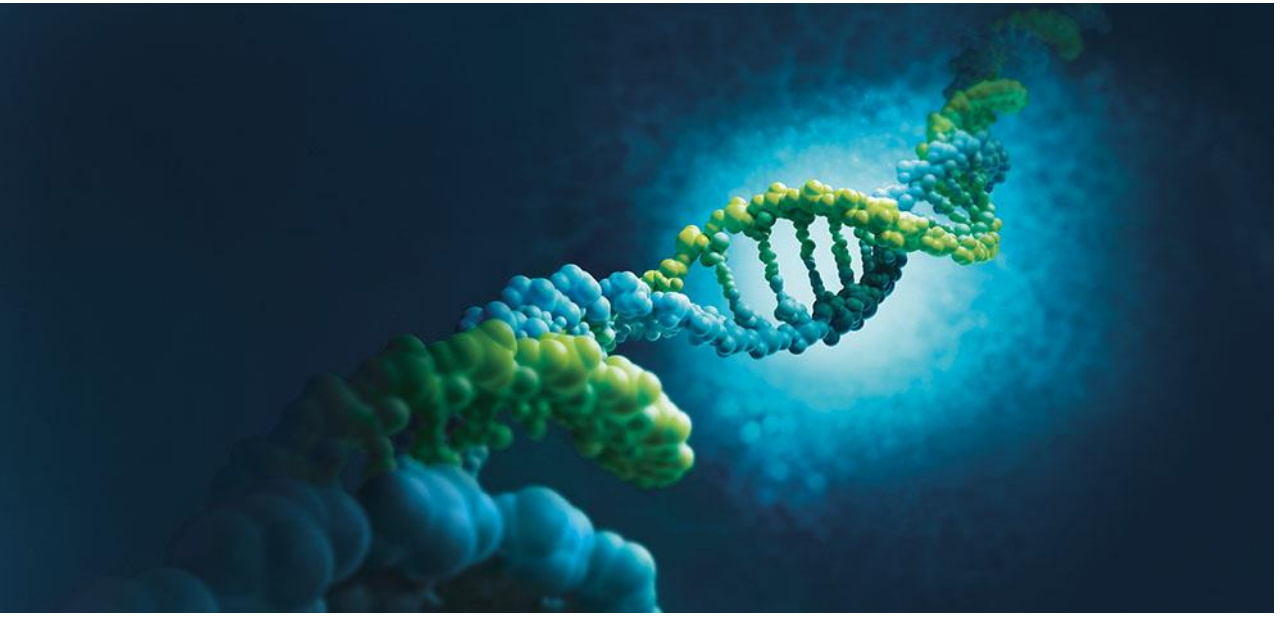
Science For A Better Life



iRODS and Objectstorage

UGM 2016, Chapel Hill

2016-06-08 / Othmar Weber, Bayer Business Services / v0.2

Agenda

- iRODS at Bayer
- Situation and call for action
- Object Storage PoC
- Pillow talks

Overview

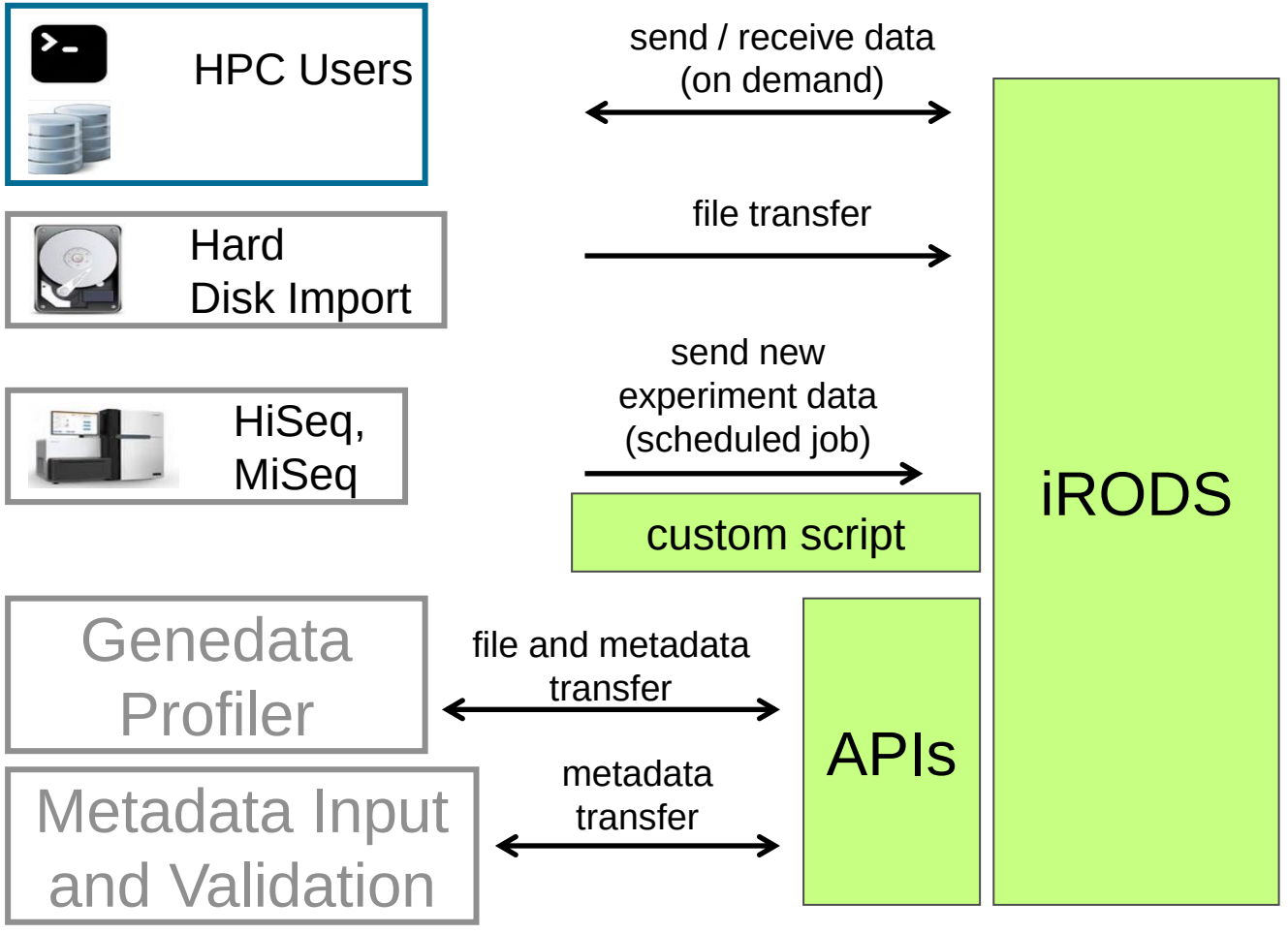
iRODS@Bayer

- Introduced in 2014 by an IT research project for LifeSciences
- Developed as internal data platform to securely store and share genomic data
- Integrated into the Bayer specific environment
- Identified as key enabler for future research data strategy
- Provided as a solution by a joint operations team (DevOps style)
- 2016: Bayer joined the iRODS consortium

- Used by
  - HC Bioinformatics (Research) for data management
  - HC Biomarker as an archival system
  - CS Digital Farming
  - … in consideration by other projects

iRODS integration example

HealthCare Bioinformatics



transparent storage access

file system, object storage

metadata storage and query

user + access rights management

PRIMA 4 PWP
IAM IDENTITY & ACCESS MANAGEMENT

audit trail

iRODS setup 1.0

- Traditional deployment like any other server
  - iCAT: VM with local database (local=SAN)
  - iRES: VM with local filesystem (local=SAN)

It works. Why should I change something?

Ever heard of NGS?

- NGS means ~ 300 GB per individual
- How do we handle the data of a study with 1000 individuals?

iRODS setup 1.0

- Deployment like any other server
  - icat: VM with local database (local=SAN)
  - ires: VM with local filesystem (local=SAN)

How does this work at Petabyte scale?

It simply does not!

- Cost: SAN storage + Backup
- DR: Data mirror in 2nd site needed
- Recovery: How do I revert a user or system error?

How should a storage solution in PB scale look like? (Whishes are for free …)

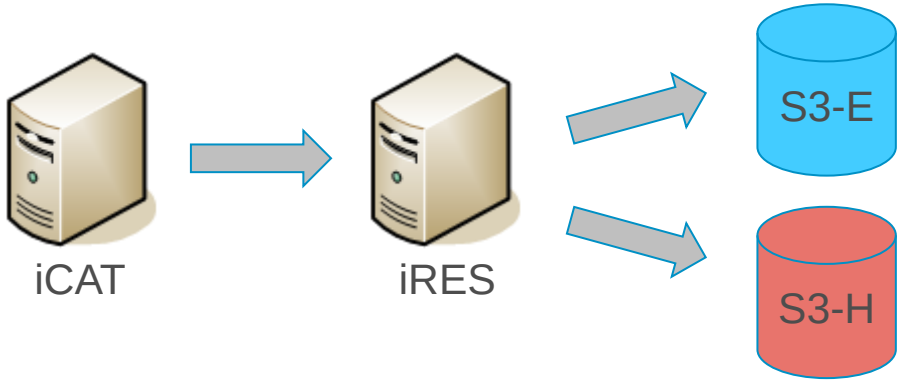
- highly scalable (from TB to PB)
- low price tag
- fully automated
- low administrative effort (self service?)
- backup included by design (replication + versioning)
- DR included by design (replication)
- data security features (fast rebuilt, check summing, self healing, access control, encryption)
- appliance with vendor support (no D.I.Y.)
- S3 interface support (de facto standard with iRODS plugin available)
- performant

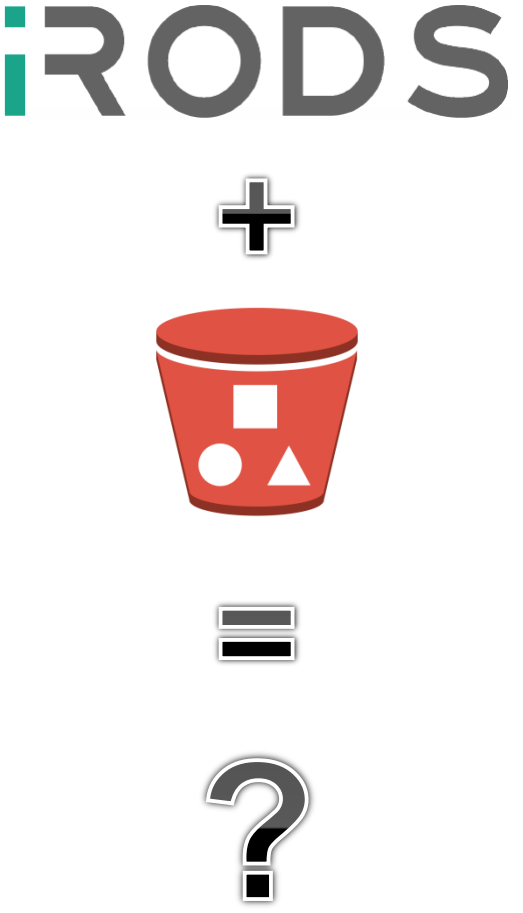
➢ **Object Storage!**

The Proof of Concept

Setup

- Setup:
  - two different storage solutions
  - S3 interface
  - dedicated resource server with local file systems
  - both storage solutions connected to the same resource server
  - iRODS version 4.0.3 (start), 4.1.8 (later)

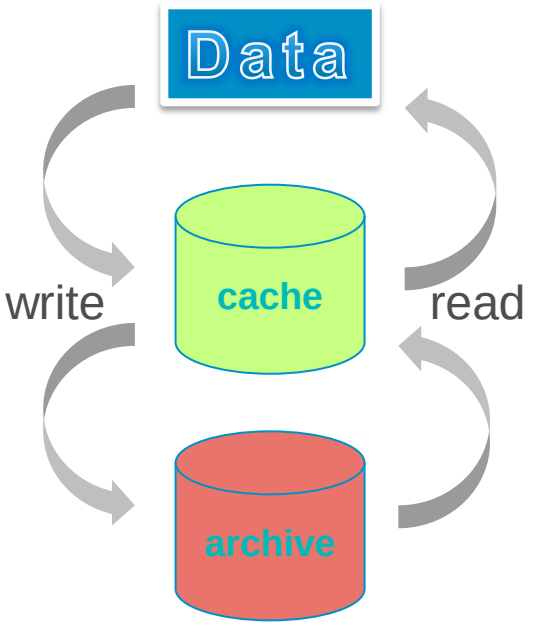




The Proof of Concept

iRODS integration (Compound resource)

- S3 resource is implemented as compound resource
  - Cache and Archive resource
- No direct storage access
  - additional cache file system needed
  - dedicated resource server with local file system
  - both storage solutions connected to the same resource server
- Observations/Findings
  - additional caching tier is not for free (housekeeping, performance)
  - consistency monitoring between cache and archive necessary
  - iput/iget provide purge cache option to delete cached objects
    - not available for all commands



The Proof of Concept

iRODS S3 resource plugin

- current available plugin is at version v1.3
  - compatible with iRODS v4.1.8 only
- Support of multiple connection parameters (->)
- Relies on libs3 & libcurl

- Object versioning was enabled on bucket level
  - restore script to revert old versions

Parameter	Meaning
S3_DEFAULT_HOSTNAME	S3 endpoint address (e.g. s3.acme.com:80)
S3_AUTH_FILE	File with Access key and secret key
S3_KEY_ID	Access key (instead of S3_AUTH_FILE)
S3_ACCESS_KEY	Secret key (instead of S3_AUTH_FILE)
S3_RETRY_COUNT	Number of retries on connection error
S3_WAIT_TIME_SEC	Time between retries
S3_PROTO	HTTP or HTTPS
…	More to come …

```
Example:
iadmin mkresc S3archive s3 server:/bucket/irods/vault
"S3_DEFAULT_HOSTNAME=s3.acme.com:80;S3_AUTH_FILE=/var/lib/irods/.S3_Auth;S3_RETRY_COUNT=3;S3_WAIT_TIME_SEC=3;S3_PROTO=HTTP"
```

The Proof of Concept

iRODS S3 resource plugin observations and findings

- Load balancing somehow tricky
  - S3 endpoints are usually hidden behind a load balancer
  - iput with bulk option was only using one S3 connection
    - multiple iput requests were faster because of load balancing
- Configuring multiple endpoints on same iRES did not work (issue #~~1826~~)
- AWS v4 signatures currently not supported (regions eu-central-1 and ap-northeast-2, issue #1831)
- Renaming issues for files with special characters (issue #1829)
- Renaming issues for large files (no multipart copy, #1830)
  - rename is a two step procedure (copy & delete) -> processing time related to object size!
  - consistency issues between iRODS catalog and S3 bucket
- Issue to delete orphan catalog entries (issue #~~3154~~)
- ichksum did not work with archive resources (hierarchy issue, #3127)

Pillow talks (1/2)

How to improve the relationship of iRODS and object storage

- iRODS currently relies on a POSIX file system
  - implemented as compound resource
    - Native object implementation possible?
- ✓ S3 plugin uses catalog entries as object keys
  - leads to issues (rename timeout, …)
  - archive nature of object storage should be considered
    - decouple object and catalog entries
- Utilize object storage checksum capabilities (iscan, ichksum)
- Consider increasing parallel sessions on bulk transfer to better utilize load balancing
  - multiple single files in bulk upload
  - multipart upload (~~#1824,#1827~~)

Pillow talks (2/2)

How to improve the relationship of iRODS and object storage

- Error handling for object storage access
  - object storage needs to be handled different than POSIX files
    - see: S3 ErrorBestPractices.html
- Think about metadata usage in object store
  - metadata is a feature of object storage
  - why not use this feature for recovery purposes?

❖ Things get better with plugin version 1.4:

- V4 signature, decoupling object names, renaming, multipart, new parameters, …

Any questions?

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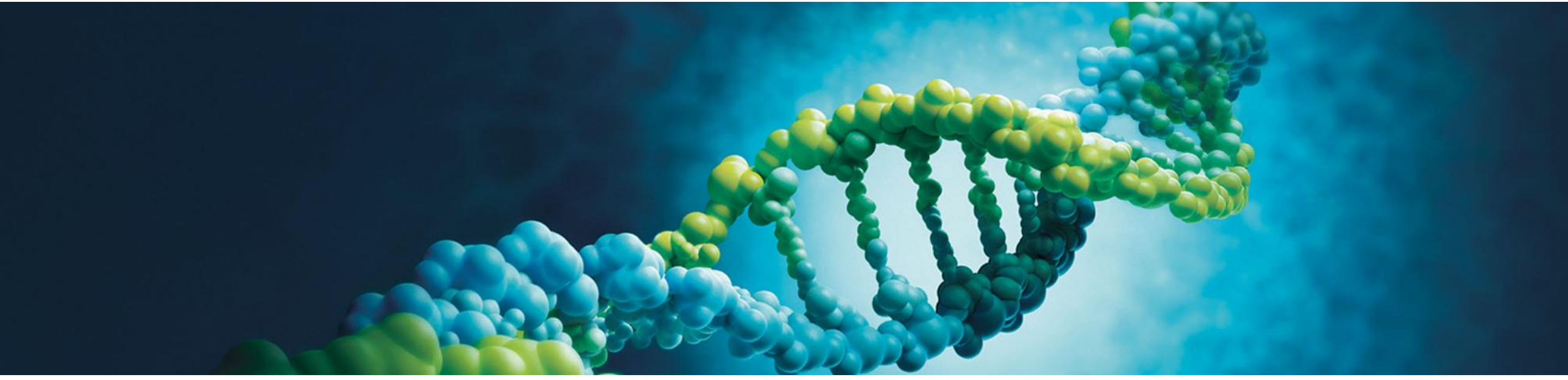

Thank you!

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