AWS re:Invent

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NFX202

Netflix Drive: A cloud drive for end users

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Agenda

Netflix Drive: Introduction and motivation

Comparison with cloud file systems

Architecture overview

Use cases

Features

Performance

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Introduction and motivation

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What is Netflix Drive?

- Multi-interface, multi-OS cloud file system
- FUSE based
- REST API interface
- Capable of supporting disparate data, metadata, and event/ alerting backends

aws

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Motivations

- Asset metadata and data managed by disparate systems and services
- Studio applications expect POSIX file interface
- Studio workflow pipelines – move assets across stages of creative iterations
- Ephemeral project-level access controls

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Cloud file systems

A quick review and comparison

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Cloud file systems

- Namespace management
- Cloud data store and metadata store
  - Mapping files to objects
  - File may be split into multiple objects
  - File attributes: size, checksum, etc.
  - Streaming bytes to data store
- Encryption
- Access control and authentication

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Netflix Drive comparison

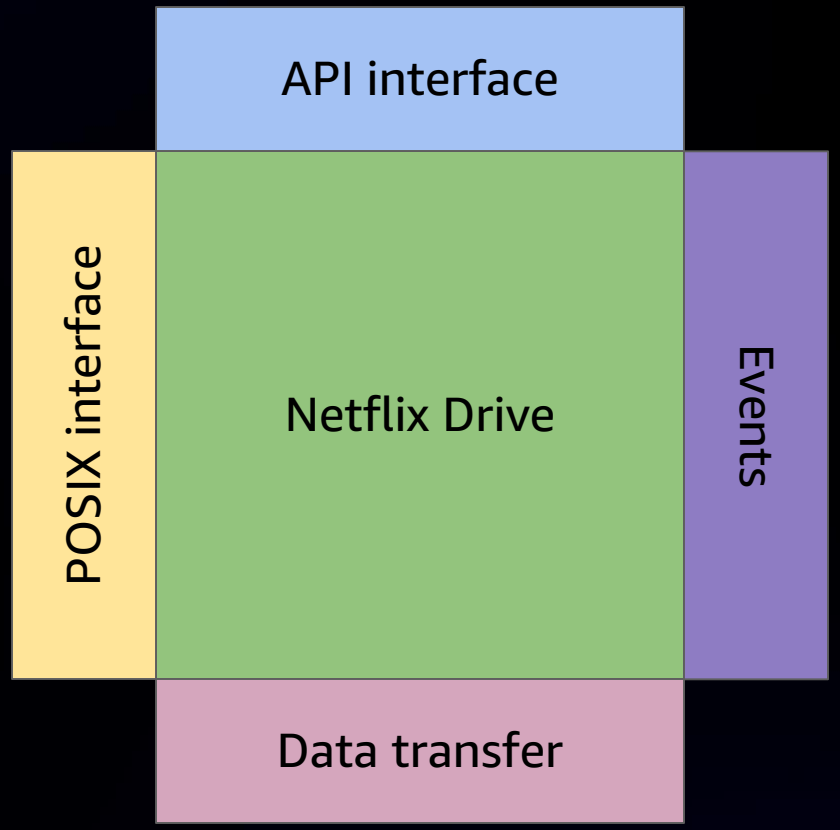
	Typical general-purpose cloud file systems	Netflix Drive
APIs	X	✓
Live file system	✓	✓
Use case–driven caching tiers	X	✓
Streaming support	✓	✓
Disparate data stores and metadata stores	X	✓
Access control and authentication	✓	✓

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Architecture overview

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Multi-interface design



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Architecture deep dive

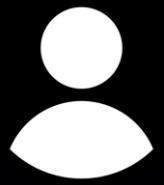
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POSIX interface

Application



User



Script/
workflow



Data and metadata operations

Read

Write

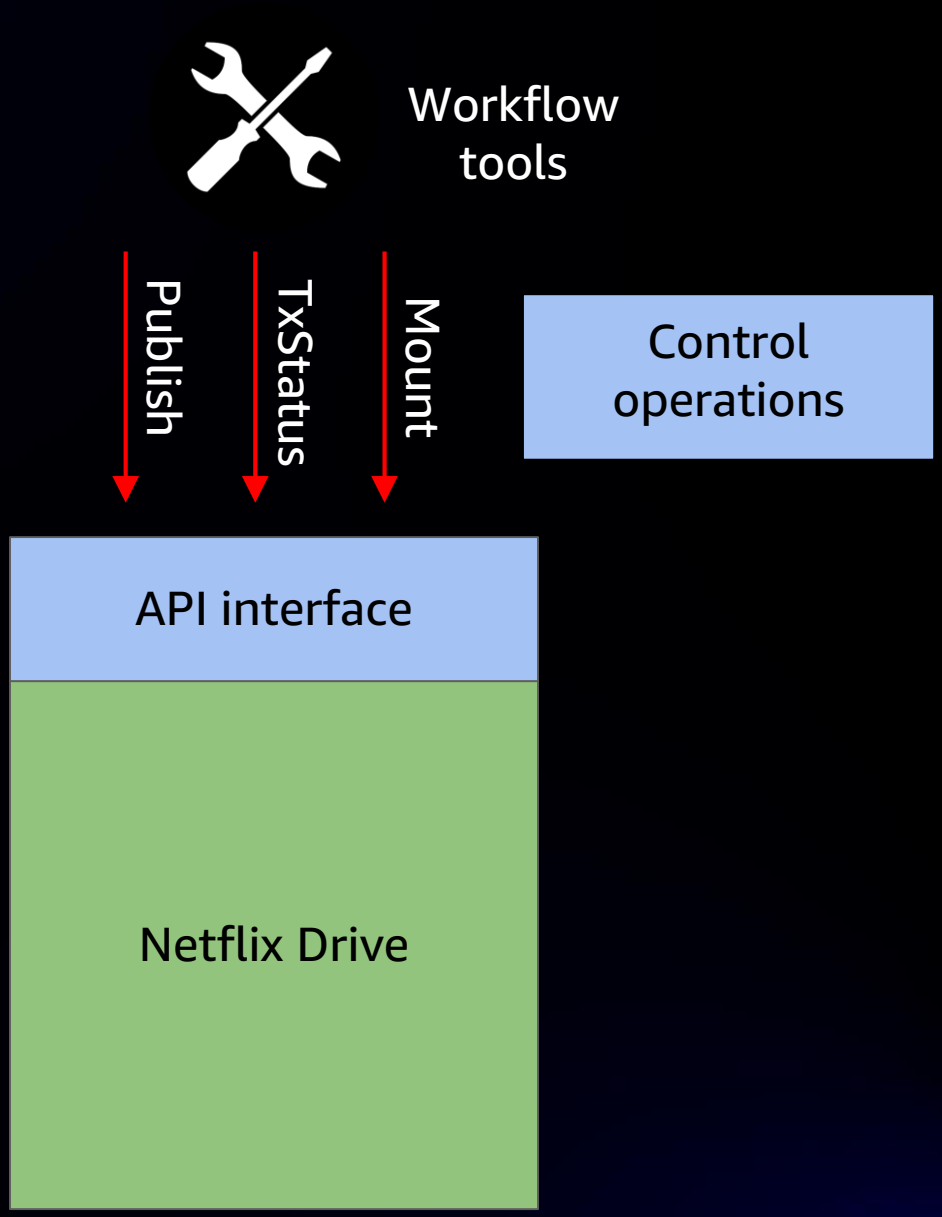
Create

POSIX interface

Netflix Drive

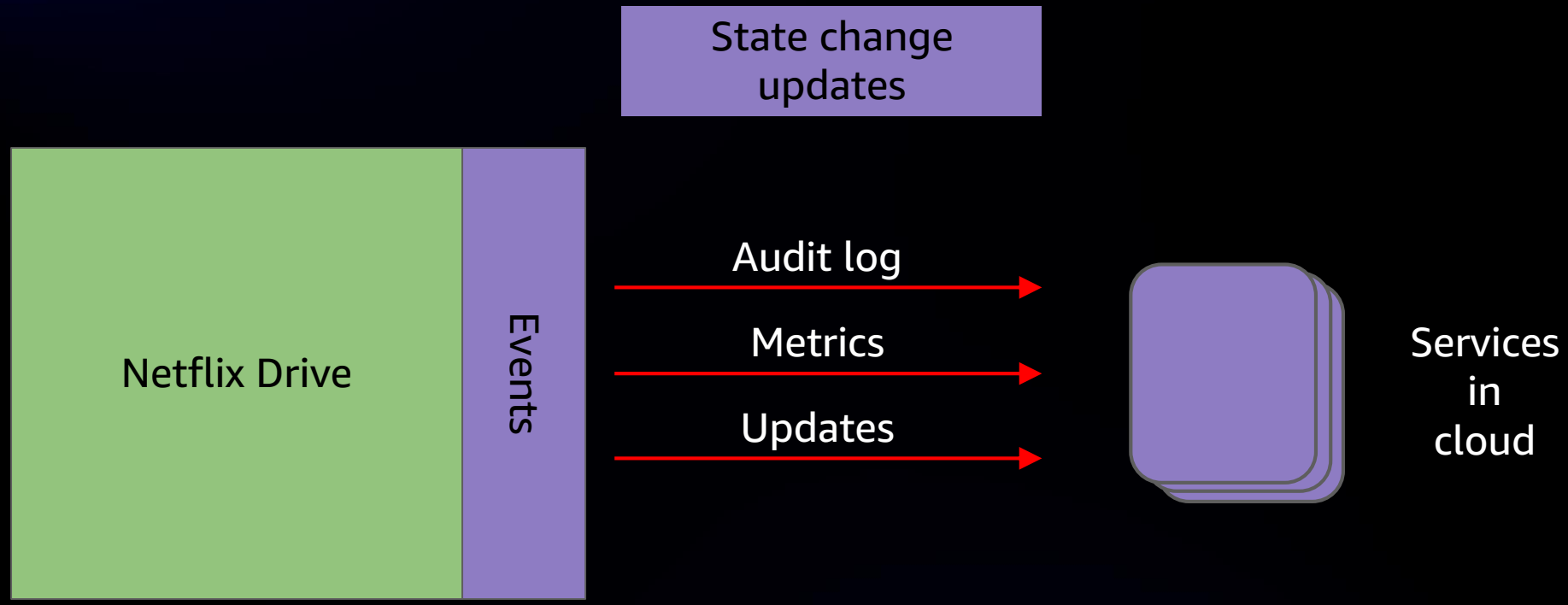
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API interface



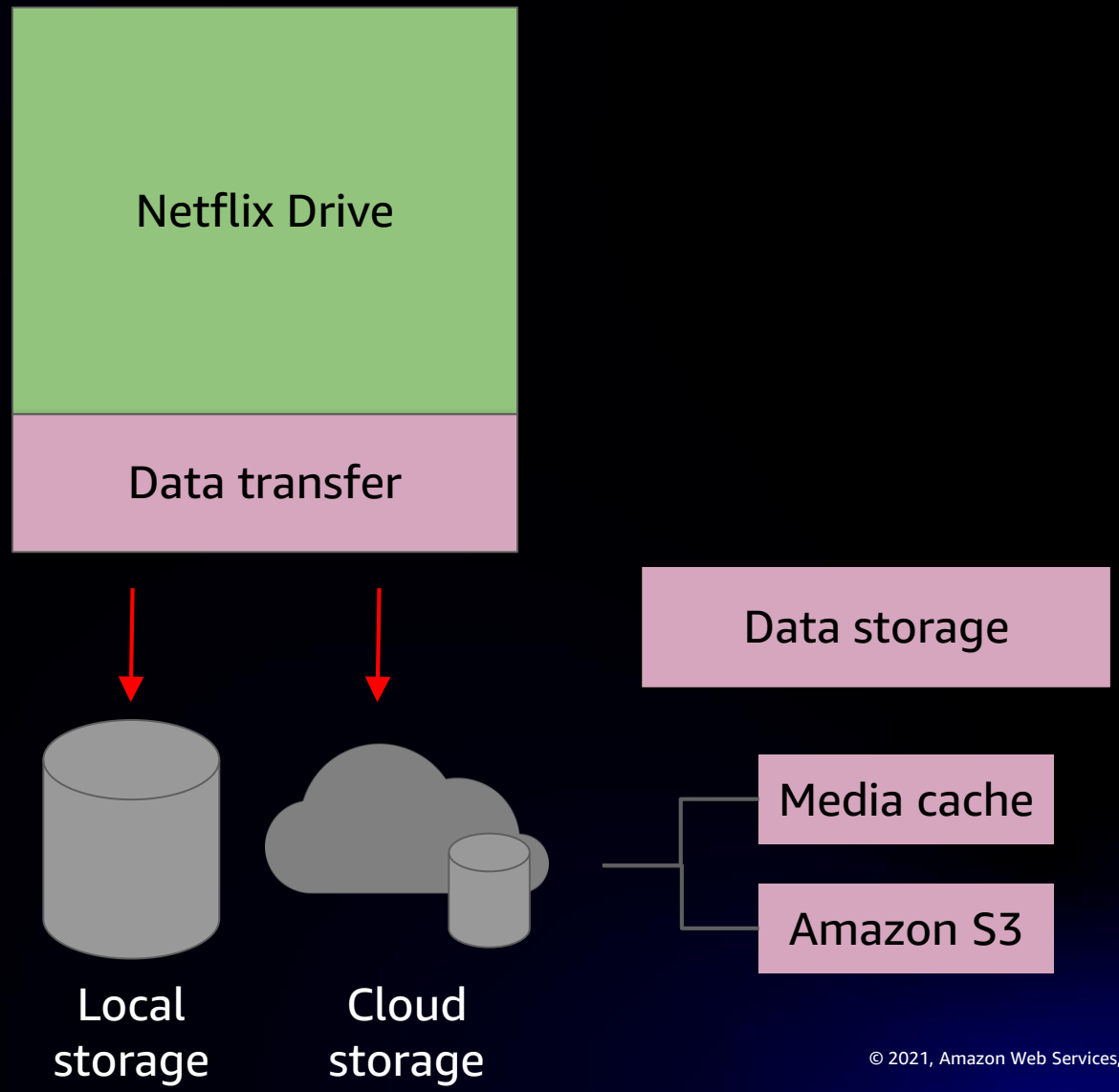
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Events



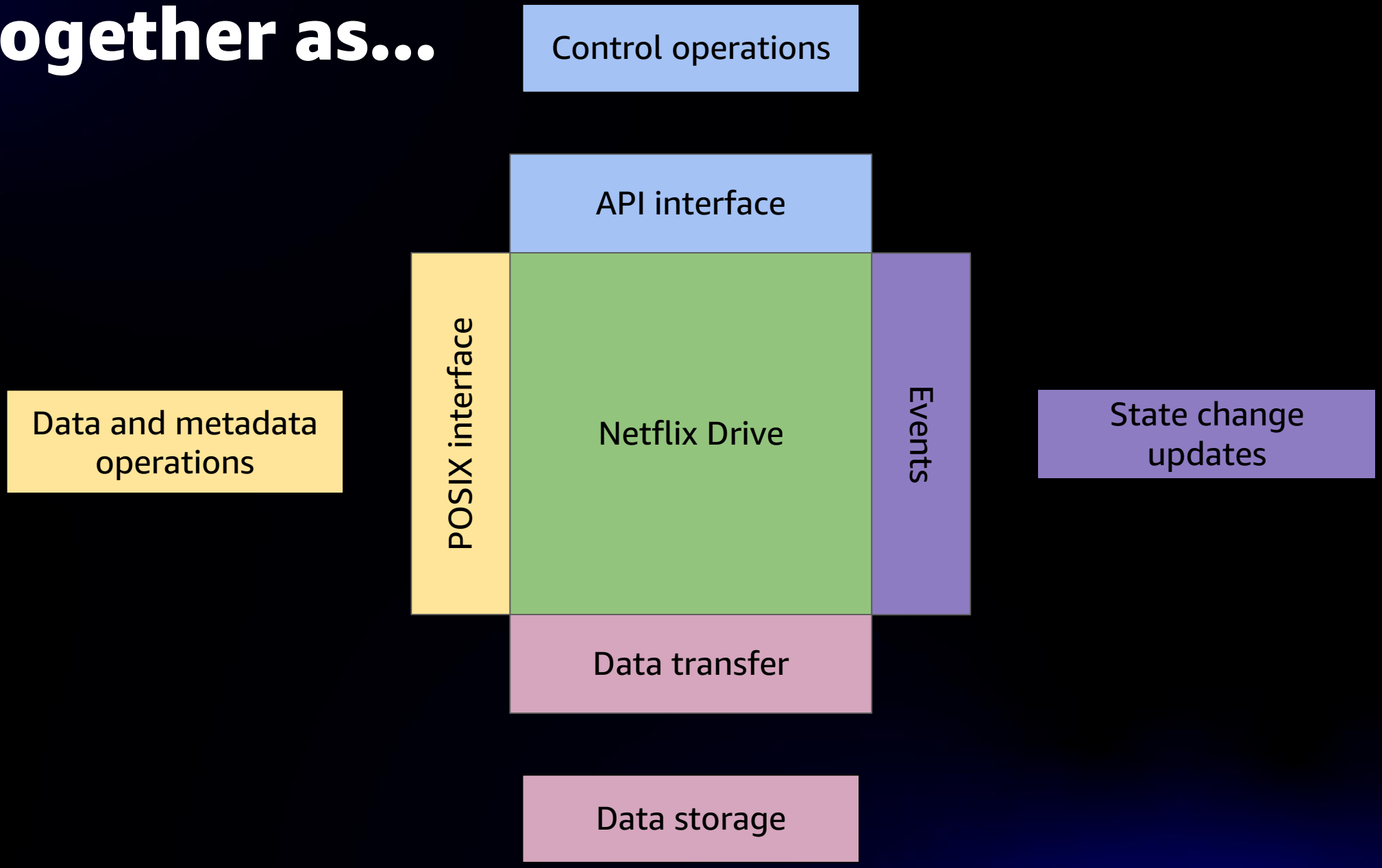
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Abstracted data transfer interface



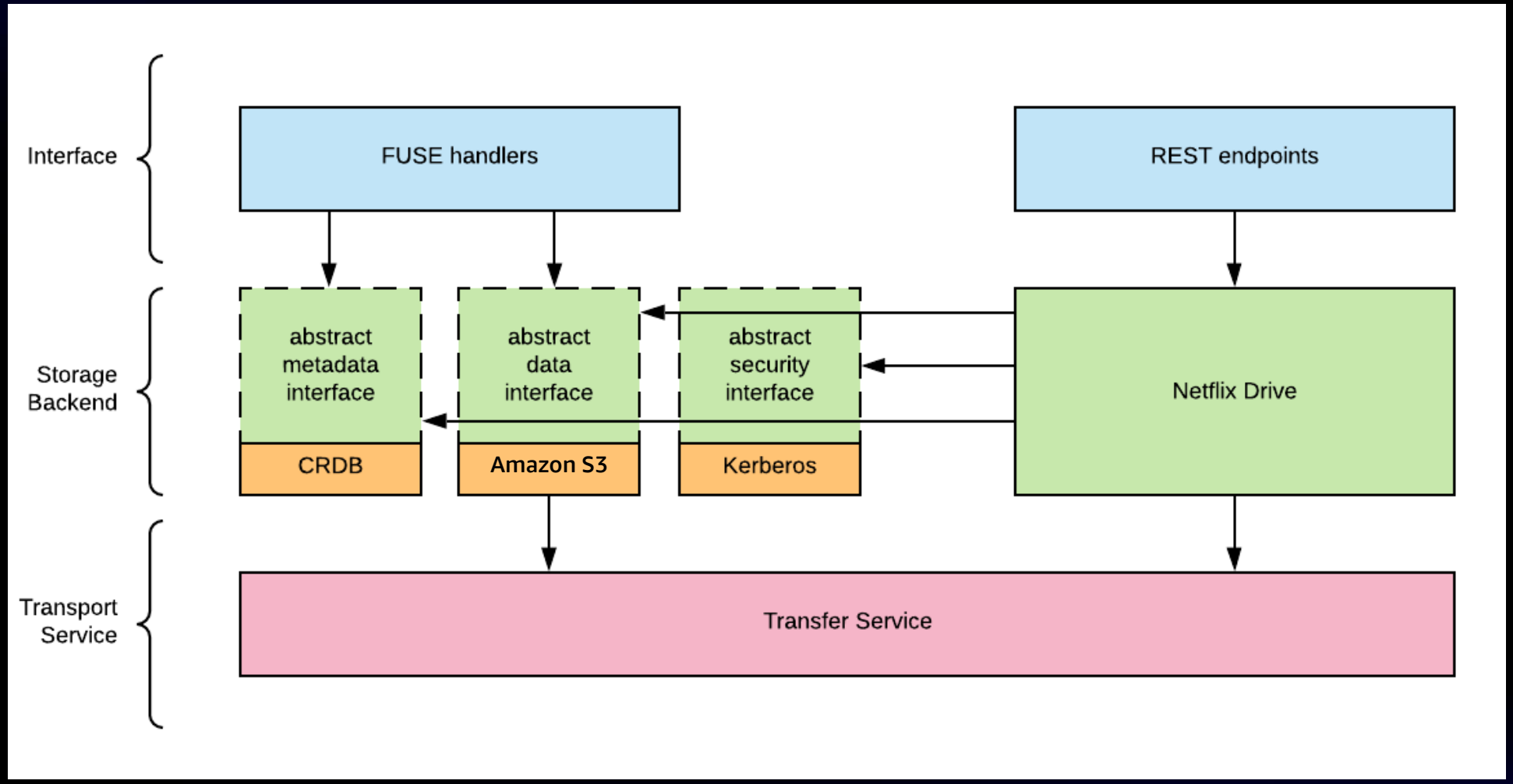
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Comes together as...



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Netflix Drive internals

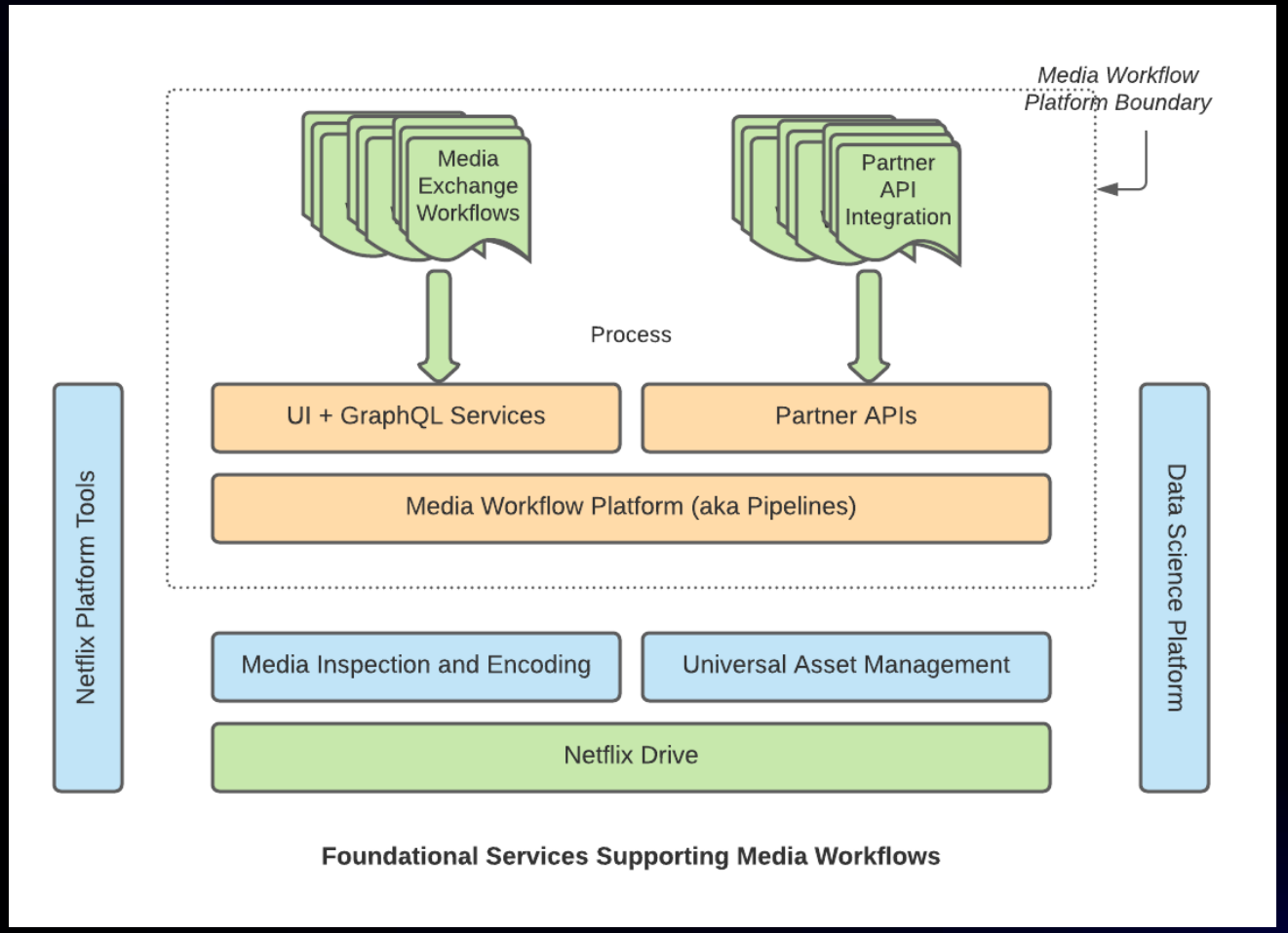


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Use cases

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Netflix context for storage in media workflows



Foundational Services Supporting Media Workflows

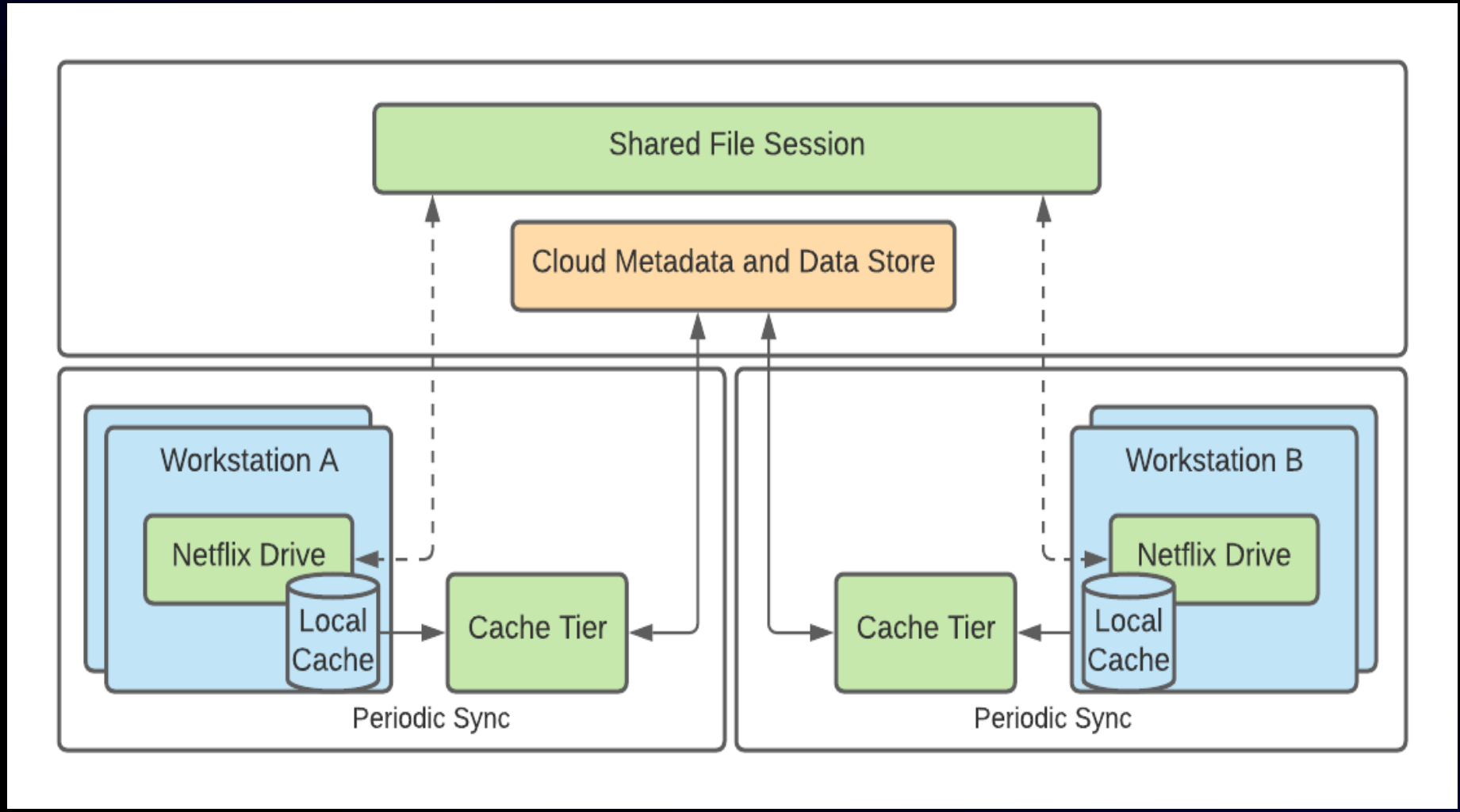
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Use case examples

- Artist workspace
- Software preferences
- Workflow-aware asset store
- Container cloud storage

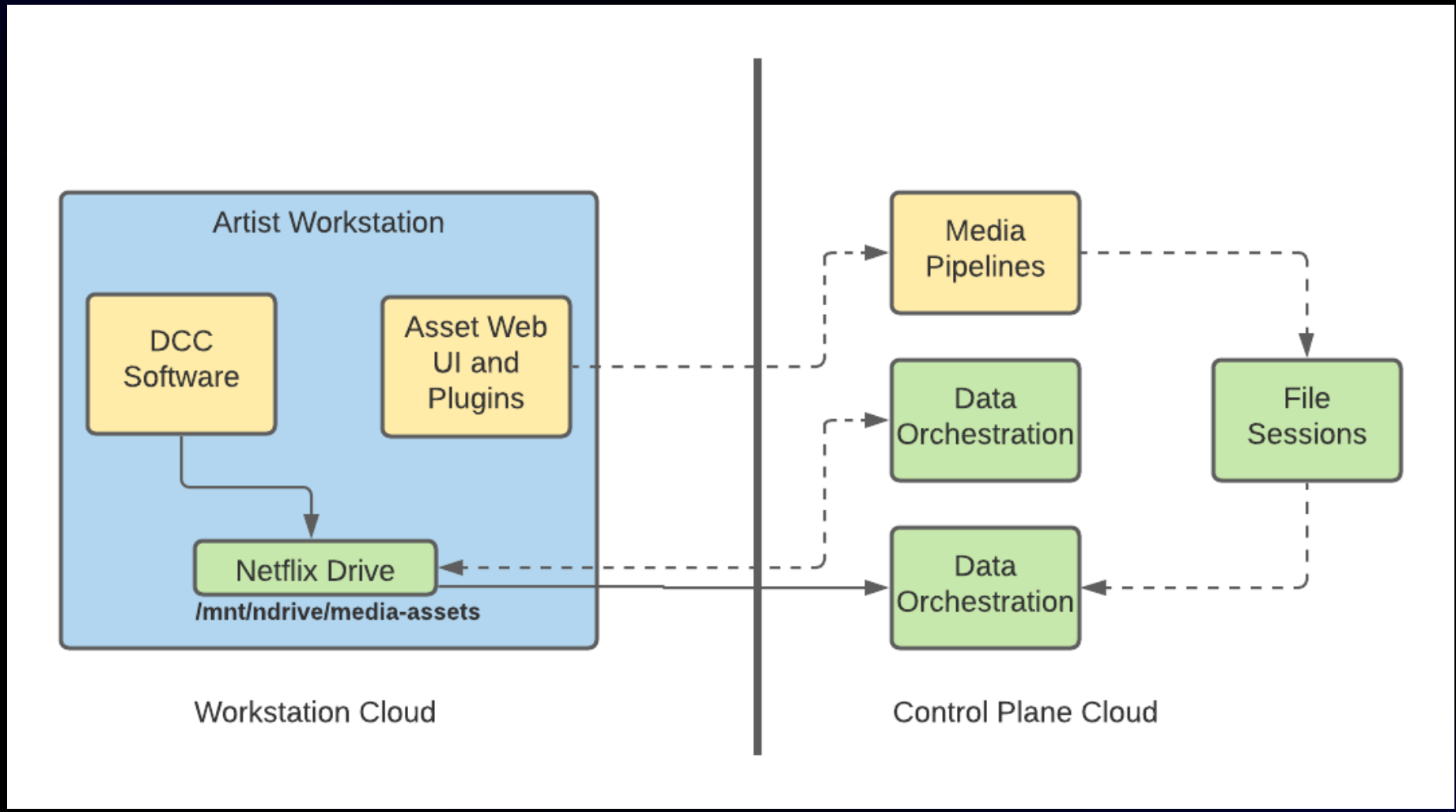
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Shared workspaces



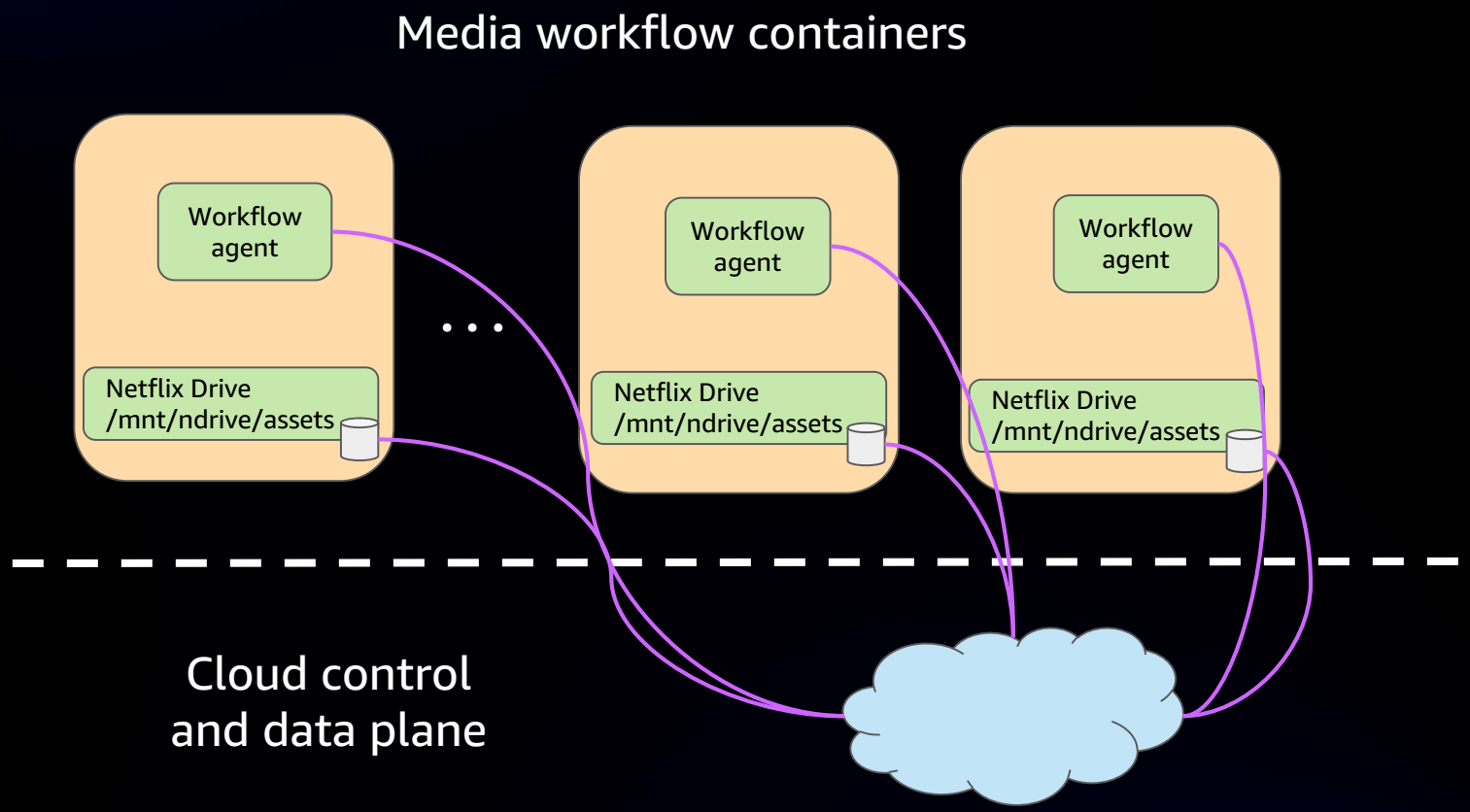
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Asset store



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Container cloud storage



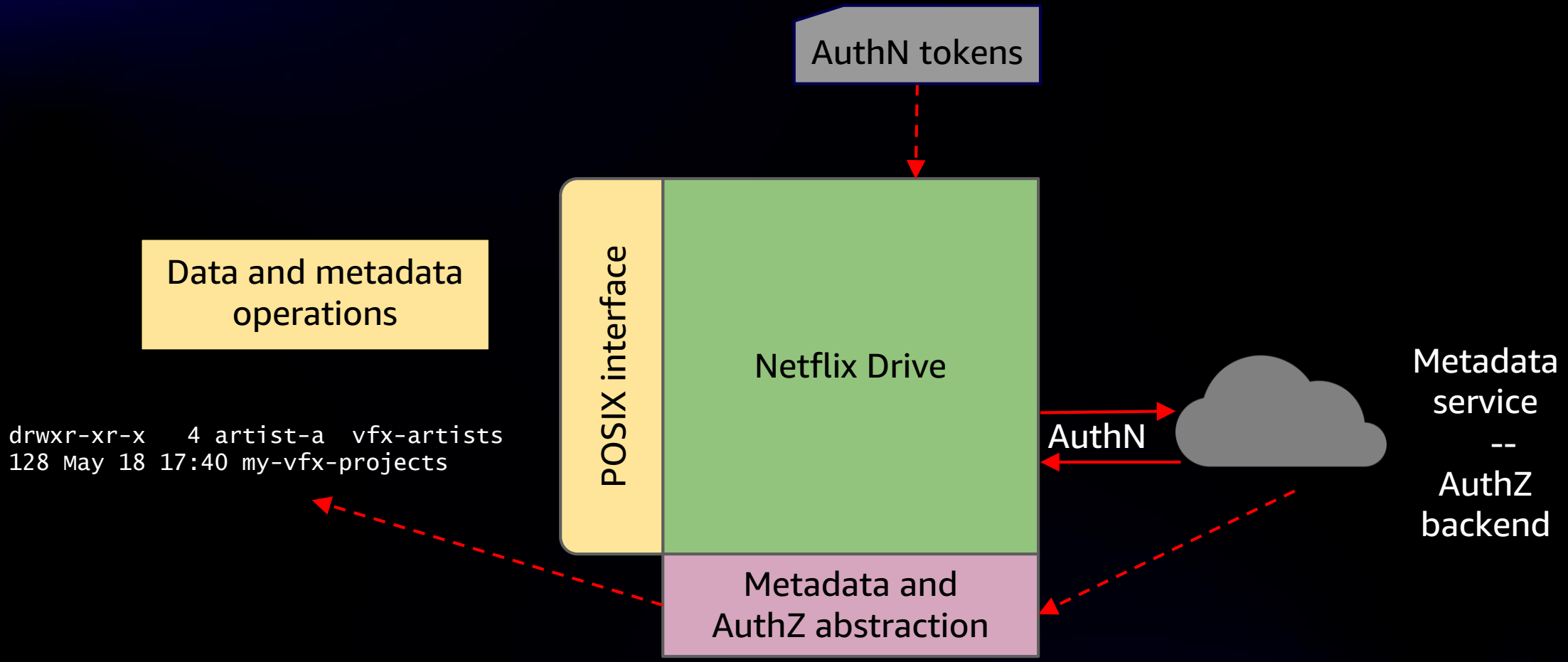
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Netflix Drive features

A peek into some distinguishing features

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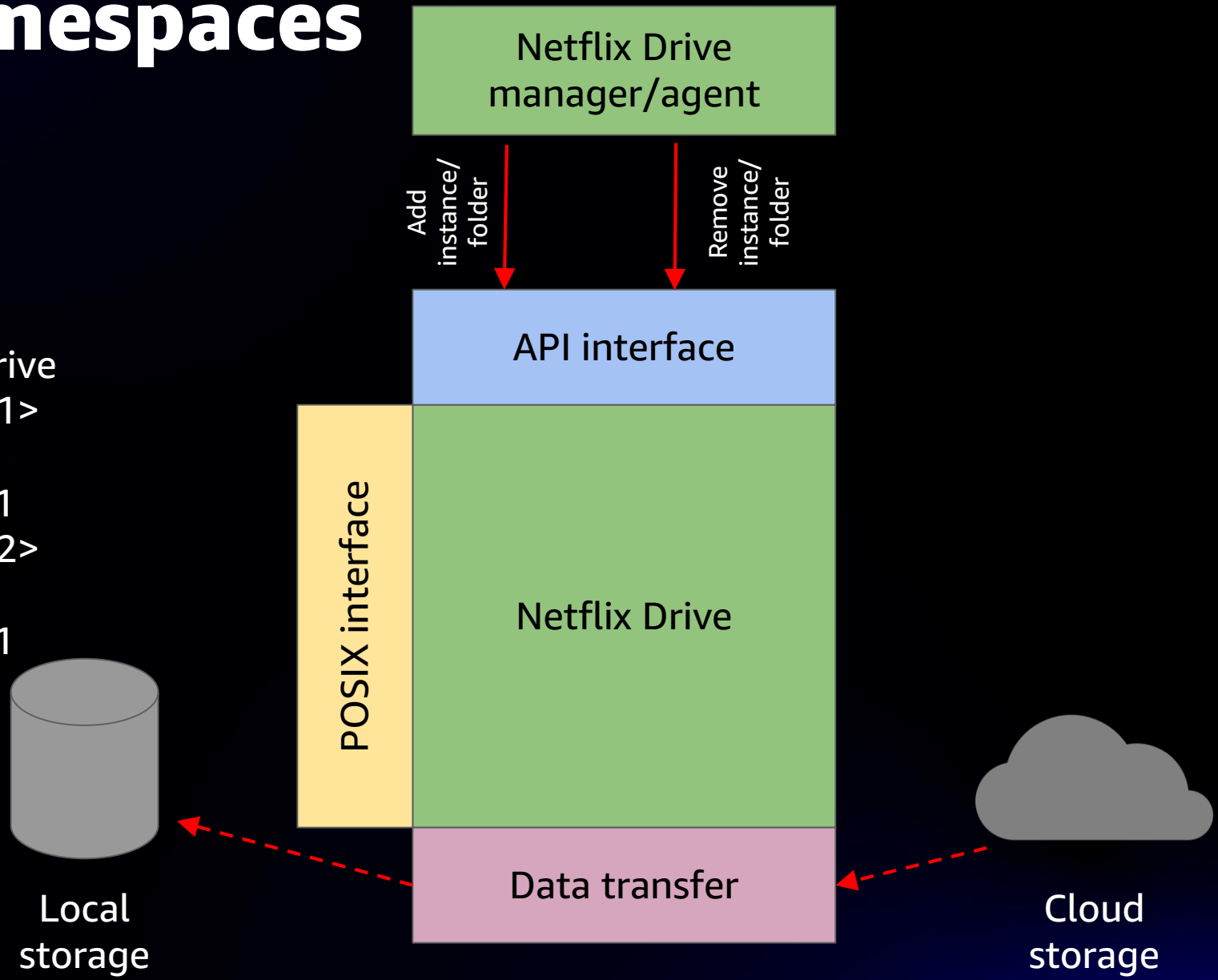
AuthN and AuthZ



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Dynamic namespaces

/mnt/netflix-drive
- <instance-1>
  - dir-1.1
  - file-1.1
- <instance-2>
  - dir-2.1
  - file-2.1
- ...



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Multiple instances during bootstrap

```
"instances":[
   {
      // Metadata store: Redis
      "metadataStoreUrl":"redis.netflix.test.com",
      // Data store: S3
      "dataStoreUrl":"s3.netflix.test.com",
      // Unique workspace for data persistence
      "filespace":"redis-s3-store",
      // User security certificate & keys
      "sslCertPath":"/certs/user.crt",
      "sslKeyPath":"/certs/user.key",
      // Optional nodes that Netflix Drive may want to prefetch
      // upon startup
      "nodes":[

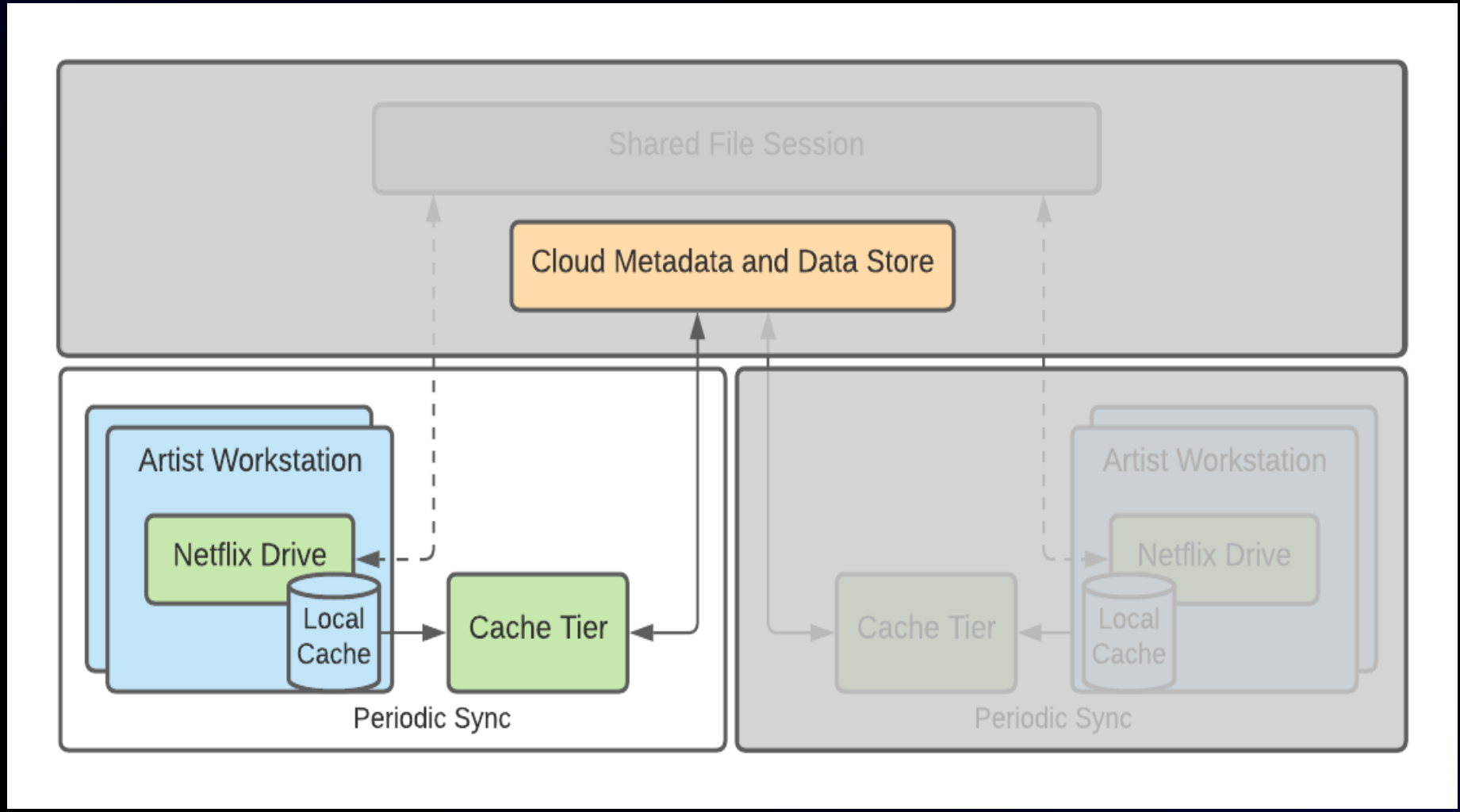
      ],
      // Instance type: dynamic, user, etc.
      "instanceType":"dynamic"
   },
```

```
   {
      // Metadata store: CockroachDB
      "metadataStoreUrl":"crdb.netflix.test.com",
      // Data store: Ceph
      "dataStoreUrl":"ceph.netflix.test.com",
      // Unique workspace for data persistence
      "filespace":"crdb-ceph-store",
      // User security certificate & keys
      "sslCertPath":"/certs/user.crt",
      "sslKeyPath":"/certs/user.key",
      // Optional nodes that Netflix Drive may want to prefetch
      // upon startup
      "nodes":[

      ],
      // Instance type: dynamic, user, etc.
      "instanceType":"user"
   }
]
```

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Tiered caching



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APIs

Static Namespace

```
{
  "localFileStore": "/tmp/ndrive-cache",
  "hostOs": "centos",
  "instances": [
    {
      "dataStoreUrl": "https://ds.netflix.net",
      "metadataStoreUrl": "https://mds.netflix.net",
      "taskDispatcherType": "orchestrator",
      "taskDispatcherUrl": "https://task-manager-service.netflix.net",
      "rootUser": "studio-user-joe@netflix.com",
      "rootName": "project",
      "nodes": [
           "a1b1",
           "a2b2",
           "a3b3",
      ],
      "sslCertPath": "/local-cert-store/user.crt",
      "sslKeyPath" : "/local-cert-store/user.key"
    }
  ]
}
```

Dynamic Namespace

```
http://localhost:9999/api/v1/stage
{
          [
                    {
                              "metadataNodeId": "a1b1",
                              "relPath": "project/chair.mb",
                    },
                    {
                              "metadataNodeId": "a2b2",
                              "relPath": "project/table.mb",
                    },
                    {
                              "metadataNodeId": "a3b3",
                              "relPath": "project/mat.mb",
                    }
          ]

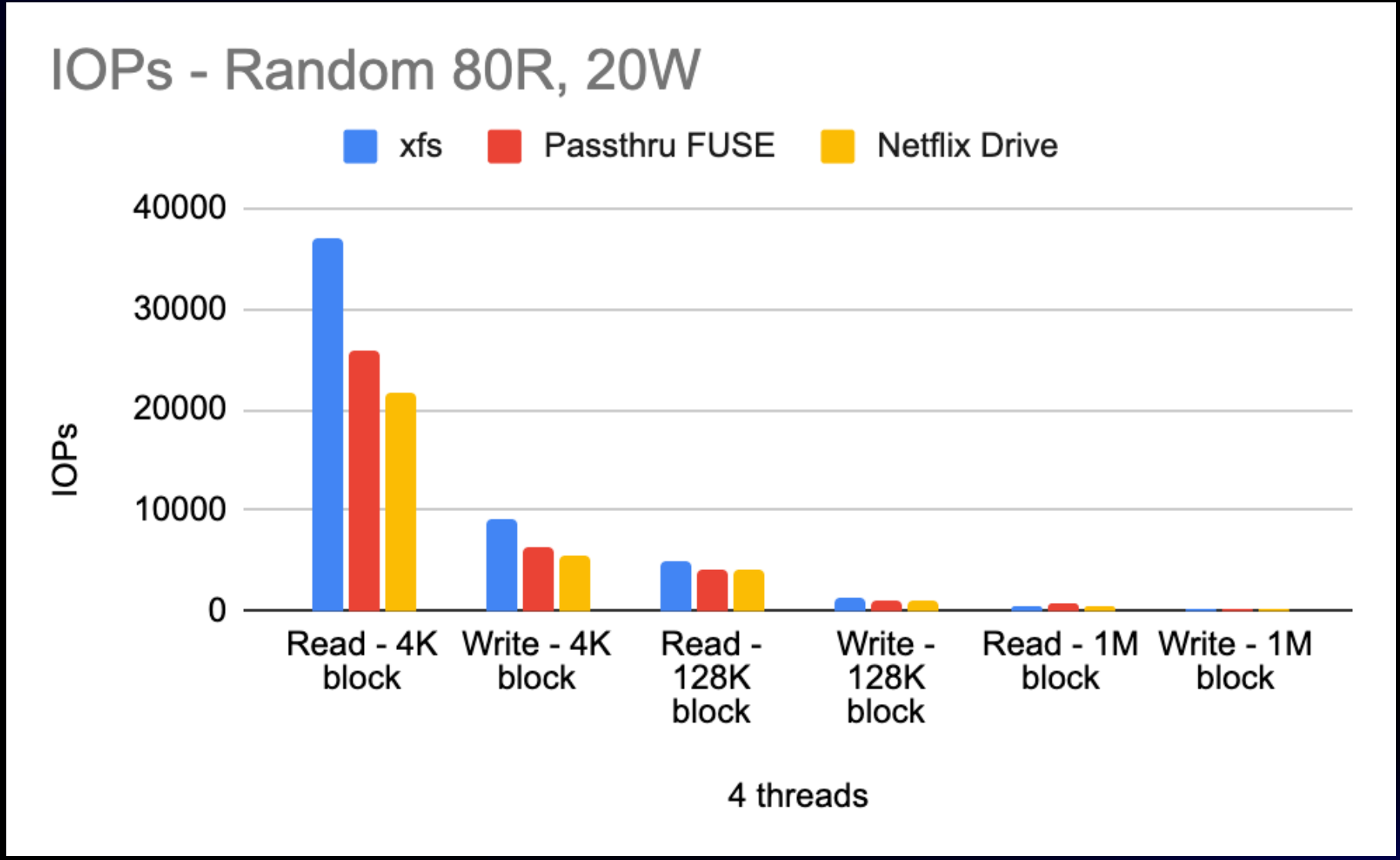
}
```

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Performance

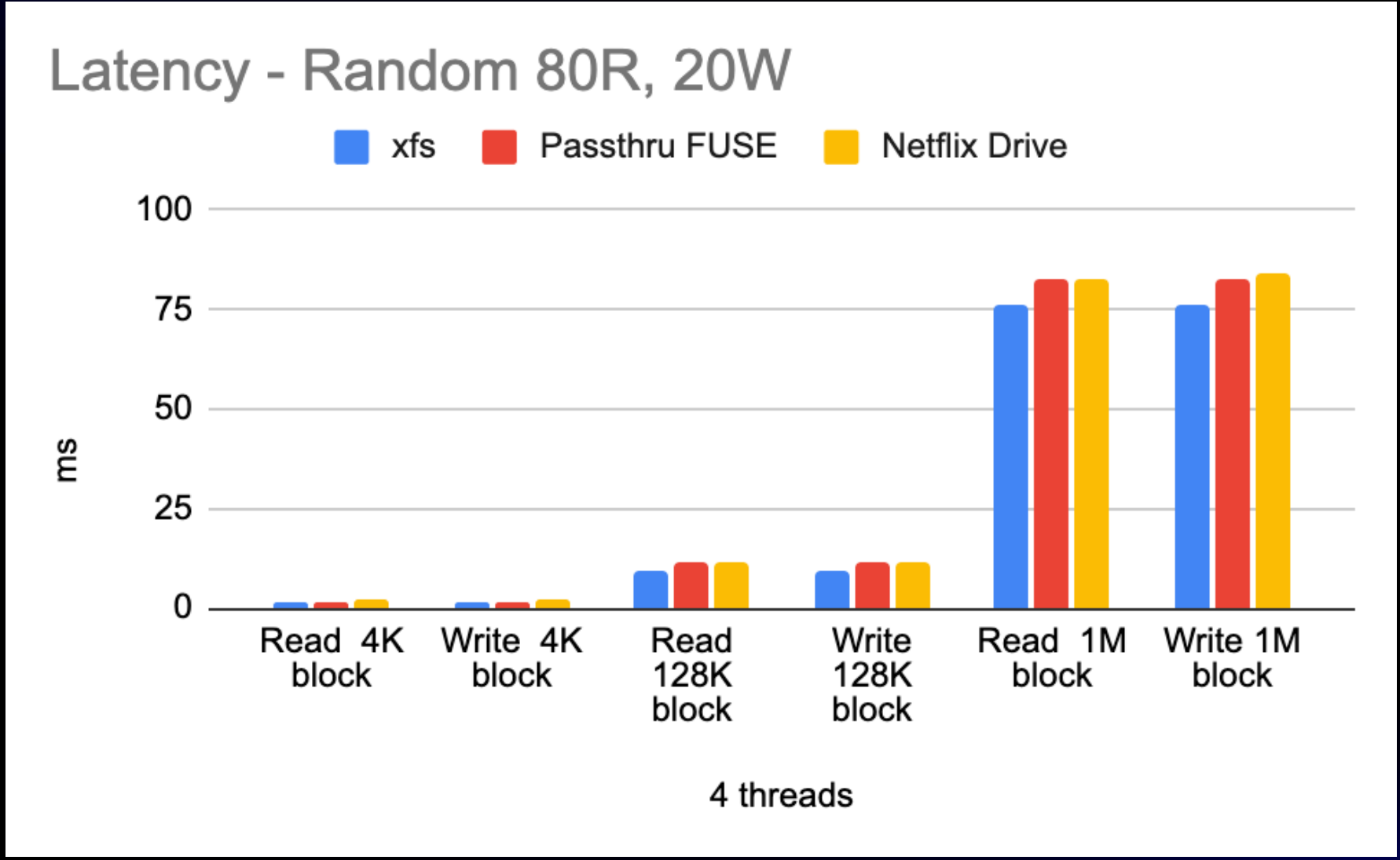
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Random read/write IOPS



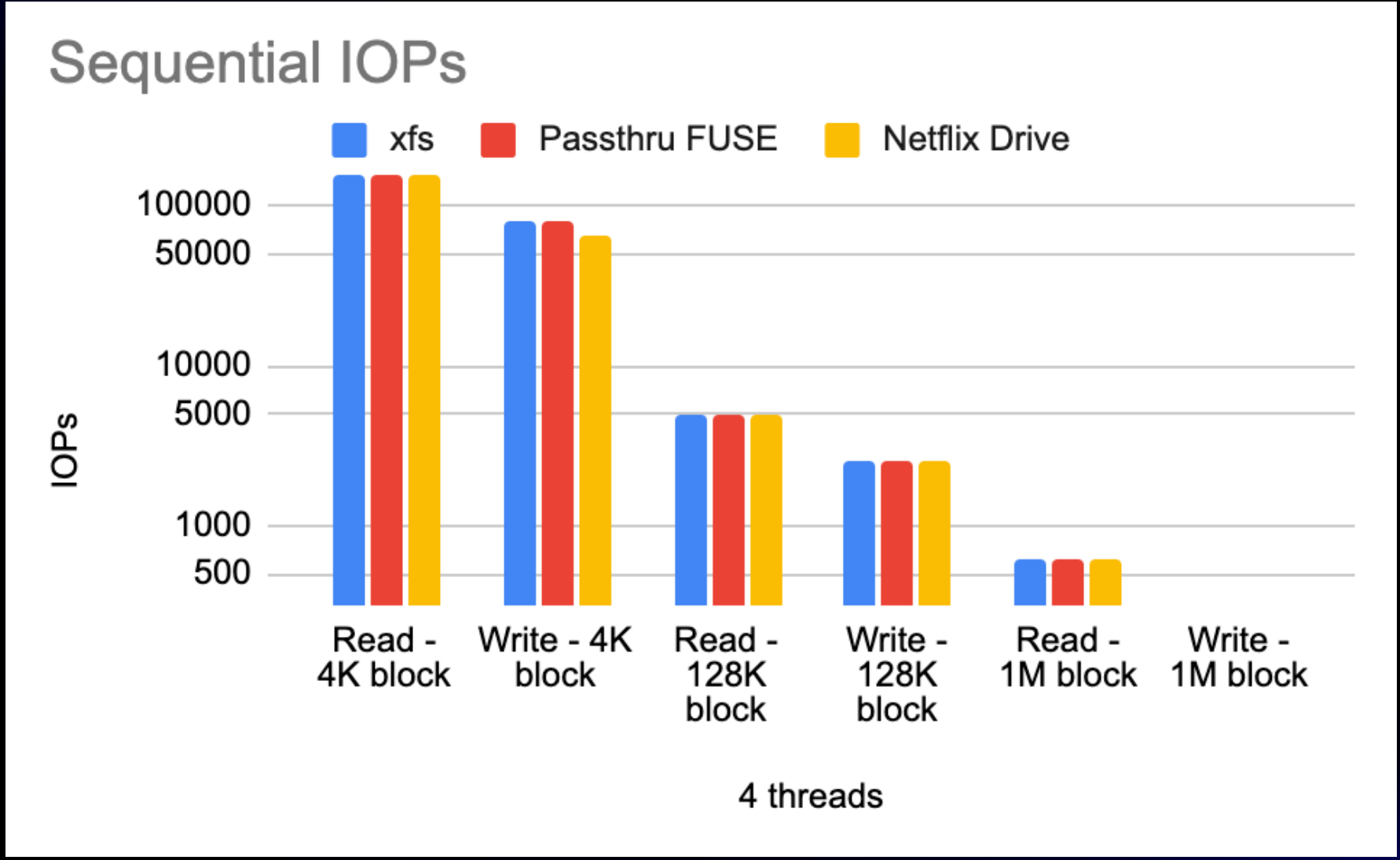
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Random read/write latencies



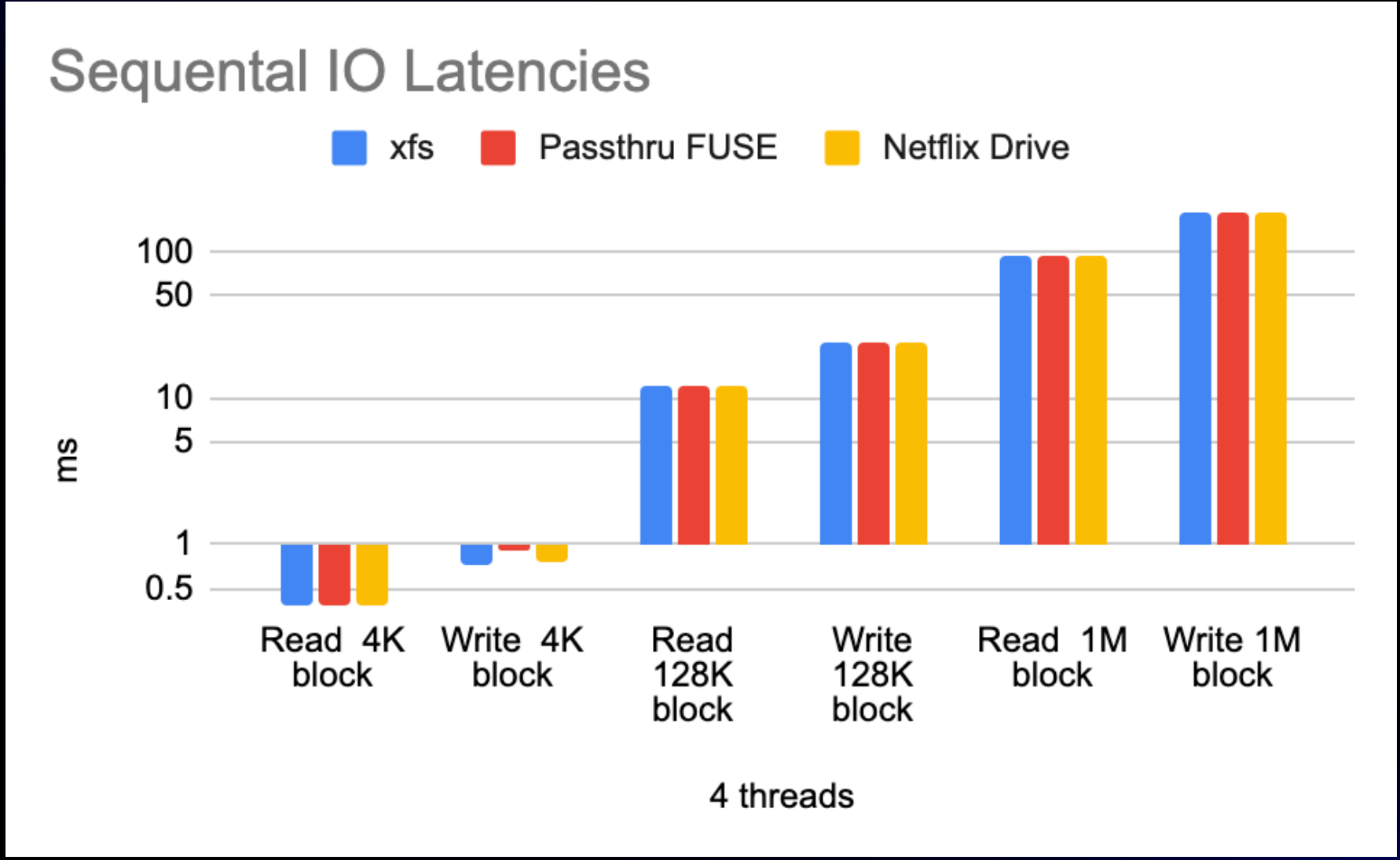
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Sequential read/write IOPS



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Sequential I/O latencies



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1M block IOPS summary and comparison

IOPS	1M I/O Size							
	1	4	1	4	1	4	1	4
	Sequential Read		Sequential Write		Random RW – Read		Random RW – Write	
XFS	627	622	333	314	343	628	87	160
Netflix Drive	627	622	334	315	475	571	120	146
Netflix Drive/XFS	**100%**	**100%**	**100%**	**100%**	**140%**	**90%**	**138%**	**91%**

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4K block IOPS summary and comparison

IOPS	4K I/O Size							
	1	4	1	4	1	4	1	4
	Sequential Read		Sequential Write		Random RW-Read		Random RW- Write	
XFS	161000	159000	85700	80700	10500	37100	2620	9280
Netflix Drive	161000	159000	36600	64700	15600	21700	3900	5430
Netflix Drive/XFS	**100%**	**100%**	**43%**	**80%**	**150%**	**58%**	**148%**	**58%**

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Extras

Netflix Drive Tech Blog

https://netflixtechblog.com/netflix-drive-a607538c3055

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Thank you!

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