



Working Draft:  
Modeling DNA Data Storage  
through Swordfish

SNIA Swordfish TWG  
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# Working Draft Disclaimer

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# Feedback

- Suggestions for revisions should be directed to <http://www.snia.org/feedback/>.

# TWG Status Disclaimer

- This proposal is a snapshot of work in progress by the SNIA Swordfish TWG.
- Contents are subject to change at any time.

# Related Materials

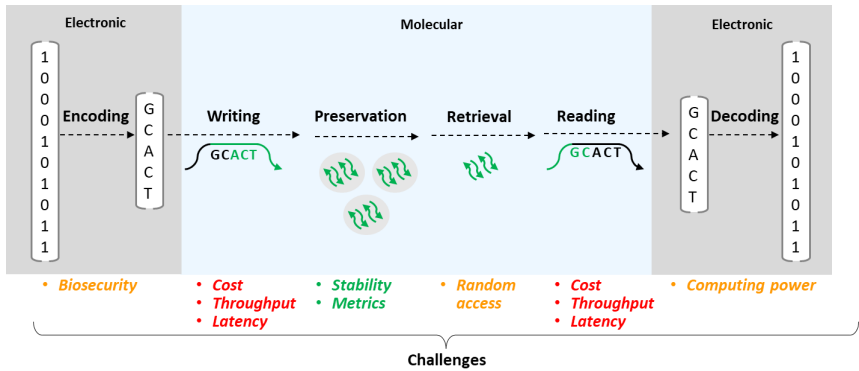
- ▣ This overview is released in conjunction with:
  - ▣ DNA Data Storage mockups published on [swordfishmockups.com](http://swordfishmockups.com)
- ▣ Contents extend the Swordfish v1.2.8 release.

# Fundamental Design Assertions

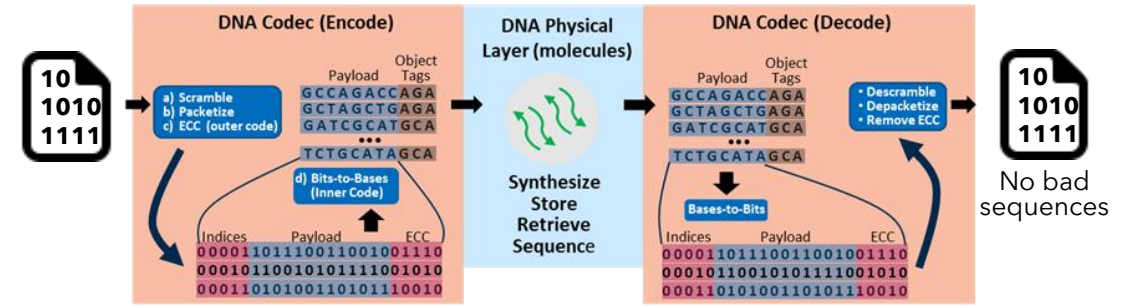
- There shall be a unified model across all types of Swordfish-managed storage devices
- The model will cover an appropriate level of abstraction for DNA Data Storage systems, based on initial modeling and mockups

**Mission :** Create an interoperable storage ecosystem based on DNA as a data storage and compute medium

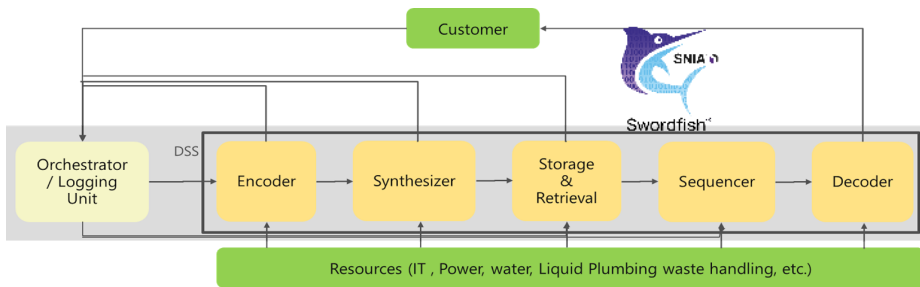
### Roadmaps, White Papers



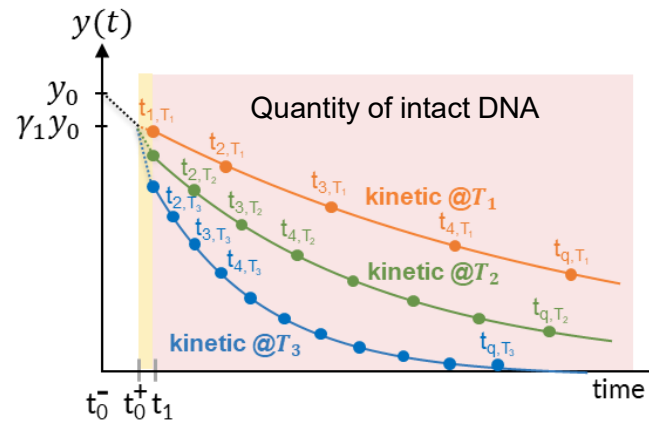
### Biosecurity/Biosafety



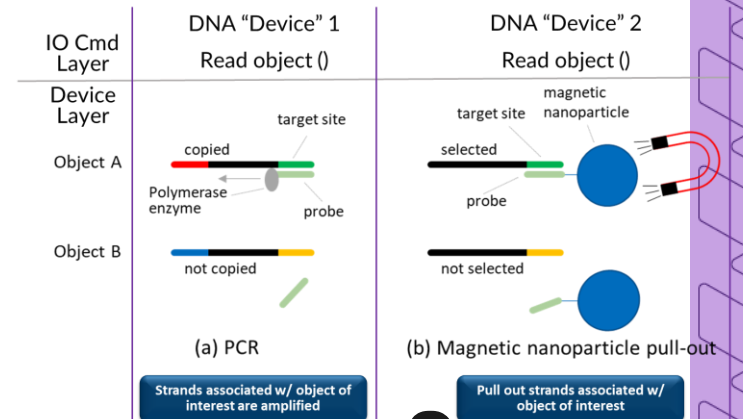
### Interoperability, Commercialization



### Data Retention

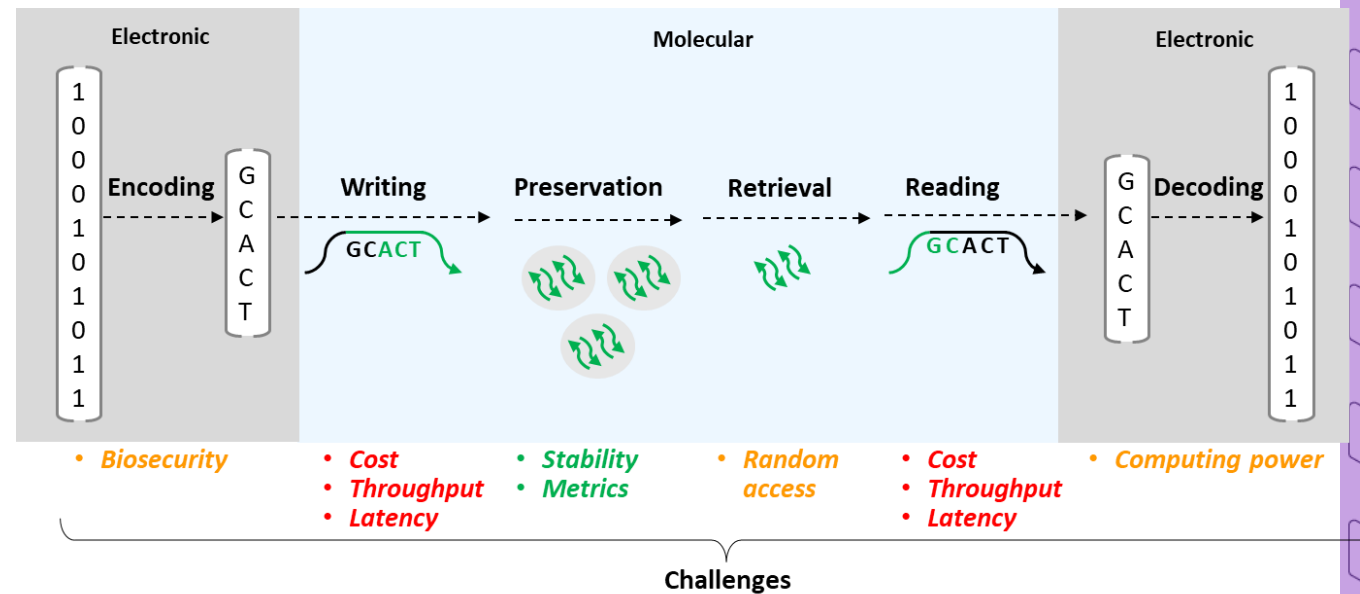


### Random Access

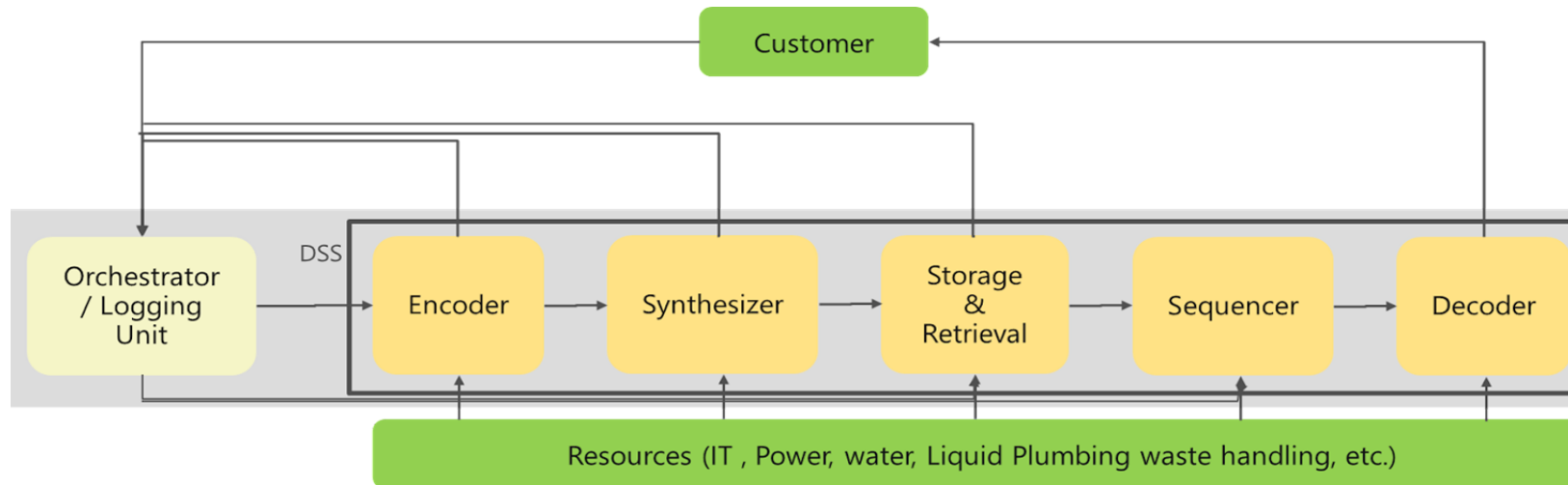


# DNA Data Storage: The basics

- Writing:
  - Take a data object and encode in DNA for long-term storage.
- Reading:
  - Decode and reassemble:  
Read / rewrite

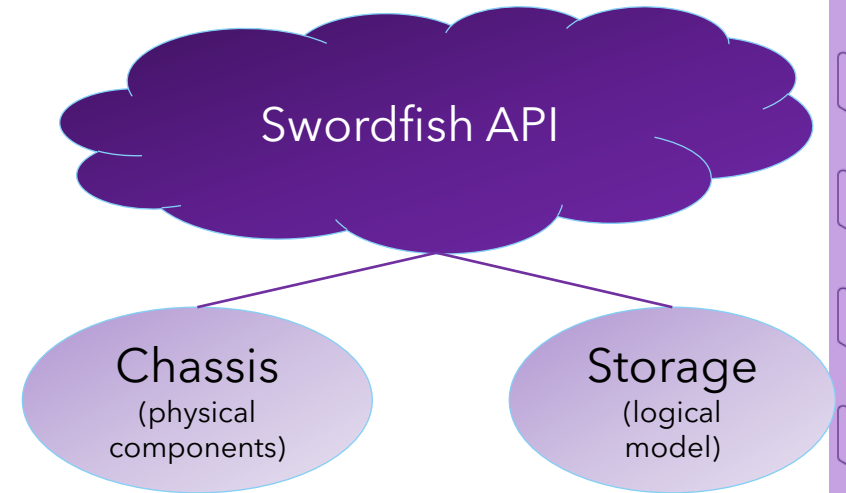
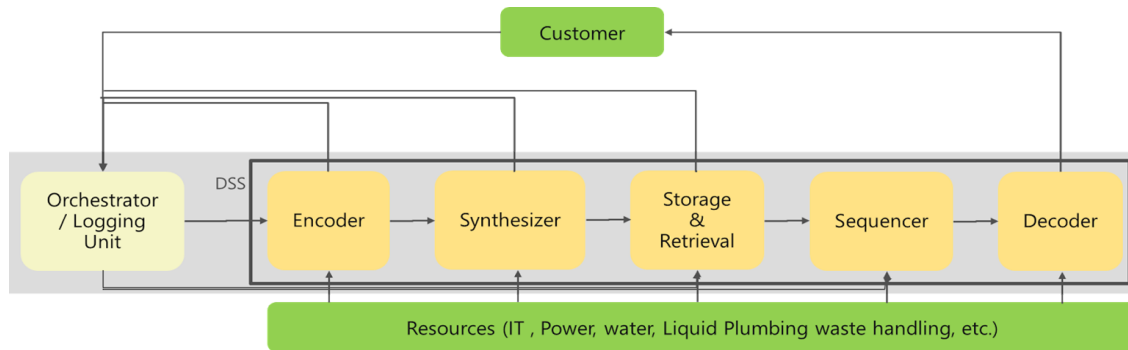


# DNA Data Storage: Standardizing the workflow



- Defines the common elements used in the process, including standardization of terminology
- Use cases include enterprise deployments with standards-based management through SNIA Swordfish

# Creating a Standards-based Interface



- Approach to extend SNIA Swordfish to manage / monitor DNA Data Storage systems:
  - Starting with data center primary functionality, map to equivalent Swordfish resources, create new where needed; adding Object stores to Swordfish, plus DNA process resources

# DNA Data Storage Resources Mapping to RF/SF

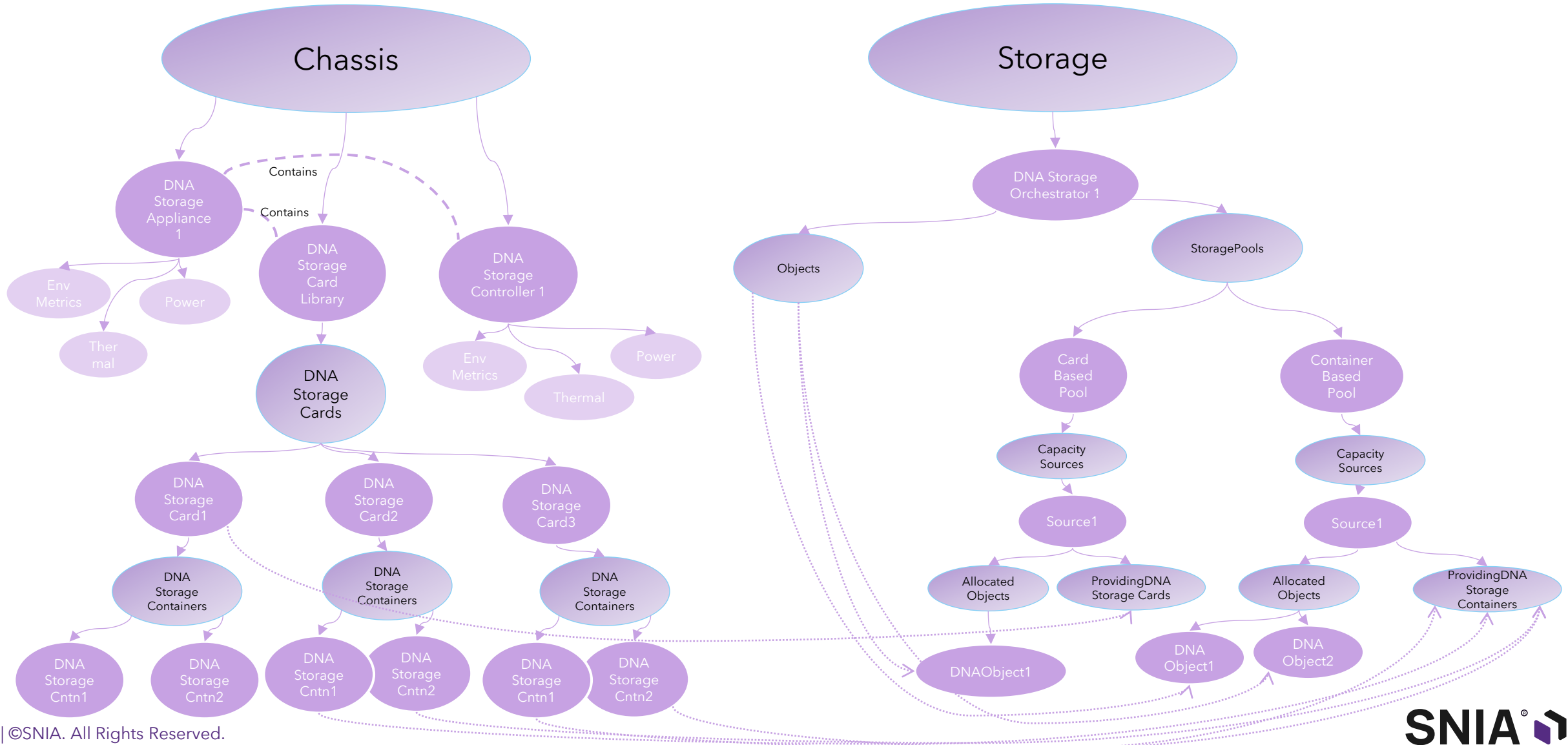
## Physical Components:

- DNA card with discrete DNA storage areas (e.g., wells) -> DNACard containing DNAStorageContainers
- DNA Card Library
  - Storage device for multiple DNA cards
- DNA Writer/Reader -> DNA Controller

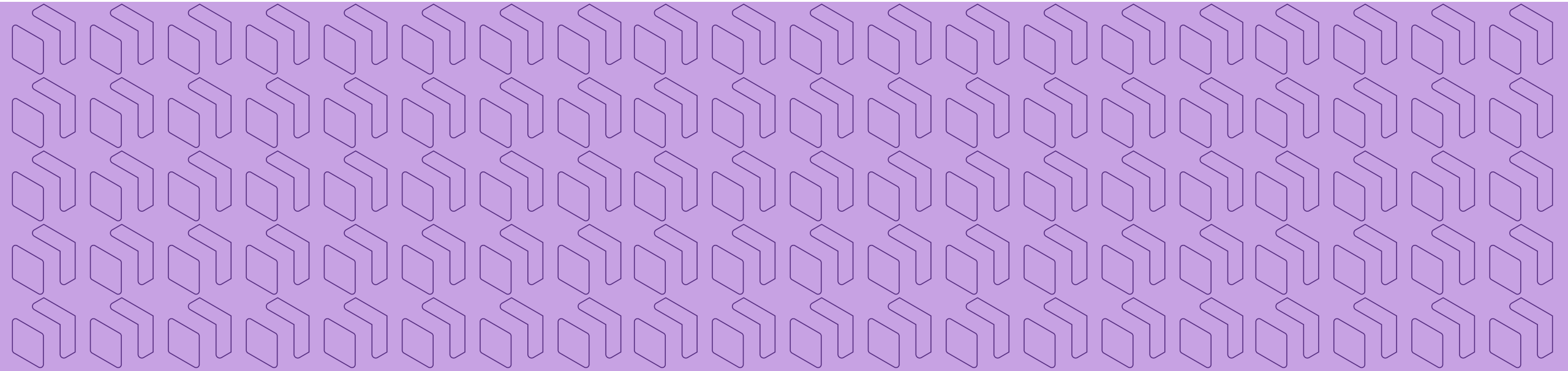
## Logical Components:

- DNA Storage Orchestrator (instrumented as Storage system)
  - Storage entity containing object stores
- ObjectStore (instrumented as Object)
  - Logical object, containing data and metadata, comprised of a collection of DNA Storage Containers
- Storage Pools
  - Defines relationships between containers
  - Contains usage information for contained elements, such as Allocated Object Stores, remaining capacity

# Mockup Representation



# Additions to Schema



# New Schema Added

- DNASTorageCards
- DNASTorageContainer
- Object

# DNA Storage Cards

- Unique properties:
- "MediaType": "SyntheticDNA"
- "ContainerSizeGB"
- "StorageContainerMapTypeSupported": ["Grid", "Linear"],
- "SealingMethodsSupported": ["HeatSeal"],

# DNA Storage Containers

- Unique properties:
  - "MediaType": "SyntheticDNA",
  - "ContainerSizeMB"
  - "StorageContainerMapType": "Grid",
  - "SealingMethod": "HeatSeal",
  - "LastWrittenTime": "2024-06-01T12:00:00Z",
  - "Lifetime": {
    - "AccessCountTotal": 100,
    - "CurrentAccessCount": 8
  - },
  - "DNAStorageContainerState": "Allocated",
  - "WellState": "InUse",
  - "IsCloned": true,
  - "Clones"

# Object

- ▣ Unique Properties:
  - ▣ "ObjectType": "DNA",
  - ▣ "DNADataStorage": [
    - ▣ {
    - ▣ "ResilienceLevel": "SingleClone"
    - ▣ }
  - ▣ ],