Seven Myths About SED

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Summary

- Introduction
  - Evolution of self-encrypting drives
  - Architecture of self-encrypting drive
- Myths to be busted
  1. Drives are using weak algorithms
  2. Software-base disk encryption on SSD
  3. ATA Security is good enough
  4. Hardware encryption adds a lot of latency
  5. Opal is only for Windows
  6. TCG is all about TPM and DRM
  7. Vendors have backdoors in their products
- Conclusion

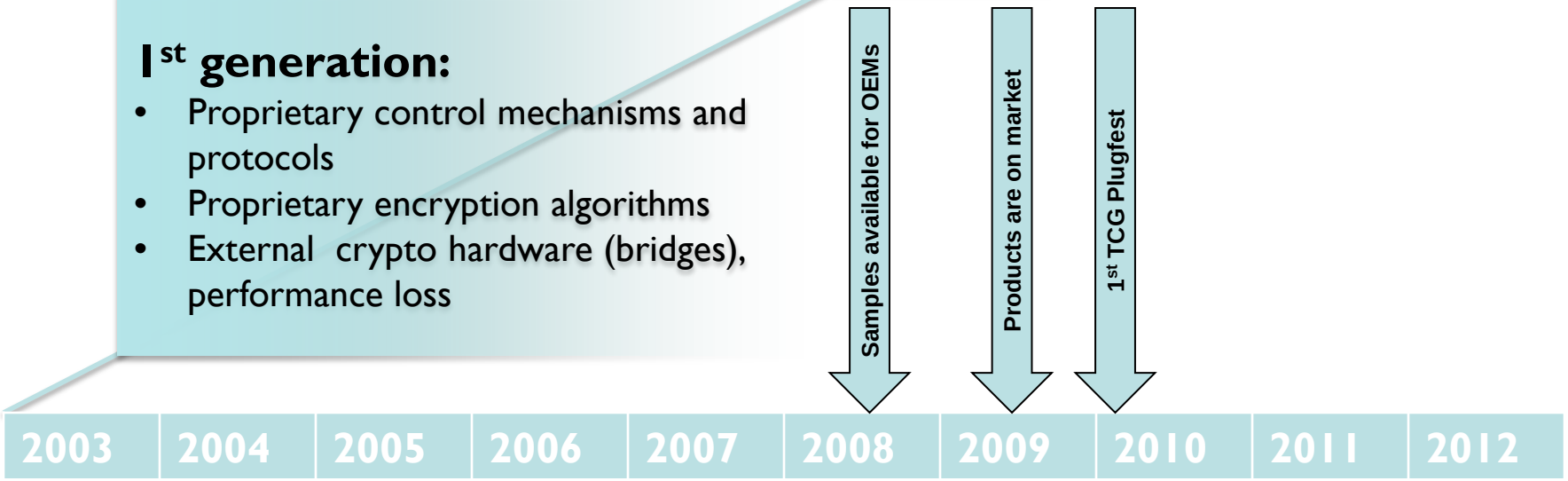
Evolution of self-encrypting drives

2nd generation:

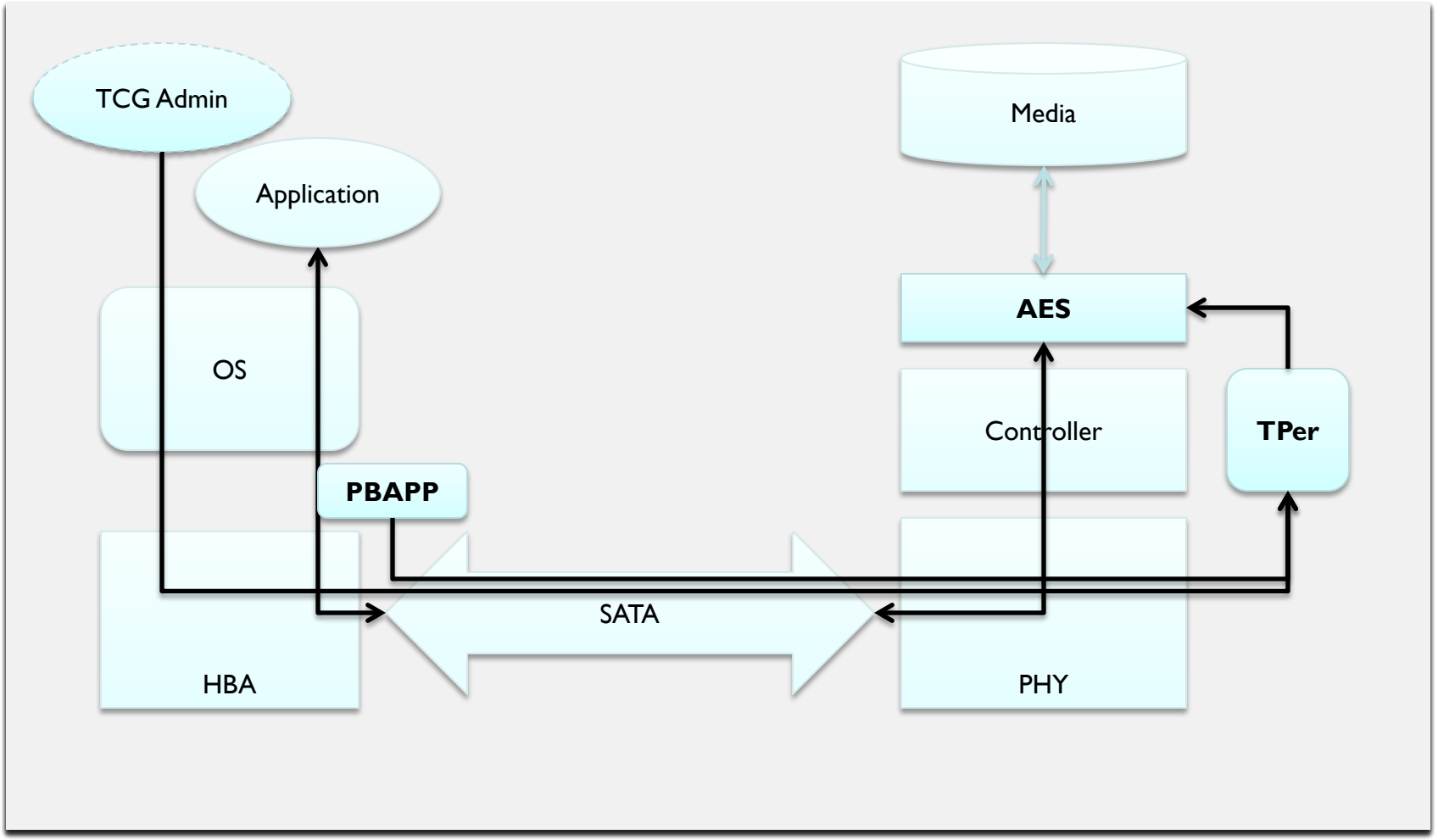
- Control mechanisms are based on standards (T13, T10, TCG)
- NIST-approved encryption algorithms (AES, SHA, HMAC, etc.)
- Built-in encryption hardware, no performance loss

1st generation:

- Proprietary control mechanisms and protocols
- Proprietary encryption algorithms
- External crypto hardware (bridges), performance loss



Architecture of SED



Myth 1: SED is using weak algorithms

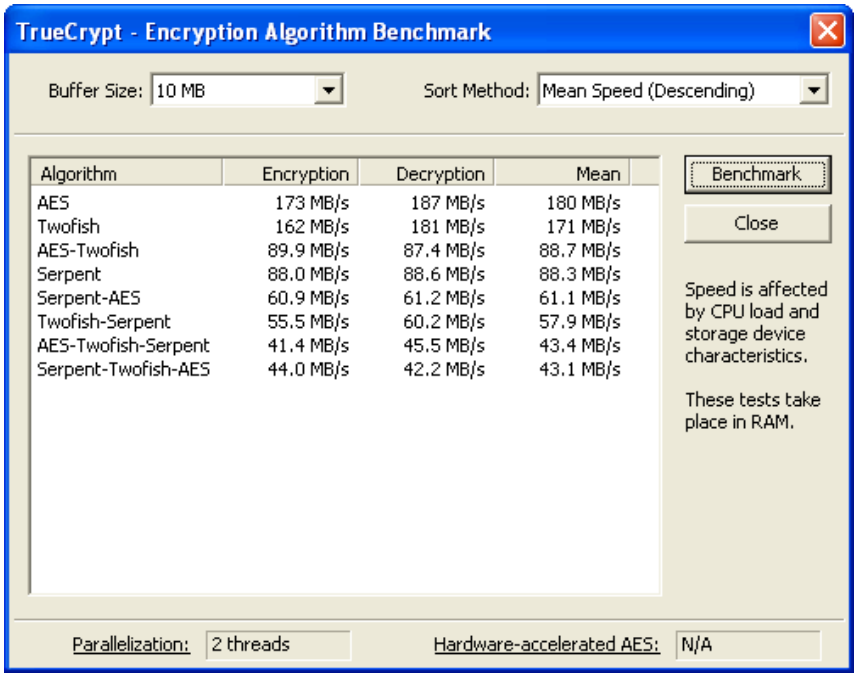
- This is true statement for the 1st generation
  - External solutions (disk enclosures, bridging, etc)
  - In best cases matching USB speed
  - "Childhood disease"
- 2nd generation is using AES 128 or 256
  - AES hardware is simple
  - AES is very efficient
  - Required for FIPS certifications

Myth 2: ATA security is enough

- ATA Security is no more than a sign.
  - There is no encryption in classical ATA security
  - "Master" passwords leaked on Internet
  - Data can be recovered by many data rescue companies
- Class 0 = ATA Security + Encryption
  - This might be enough for simple use cases
  - Inherited problems from ATA security
  - Not fully compatible with ATA specifications
  - Can be disabled by user (compliance problems)
- Not suitable for more complicated security use cases
  - No multiple users
  - No access right configuration
  - No security log
  - Notepad VS. Word

Myth 3: Software Encryption works better on SSD

231 MB/s [2]

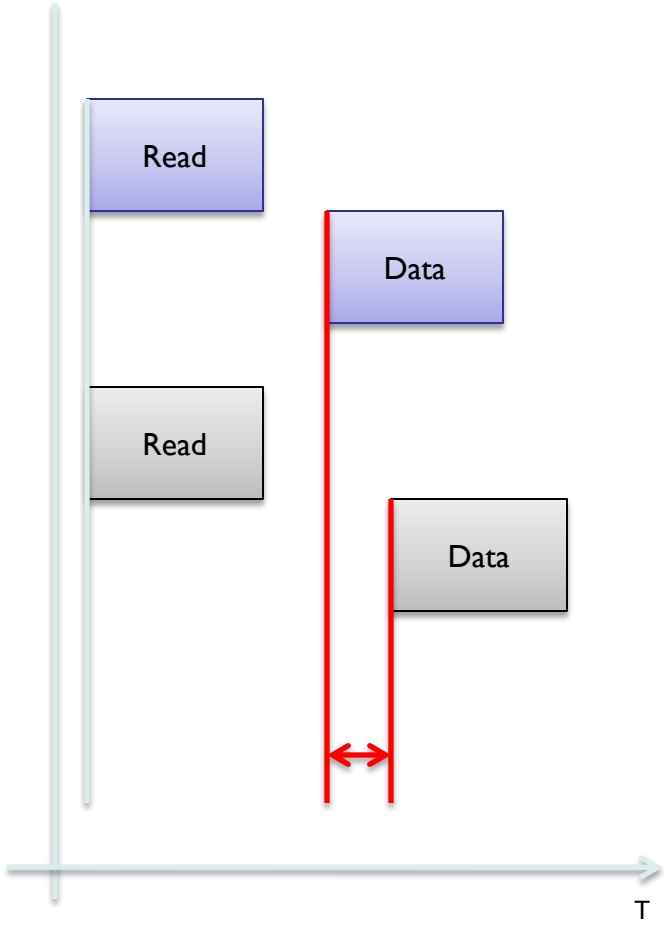


187 MB/s

Myth 3: Software encryption for SSD

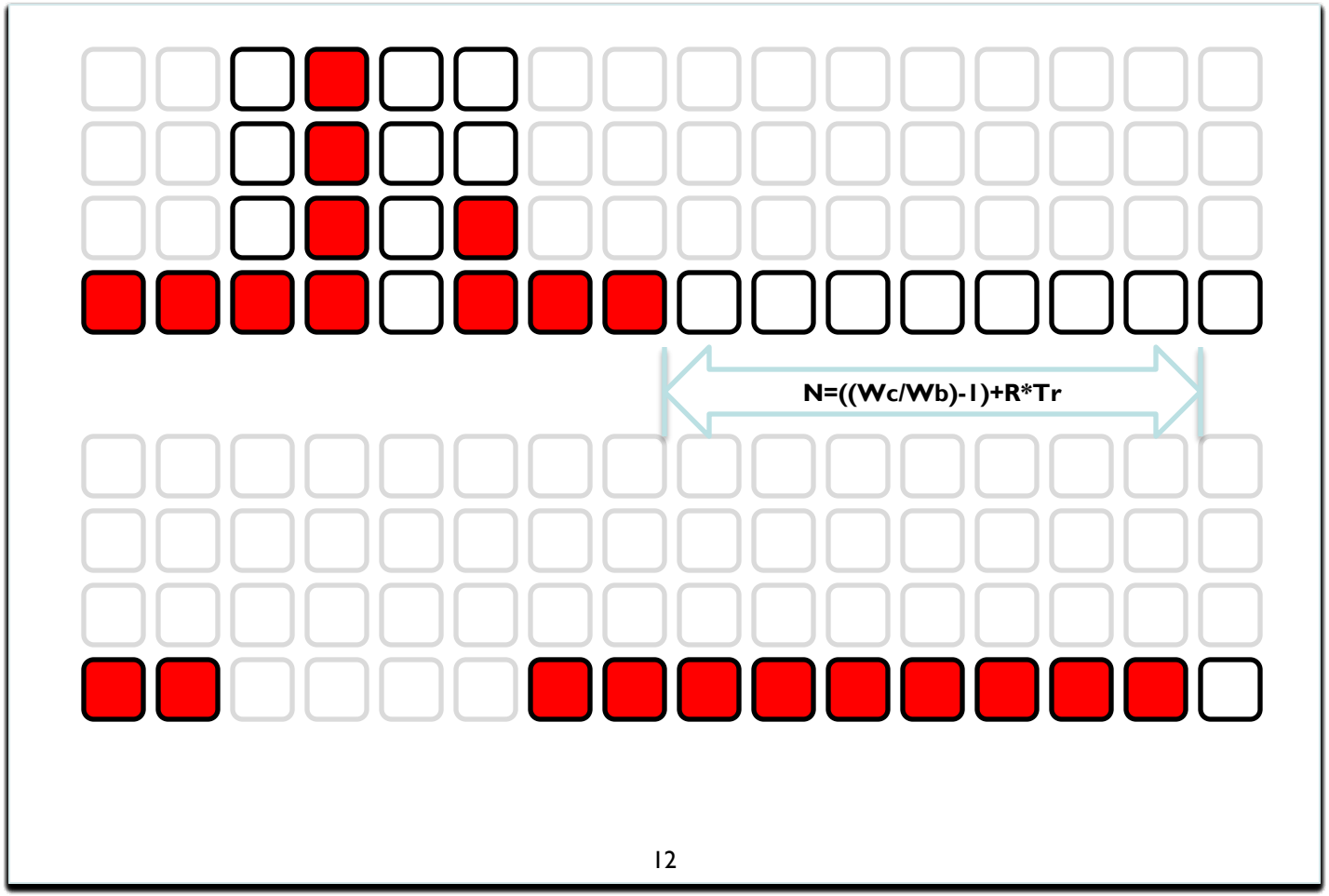
- Software encryption cost
  - AES: 21 clock/byte (Pentium, 512 byte/block)
  - Throughput: 231 MB/s
  - 5,083 MIPS for throughput encryption
- Comparable to overall power of mobile CPU
  - Netbooks: Atom 3,300 MIPS [3]
  - Easily can eat half of notebook CPU
- Hardware encryption
  - Zero CPU consumption
  - Scalable with throughput

Myth 4: Latency of SED



- There were a lot of speculations about latency
- Write latency – impossible to measure on host side
- Read latency – delta in response to read command

M4: Latency mechanism



M4: down to numbers

- Clock tick
  - 3Gb/S = 2.4Gb/S after 10 to 8 decoding
  - 0.4 nS per bit
  - 13 nS per 32-bit word
- Latency in clock cycles
  - 128 bit of AES block / 32 bit bus = 3 clocks
  - 14 rounds of AES 256
  - 17 clocks total
- Good news: ~**221 nS** of total latency added
  - ~0.1-0.2% for SSD
  - 15K RPM HDD ~ 66 uS to position a sector
- Even better news: latency is scalable with interface speed
  - For 6G 1 clock is 6.5 nS, 17 clocks = 111 nS

Myth 5: TPM/DRM

- TCG is known for TPM (Trusted Peripheral Module)
- TPM might be used for DRM protection
- Many users don't like DRM

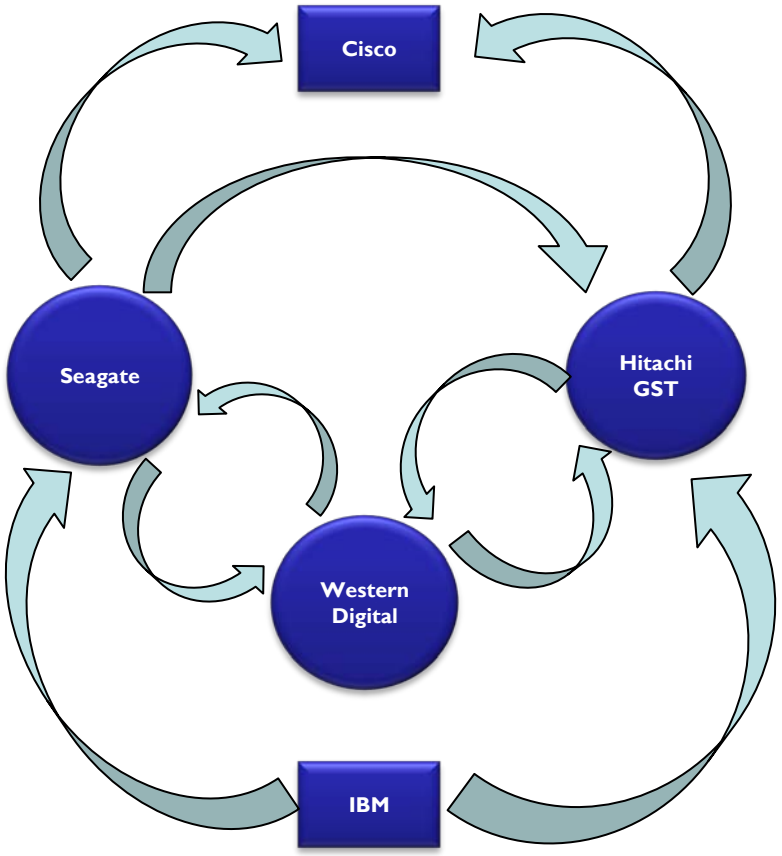
- But the fact is:
- **THERE IS NO TPM or DRM in TCG STORAGE SPECIFICATIONS**

- TPM is a host security device
- Take a moment and read these specs

Myth 6: Opal is only for Windows

- There are 3 software components in security system:
  - Firmware – host independent
  - Pre-boot application – platform-specific (PC/Mac)
  - Configuration software – OS specific
- Configuration software
  - Supported OS: Windows XP, Vista, 7, Mac OS
  - Potential support: GRUB, Truecrypt, LUKS, CryptoFS
- Linux community is more than welcome to develop support for TCG drives
  - Protocols are free
  - Specifications are open and free
  - TCG Storage Workgroup will support this initiative

Myth 7: Backdoors and conspiracy theories



- There is no pressure to make backdoors from government agencies
- Failure analysis people are most interested in "debug features"
- There is no vendor that can afford such dirty secret as backdoor
  - Problems with FIPS certifications
  - Workforce dynamics (LinkedIn research)

References

1. AES Performance Comparisons, Bruce Schneier
2. http://www.tomshardware.com/charts/2009-flash-ssd-charts/Read-Throughput-h2benchw-3.12,906.html
3. http://en.wikipedia.org/wiki/Intel_Atom