



# Looking for (and Thinking about) Storage at the 2018 CES



Tom Coughlin  
IEEE Fellow

©

©

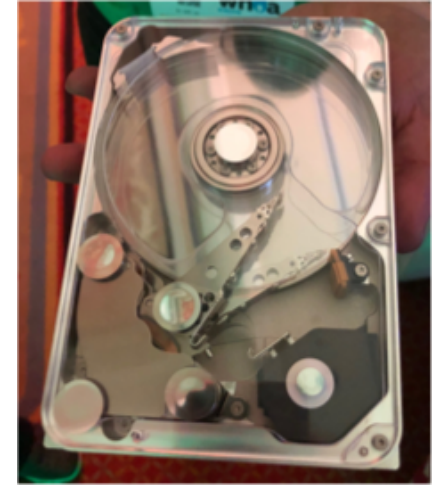


# Hard Disk Drives

- My first view of Seagate's multi-actuator 3.5-inch HDD
- Seagate says that they will ship HAMR drives to customers by 2019.
- WD and Toshiba favor use of MAMR in enterprise HDDs
- He-filled drives are everywhere—squeak, squeak
- Toshiba said that 1 and 2 disk 2.5-inch HDDs are moving to SMR



Toshiba 14 TB He-Filled HDD



Seagate Dual Actuator HDD



Toshiba 2.5-inch mobile HDD



Seagate HAMR HDD

# Solid State Drives



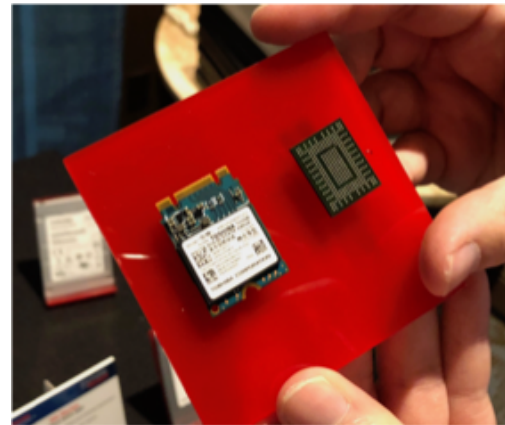
Toshiba RC100 NVMe SSD



Kingston PCIe SSD



Kingston DCU1000 NVMe U.2 SSD



Toshiba Embedded NVMe SSD

- Seagate, WD and Toshiba were showing SSDs (64 layer 3D flash in production, 92-96 layer by end of year)
- Kingston showing SSDs based upon collections of U.2 devices in a single chassis (e.g. DCU1000 has 4 U.2 modules).
- NVMe SSDs will dominate in consumer as well as enterprise apps—faster performance.
- Embedded NVMe SSDs will be used in space constrained consumer devices
- Flash prices will drop in 2018 and 2019

# Solid State External Storage

- SSD portable drives with USB-C and up to 2 TB (still a bit expensive)
- Thunderbolt SSD devices for M&E editing applications (as well as ingest)
- Higher speed external SSDs could replace portable HDDs as the \$/GB declines—depending upon the application



SanDisk Extreme Portable SSD



WD G-Drive Mobile SSD



OWC Thunderblade V4



Two Kingston Portable SSDs



Toshiba XS700 Portable SSD

# HDD External Storage



Seagate Portable Drive Lineup



Toshiba Updated Canvio Portable HDDs



Seagate Gaming HDDs

- Seagate has a few external storage partnerships—one with drone maker DJI (the CoPilot). Another combination storage and battery charger with JD in China (the Joy Drive)
- Seagate also showing external game drives in partnership with Microsoft Xbox
- Toshiba had updated Canvio HDDs

# Content Ingest and Storage



Gnarbox



WD My Passport Wireless Pro SSD



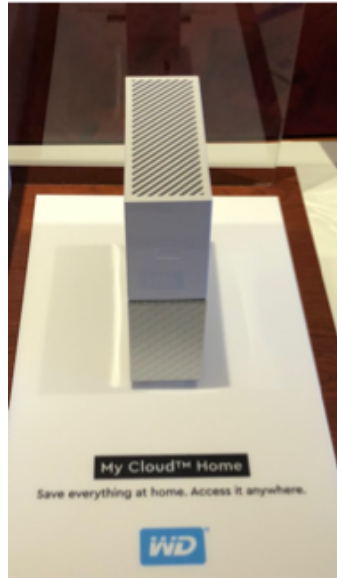
LaCie DJI CoPilot

- A great variety of HDD and flash-based devices for ingesting content from flash cards or smartphones
- Some are devices where you provide the USB storage—e.g. Kwilt and Monument

# Connecting with NAS



Promise Apollo Cloud 2



WD My Cloud Home

- Some including AI features, IP camera integration
- Capacities of 20 TB or higher available
- Synology and ioSafe exhibited with Seagate at CES Unveiled



ioSafe, Fireproof and Waterproof

Synology SSD and HDD NAS



# USB Drives

- Kingston was showing their HW encrypted USB drives, including IronKey drives (seem to be waterproof)
- SanDisk introduced very small Ultra Fit USB 3.1 USB drive
- SanDisk also introduced a 1 TB USB-C drive
- Kingston Bolt and SanDisk iXpand for memory expansion for iPhone and iPad (Lightning Connector)



Kingston Waterproof and Secure Storage



SanDisk Ultra Fit USB 3.1



SanDisk 1 TB USB-C



Kingston Bolt Drive



SanDisk iXpand Drive

# Other Storage

- Digital storage products can be found throughout the CES
- Many are just showings incidental to their main advertised product
- Storage and memory are everywhere!



Seagate Cloud Scale Storage Array (1 PB in 5U)



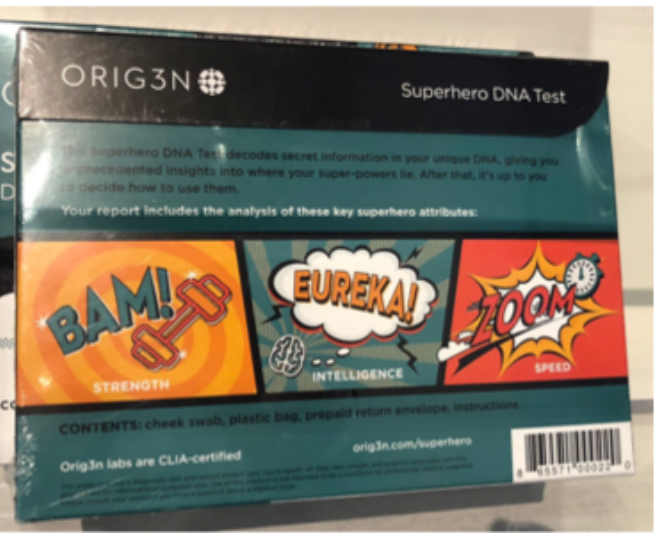
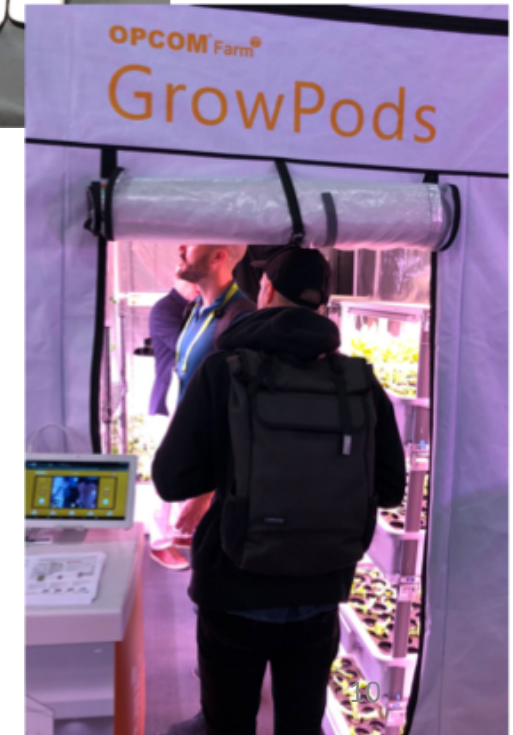
SanDisk Extreme Pro Card



Macronix had a presence



# What else was at the 2018 CES, well...



# And more!

Quantum Computing

