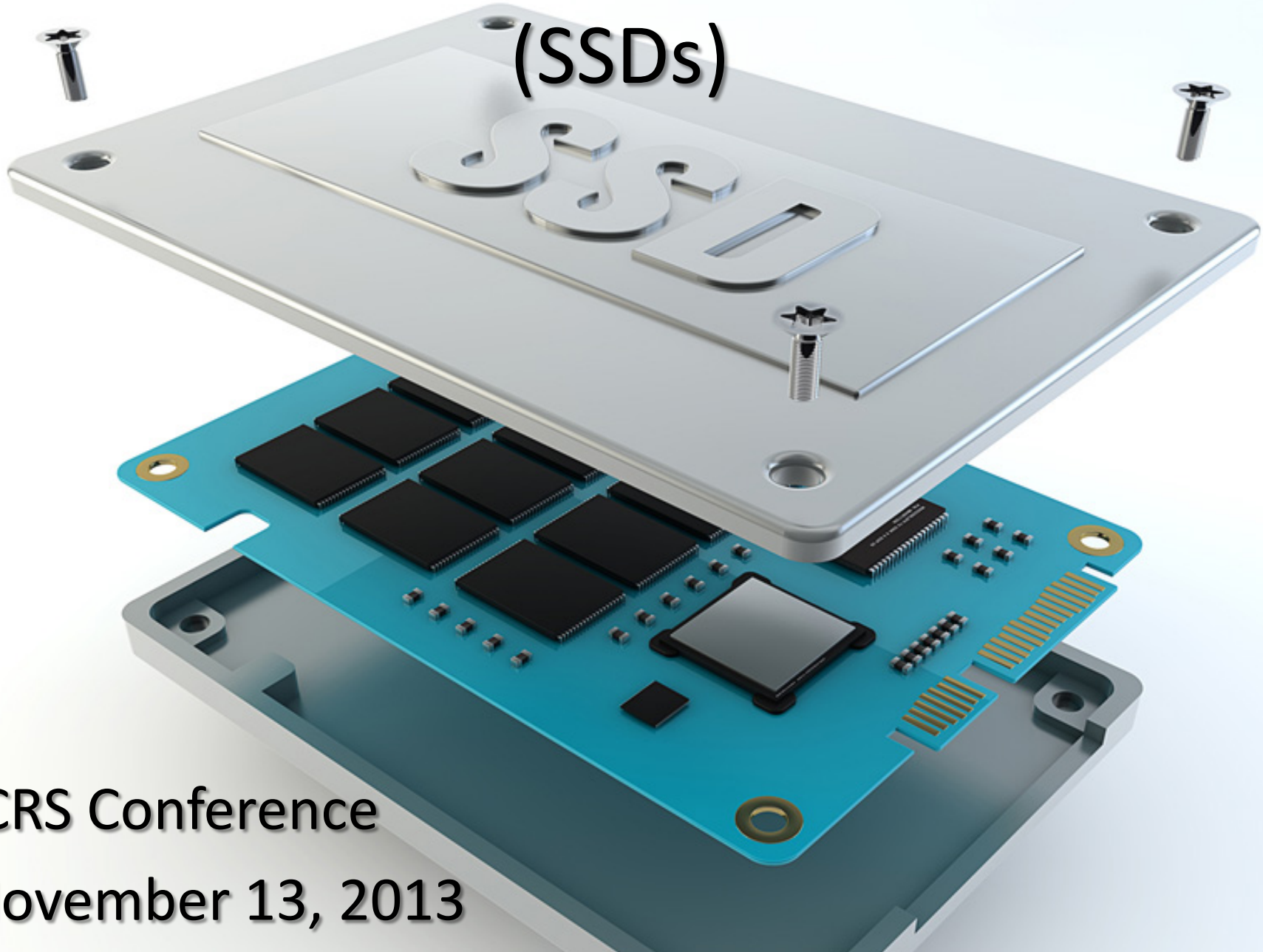
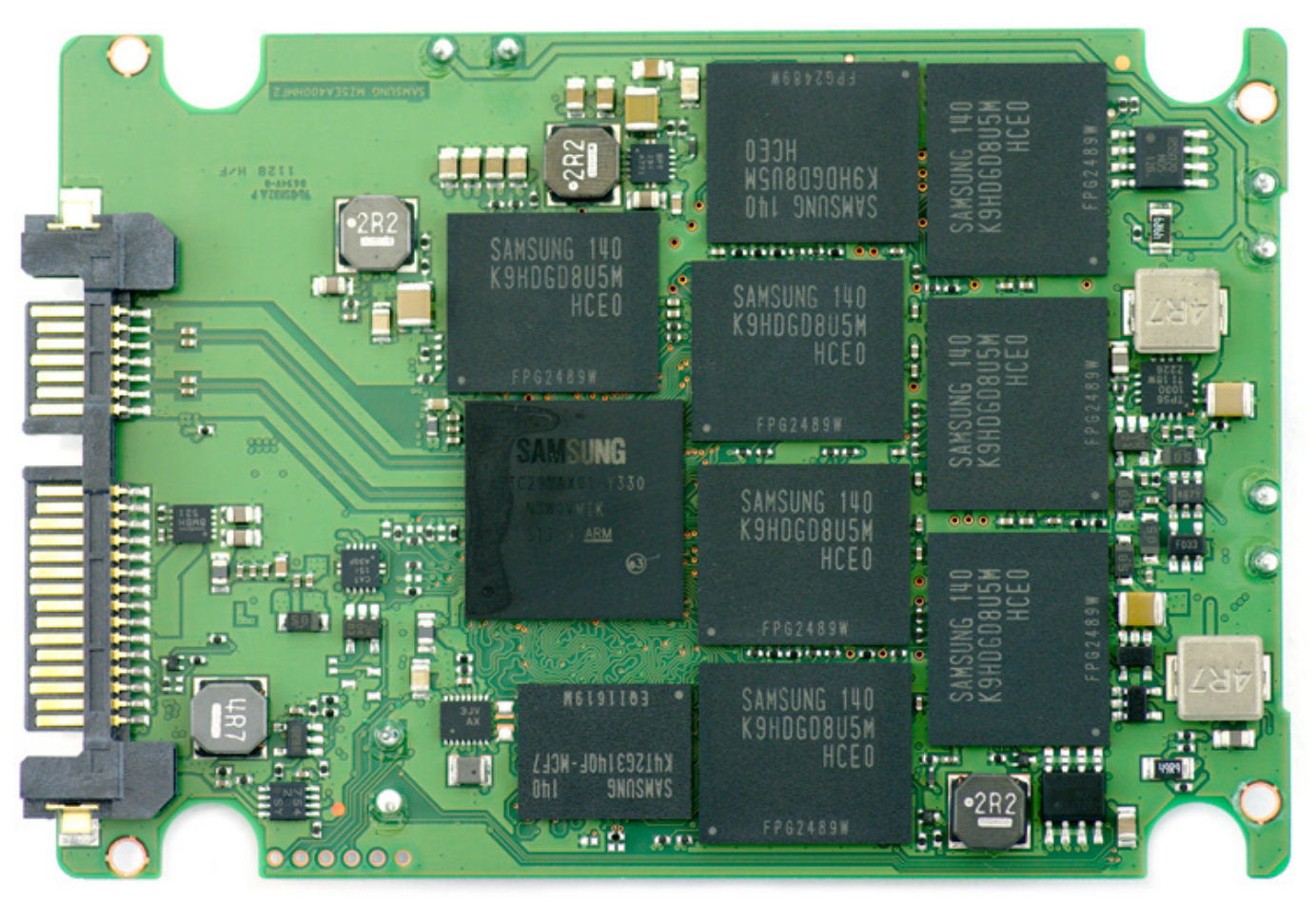
Sanitization of Solid State Disks (SSDs)



ICRS Conference

November 13, 2013

Solid State Disk (SSD)



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Benefits of SSDs

- Speed – much faster than HDDs
- Low power consumption
- Durability – more shock resistant than HDDs
- Smaller footprint/less weight

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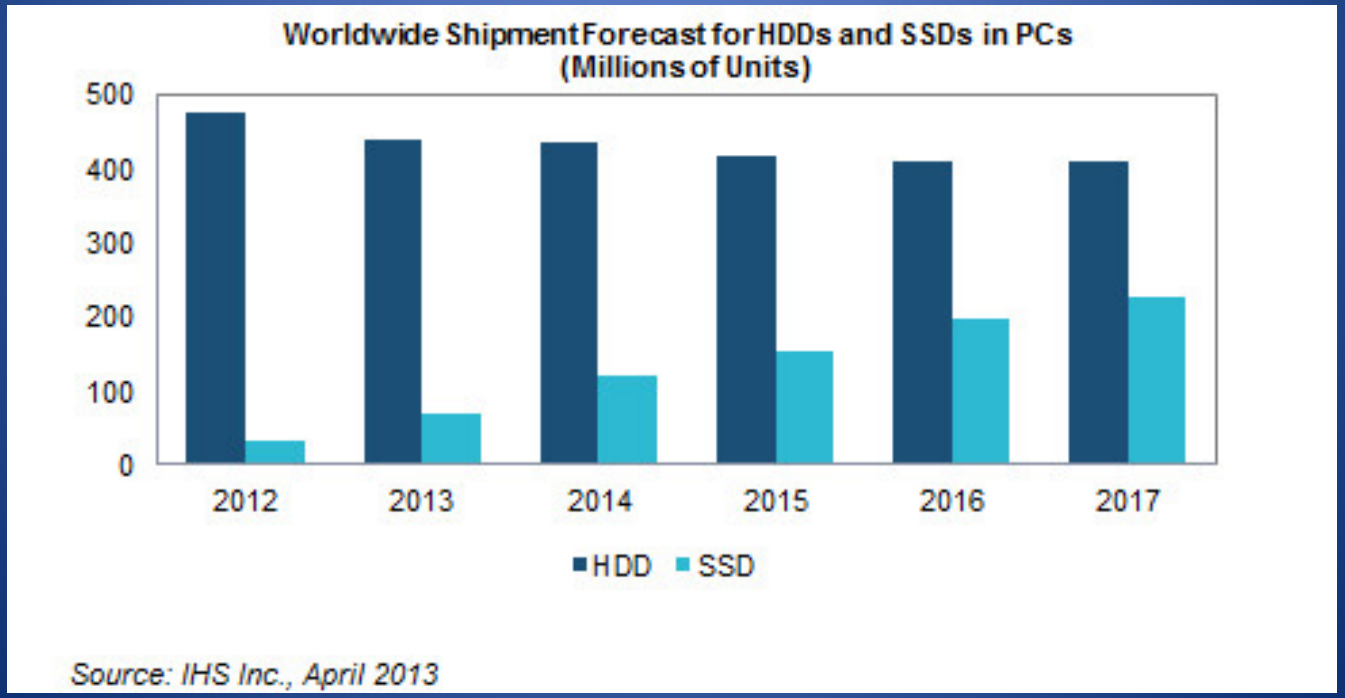
SSD market is growing

Growth of tablets and other mobile devices

Worldwide Device Shipments by Segment (Thousands of Units)			
Device Type	**2012**	**2013**	**2014**
PC (Desk-Based and Notebook)	341,273	303,100	281,568
Ultramobile	9,787	18,598	39,896
Tablet	120,203	184,431	263,229
Mobile Phone	1,746,177	1,810,304	1,905,030
Total	**2,217,440**	**2,316,433**	**2,489,723**
Source: Gartner (October 2013)			

SSD market is growing

Growing in the PC market (both consumer and enterprise markets)



Reuse/recycling challenges exist

SSDs are now commonplace and present unique resale and retirement challenges because sanitization techniques for HDDs have not been proven effective for SSDs

- NO direct access to disk sectors *and*
- NOT STANDARDIZED (like HDDs have been), each manufacturer implements proprietary control systems

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Reuse/recycling challenges exist

- SSDs are problematic in different ways:
  - Identification
  - Erasure
  - Non-standardization

"Both revolutionary and evolutionary changes make sanitization more difficult"

-NIST SP 800-88 Rev 1

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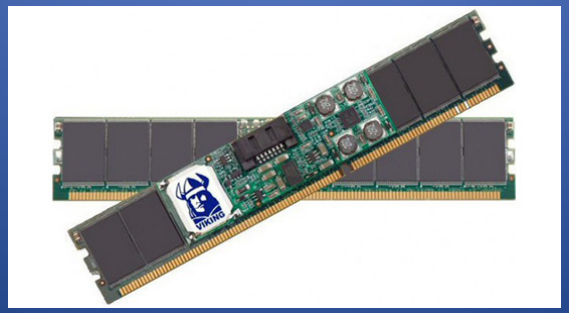
Problem of identification

- Many different types of SSDs on the market
  - SSDs can resemble other computer components
    - SSD vs HDD or Hybrid
    - Can look like an adapter card, memory, etc
  - SSDs can reside in many types of interfaces
    - SATA, mSATA, PCI Express, Mini PCIe, M.2, etc



Sanitization challenges

Effective sanitization requires

- Identification of the storage device media type (Flash/hard disk/hybrid…)
- Applying the appropriate sanitization method for the specific media
- Verification that sanitization was successful

Sanitization challenges

Smart phones/tablets often utilize built-in Unit Erase commands for sanitization, however…

- Support varies among vendors
- Salability requires Operating Systems on devices to remain intact while other data are sanitized
- Models and firmware can change often
- Specialized software is required in some cases

Sanitization challenges

- Software overwriting of PC/laptop SSDs isn't always successful due to firmware issues
  - Flash translation layer hides data from OS
    - Un-provisioned space
    - Data are copied and moved (and controlled by the drive)

Sanitization challenges

- SSD manufacturers implement firmware differently and it's sometimes buggy
  - This creates issues for drive erasure as sanitization programs try to utilize firmware commands
  - FAST research paper from researchers at SDSU found that Secure Erase functions were effective in many drives but not all
  - Each model of SSD would need to be evaluated independently to verify effectiveness of sanitization

Sanitization solutions

- Crypto-erase – encrypting the drive and then removing the encryption key
  - Extremely fast
  - Encryption has shown vulnerabilities over time
  - Encryption can be implemented poorly
  - Data remains on the drive although unreadable without key
- Degaussing is ineffective

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Sanitization solutions

- Some sanitization software providers are marketing SSD sanitization capabilities
  - Building in capabilities to access un-provisioned areas on at least some models/types of drives
  - Often combining methods of erasure to deal with problems and inconsistencies of firmware/FTL issues
    - Crypto-erase
    - Secure Erase
    - Overwrites (multiple wipes)

Sanitization solutions

- Challenged with verification limitations of crypto-erase and overwriting, sanitization program developers are working to shift the burden of proof:
  - Industry pressure to prove verification at the sector level but it's very difficult to prove crypto or overwrite success/failure with SSD architecture
  - Sanitization companies are instead giving their solutions to 3rd party forensic testing…"Prove us wrong"

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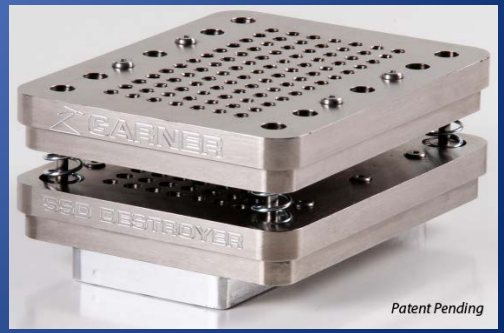
Theory vs. Practicality?

- Research shows data remanence from some SSDs and other flash memory even after Secure Erase has been run
- Practicality says data recovery is unlikely, especially when data removal tools have been applied (crypto, SE, overwrites)

Destructive solutions

- Destructive solutions are working to meet smaller particle needs
  - Disintegrators/Pulverisers/Media shredders
  - Hard drive crushers with SSD inserts



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What we've learned…

Verification methods are key to sanitization efficacy – three key verification areas:

- Verification of sanitization – investigating devices to ensure target data has been effectively sanitized
- Verification of personnel – ensuring operator competency to identify devices and sanitize devices
- Process verification – verifying that sanitization processes are effective when applied to different types of SSD devices

What we've learned…

- Each device type needs independent evaluation – 3rd party validation should be part of the evaluation process
- Inventory and control of devices throughout the process is important – chain of custody and physical control is essential
- Keeping up with hardware and industry changes is important – use available resources to stay on top of industry changes

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Resources

- NAID – National Association of Information Destruction www.naidonline.org
- SDSU Non-Volatile Systems Laboratory nvsl.ucsd.edu
- Storage and Destruction Business Magazine www.sdbmagazine.com

Thank you!

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