

# Toward **Open** **Object-Based Computational Storage** For **Analysis** **Query Pushdown**

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# 3 Things About Scientific Data Analytics

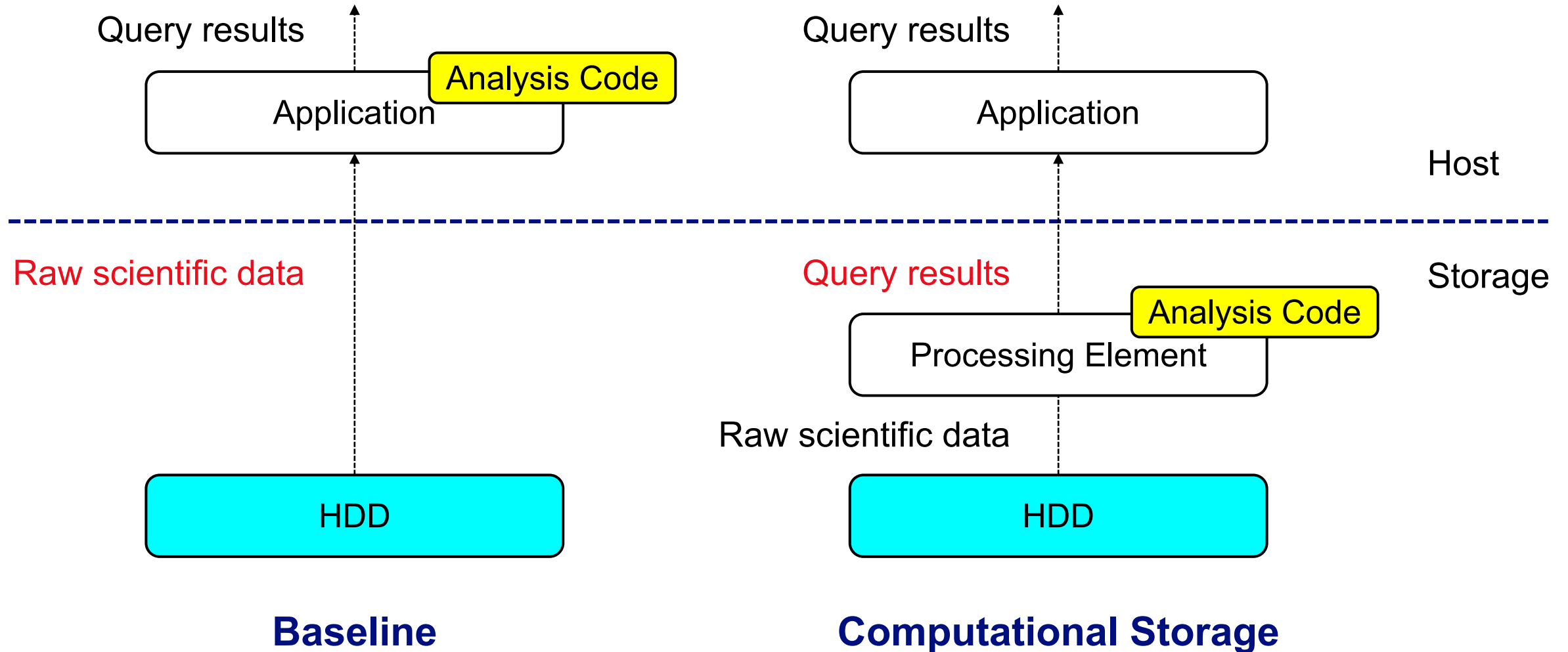
Data is big

Moving data is expensive

Queries often target a tiny portion of a large dataset



# Query Pushdown Through Computational Storage



# Data Agnostic vs Data Aware Offloads

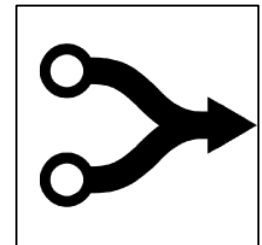
## Data Agnostic

- Storage does not know what's in the data (view data as byte streams)
  - Like what POSIX filesystems do today
- Example offloads: data compression, encryption, custom risc-v, eBPF functions

This effort will use the data aware approach

## Data Aware

- Storage and apps agree on a data format (e.g., Apache Parquet) and a query format (e.g., Substrait)



# Storage Interface: Block? KV? Object?

## Block

- Best for **data agnostic operations**  
(compression, encryption)

## KV

- Best for **row-based** applications such as  
various particle codes

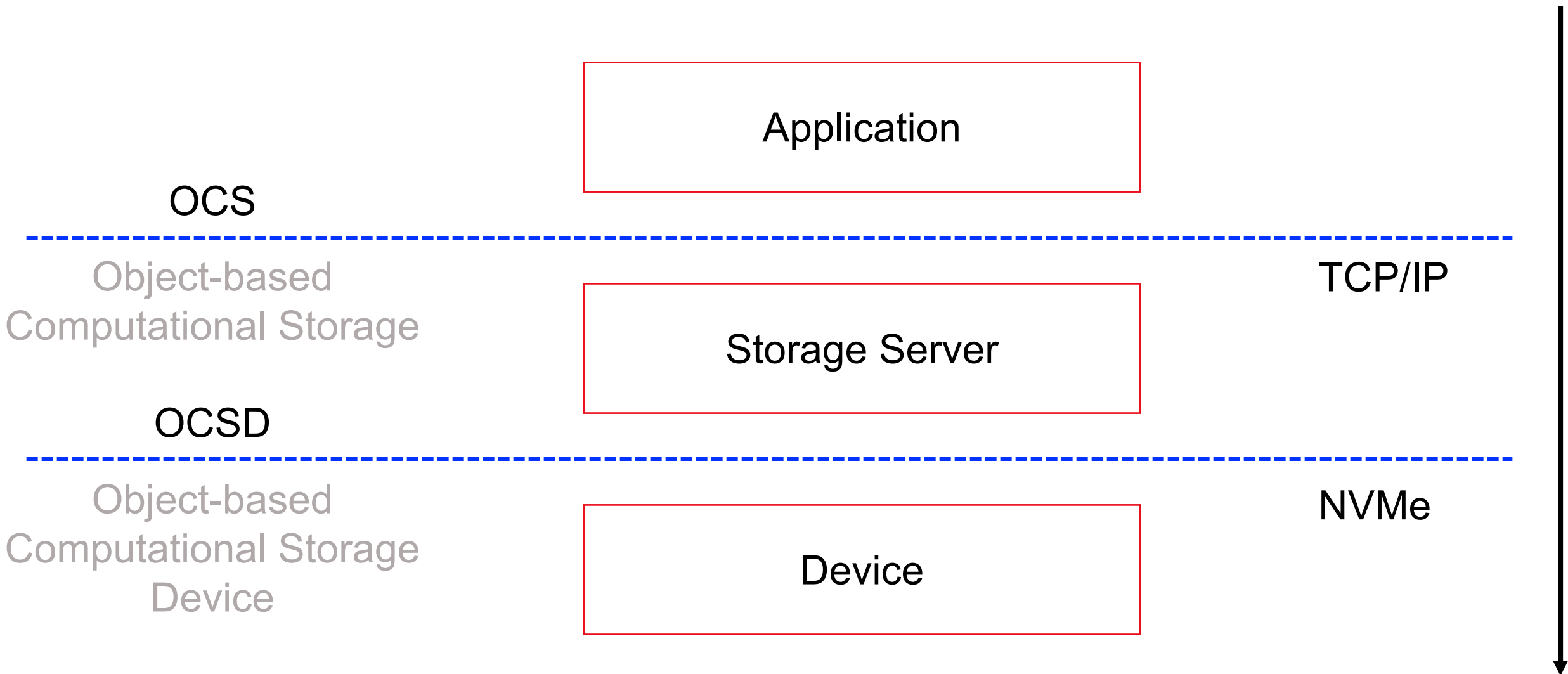
## Object (think of each as a Parquet fragment)

- Enable **columnar** analytics often seen in grid-based codes

Prior work at Los Alamos looked at these (ZIA, KV-CSD, C2) in collaboration with Aeon, Eideticom, Nvidia, SK hynix, Seagate

# Standardization

Query Pushdown



# Industry Partners

OCS

Neuroblade

Presto

S3 Client

Object-based  
Computational Storage

OCSD

AirMettle

Versity

Neuroblade

TCP/IP

Object-based  
Computational Storage  
Device

SK hynix

Neuroblade

...

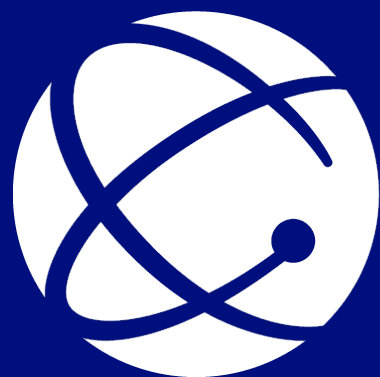
NVMe-OF

The background of the entire image is a black and white photograph of a total solar eclipse. A large, perfectly black circle representing the Moon is positioned on the right side, completely obscuring the bright disk of the Sun. A soft, white glow surrounds the black circle, indicating the Sun's corona. The background is filled with numerous small, white stars of varying brightness, creating a deep space atmosphere.

# **LANL/SK hynix Demo at Exhibition Hall**

**Booth #2101**





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