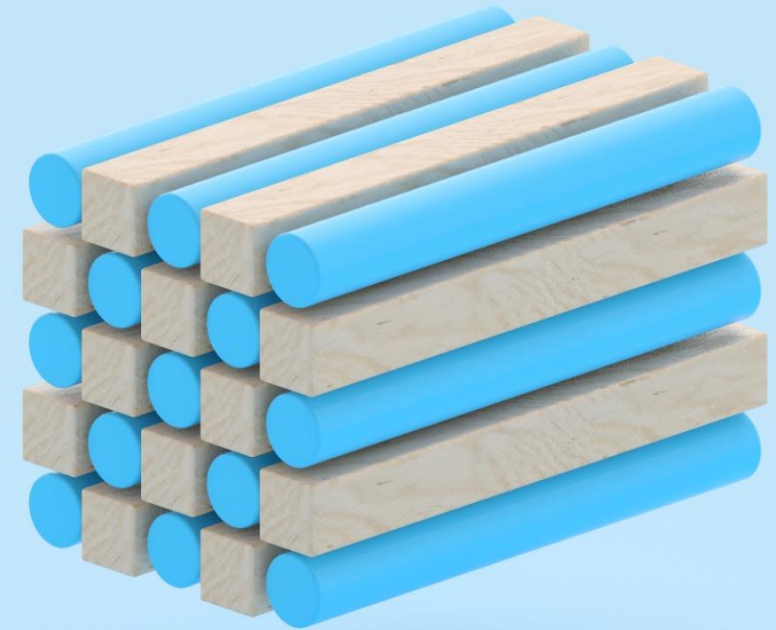# NetApp ONTAP File System Analytics
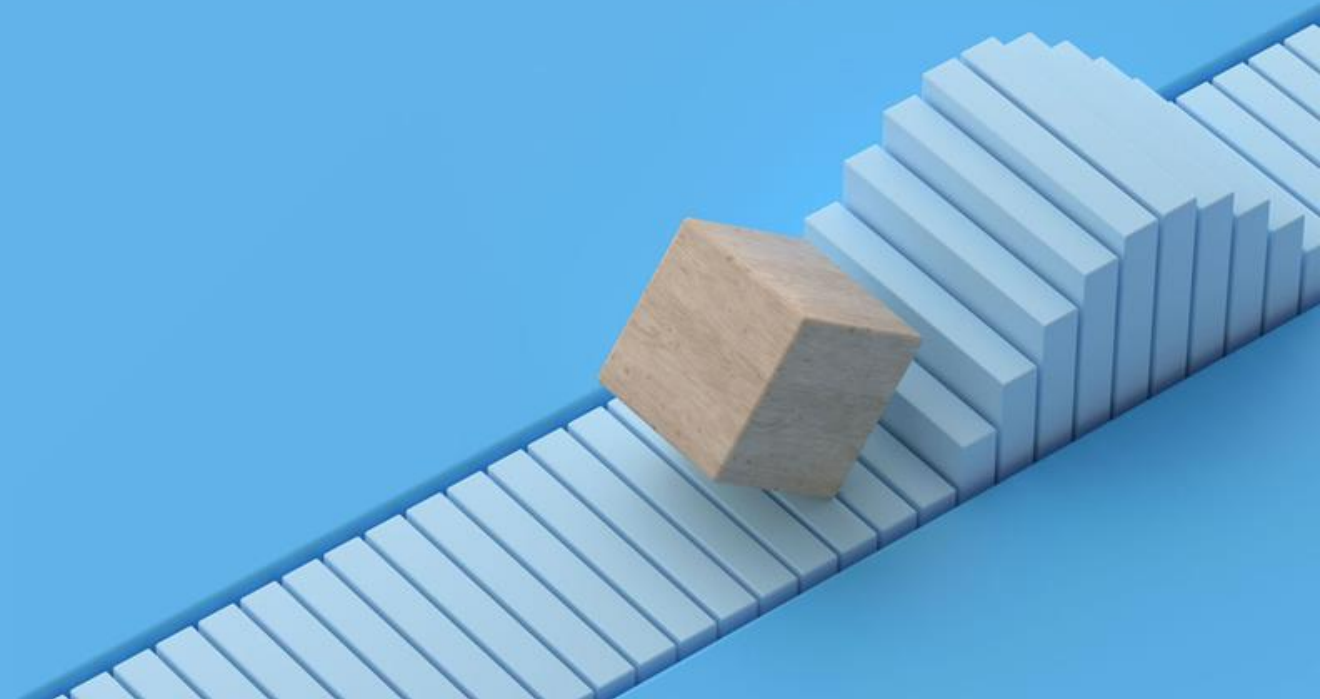
NAS analytics in ONTAP

NetApp

Agenda

ONTAP File System Analytics

- NetApp® ONTAP® File System Analytics capabilities with use cases

- ONTAP File System Analytics: Overview

- ONTAP File System Analytics: REST API

- Key takeaways

NetApp ONTAP File System Analytics capabilities with use cases

Challenges, capabilities, solutions, and benefits

File System Analytics: top three challenges

Need actionable
intelligent insights

Real-time
analytics

Hierarchical
with granularity

Customer challenges

The quantity of unstructured data doubles every year. Organizations realize the value of information and its role in making informed decisions; they consider it as "life-blood" and a key to their success. This new mindset poses both challenges and opportunities to organizations.

Challenges

- Who is creating what data and how much space is being consumed?

- How much data is actively in use?

- How can we identify the right value and extract the insights?

- What are the right tools to get metadata and manage and move?

Opportunities

- Gather business intelligence

- Increase security posture

- Optimize resource utilization

- Resource planning

Data

Unstructured data has become a predominant data type in our data-centric world

- Organizations hold growing volumes of unstructured data
  - 60% of organizations have >100TB and 32% have >1PB of this kind of data in their data centers

- New regulations
  - A changing regulatory landscape puts pressure on businesses to understand their data and take appropriate action as data protection and privacy laws evolve around the globe

- Untapped insights – unlock the potential

- Storage optimization and migration

- Redundant, outdated, and trivial information (ROT) identification
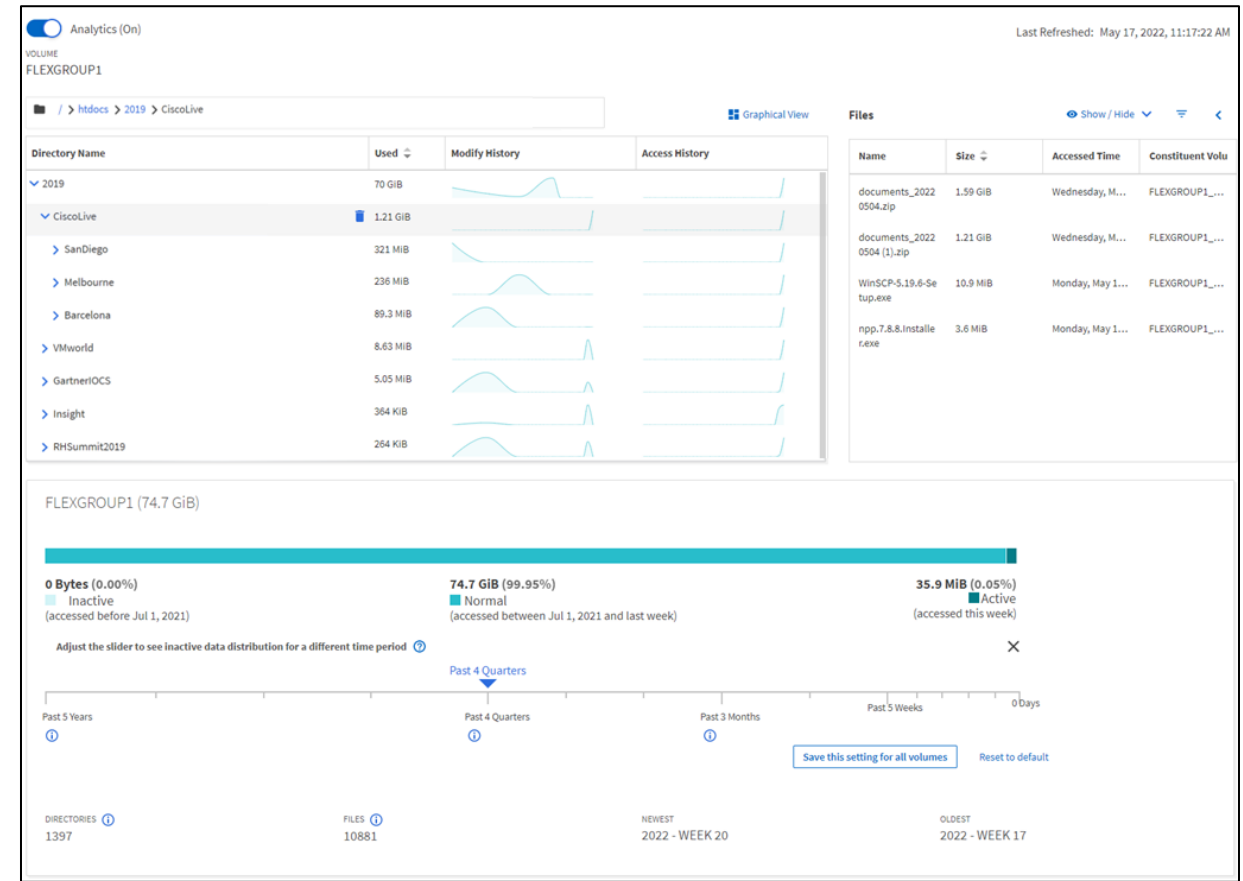
File System Analytics
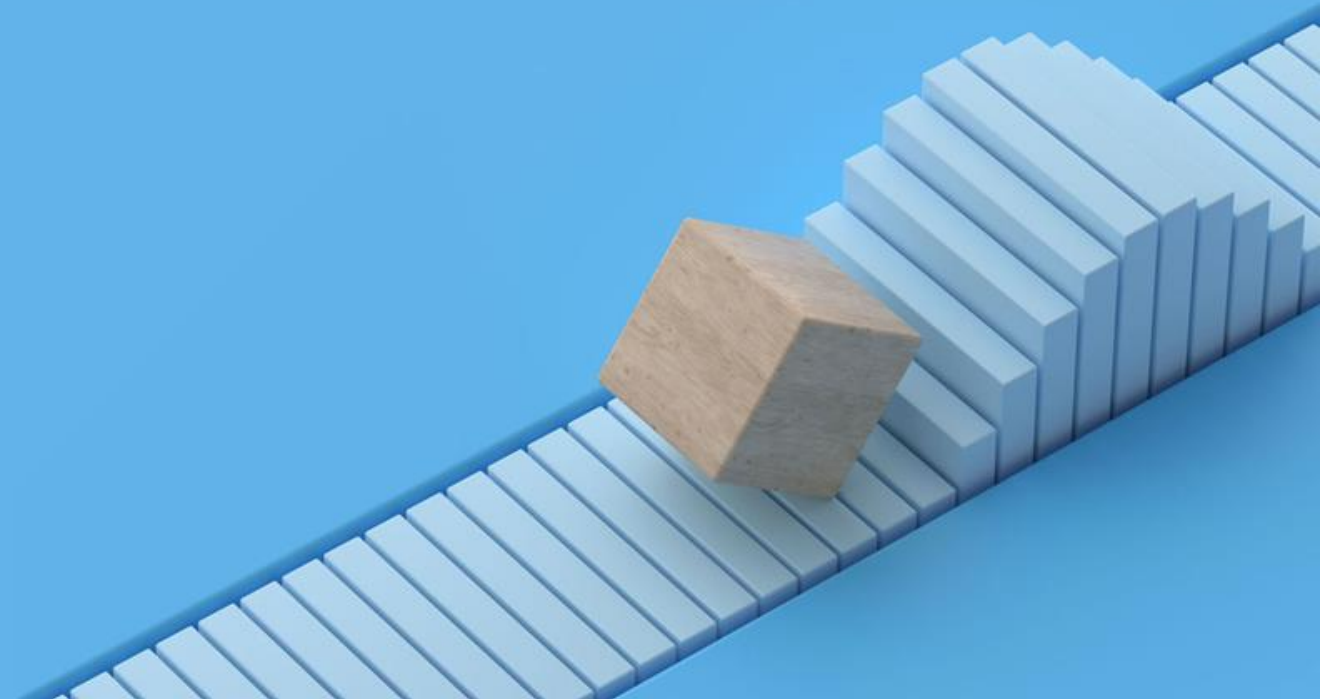
Overview

NetApp ONTAP File System Analytics

Explorer overview

- Insights into NAS data without an external tool

- Real-time visibility for effective data management and operation

- Real-time collection and aggregation of data

- Hierarchical structure of directories in NAS

  - Storage VM (SVM)

  - Volume

  - Subdirectories count and performance

  - File size, count, location and performance

  - File age histograms for modify and access history

- Visualizing active, normal, inactive data

- Edit inactivity period

- Control access to activity tracking with role-based access control (RBAC)

What's new in ONTAP for File System Analytics

ONTAP 9.9.1

- Availability for volumes transitioned from 7-mode systems
- Option to change inactive period in System Manager

ONTAP 9.10.1

- Activity tracking (volume-level)
- Download to CSV (activity tracking, volume-level)

ONTAP 9.11.1

- Activity tracking (SVM-level)
- Download to CSV (activity tracking, SVM-level)
- Timeline

ONTAP File System Analytics

Integration with ONTAP System Manager

- New explorer tab for each data volume

- Administrator visibility at SVM, volume, directory, and file level

- NetApp® ONTAP® File System Analytics enable/disable switch
  - Overall logical space: directory and decedents
  - Tree contents: modification and access history
  - Sort: modification, access, name, and used space
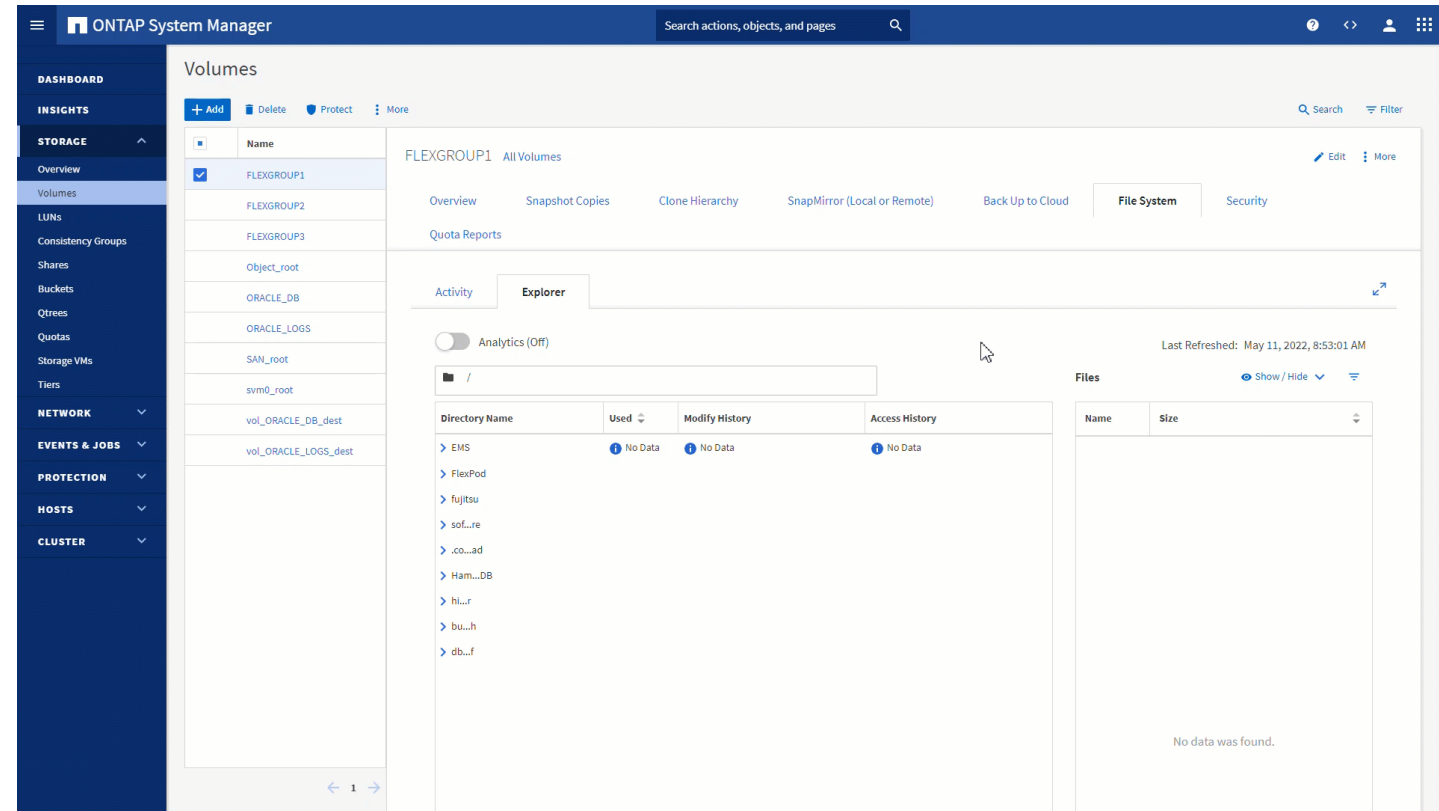
ONTAP File System Analytics

Integration with ONTAP System Manager
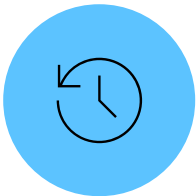
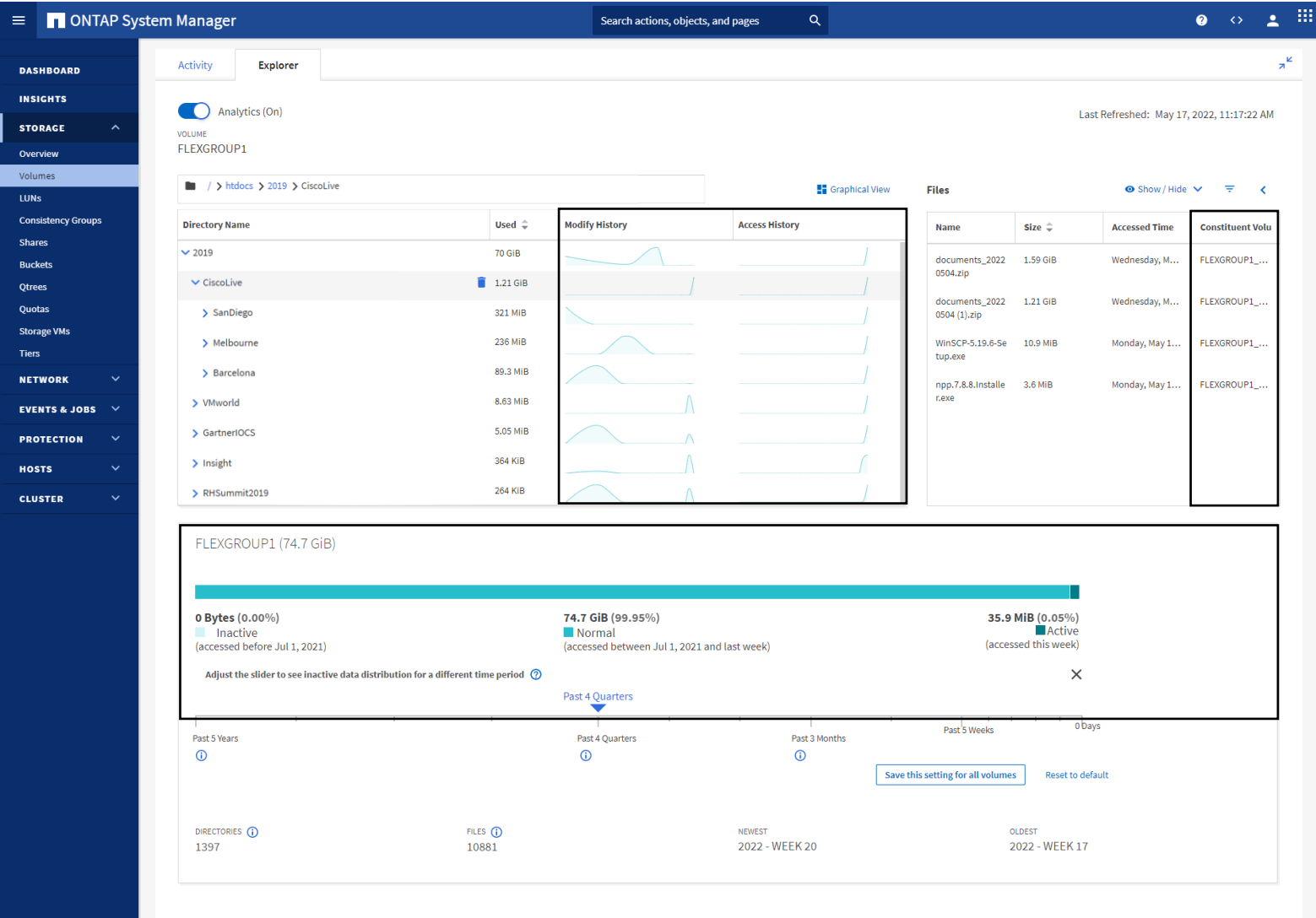- Histogram up to four years

- Graphical view of the directory

- Bottom pane: selected directory

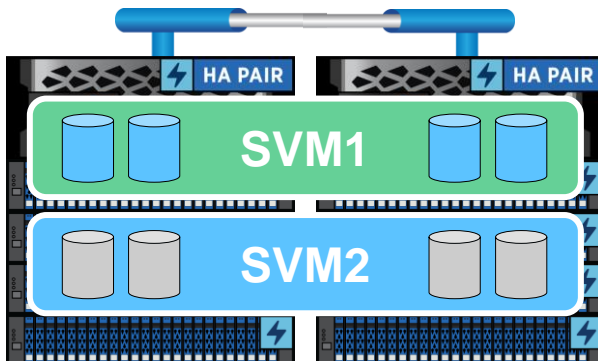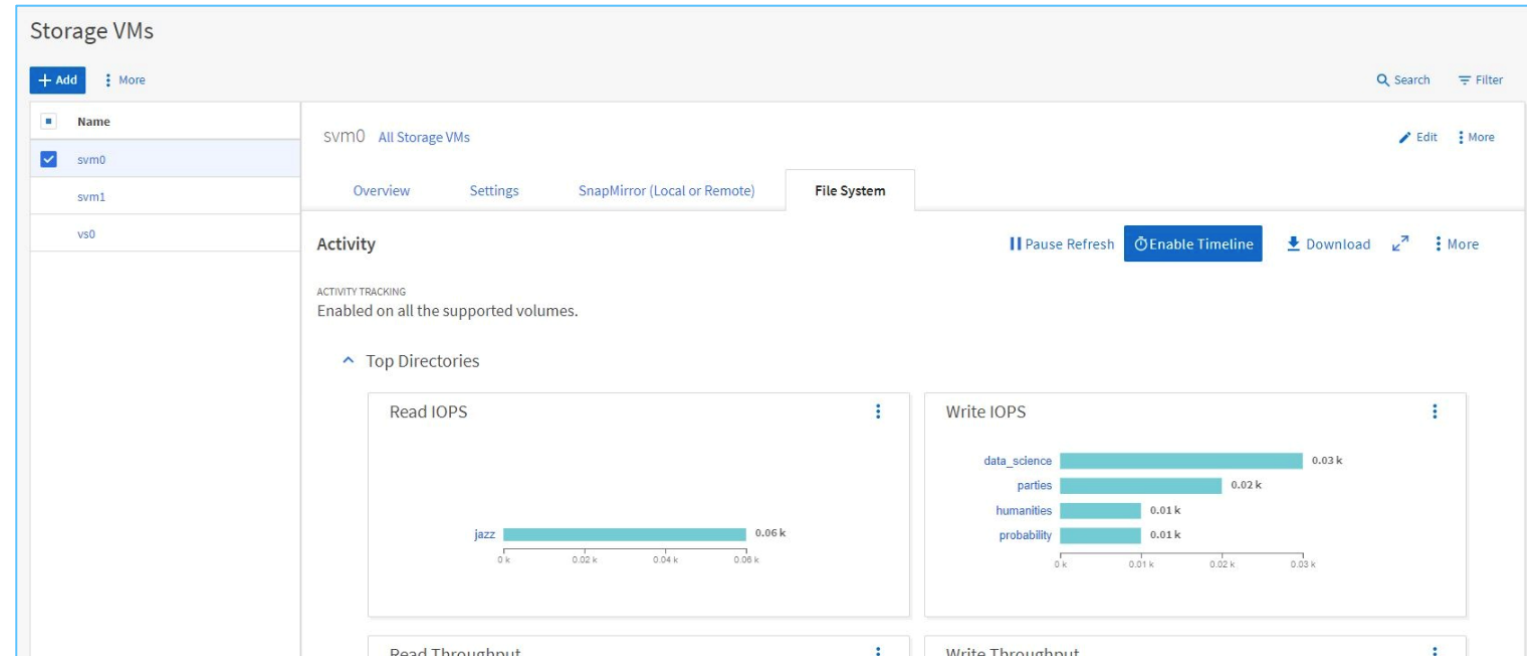- View file location on constituent of NetApp® ONTAP® FlexGroup

- Edit inactivity period

ONTAP File System Analytics capability

Capacity and performance analytics at SVM granularity

- Identify the top directory, file, user and client for each storage virtual machine (SVM) on the system

- Enable timeline for short term data capture

- Easy export of performance data

Top files, directories, clients

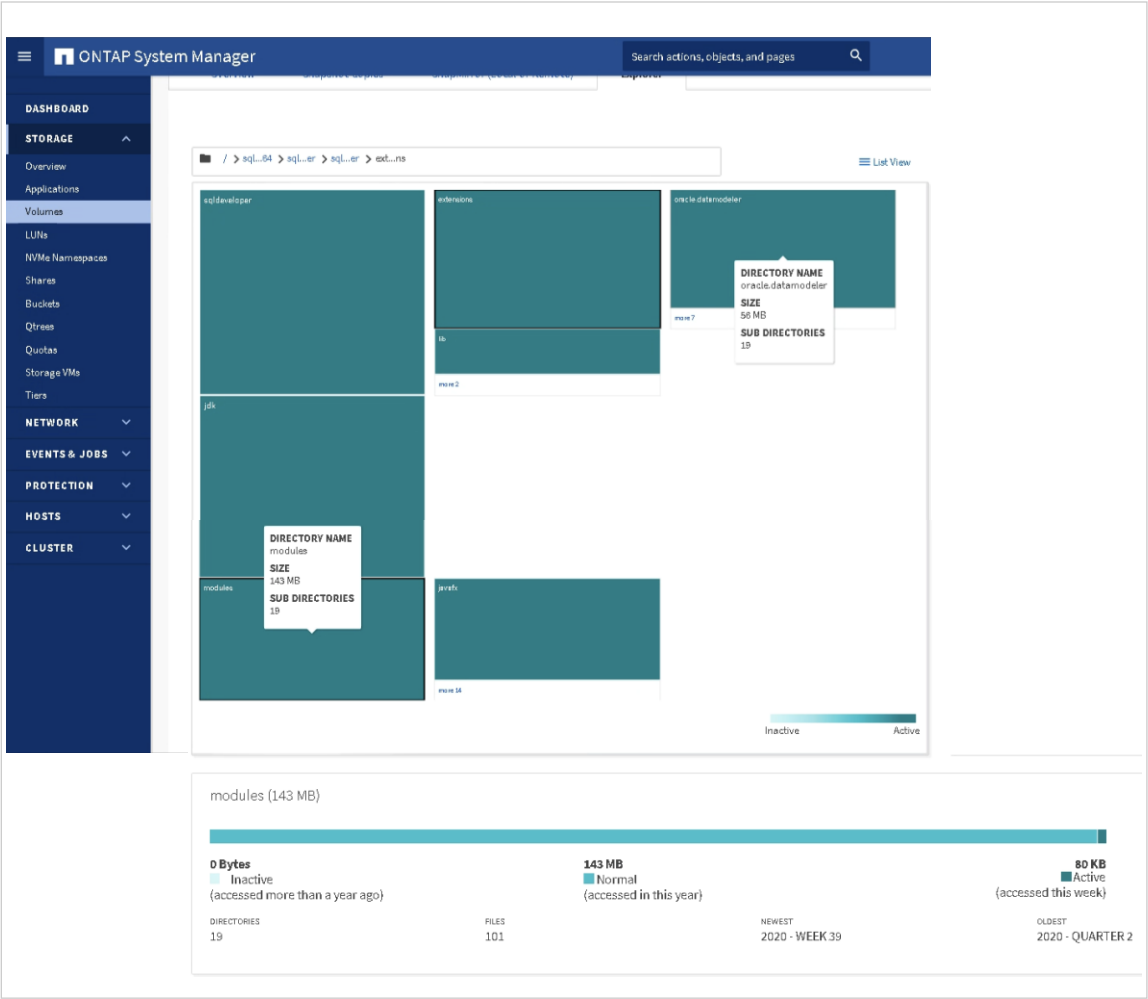# ONTAP File System Analytics capability

Top size folders

- Engineering and technology customer: large users' home folders

- Real-time analytics and hierarchical details: size-based folders
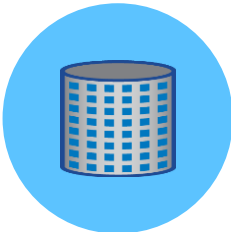
- Volumes > Explorer > Graphical View

ONTAP File System Analytics capability

Least- and most- changed workload

Transactional workload changes more
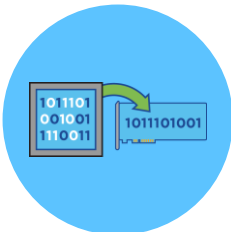
Intelligent insights when most or least changes over the lifespan

Sorted modification history
Volumes > Explorer > Modify History
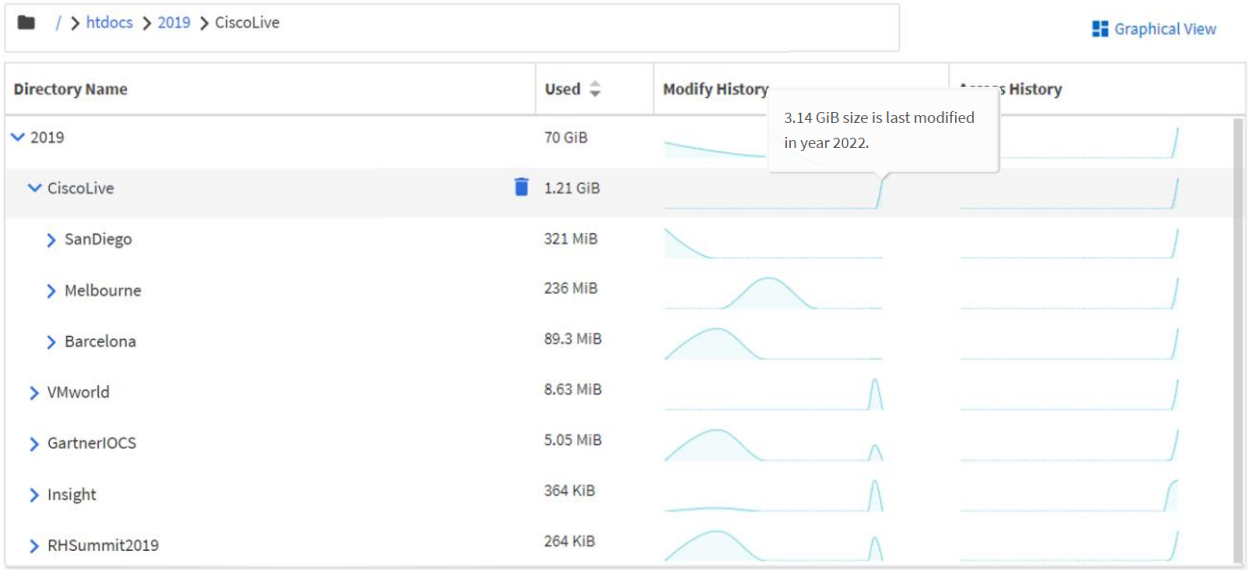

```
curl -siku $user:$pw  --request GET
"https://${server}/api/storage/volumes/843a457d-a612-11ea-964e-
005056ac950e/files?fields==analytics.by_modified_time.bytes_use
d&order_by=analytics.by_modified_time.bytes_used+desc
```

ONTAP File System Analytics capability

Performance activity tracking

- Spikes from expected behavior mean you need to pay attention to sensitive data
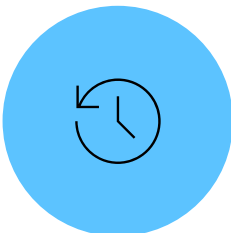
- A lot of activity or ransom attacks are occurring…take action!

- Banking: pay attention to abnormal changes in files or folders (in real time)

- Volumes > folder > folder list and select the folder that has abnormal spikes
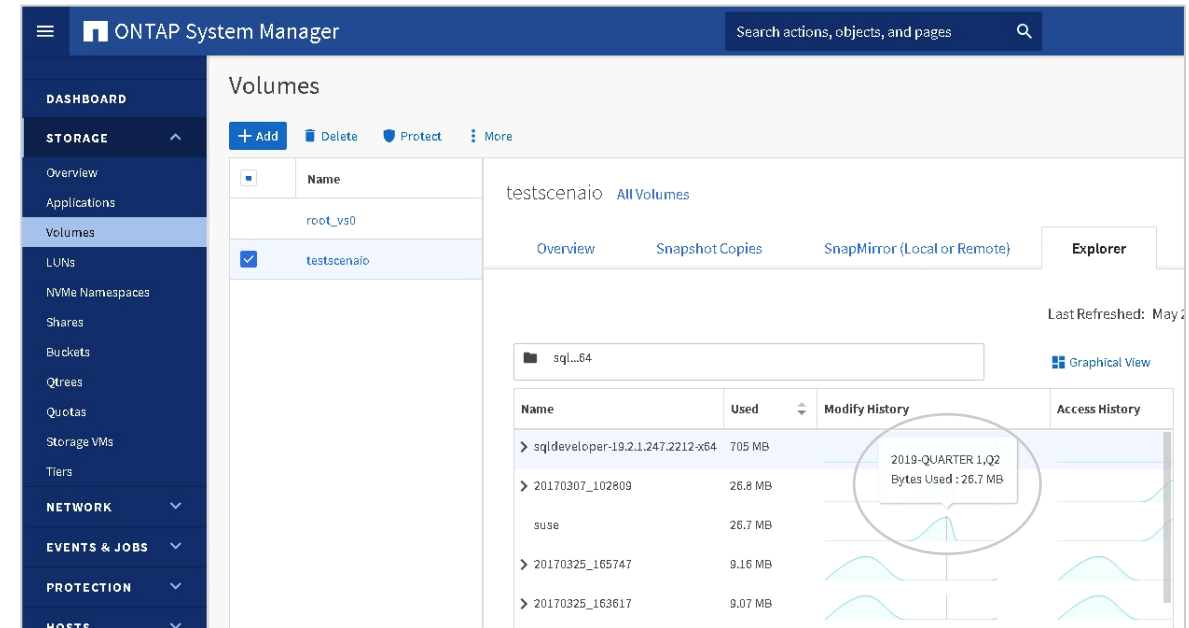
ONTAP File System Analytics capability

Performance activity tracking

Users

Clients
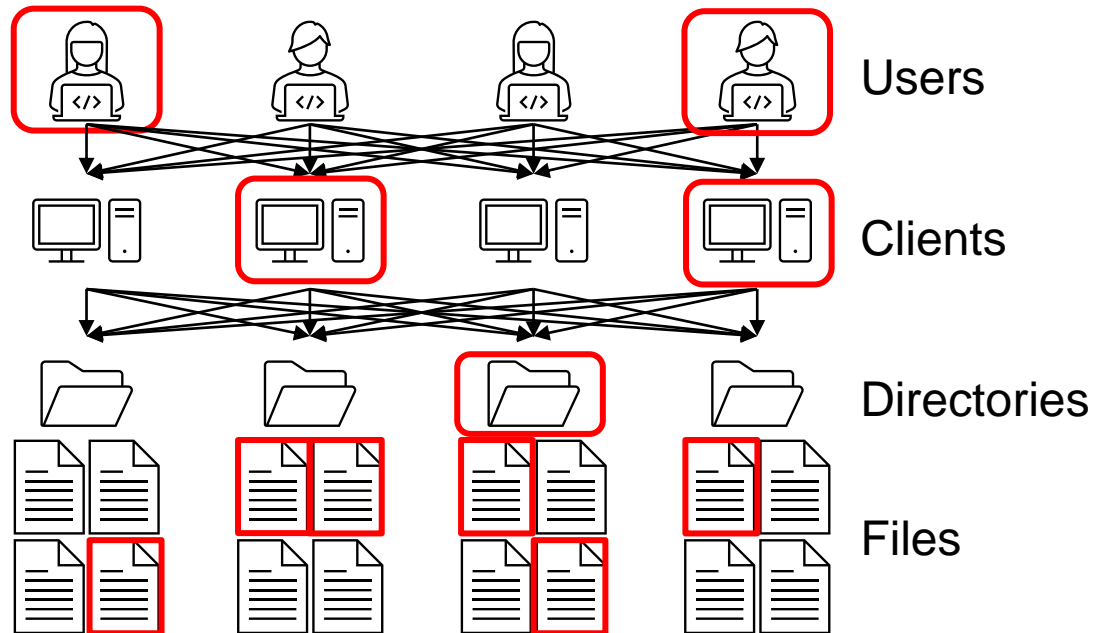
Directories

Files

- Monitor storage clients, users, directories and files for each storage virtual machine (SVM) or volume to locate performance issues

- List of top 25 at each volume

- Target use cases
  - Performance troubleshooting
  - Rebalance users, clients and directories or quality-of-service (QoS) planning
  - Identify potential threat vectors like malware/ransomware activity

Hot directory identification

Example
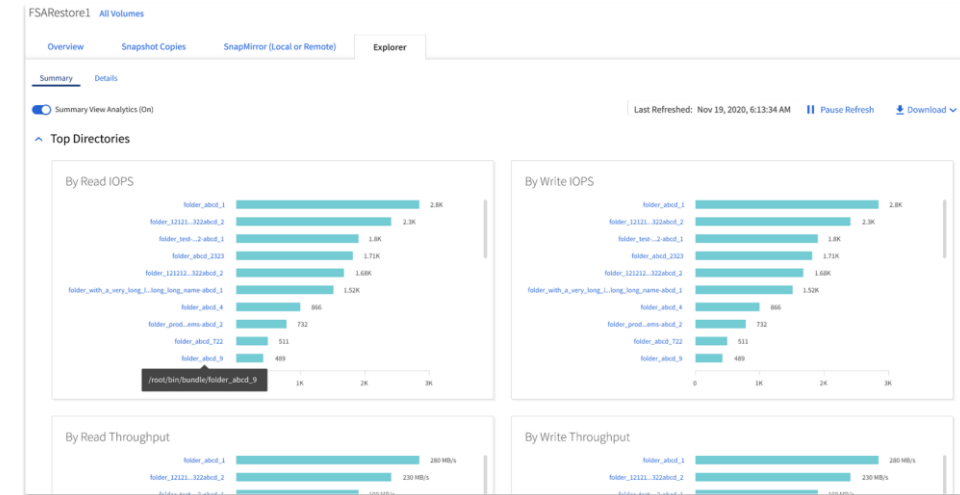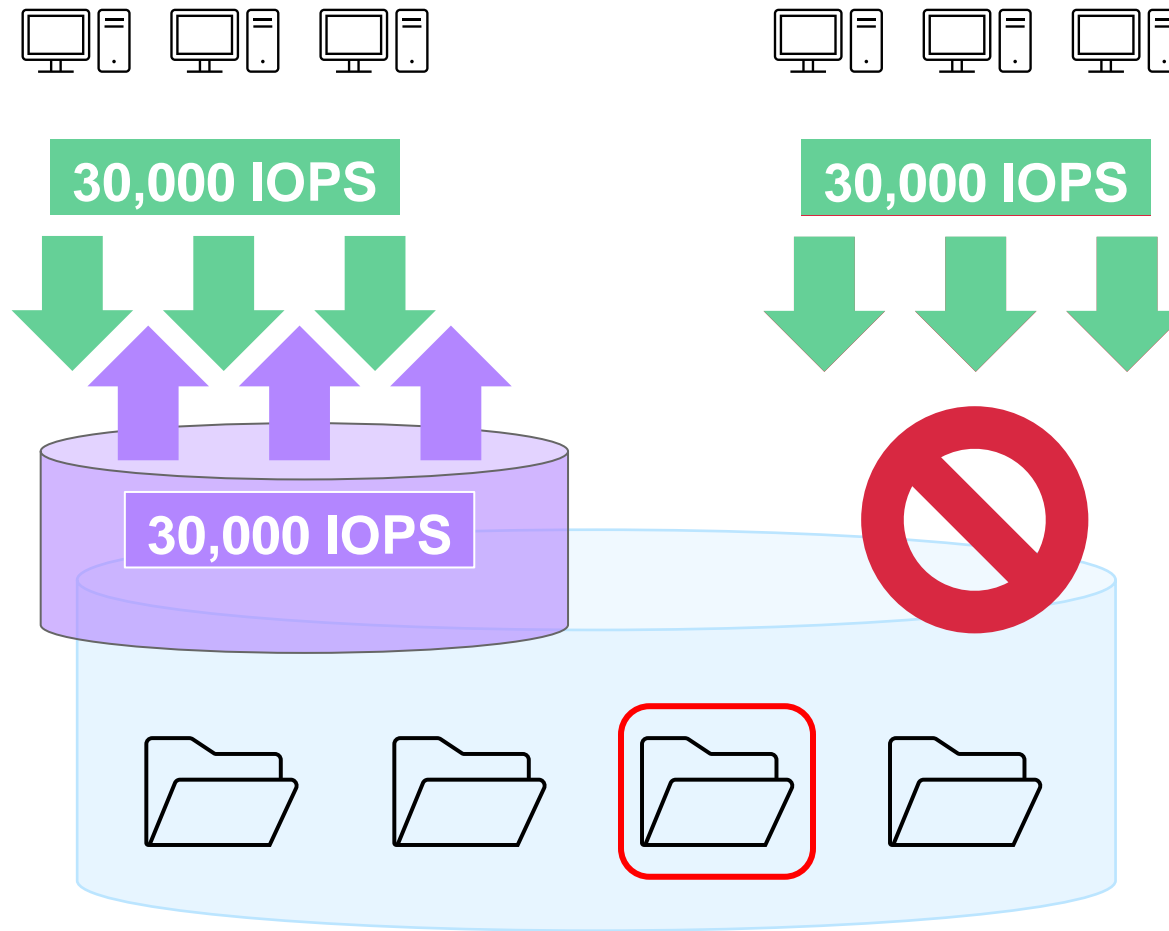
- Notify resource consumers

- Use nondisruptive volume moves to underutilized nodes

- Apply quality-of-service (QoS) policies

- Offload reads with NetApp® FlexCache® volumes

ONTAP File System Analytics capability

Performance activity tracking
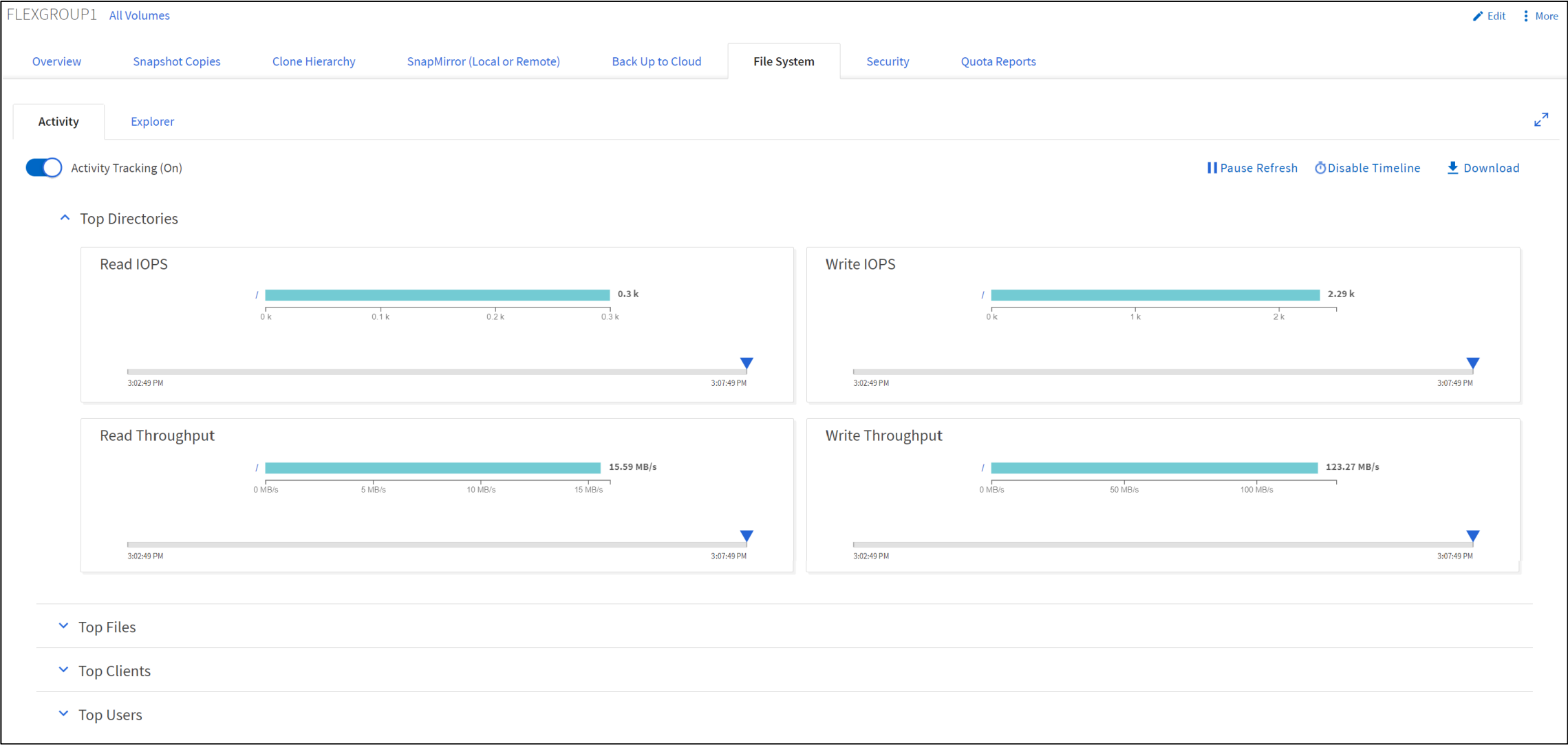
ONTAP File System Analytics

REST API

ONTAP File System Analytics: REST API

Custom integration with application

- REST API: option for custom integration such as Graphana

- NetApp® ONTAP® File System Analytics supports REST API

- Integrate ONTAP File System Analytics with customer application

- Top clients by
  - /svm/svms/{svm.uuid}/top-metrics/clients
  - /storage/volumes/{volume.uuid}/top-metrics/clients

- Top directories by
  - /svm/svms/{svm.uuid}/top-metrics/directories
  - /storage/volumes/{volume.uuid}/top-metrics/directories

- Top files by
  - /svm/svms/{svm.uuid}/top-metrics/files
  - /storage/volumes/{volume.uuid}/top-metrics/files

- Top users by
  - /svm/svms/{svm.uuid}/top-metrics/users
  - /storage/volumes/{volume.uuid}/top-metrics/users

Customer application

REST API

ONTAP File System Analytics

ONTAP NAS file system
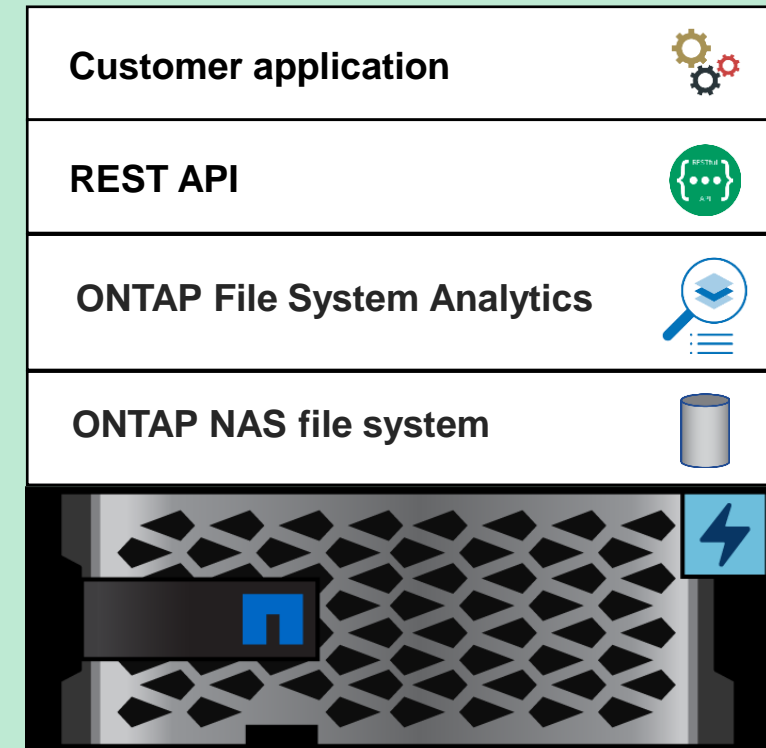
NetApp ONTAP File System Analytics: top clients

```
curl -X GET "https://<server>/api/svm/svms/<svm-uuid>/top-metrics/clients?top_metric=
<iops or throughput>.<read or write>" -H  "accept: application/json" -H  "authorization:
Basic ABCDEFGHIJKLMNOPQRSTUVWXYZ" -k -s
```

iops.read

```
"records": [
  {
    "svm": {
      "name": "DEMO"
    },
    "iops": {
      "read": 112,
      "error": {
        "lower_bound": 112,
        "upper_bound": 112
      }
    },
    "client_ip": "10.63.171.17"
  },
  {
    "svm": {
      "name": "DEMO"
    },
    "iops": {
      "read": 39,
      "error": {
        "lower_bound": 39,
        "upper_bound": 39
      }
    },
    "client_ip": "10.63.171.14"
  }
],
"num_records": 2
```

iops.write

```
"records": [
  {
    "svm": {
      "name": "DEMO"
    },
    "iops": {
      "write": 695,
      "error": {
        "lower_bound": 695,
        "upper_bound": 695
      }
    },
    "client_ip": "10.63.171.14"
  },
  {
    "svm": {
      "name": "DEMO"
    },
    "iops": {
      "write": 435,
      "error": {
        "lower_bound": 435,
        "upper_bound": 435
      }
    },
    "client_ip": "10.63.171.17"
  }
],
"num_records": 2
```

throughput.read

```
"records": [
  {
    "svm": {
      "name": "DEMO"
    },
    "throughput": {
      "read": 102064128,
      "error": {
        "lower_bound": 102064128,
        "upper_bound": 102064128
      }
    },
    "client_ip": "10.63.171.17"
  },
  {
    "svm": {
      "name": "DEMO"
    },
    "throughput": {
      "read": 70660915,
      "error": {
        "lower_bound": 70660915,
        "upper_bound": 70660915
      }
    },
    "client_ip": "10.63.171.14"
  }
],
"num_records": 2
```

throughput.write

```
"records": [
  {
    "svm": {
      "name": "DEMO"
    },
    "throughput": {
      "write": 131858432,
      "error": {
        "lower_bound": 131858432,
        "upper_bound": 131858432
      }
    },
    "client_ip": "10.63.171.17"
  },
  {
    "svm": {
      "name": "DEMO"
    },
    "throughput": {
      "write": 103651737,
      "error": {
        "lower_bound": 103651737,
        "upper_bound": 103651737
      }
    },
    "client_ip": "10.63.171.14"
  }
],
"num_records": 2
```

NetApp ONTAP File System Analytics: top directories

```
curl -X GET "https://<server>/api/svm/svms/<svm-uuid>/top-metrics/directories?top_metric=
<iops or throughput>.<read or write>" -H  "accept: application/json" -H  "authorization:
Basic ABCDEFGHIJKLMNOPQRSTUVWXYZ" -k -s
```

iops.read

```
"records": [
  {
    "svm": {
      "name": "DEMO"
    },
    "iops": {
      "read": 3789,
      "error": {
        "lower_bound": 3789,
        "upper_bound": 3789
      }
    },
    "path": "/vol/FLEXGROUP1/",
    "junction_path": "/FLEXGROUP1",
    "volume": {
      "name": "FLEXGROUP1",
      "uuid": "b4365290-dacc-11ec-
8e6f-d039ea1b6069"
    }
  }
],
"num_records": 1
```

iops.write

```
"records": [
  {
    "svm": {
      "name": "DEMO"
    },
    "iops": {
      "write": 1756,
      "error": {
        "lower_bound": 1756,
        "upper_bound": 1756
      }
    },
    "path": "/vol/FLEXGROUP1/",
    "junction_path": "/FLEXGROUP1",
    "volume": {
      "name": "FLEXGROUP1",
      "uuid": "b4365290-dacc-11ec-
8e6f-d039ea1b6069"
    }
  }
],
"num_records": 1
```

throughput.read

```
"records": [
  {
    "svm": {
      "name": "DEMO"
    },
    "throughput": {
      "read": 123820441,
      "error": {
        "lower_bound": 123820441,
        "upper_bound": 123820441
      }
    },
    "path": "/vol/FLEXGROUP1/",
    "junction_path": "/FLEXGROUP1",
    "volume": {
      "name": "FLEXGROUP1",
      "uuid": "b4365290-dacc-11ec-
8e6f-d039ea1b6069"
    }
  }
],
"num_records": 1
```

throughput.write

```
"records": [
  {
    "svm": {
      "name": "DEMO"
    },
    "throughput": {
      "write": 32951500,
      "error": {
        "lower_bound": 32951500,
        "upper_bound": 32951500
      }
    },
    "path": "/vol/FLEXGROUP1/",
    "junction_path": "/FLEXGROUP1",
    "volume": {
      "name": "FLEXGROUP1",
      "uuid": "b4365290-dacc-11ec-
8e6f-d039ea1b6069"
    }
  }
],
"num_records": 1
```

NetApp ONTAP File System Analytics: top files

```
curl -X GET "https://<server>/api/svm/svms/<svm-uuid>/top-metrics/files?top_metric=
<iops or throughput>.<read or write>" -H  "accept: application/json" -H  "authorization:
Basic ABCDEFGHIJKLMNOPQRSTUVWXYZ" -k -s
```

iops.read

```
"records": [
    {
    "svm": {
      "name": "DEMO"
    },
    "iops": {
      "read": 736,
      "error": {
        "lower_bound": 736,
        "upper_bound": 736
      }
    },
    "path":
"/vol/FLEXGROUP1/file.txt",
    "junction_path": "/FLEXGROUP1",
    "volume": {
      "name": "FLEXGROUP1",
      "uuid": "b4365290-dacc-11ec-
8e6f-d039ea1b6069"
    }
  }
],
  "num_records": 1
```

iops.write

```
"records": [
    {
    "svm": {
      "name": "DEMO"
    },
    "iops": {
      "write": 43,
      "error": {
        "lower_bound": 43,
        "upper_bound": 43
      }
    },
    "path":
"/vol/FLEXGROUP1/file.txt",
    "junction_path": "/FLEXGROUP1",
    "volume": {
      "name": "FLEXGROUP1",
      "uuid": "b4365290-dacc-11ec-
8e6f-d039ea1b6069"
    }
  }
],
  "num_records": 1
```

throughput.read

```
"records": [
    {
    "svm": {
      "name": "DEMO"
    },
    "throughput": {
      "read": 44387532,
      "error": {
        "lower_bound": 44387532,
        "upper_bound": 44387532
      }
    },
    "path":
"/vol/FLEXGROUP1/file.txt",
    "junction_path": "/FLEXGROUP1",
    "volume": {
      "name": "FLEXGROUP1",
      "uuid": "b4365290-dacc-11ec-
8e6f-d039ea1b6069"
    }
  }
],
  "num_records": 1
```

throughput.write

```
"records": [
    {
    "svm": {
      "name": "DEMO"
    },
    "throughput": {
      "write": 16252928,
      "error": {
        "lower_bound": 16252928,
        "upper_bound": 16252928
      }
    },
    "path":
"/vol/FLEXGROUP1/file.txt",
    "junction_path": "/FLEXGROUP1",
    "volume": {
      "name": "FLEXGROUP1",
      "uuid": "b4365290-dacc-11ec-
8e6f-d039ea1b6069"
    }
  }
],
  "num_records": 1
```

NetApp ONTAP File System Analytics: top users

```
curl -X GET "https://<server>/api/svm/svms/<svm-uuid>/top-metrics/users?top_metric=
<iops or throughput>.<read or write>" -H  "accept: application/json" -H  "authorization:
Basic ABCDEFGHIJKLMNOPQRSTUVWXYZ" -k -s
```

iops.read

```json
"records": [
    {
    "svm": {
     "name": "DEMO"
    },
    "iops": {
     "read": 1322,
     "error": {
      "lower_bound": 1322,
      "upper_bound": 1322
     }
    },
    "user_id": "S-1-5-21-
3552729481-4032800560-2279794651-
500",
    "user_name":
"NTAP\\Administrator"
    }
  ],
  "num_records": 1
```

iops.write

```json
"records": [
    {
    "svm": {
     "name": "DEMO"
    },
    "iops": {
     "write": 284,
     "error": {
      "lower_bound": 284,
      "upper_bound": 284
     }
    },
    "user_id": "S-1-5-21-
3552729481-4032800560-2279794651-
500",
    "user_name":
"NTAP\\Administrator"
    }
  ],
  "num_records": 1
```

throughput.read

```json
"records": [
    {
    "svm": {
     "name": "DEMO"
    },
    "throughput": {
     "read": 63431475,
     "error": {
      "lower_bound": 63431475,
      "upper_bound": 63431475
     }
    },
    "user_id": "S-1-5-21-
3552729481-4032800560-2279794651-
500",
    "user_name":
"NTAP\\Administrator"
    }
  ],
  "num_records": 1
```

throughput.write

```json
{
  "records": [
    {
    "svm": {
     "name": "DEMO"
    },
    "throughput": {
     "write": 167994982,
     "error": {
      "lower_bound": 167994982,
      "upper_bound": 167994982
     }
    },
    "user_id": "S-1-5-21-
3552729481-4032800560-2279794651-
500",
    "user_name":
"NTAP\\Administrator"
    }
  ],
  "num_records": 1
```

Solution and benefits to customers

- Most or least changed and top-sized folders

- Abnormal behavior and real-time analytics

- Application integration through REST APIs

- Locate the largest number of files

- Data discovery and storage optimization use cases

- Heat and sort map based on modified time

- Cost-effective decisions for primary and secondary storage

- Directory granularity

Resources

- File System Analytics overview
  https://docs.netapp.com/us-en/ontap/concept_nas_file_system_analytics_overview.html

- Visibility Into Sub-Directory Granular Data with ONTAP File System Analytics
  https://www.netapp.tv/details/26202

- Best-practice guidelines for ONTAP File System Analytics Solution deployment
  https://www.netapp.com/media/20707-tr-4867.pdf

- ONTAP File System Analytics: Better visibility for better management
  https://www.netapp.com/blog/ontap-file-system-analytics/

Thank you

N NetApp