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Toward Open Object-Based Computational Storage For Analysis Query Pushdown

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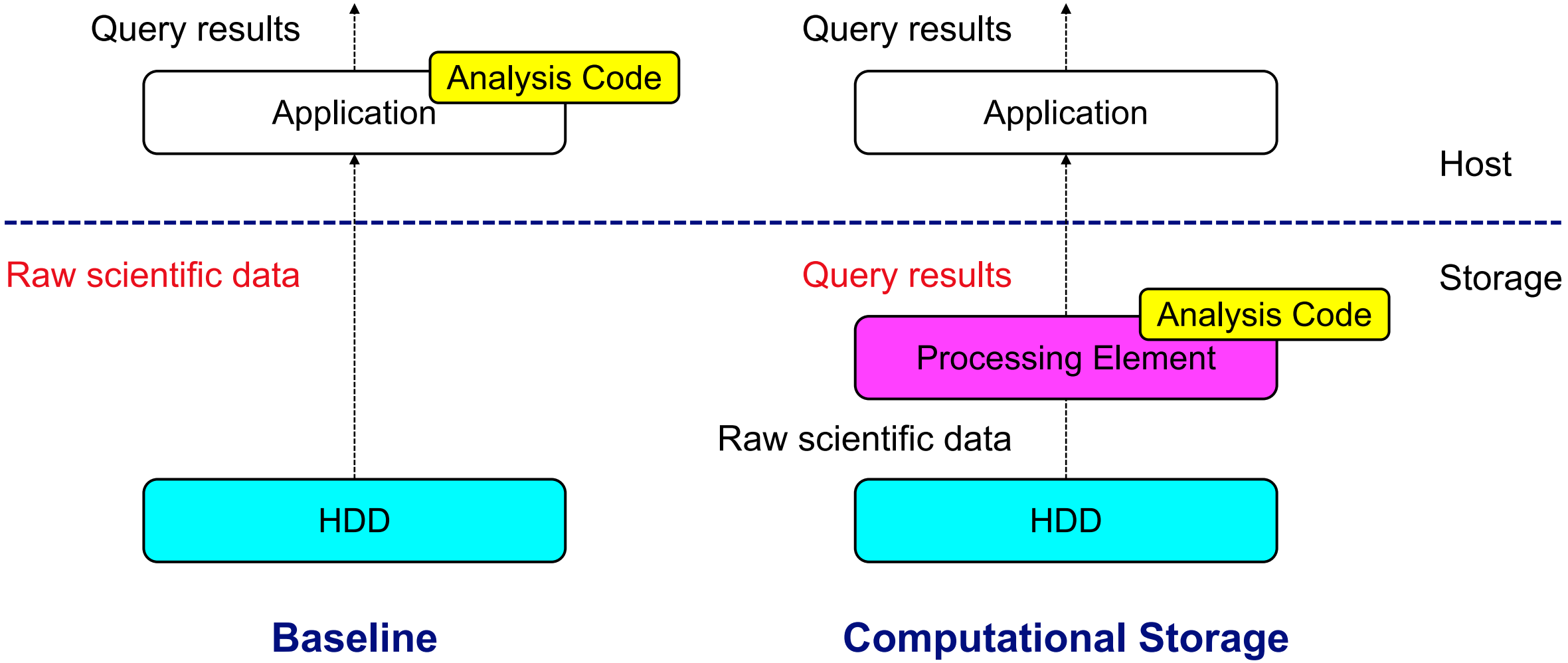
3 Things About Scientific Data Analytics

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

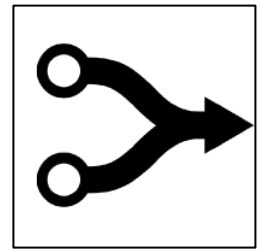
Data Agnostic

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

This project 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

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

KV

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

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

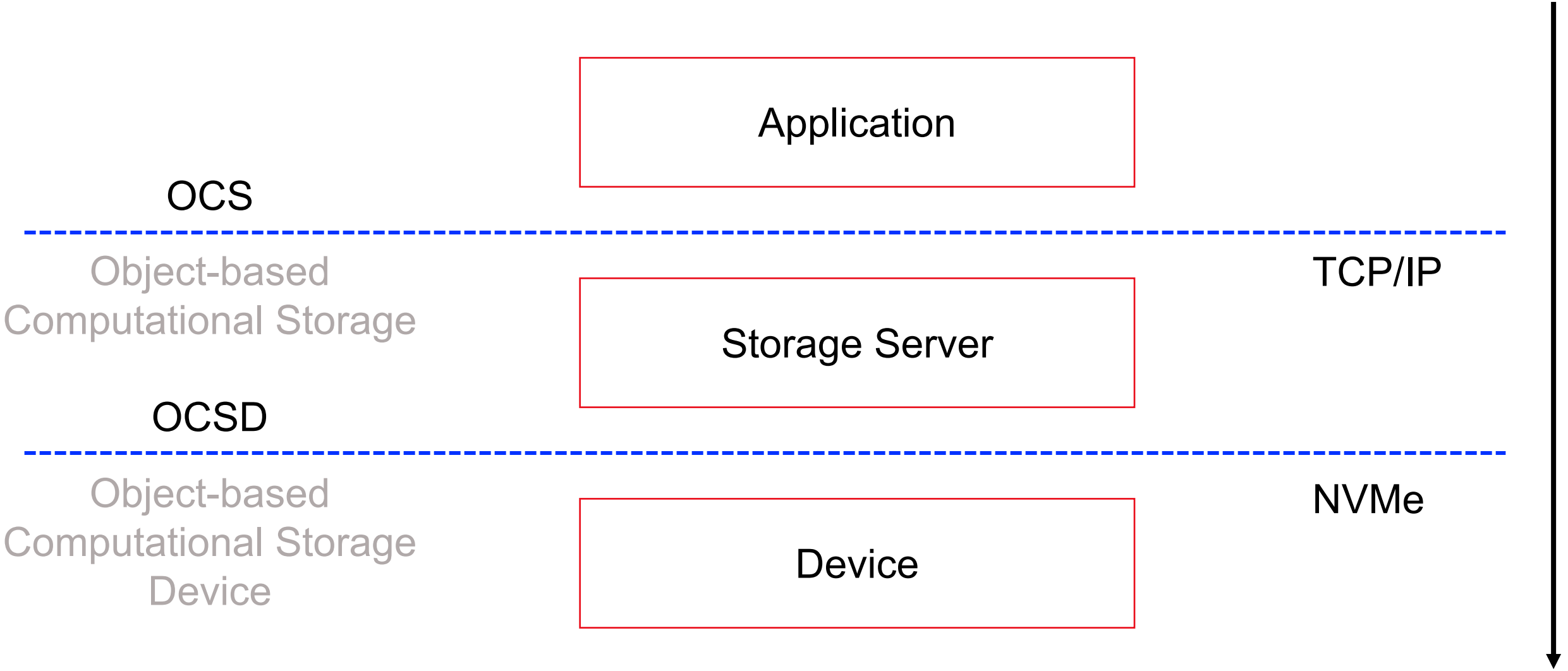
Object (think of each as a Parquet fragment)

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

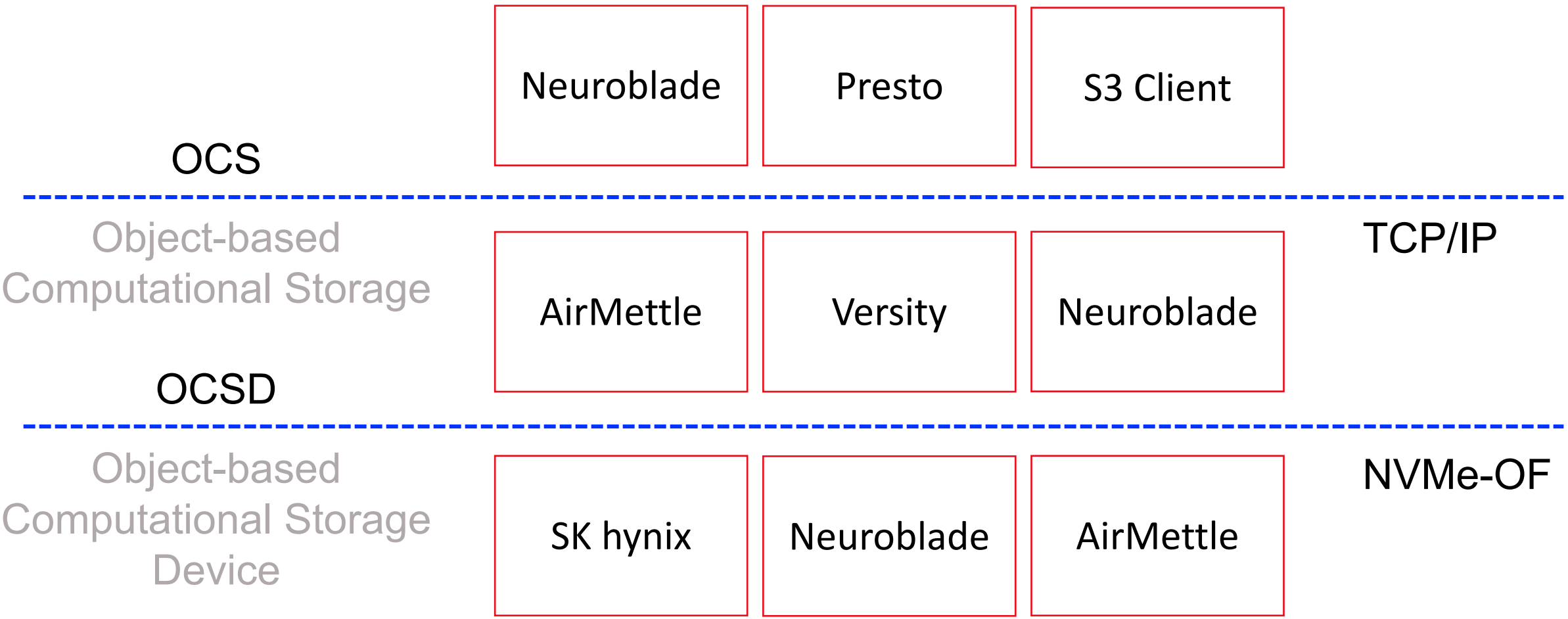
This project will use objects

Standardization

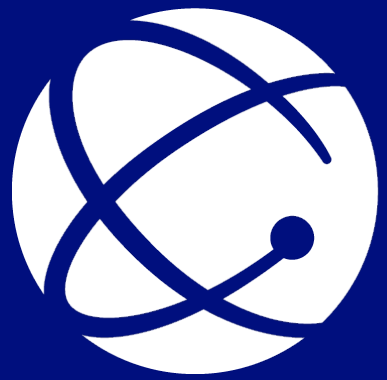
Query Pushdown



Industry Partners



LANL/SK hynix Demo
at Exhibition Hall
Booth #2101



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