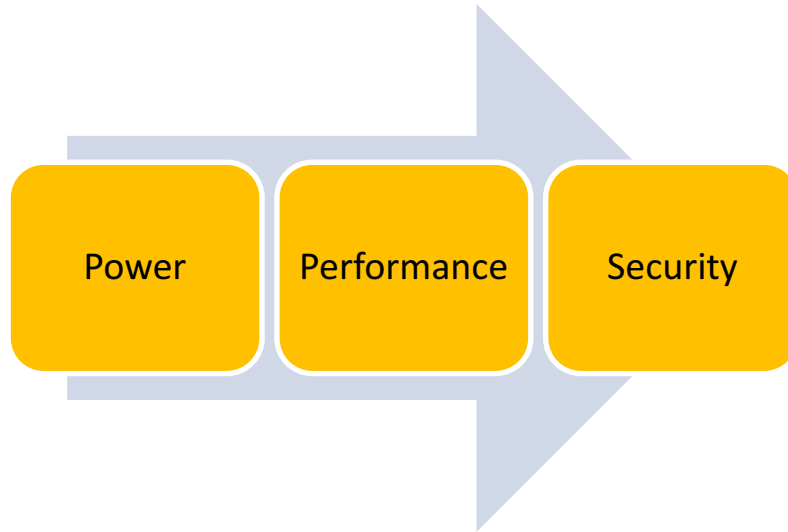
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DEVELOPERS  
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# Agenda

- Unique requirements of Mobile SoCs
  - Power, Performance and Security
- eMMC and UFS IP Solutions for Mobile SoCs
- Verification and Validation before silicon
- Summary

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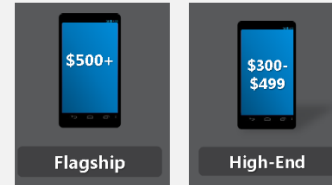
# Unique Requirements of Mobile SoCs



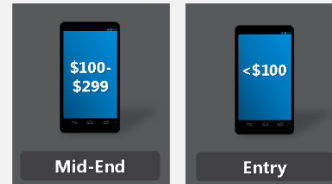
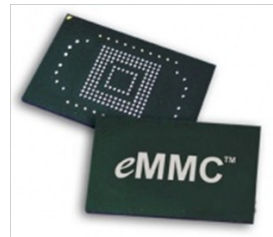
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# Emergence of Embedded Storage Solutions – UFS & eMMC

UFS for high-end and eMMC for mainstream

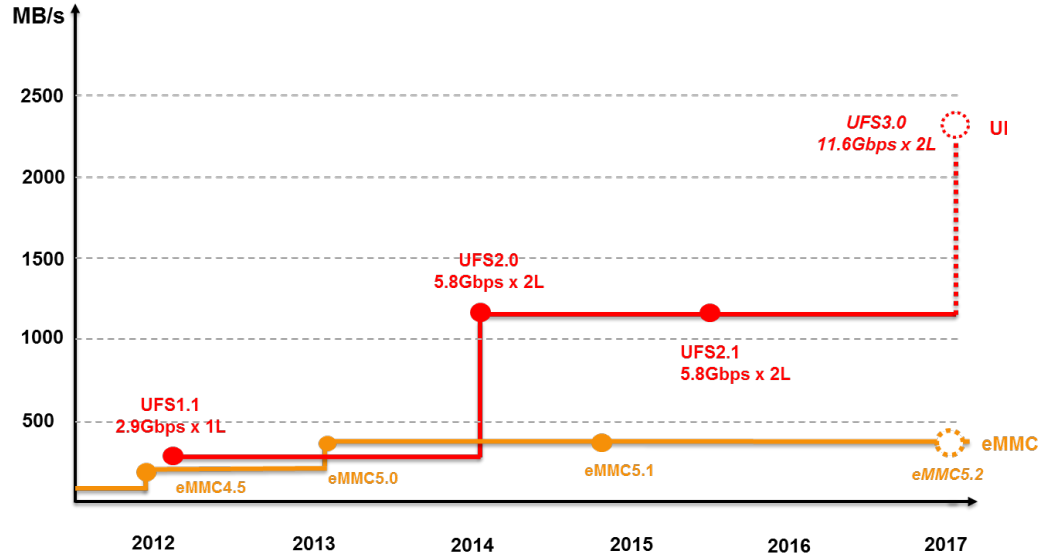


*Image Source: Micron*



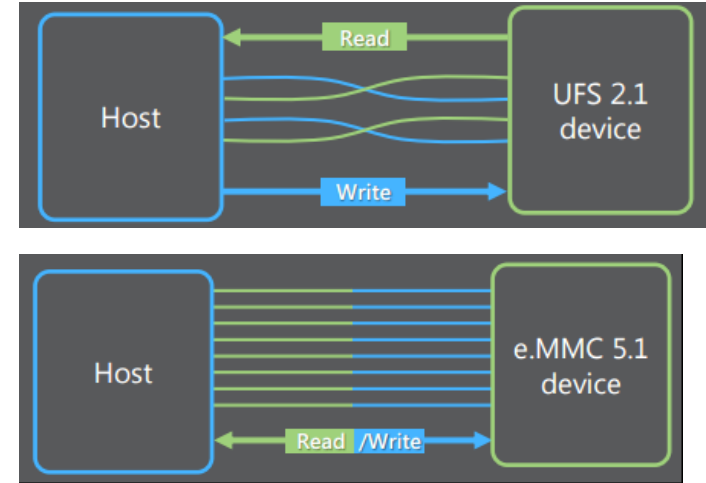
*Source: Micron*

# Performance Evolution



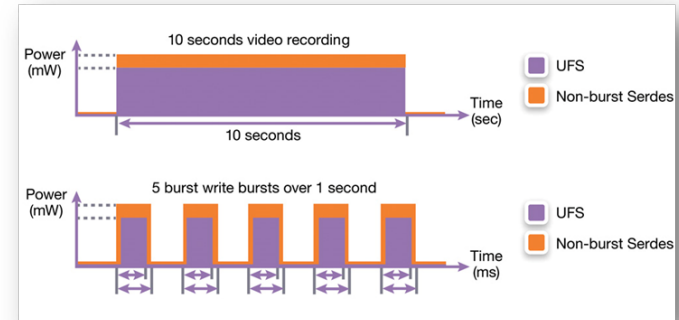
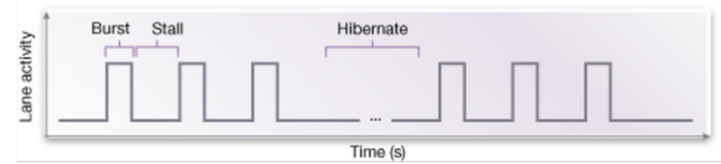
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Source: Micron



# UFS Supports Major Power Saving Techniques

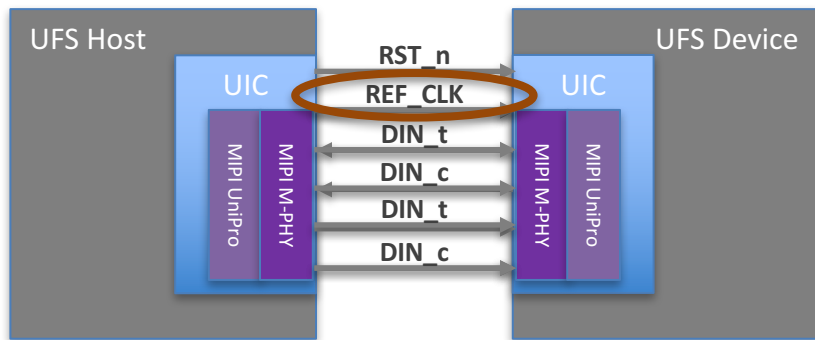
- MIPI M-PHY<sup>®</sup> specification is built for “bursty” transmission
- Fast exit & entry to Low-power mode allows significant power reduction over time
- “hurry up and shut down”
- UFS Power Mode State Machine
- M-PHY low-power state
  - HIBERN8
  - STALL (in HS)
  - SLEEP (in LS)
- MIPI UniPro<sup>SM</sup> low power state
  - HIBERN8
  - SLEEP



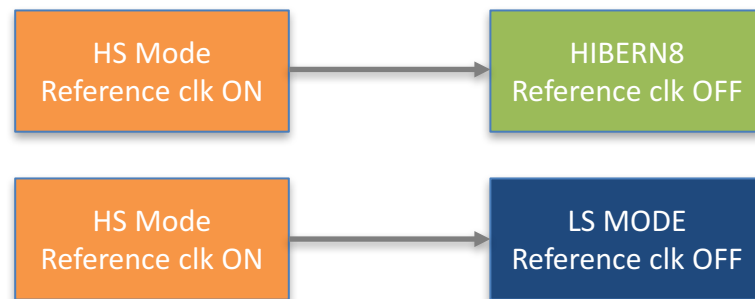
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# UFS Supports Reference Clock Gating for More Power Savings

Example of a UFS host and device interconnect



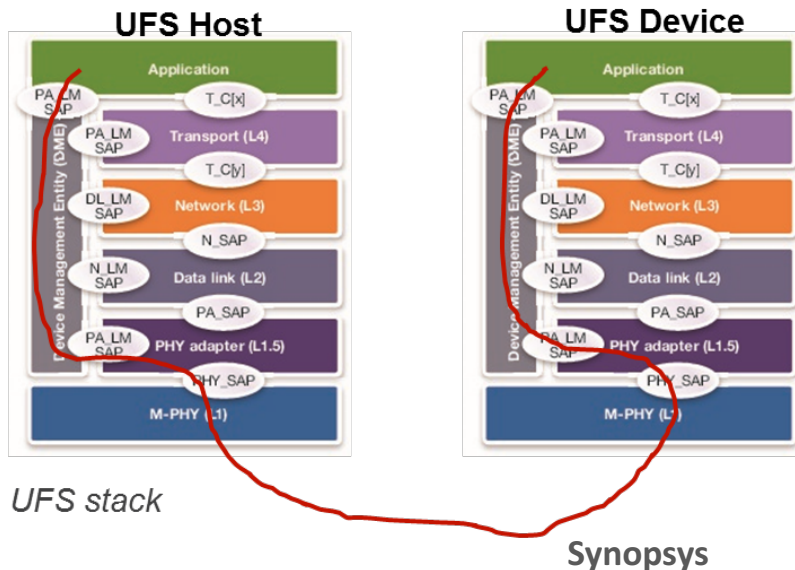
Link state transitions and presence of reference clocks



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# UFS Supports Reference Clock Gating for More Power Savings

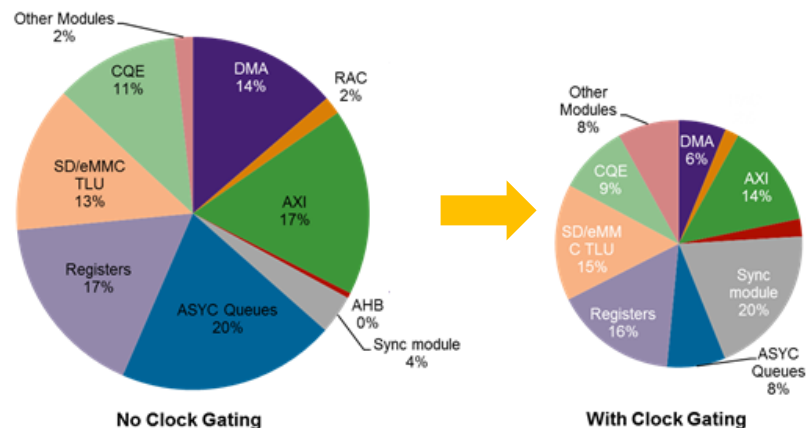
- New attribute to enable wide adoption of this low power feature





# Other Low-Power Techniques

- Intelligent clock partitioning
  - Allows SoC designers to determine power profile
- Clock gating/context sensitive clock gating
  - Reduce dynamic power
  - Context-based gating of individual modules in the design

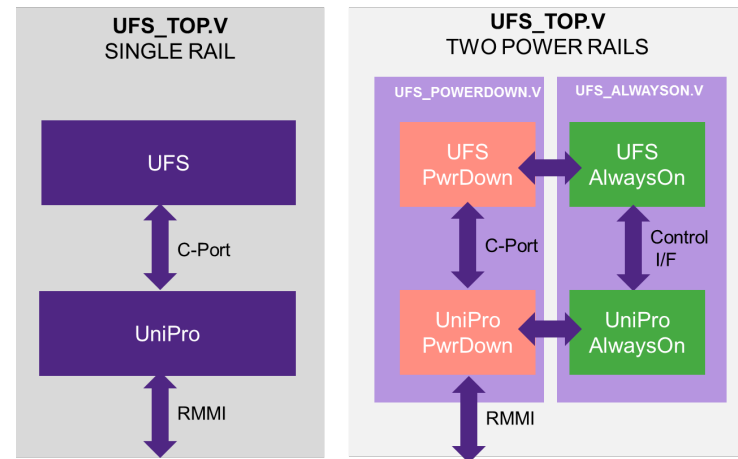


*eMMC example -> up to 75% power reduction*

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# Other Low-Power Techniques

- Multi-rail / power gating
  - Reduces leakage power
  - Only a portion of the entire UFS controller hierarchy will be on 'always-on' power domain; rest can be switched off
  - Deep power saving in HIBERN8 power state



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# Security Features

## Encryption Capabilities That Meet Mobile/Android Needs

- Android supports full-disk encryption
  - The encryption algorithms are AES-CBC or ESSIV-AES-CBC
- Android supports file-based encryption
  - The encryption algorithms are AES-XTS or AES-CBC-CTS

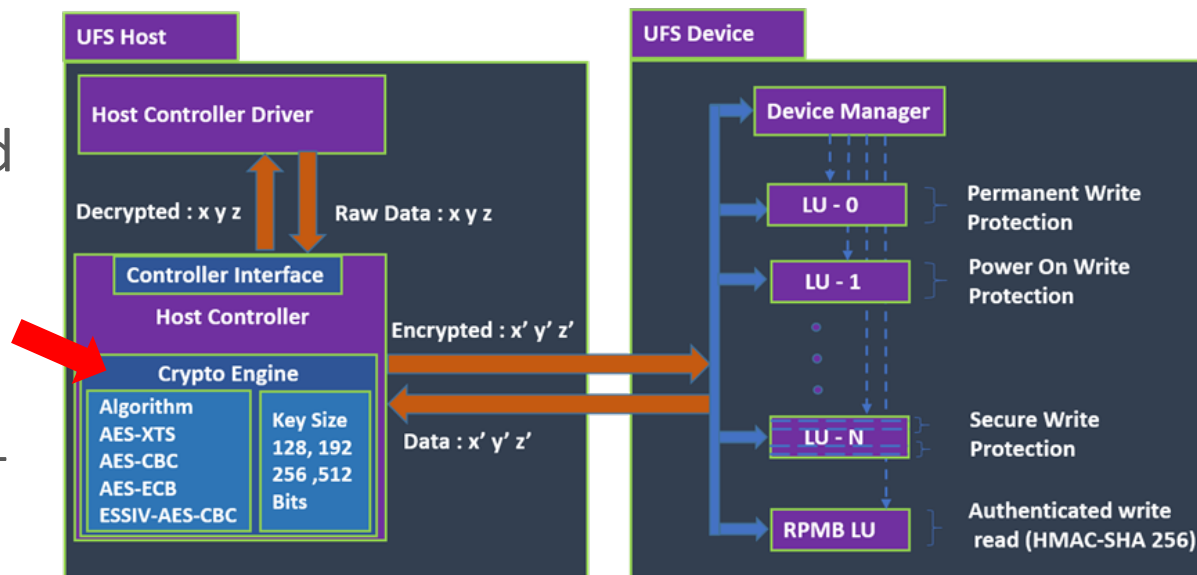


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# Security Features

Encryption Capabilities That Meet Mobile/Android Needs

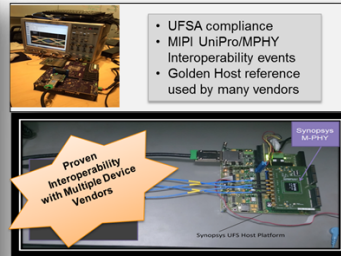
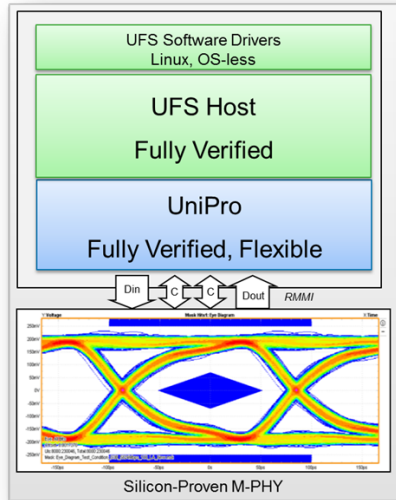
- UFS (and soon eMMC) supports AES-XTS, AES-CBC-CTS, AES-CBC, ESSIV-AES-CBC and AES-ECB



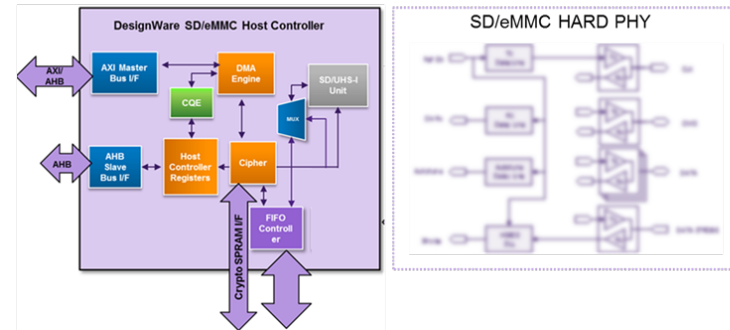
# Addressing Design Challenges by Integrating High-Quality IP

## eMMC & UFS Solutions

### UFS v2.1 Complete Solution

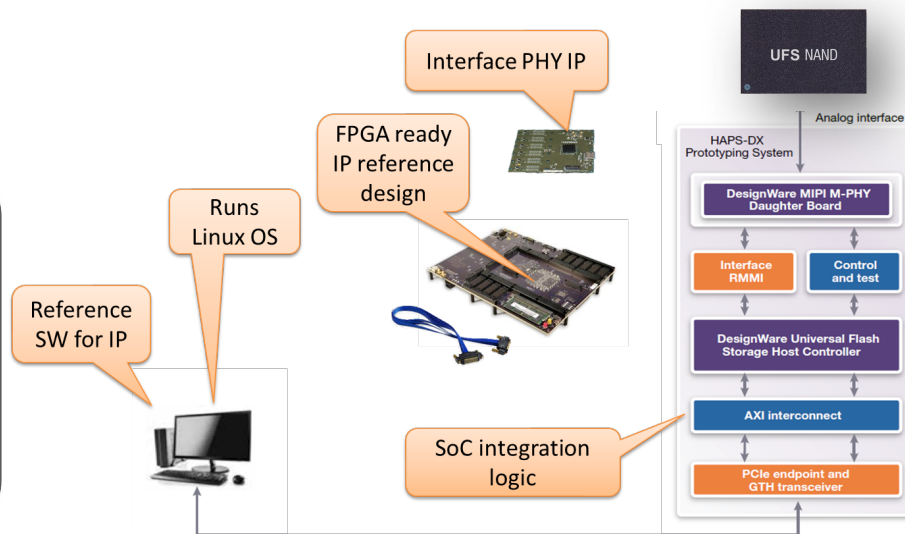
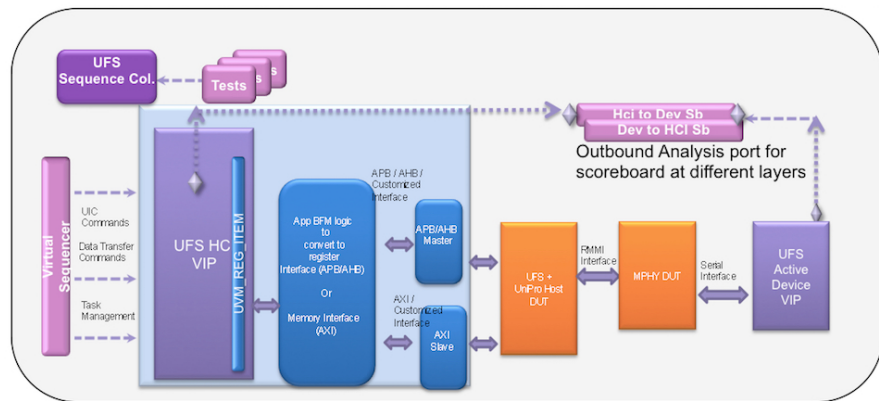


### SD6.0/eMMC5.1 Host Complete Solution



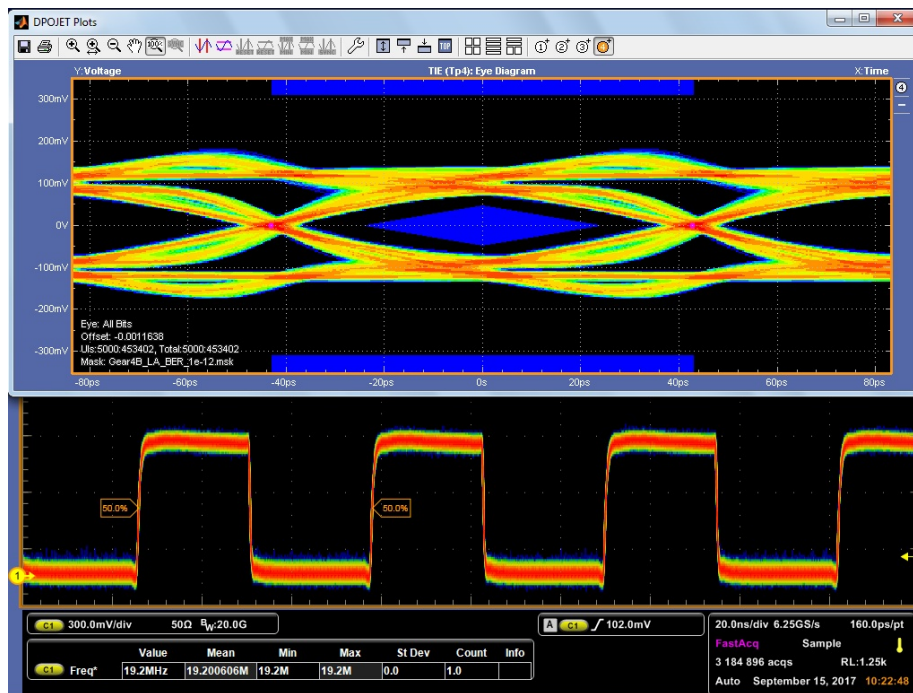
# Verification & Validation Before Silicon

## Verifying UFS with VIP



FPGA-based Prototype for HW **validation** & early SW development

# MIPI M-PHY v4.1 Proven in Silicon



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# Summary

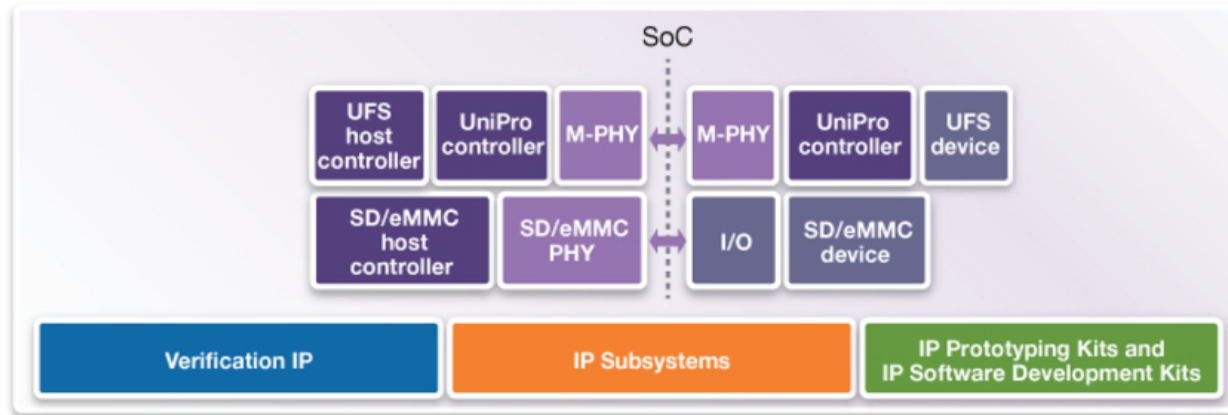
- Available high-quality IP, verification IP and hardware validation solutions
- eMMC: mainstream mobile storage applications balancing performance & cost
- UFS: next-generation smart & powerful high-end devices for mobile & beyond



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# Synopsys® DesignWare® Mobile Storage IP Portfolio



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