

# 20 Years of Storage Innovation ....and Predictions for the Next 20 Years



Michael Oros
Executive Director

#### How did we get here...



- Cave paintings...40,000 years ago
- Pictograms...9,000 years ago
- Writing...5,000 years ago
- Paper data storage...300 years ago
- Commercial electricity generation...~140 years ago

#### How did we get here...



- Transistor...70 years ago
- Hard disk drive...63 years ago
- Networked storage...34 years ago
- Flash memory...33 years ago
- Storage area networks...23 years ago
- SNIA...20 years ago

## Why standards are important: Electricity as an example



- ◆ AC / DC the battle of the currents
- AC voltage and frequency
  - 220-240V and 100-127V are the standard for commercial power
  - 14 frequencies were initially commercialized
  - 50 and 60 Hz are the dominant world frequencies today
  - 4-combination of voltage and frequency today...and 15 plugs

## Why standards are important: Electricity as an example



#### Impact:

- Electronics industry has to account for all permutations
- Electric machinery/motors has to be customized for each voltage/frequency combination
- Higher costs for manufacturers and customers

#### Examples and consequences:

- Los Angeles power grid
- Japan's incompatible power grids

#### Remembering how far we've come...





#### Who remembers dialup?





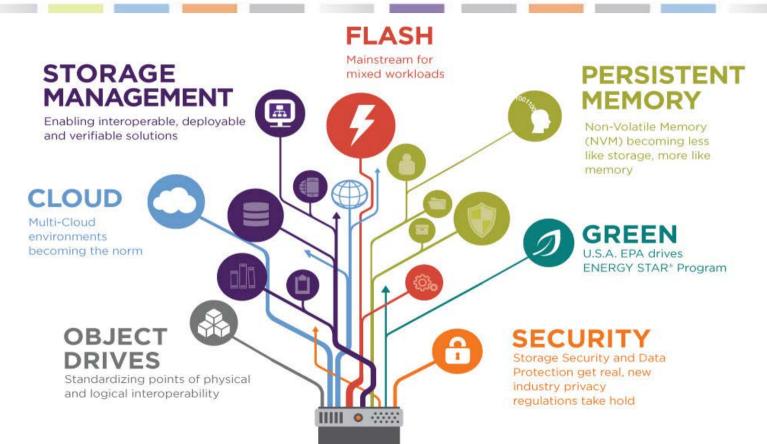
#### **Data Center Dependent**





#### **SNIA** in Action





#### **SNIA-at-a-Glance**





160 unique member companies



2,500 active contributing members



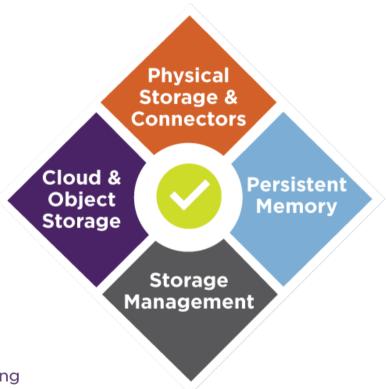
**50,000**IT end users & storage pros worldwide

#### **Standards Development**





- ✓ ISO & ANSI Standards
- Storage Standards
- ✓ Best Practices & Security
- ✓ Interoperability & Conformance Testing



#### **Standards Development – Past 20 Years**



IP-Based Drive Management Specification 1.0 NVM Programming Model v1.2 SFF TA TWG Self-contained Information Retention Format (SIRF) Specification 1.0 Swordfish Scalable Storage Management API Specification 1.0 Storage Management Initiative Specification (SMI-S) 1.7 LTFS Bulk Transfer 1.0 SSS PTS Client 1.2 SNIA Emerald™ Power Efficiency Measurement Specification 2.1 Linear Tape File System (LTFS) Format Specification 2.3 Storage Management Initiative Specification (SMI-S) 1.6.1 SSS PTS Enterprise 1.1.1 NVM Programming Model 1.0 TLS Specification for Storage Systems 1.0 **NVM Programming Model 1.1** Cloud Data Management Interface (CDMI) 1.1 SSS PTS Enterprise 1.1 Linear Tape File System (LTFS) Format Specification 2.2 SNIA Emerald™ Power Efficiency Measurement Specification 2.0 Storage Management Initiative Specification (SMI-S) 1.6 SSS PTS Client 1.0 SNIA Emerald™ Power Efficiency Measurement Specification 1.0 SSS PTS Client 1.1 SSS PTS Enterprise 1.0 Storage Management Initiative Specification (SMI-S) 1.5 Cloud Data Management Interface (CDMI) 1.0 Storage Management Initiative Specification (SMI-S) 1.4 Multipath Management API 1.1 **XAM SDK 1.0.1** Storage Management Initiative Specification (SMI-S) Common RAID Disk Data Format (DDF) 2.0 NDMPv4 Release 1.0 XAM Specification 1.0 Storage Management Initiative Specification (SMI-S) 1.3 iSCSI Management API 2.0 Storage Management Initiative Specification (SMI-S) 1.2 Storage Management Initiative Specification (SMI-S) 1.1

Common RAID Disk Data Format (DDF) 1.2

© 2017 Storage Networking Industry Association. All Rights Reserved: Management API 1.1

Storage Management Initiative Specification (SMI-S) 1.0

Multipath Management API 1.0

12

#### SFF TA TWG: since creation in July 2016



- ♦ SFF-8071 Specification for SFP+ 1X 0.8mm Card Edge Connector Rev 1.8
- ♦ SFF-8351 3.5" Form Factor Drive with High Density Connector Rev 1.0
- SFF-8449 Specification for Management Interface for SAS Shielded Cables Rev 2.1
- SFF-8617 Specification for Mini Multilane 12X Shielded Cage/Connector (CXP) Rev 1.7
- SFF-8642 Specification for Mini Multilane 12X 10 Gb/s Shielded Connector (CXP10) Rev 3.2
- SFF-8636 Specification for Management Interface for Cabled Environments Rev 2.9
- SFF-8024 Specification for SFF Cross Reference to Industry Products Rev 4.2
- SFF-8448 Reference Guide for SAS Sideband Signal Assignments Rev 1.3
- SFF-9402 Reference Guide for Multi-Protocol Internal Cables for SAS and/or PCIe Rev 0.7

#### 17 Active Projects

#### From Idea to New ISO Standard



- Do you have an idea for a new technical standard or a proprietary standard you would like to standardize?
- As a SNIA Member, find two other SNIA companies that agree with you
  - Statements of support from at least three active SNIA members are a prerequisite for TWG approval. "Support" includes intent to actively participate in the TWG
- Create a proposal and present to the Technical Council for review/approval
  - Prepare a draft charter and proposed Program of Work
- For additional information send an email to <a href="mailto:tcmd@snia.org">tcmd@snia.org</a>

#### **Technical Work Today**



#### SNIA Technical Work Groups Drive Important Storage Specifications



- ✓ Non-Volatile Memory Programming Model (NVM)
- ✓ Object Drive IP-Based Management Specification
- ✓ SNIA Emerald™ Power Efficiency Measurement Specification
- Storage Management Specification (SMI-S)
- ✓ Transport Layer Security (TLS) Specification for Storage Systems
- ✓ Solid State Storage Performance Test Specification (PTS)
- ✓ Linear Tape File System (LTFS) Format Specification
- LTFS Bulk Transfer Technical Position
- Self-contained Information Retention Format (SIRF)
- ✓ Device level connectors, interfaces, and form factors (SFF)

#### **SNIA TWG Projects - Specifications**



- Cloud Data Management Interface (CDMI)
- IP-Based Drive Management
- Key Value API
- Linear Tape File System (LTFS) Format
- NVM Programming Model (NPM)

#### **SNIA TWG Projects - Specifications**



- Self-contained Information Retention Format (SIRF)
- ◆ SNIA Emerald<sup>™</sup> Power Efficiency Measurement
- Solid State Storage (SSS) Performance Test Specification (PTS)
- Storage Management Initiative Specification (SMI-S)
- Swordfish Scalable Storage Management API

#### **SNIA SFF Technology Affiliate TWG**



- Specifications for:
  - Connectors
  - Transceivers
  - Form Factors

#### 17 Active Projects

### SNIA TWG Projects - Open Source Software SNII



- API emulator for Swordfish
  - Extends Redfish emulator
- Swordfish client reference implementations
  - Basic Swordfish web client
  - PowerBI sample client
  - DataDog sample client
- CDMI Reference Implementation

#### **CLA Proof Point**



- Participation in Software projects for SNIA is not limited to just members
  - Any individual may now sign the Contributors License Agreement
- Projects such as the CDMI Reference Implementation exist due to volunteer contributions, now both member and non-member
- The Horizon 2020 project <u>Indigo Data Cloud</u> has taken the RI and used it for their project, creating a "fork"
  - Signed the CLA and contributed back their changes
  - SNIA benefits from the improved code



### Success Story: CDMI and Philips Research CNII

- Philips HealthSuite imaging and monitoring systems
- Problem: Moving medical records to other countries and hospitals thru commercial cloud technologies
  - How to do securely and with correct permissions/consents
- Decided to use SNIA's CDMI standard and do joint development with CDMI Technical Working Group
  - CDMI Encrypted Object Extension
    - Makes a cloud object storage server "encryption -aware"
    - Server or client can do in-place encryption and decryption
  - CDMI **Delegated Access Control** extension
    - Gives control of access decisions back to data owner and can be client or server side





#### **SNIA Projects**



- I/O Traces, Tools & Analysis (IOTTA) Repository
- DPCO: 100 year archive
- Workload (Provisional TWG)

## SNIA Public Review Drafts <a href="http://www.snia.org/publicreview">http://www.snia.org/publicreview</a>



- SNIA Emerald™ Power Efficiency Measurement Specification v3.0 rev 55
- Storage Management Initiative Specification (SMI-S) v1.8.0r1
- Swordfish Scalable Storage Management API v1.0.4
- Simple IP Based Drive Mockup-4
- IP Based Drive Array Mockup-2
- Persistent Memory Security DRAFT
- CDMI Test Specification v1.0a DRAFT
- CDMI Reference Implementation v1.0e DRAFT
- DRAFT CDMI Extensions and Profiles

Check them out! - Provide Feedback! Participate in their development!

5G A.I. IOT VRIAR
Smart City Moore's Law

### Autonomous Machines ION Object Social Recognition Media

#### The Need for Speed and Capacity





#### What's Next?



- ◆ Data: Efficient management, movement and security of information
  - Industry: ^growth, higher scrutiny and liability for collected private data
- Physical Storage: Persistent Memory over Fabrics, Hyperscaler Storage
  - Industry: high density/lower cost media, persistent media, new interfaces
- Storage Management: Device/System management, SNIA Swordfish™
  - Industry: automation, self-management and healing
- Object Storage: IP Drive Management Specification, Object Storage API
  - Industry: classification/categorization of data will become overwhelming
- Cloud Storage: Data into and out of Cloud Storage
  - Industry: physical transport of data

# Join the community! snia.org/join Startup Membership Category Launched





### CELEBRATING 20 YEARS OF STANDARDS DEVELOPMENT

STORAGE NETWORKING INDUSTRY ASSOCIATION

STORAGE DEVELOPER CONFERENCE
SEPTEMBER 11-14, 2017
SANTA CLARA, CA, HYATT REGENCY HOTEL
WWW.STORAGEDEVELOPER.ORG