Lustre + Cloud for Bigger Hot/Cold Data Solution

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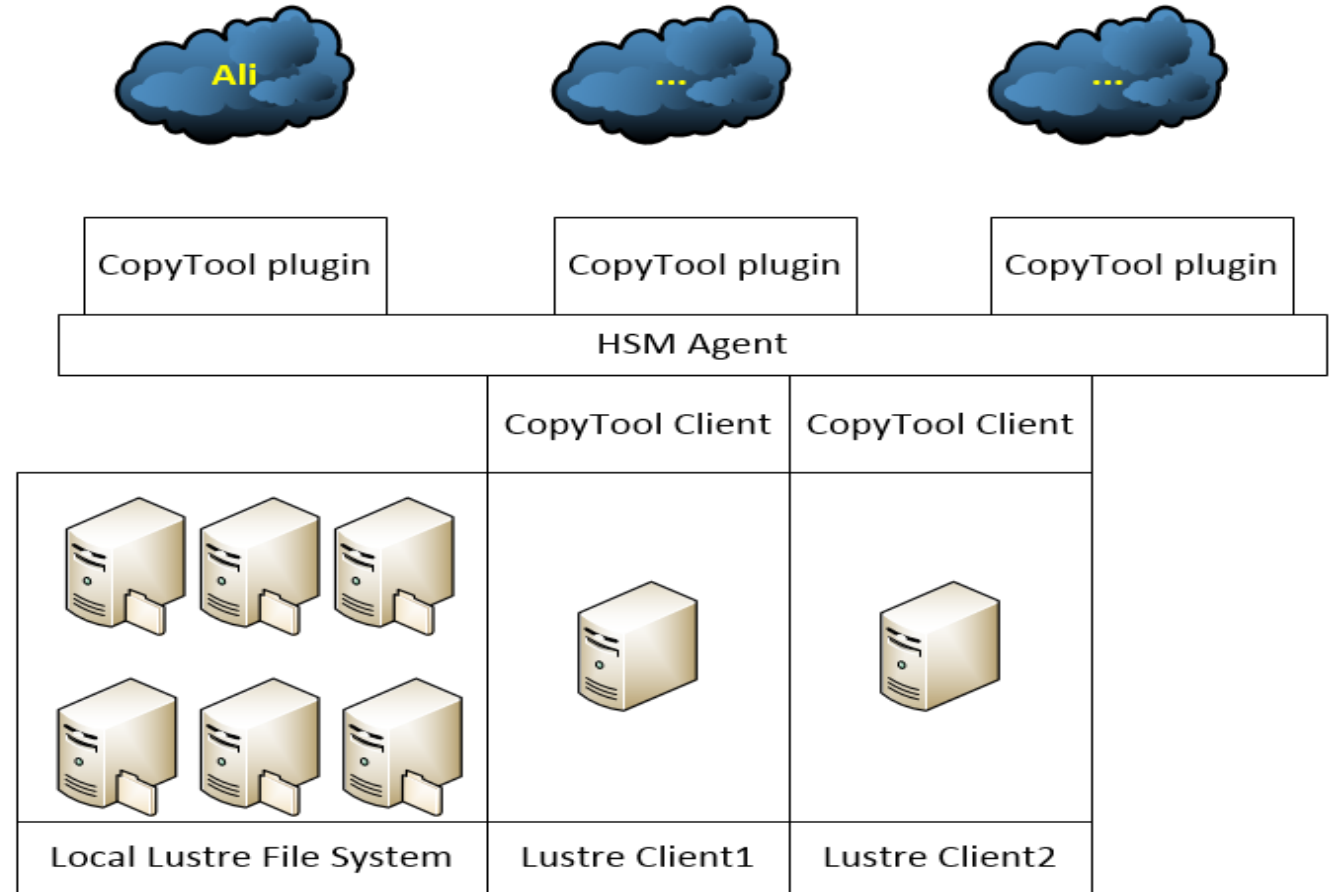
Software Architect

Intel Corporation
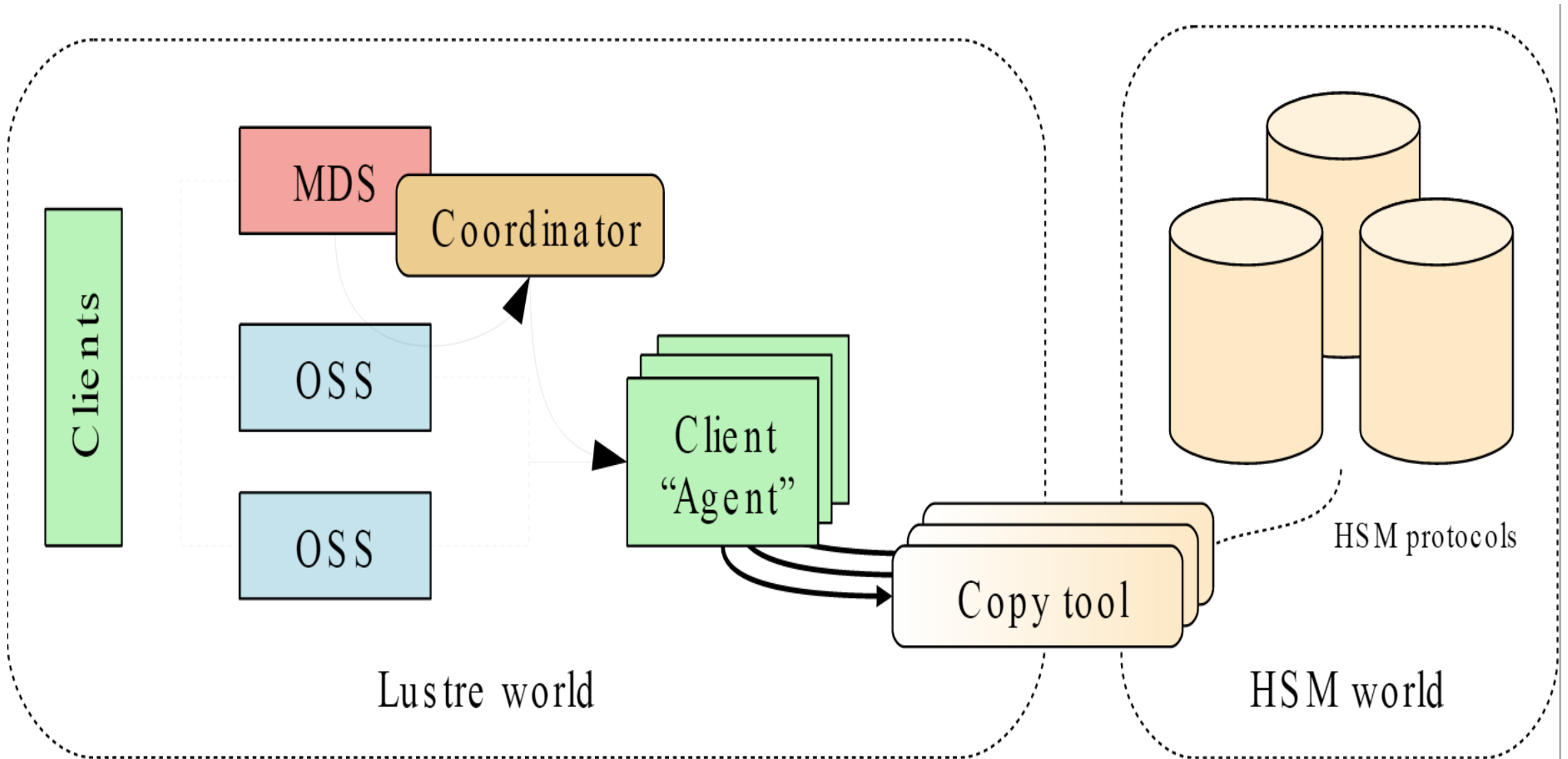
Lustre + Cloud HSM For Bigger Data Architecture
https://github.com/intel-hpdd/lemur

- Bigger Data, Balance Cache and Storage

- Scalable to Other Cloud by Plugin

- Auto File Status Management

- Nature Language Interface

- Parallelized upload/download with many lustre clients

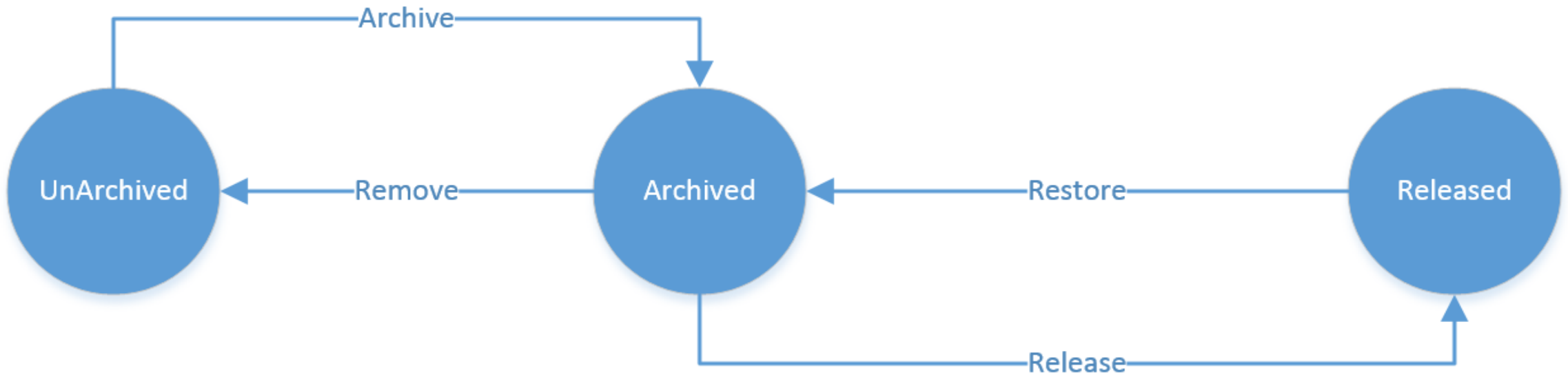- Seamless integration with legacy ecosystem

Lustre HSM Copy Tool Work Model

Lustre HSM Status Machine

- ARCHIVE Copy data from a Lustre file system file into the HSM solution.

- RELEASE Remove file data from the Lustre file system.

- RESTORE Copy back data from the HSM solution into the corresponding Lustre file system file.

- REMOVE Delete the copy of the data from the HSM solution.

Nature Language Interface


```
@ali
Feature: ali data mover
        As a Lustre administrator
        I want to configure a ali data mover
        In order to migrate Lustre file data to and from a ali bucket.

Background:
        Given I am the root user
        And I have a Lustre filesystem
        And the HSM coordinator is enabled
        When I configure the HSM Agent
        And I configure the ali data mover
        And I start the HSM Agent
        Then the HSM Agent should be running
        And the ali data mover should be running

Scenario: Archive
        When I archive folder1/cancer
        Then folder1/cancer should be marked as archived
        And the data for folder1/cancer should be archived

        When I archive folder1/cancer2
        Then folder1/cancer2 should be marked as archived
        And the data for folder1/cancer2 should be archived

        When I archive folder1/cancer3
        Then folder1/cancer3 should be marked as archived
        And the data for folder1/cancer3 should be archived
~
```

Example Case

- Archive 1G Data from Local Lustre to Cloud (Make File be in both local and cloud)

- Release 1G Data from Local Lustre (Make File be only in Cloud)

- Restore 1G Data from Cloud to Local Luster (Make File be in both local and cloud)

- Remove 1G Data from Cloud (Make File be only in local)

Archive

```
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Scenario: Archive
        When I archive folder1/cancer
        Then folder1/cancer should be marked as archived
        And the data for folder1/cancer should be archived
```

```
[root@cli3 folder1]# lfs hsm_state cancer
cancer: (0x00000009) exists archived, archive_id:1
[root@cli3 folder1]# du cancer
1024004 cancer
```

File System std

Overview

Management Server: mds1
MDTs: 1
OSTs: 2
Alerts: ✔ No alerts
Actions: Actions ▾

1.06GB/35.9GB 247/10.5M files

Update Advanced Settings   View Client Mount Information

lihaobucket-2

Object管理   ☁ 上传文件

	文件名	大小	类型
企	MyDataAli/ (返回上一级)		
☐	276ca203-d75d-475f-87d9-1dcd838bdc07	1000.0MB	-

Release

```
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        Given I am the root user
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        And I configure the ali data mover
        And I start the HSM Agent
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        And the ali data mover should be running


Scenario: Release
        And I have released folder1/cancer
```

Overview

Management Server: mds1
MDTs: 1
OSTs: 2
Alerts: ✔ No alerts
Actions: Actions ▾

⚙ Update Advanced Settings   View Client Mount Information

90.2MB/35.9GB   247/10.5M files

```
[root@cli3 folder1]# lfs hsm_state cancer
cancer: (0x0000000d) released exists archived, archive_id:1
[root@cli3 folder1]# du cancer
1       cancer
```

🌩 lihaobucket-2

▌ Object管理   ☁ 上传文件

	文件名	大小	类型
企	MyDataAli/ (返回上一级)		
☐	276ca203-d75d-475f-87d9-1dcd838bdc07	1000.0MB	-

Restore

```
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        And I start the HSM Agent
        Then the HSM Agent should be running
        And the ali data mover should be running


Scenario: Restore
        When I restore folder1/cancer
        Then the data for folder1/cancer should be restored
```

```
[root@cli3 folder1]# lfs hsm_state cancer
cancer: (0x00000009) exists archived, archive_id:1
[root@cli3 folder1]# du cancer
1024004 cancer
```

File System std

Overview

Management Server:	mds1
MDTs:	1
OSTs:	2
Alerts:	✔ No alerts
Actions:	Actions ▾

1.06GB/35.9GB   247/10.5M files

⚙ Update Advanced Settings   View Client Mount Information

☁ lihaobucket-2

| Object管理 | ☁ 上传文件 |

文件名	大小	类型
⬆ MyDataAli/ (返回上一级)		
☐ 276ca203-d75d-475f-87d9-1dcd838bdc07	1000.0MB	–

Remove

```
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        And I configure the ali data mover
        And I start the HSM Agent
        Then the HSM Agent should be running
        And the ali data mover should be running



Scenario: Remove
        When I remove folder1/cancer
        Then folder1/cancer should be marked as unmanaged
        And the data for folder1/cancer should be removed
~
```

```
[root@cli3 folder1]# lfs hsm_state cancer
cancer: (0x00000000), archive_id:1
[root@cli3 folder1]# du cancer
1024004 cancer
```

File System std

Overview

Management Server: mds1
MDTs: 1
OSTs: 2
Alerts: ✔ No alerts
Actions: Actions ▾

1.06GB/35.9GB   247/10.5M files

⚙ Update Advanced Settings   View Client Mount Information

lihaobucket-2

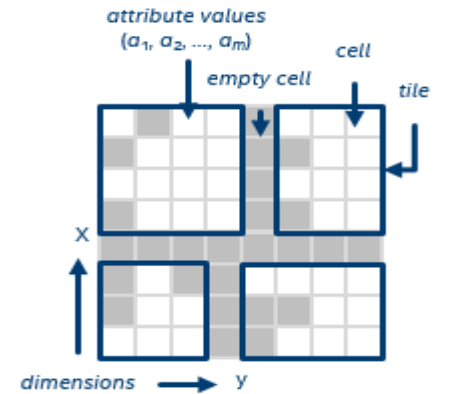| Object管理 | | ☁ 上传文件 |

文件名	大小	类型

暂无数据

Backup

Example case about seamless integration with legacy application

GenomicsDB -
https://github.com/Intel-HLS/GenomicsDB

- Optimized for sparse data

- High-performance Linear Algebra

Just need to mount lustre file system, which act as normal file system


```
#CHROM POS       ID     REF    ALT     QUAL    FILTER INFO    FORMAT  ERR899726
1      248679070  .     A      G       875.77  .       AC=2;AF=1.00;AN=2;DP=29;FS=(
1      248679423  .     T      G       605.77  .       AC=2;AF=1.00;AN=2;DP=21;FS=(
1      248679685  .     G      C       839.77  .       AC=2;AF=1.00;AN=2;DP=28;FS=(
1      248680013  .     C      T       843.77  .       AC=2;AF=1.00;AN=2;DP=28;FS=(
1      248680967  .     C      CGTGT,CGTGTGTGTGT  440.73  .        AC=1,1;AF=0.
1      248681796  .     C      T       338.77  .       AC=2;AF=1.00;AN=2;DP=13;FS=(
1      248682110  .     G      A       504.77  .       AC=2;AF=1.00;AN=2;DP=18;FS=(
1      248682157  .     C      T       652.77  .       AC=2;AF=1.00;AN=2;DP=22;FS=(
2      107601   .     G      A       461.77  .       AC=1;AF=0.500;AN=2;BaseQRankSum=2.3(
2      108411   .     A      T       92.77   .       AC=1;AF=0.500;AN=2;BaseQRankSum=-2.(
2      110345   .     C      T       418.77  .       AC=1;AF=0.500;AN=2;BaseQRankSum=1.3'
2      110385   .     G      A       223.77          AC=1;AF=0.500;AN=2;BaseQRankSum=1.5'
```

```
{
    "callsets" : {
        "HG00141" : {
            "row_idx" : 0,
            "idx_in_file": 0,
            "filename": "test_outputs/merged_java_alt3.list.vcf.gz"
        },
        "HG01530" : {
            "row_idx" : 1,
            "idx_in_file": 1,
            "filename": "test_outputs/merged_java_alt3.list.vcf.gz"
        },
        "HG01958" : {
            "row_idx" : 2,
            "idx_in_file": 2,
            "filename": "test_outputs/merged_java_alt3.list.vcf.gz"
        }
    }
}
```

```
{

"workspace" : "/tmp/ws/",

"array" : "t0_1_2",

"query_column_ranges" : [ [ [0, 100 ], 500 ] ],

"query_row_ranges" : [ [ [0, 2 ] ] ],

"query_attributes" : [ "REF", "ALT", "BaseQRankSum",

}
```