An Alternative Way for Genome Analysis on Cloud

ETL, ExTL, and introduction of its engine: `awsub`

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Genome analysis on Cloud Resources

aws

Google Cloud Platform

Azure

DigitalOcean

IBM SOFTLAYER®

openstack®

and more

How to use "Cloud"?

"Building a Cluster on Cloud"

- Galaxy
- cfn-cluster
- ElastiCluster
- Butler
- etc...

Pros and Cons of "Cluster on Cloud"

- Pros:
    - We are **VERY** used to cluster on HPC
        - *Grid Engine, HTCondor, SLURM, etc...*
        - e.g. `qsub ./my-workflow.sh`

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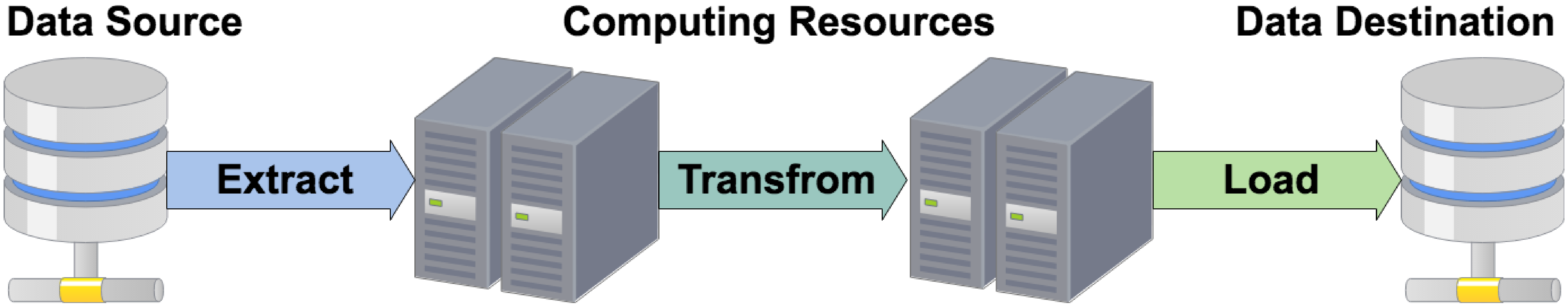
- Pros:
  - We are **VERY** used to cluster on HPC
    - *Grid Engine, HTCondor, SLURM, etc...*
    - e.g. `qsub ./my-workflow.sh`
- Cons:
  - Persistent static resources
    - Scheduler Node, Queue Database, Filesystem

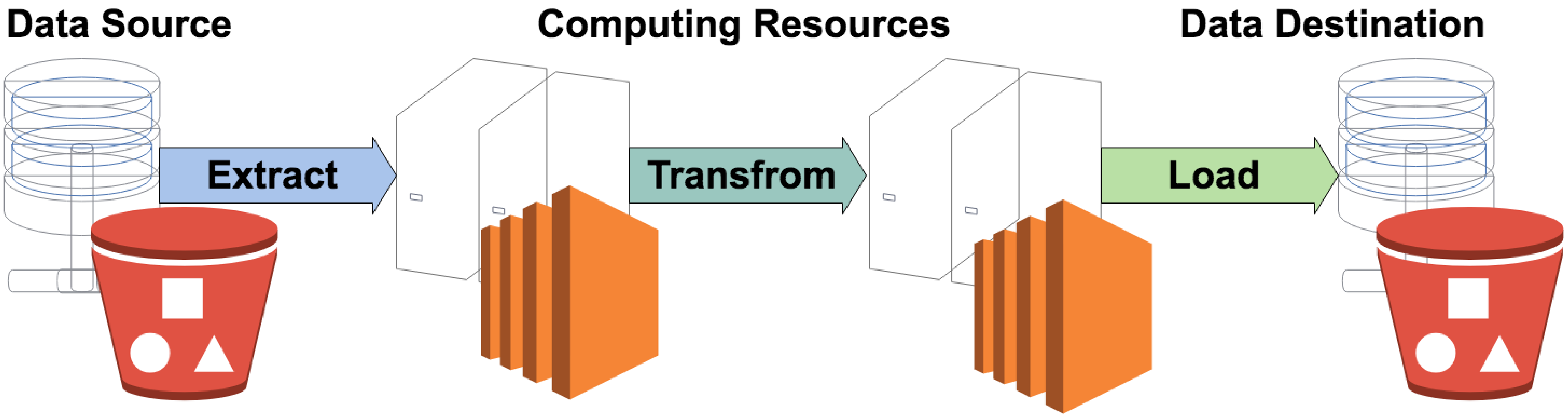
Suggestion: "On-Demand ETL"

ETL is

- Extract, Transform, Load
- Data processing model for general purpose



Do it on Cloud



Data Source

Computing Resources

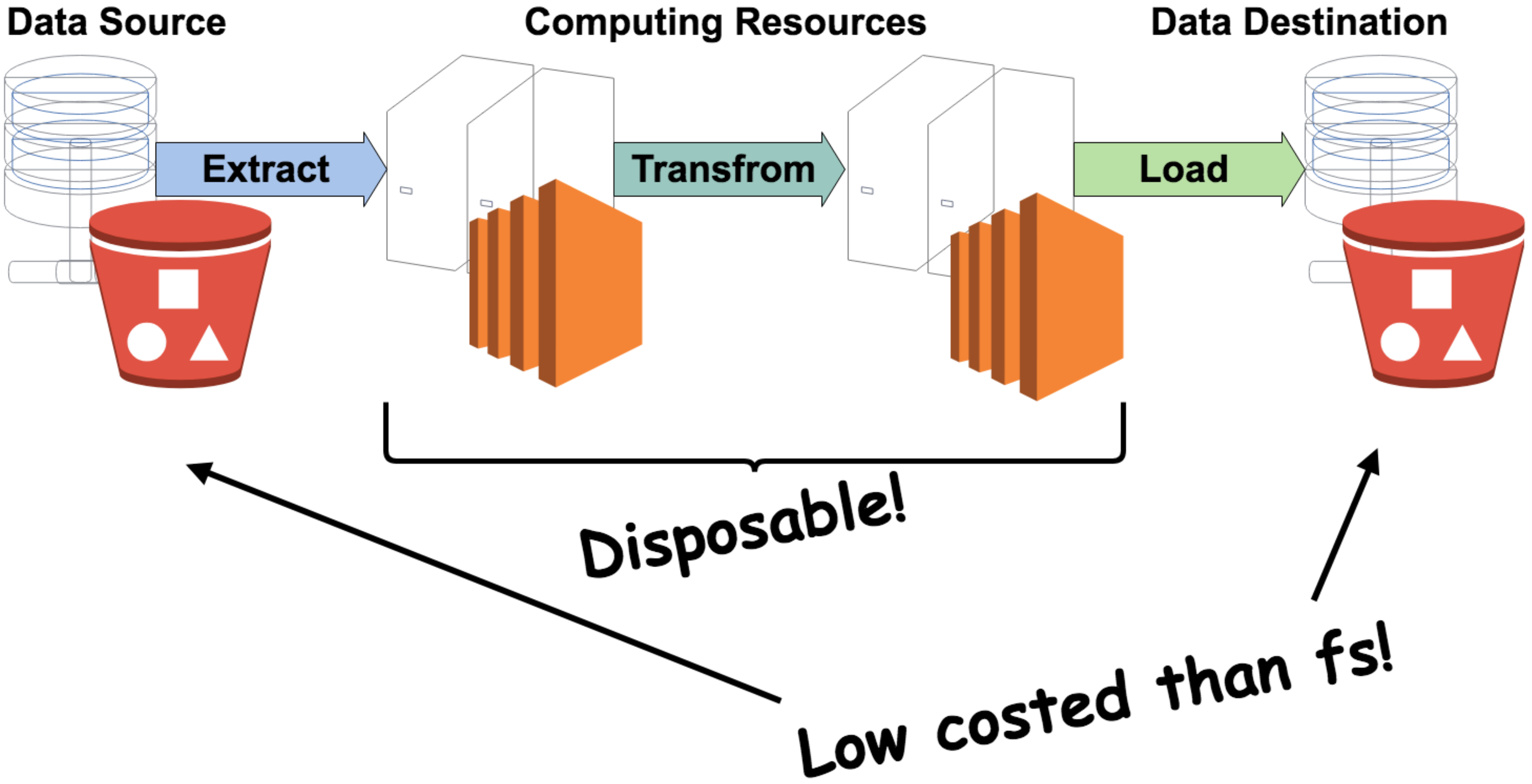
Data Destination

Extract

Transfrom

Load

Do it on Cloud



Data Source

Computing Resources

Data Destination

Extract

Transfrom

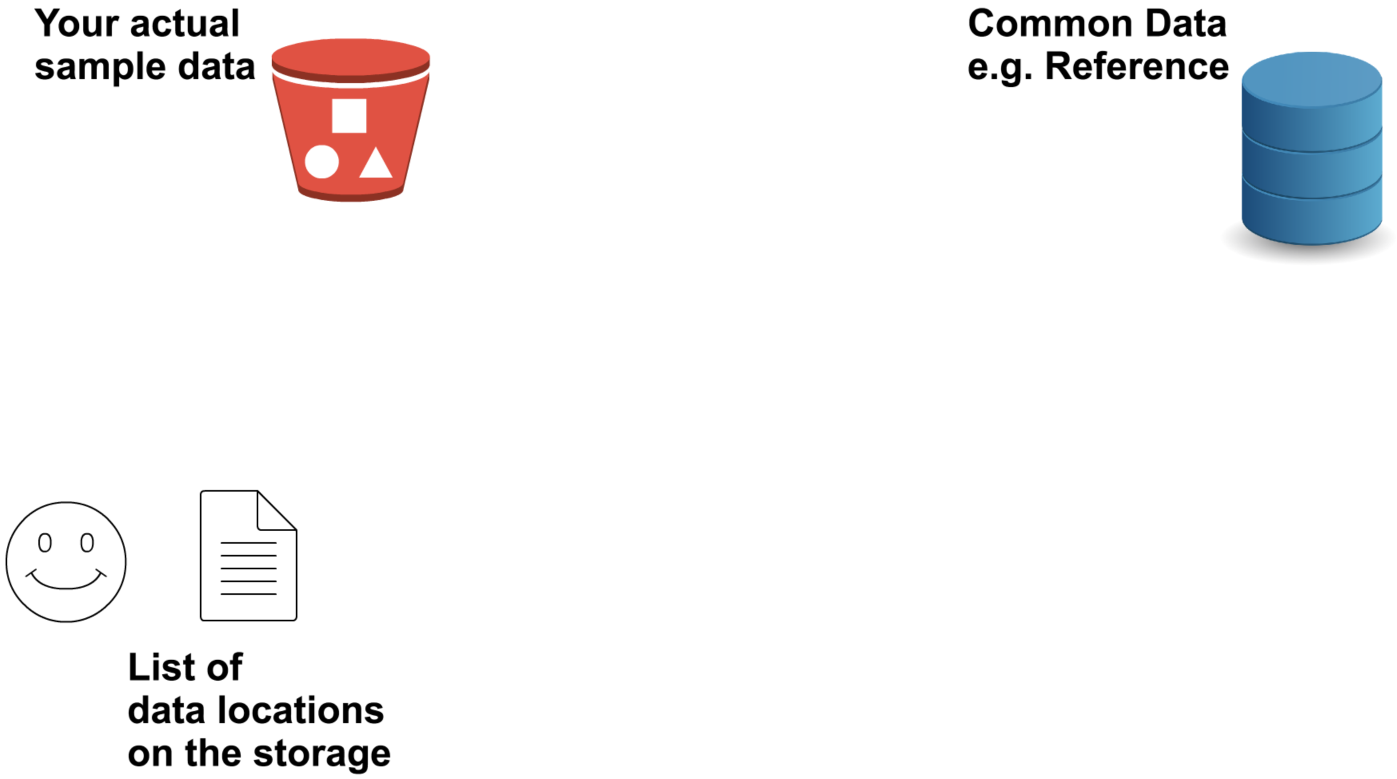
Load

Disposable!

Low costed than fs!

Do it with `awsub`!

If you have 4 Fastq samples

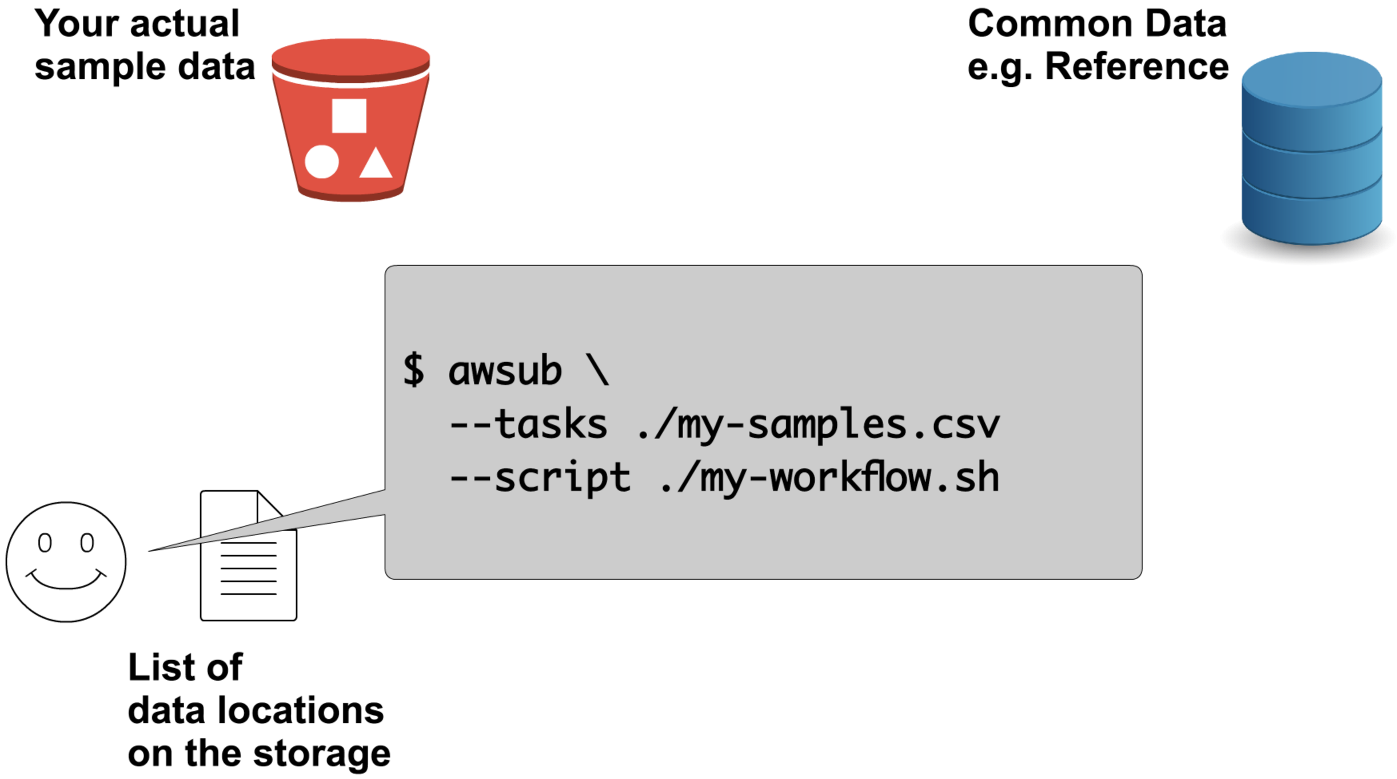


Your actual sample data

Common Data e.g. Reference

List of data locations on the storage

Specify workflow script and samples



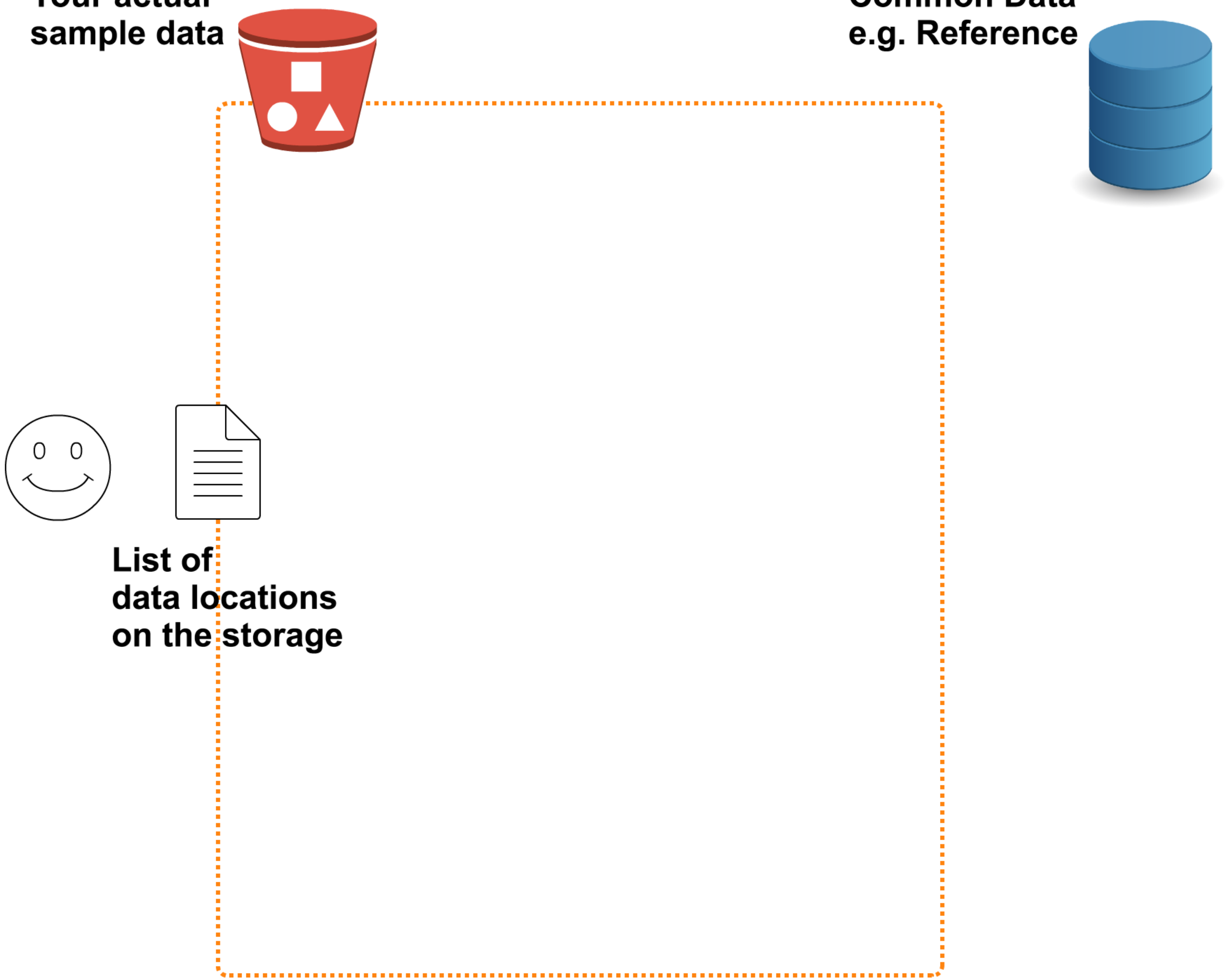
Your actual sample data

Common Data e.g. Reference

```
$ awsub \
  --tasks ./my-samples.csv
  --script ./my-workflow.sh
```

List of data locations on the storage

Security Group

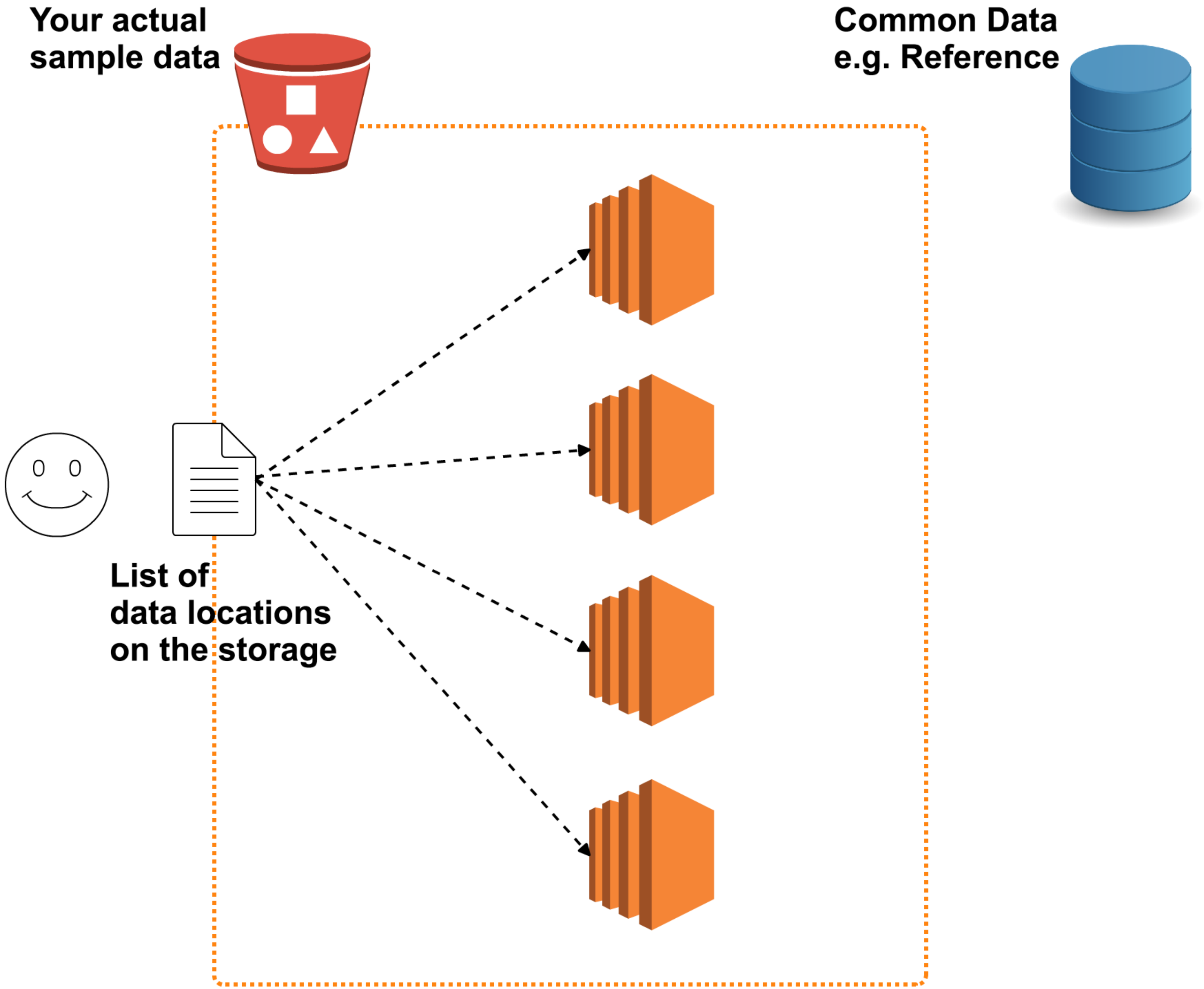


Your actual sample data

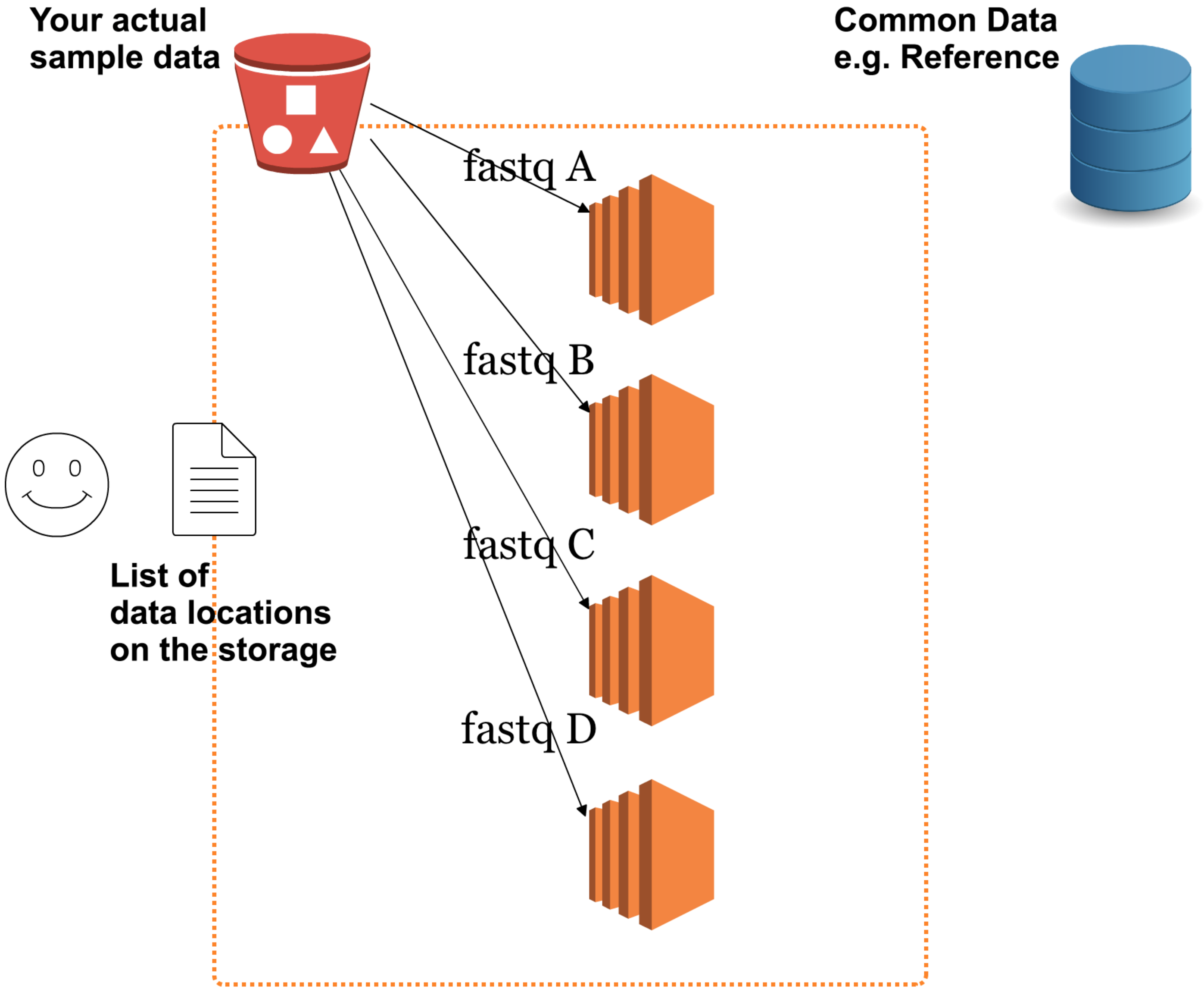
Common Data e.g. Reference

List of data locations on the storage

Inscances for each sample



Fetch specific sample data according to the location

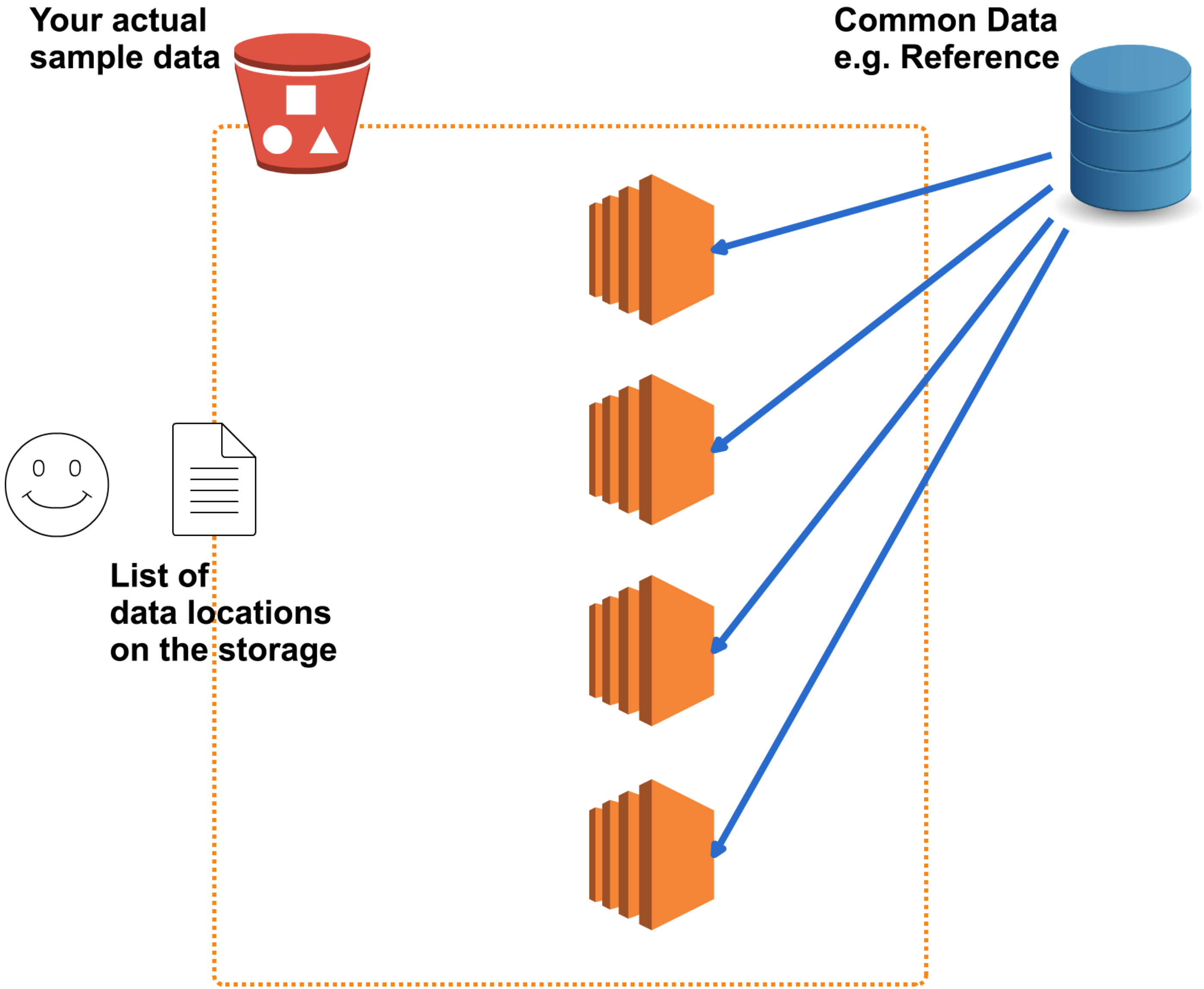


Your actual sample data

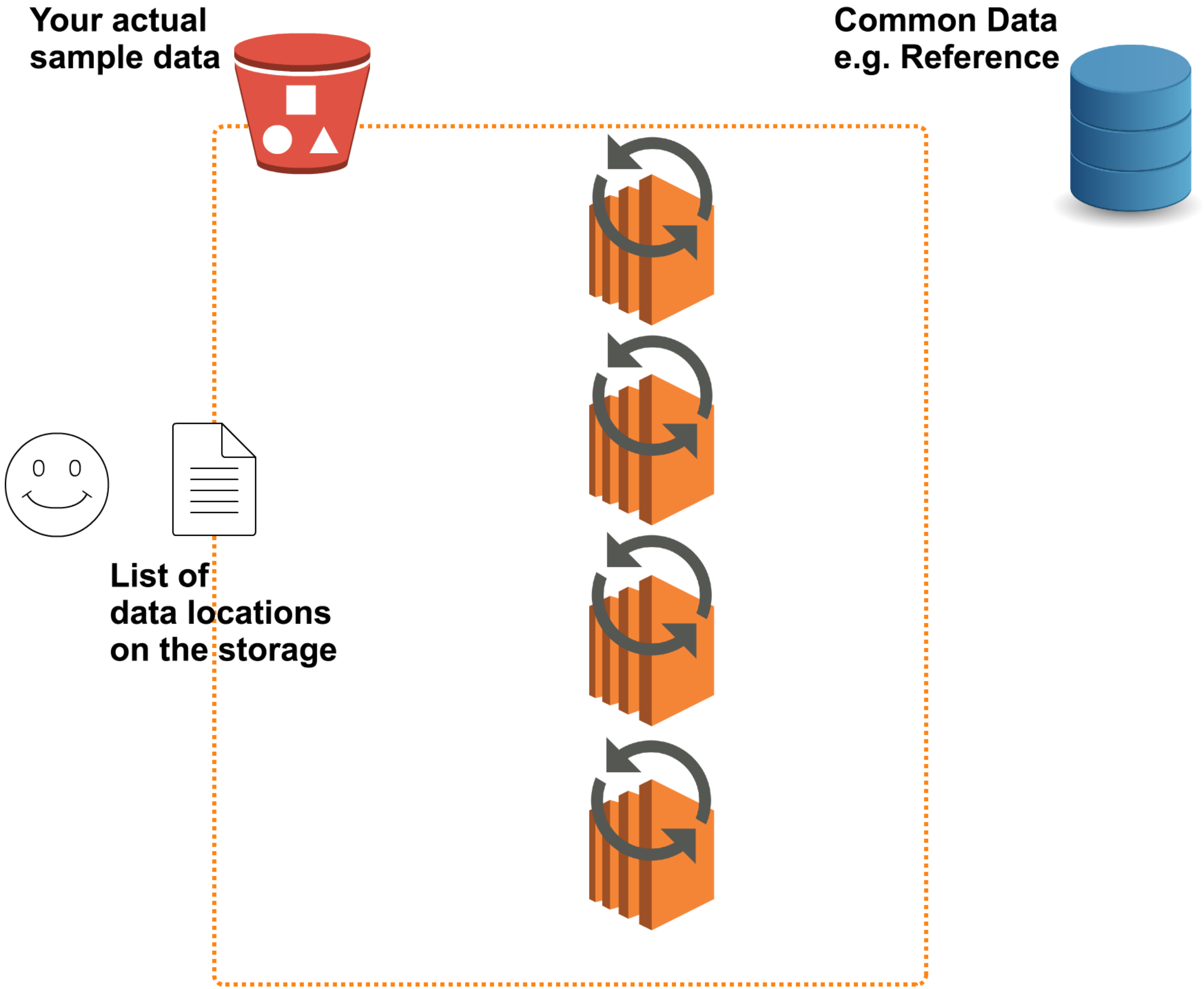
Common Data e.g. Reference

List of data locations on the storage

Fetch reference data from common data source



Execute your workflow for each

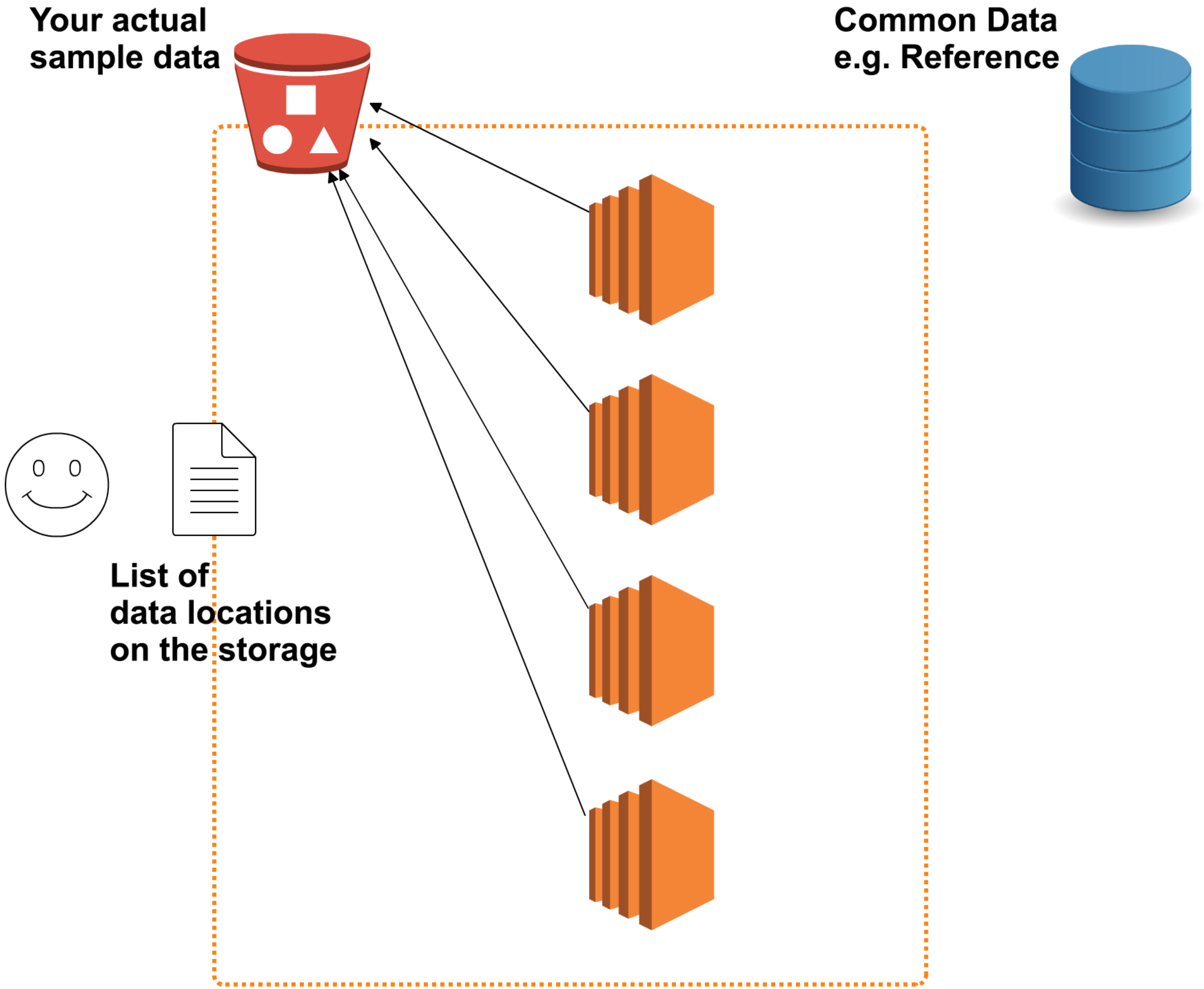


Your actual sample data

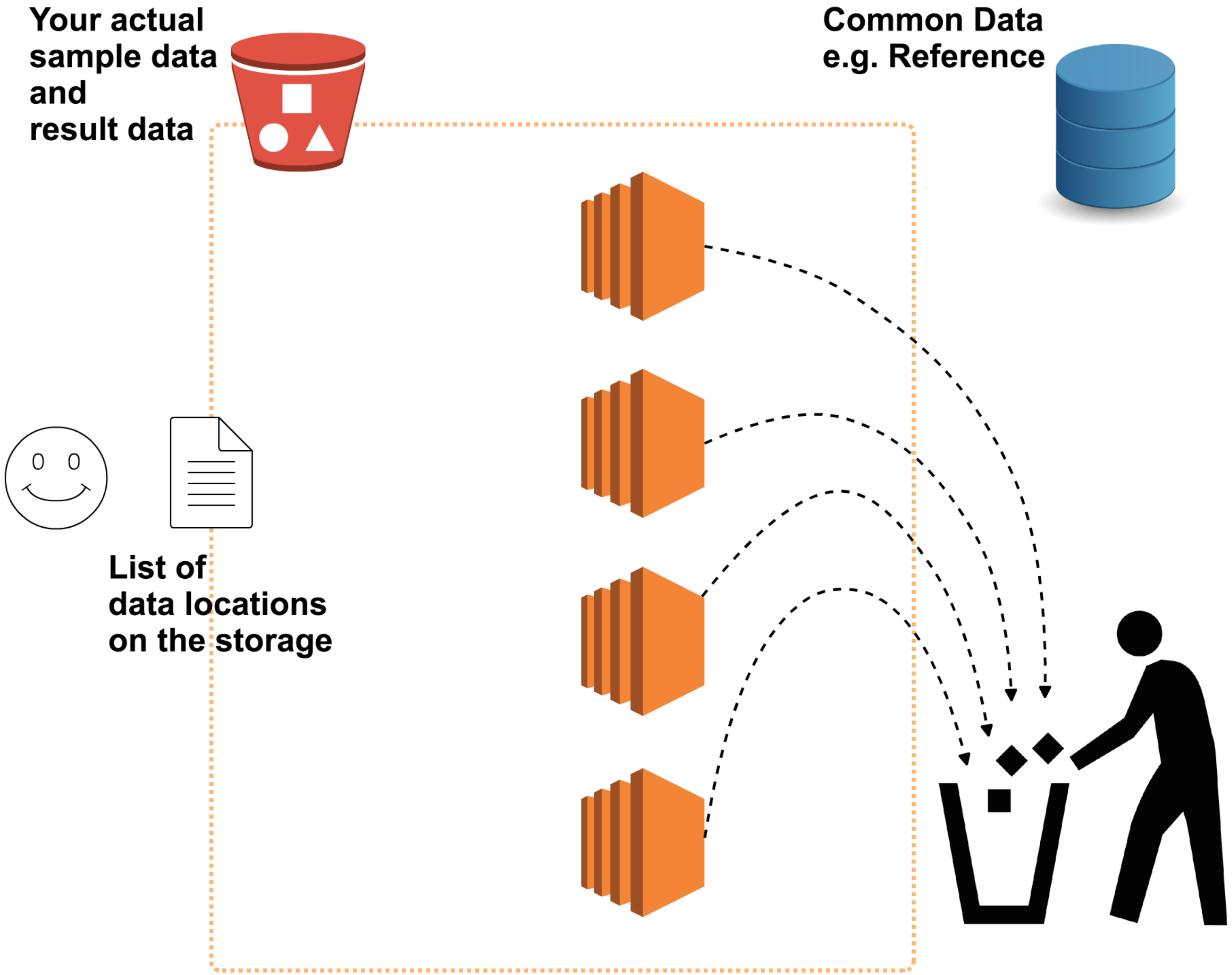
Common Data e.g. Reference

List of data locations on the storage

Push the result data back to the storage



Dispose all the computing resources no longer used



Your actual sample data and result data

Common Data e.g. Reference

List of data locations on the storage

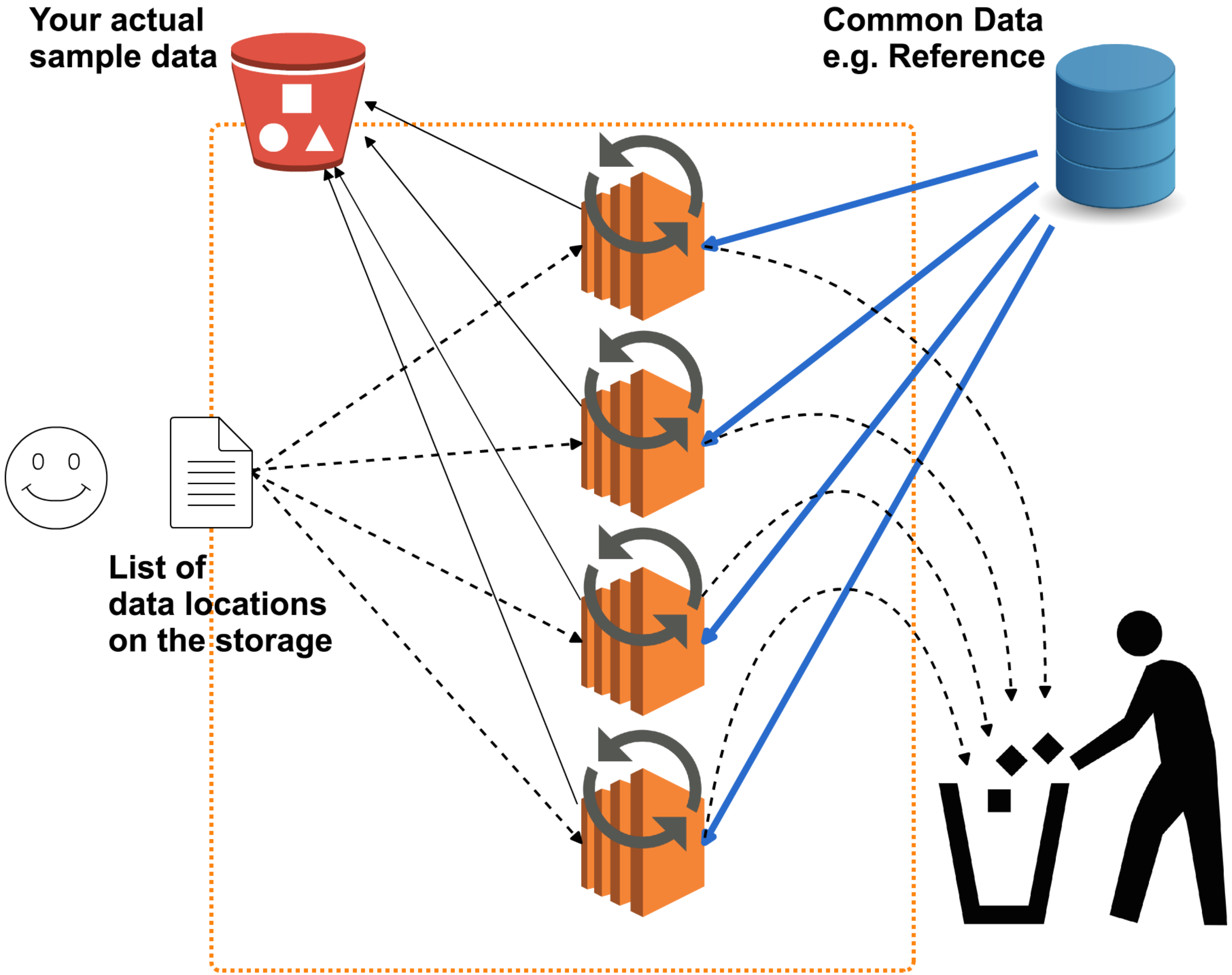
All you got is the result data!

Your actual
sample data
and
result data

Common Data
e.g. Reference

List of
data locations
on the storage

Overall


Your actual
sample data
Common Data
e.g. Reference
List of
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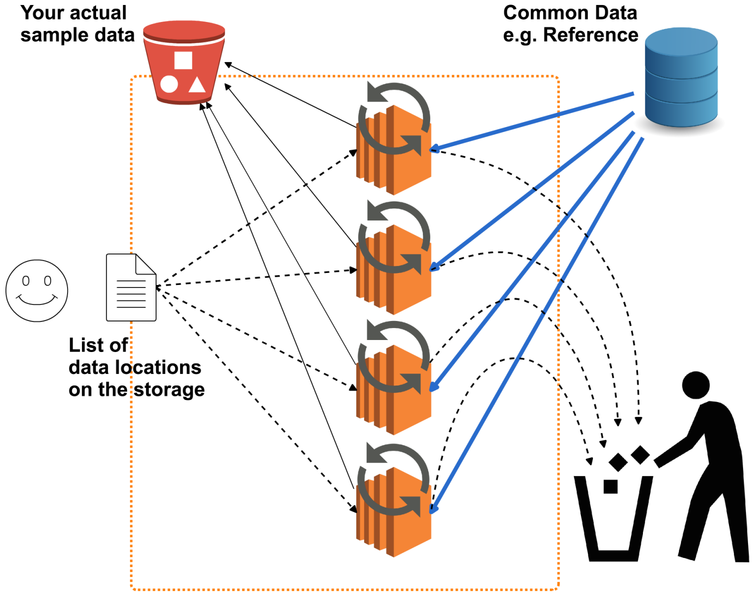
on the storage

by using `awsub`

```
$ awsub \
  --tasks  ./my-samples.csv \
  --script ./my-workflow.sh \
  --image  otiai10/STAR-alignment # any Docker image
```



Problems of ETL on Bioinformatics

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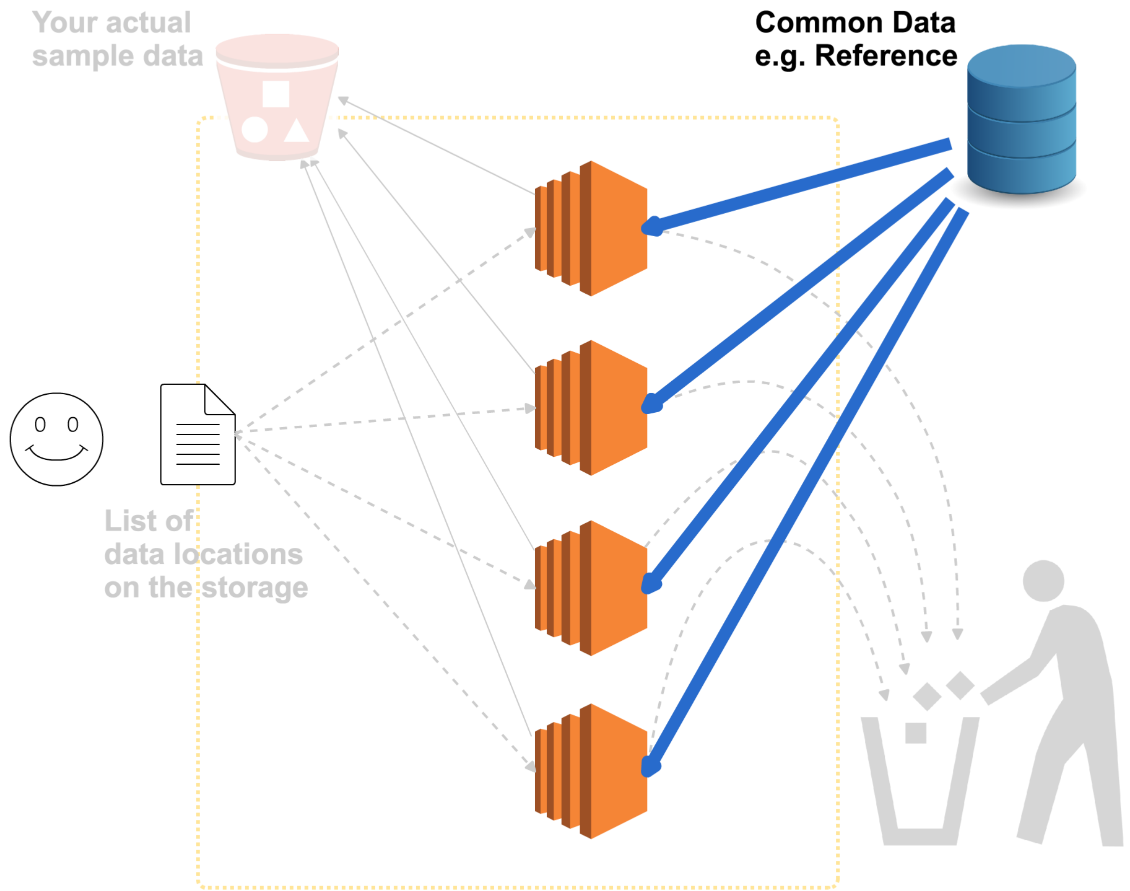
Your actual sample data
Common Data e.g. Reference
List of data locations on the storage

- Common Reference Data is so huge
  - Copying huge reference data uses
    - inefficient **traffic**
    - inefficient **instance time**
    - inefficient **storage area**
  - e.g. Human Reference for STAR alignemt: **30GB**

Suggestion: *Extended* ETL (ExTL)

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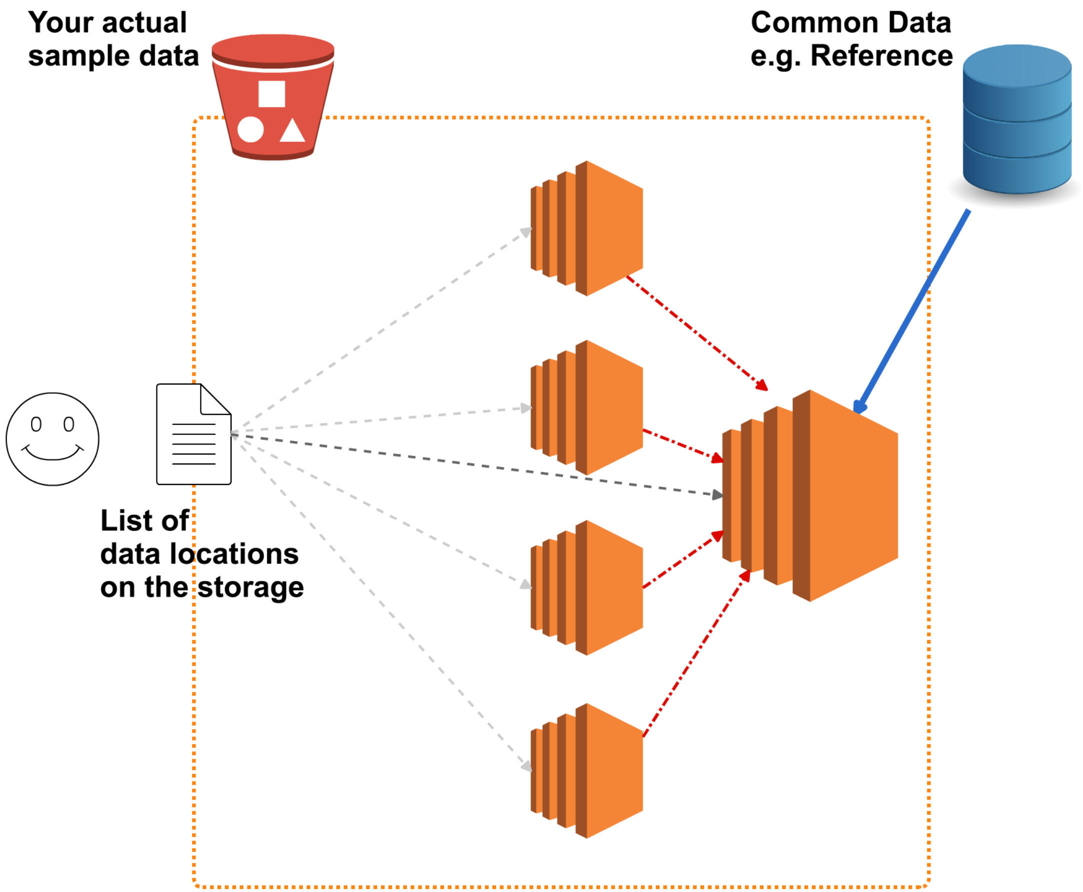
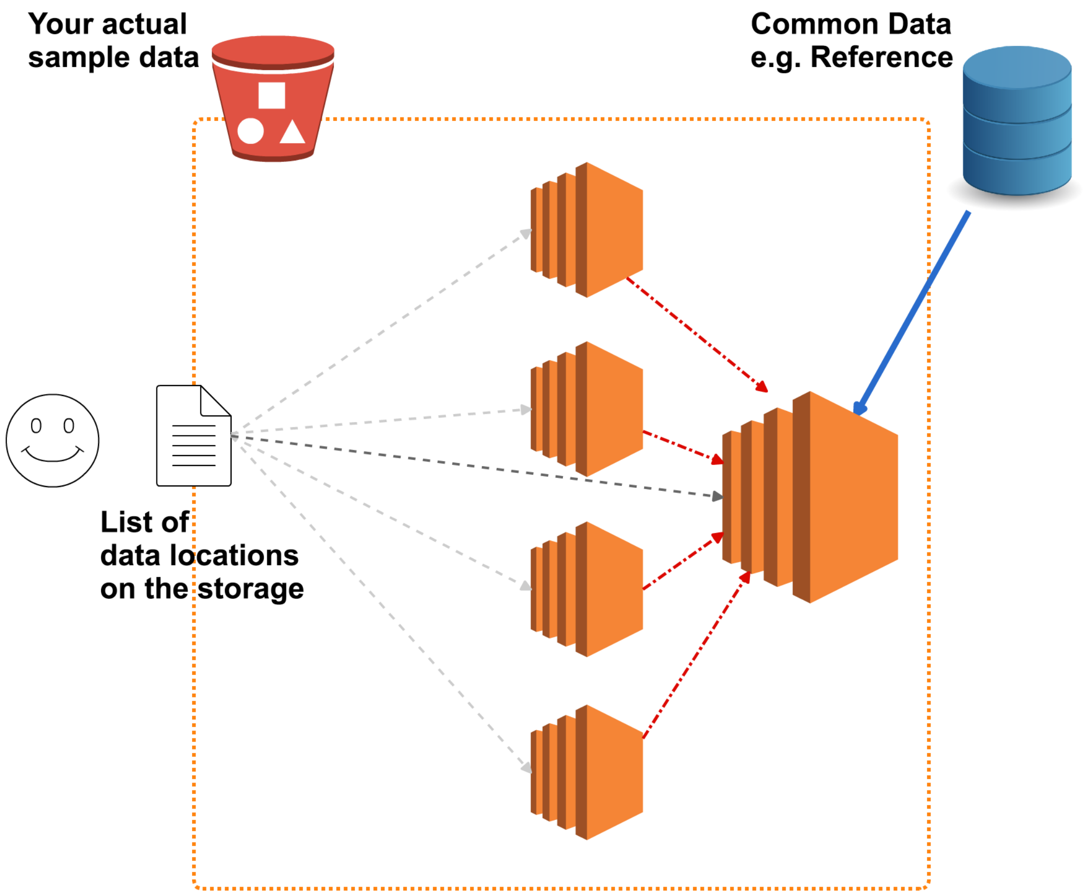


- Create a `Shared Data Instance`
- Fetch external common data **once**
- Let computing instances **mount**

Suggestion: *Extended* ETL (ExTL)


Your actual sample data
Common Data e.g. Reference
List of data locations on the storage

- Create a `Shared Data Instance`
- Fetch external common data **once**
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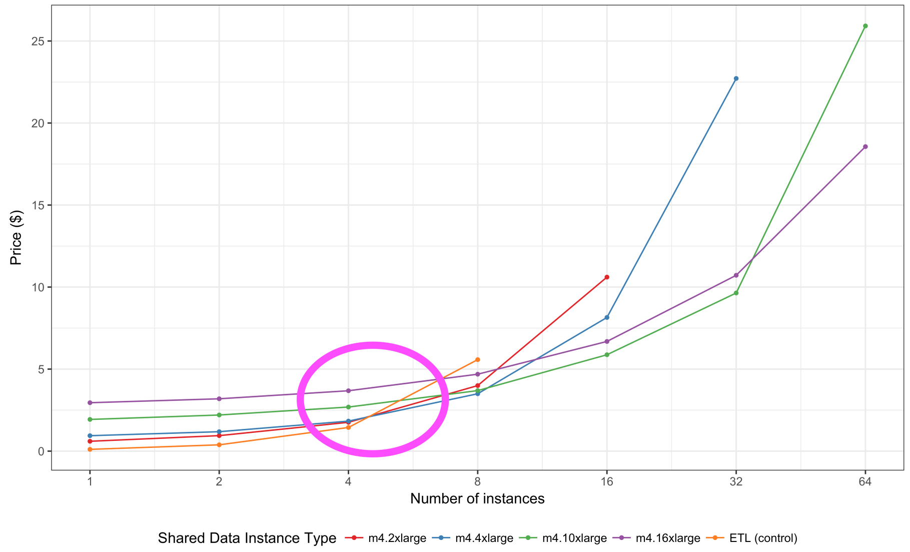
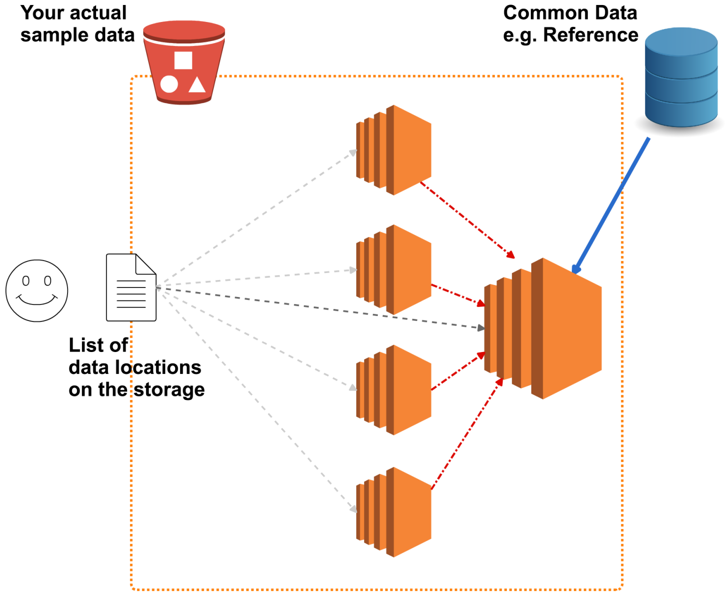
Cost Saving!

- Network traffic, instance time, ...



ExTL by using `awsub`

```
$ awsub \
  --tasks  ./my-samples.csv \
  --script ./my-workflow.sh \
  --image  otiai10/STAR-alignment \
+ --shared REFERENCE=s3://bucket/huge/reference
```



Summary

- Another approach than "Cluster on Cloud"
    - **"On-demand ETL on Cloud"**
- Huge common data can be a problem of "ETL on Cloud"
- **"Extended ETL"** (ExTL)
- Working Example Implementation of ExTL: `awsub`

More on the poster

about

- How to **Get started**
- **Google Cloud**, Microsoft Azure, OpenStack and more
- Common Workflow Language (**CWL**)
- Execution **Protocol** and Security Groups / IAM Instance Profile
- ***Go*** implementation
- etc...

Come to poster **B29**, and any feedback is welcome!

https://github.com/otiai10/awsub