

Building a scalable, open source storage and processing solution for biodiversity data



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Anthony Goddard



> Biodiversity Heritage Library's data

- all BHL storage is handled by the Internet Archive
- 38,000+ scanned books
- approximately 48 terabytes of data
- unable to self-host



> BHL – Europe

- 3 year, EU funded project
- 28 major natural history museums, botanical gardens and other cooperating institutions
- third file-store of all BHL data
- collecting cultural heritage from all over Europe

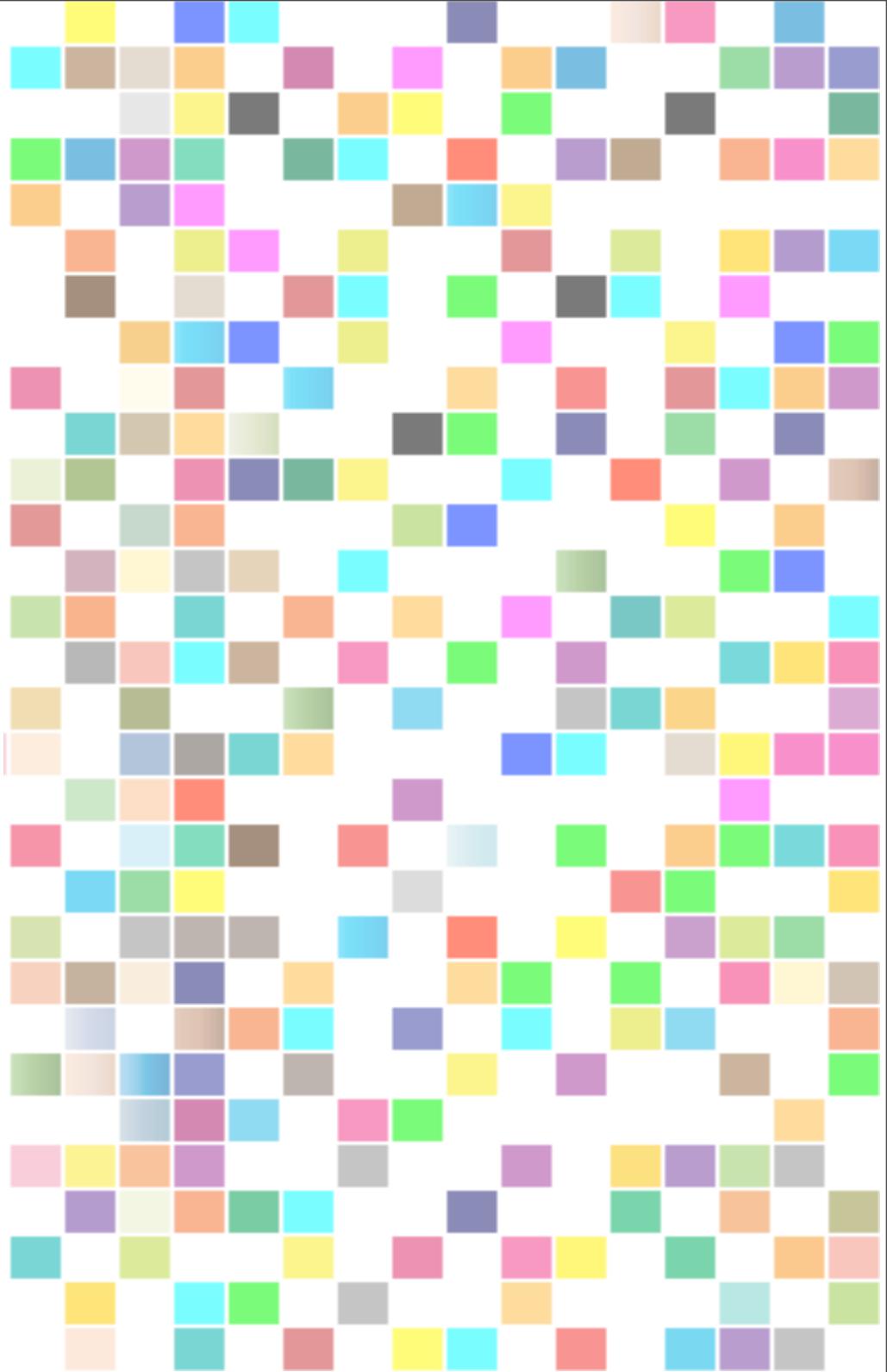


> Data explosion

- more data being created
- more data being saved
- **more data tomorrow**
- storage has not kept up with Moore's Law
- this presentation will be saved online, more data!

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> Potential #fail's

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When will biodiversity informatics resources be available 24/7? All the #ebioo9 and #gbif hot air is for nothing if we can't do this #fail

4:19 AM Oct 8th from Twitterrific

 **rdmpage**
Roderic Page

> Problem 1 - Data access

- file size we can't store
- latency of large files
- quality user experience
- processing data-mining

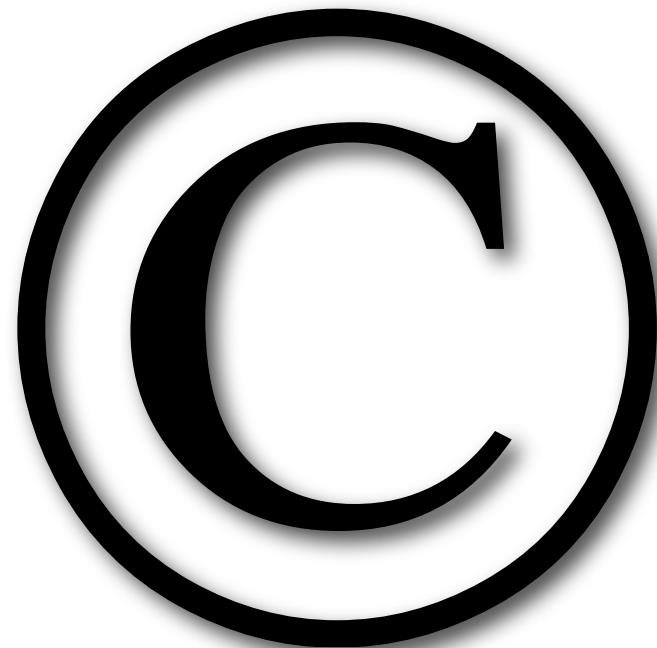
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> Problem 2 – Copyright concerns

- international copyright concerns
- potential related funding issues
- we'd rather not let this be an issue



> Problem 3 – Redundancy



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> Problem 3 – Redundancy

- computers crash
- hard drives die
- networks fail
- natural disasters occur



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but...

This is *NOT* a problem!



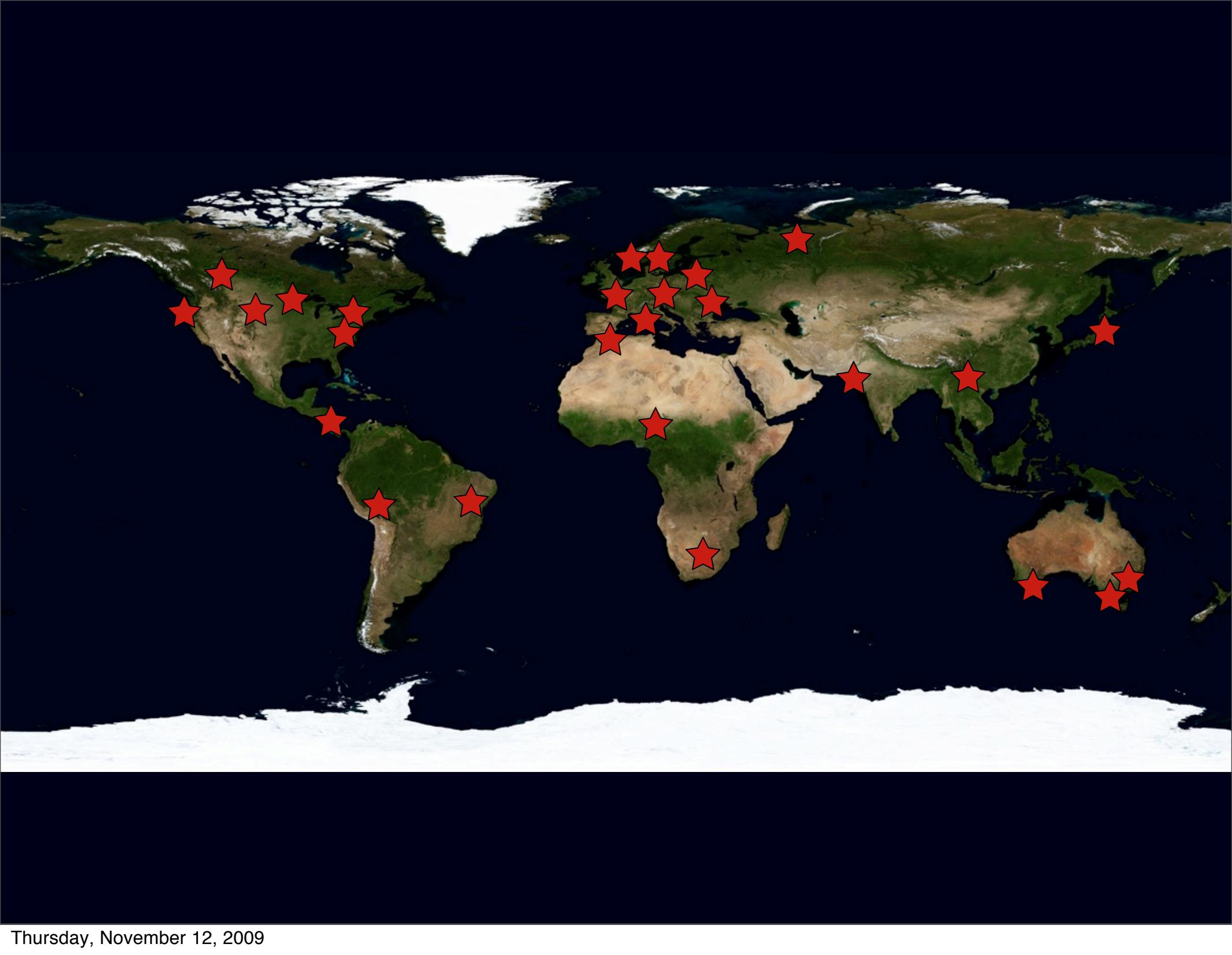
...so plan for it.



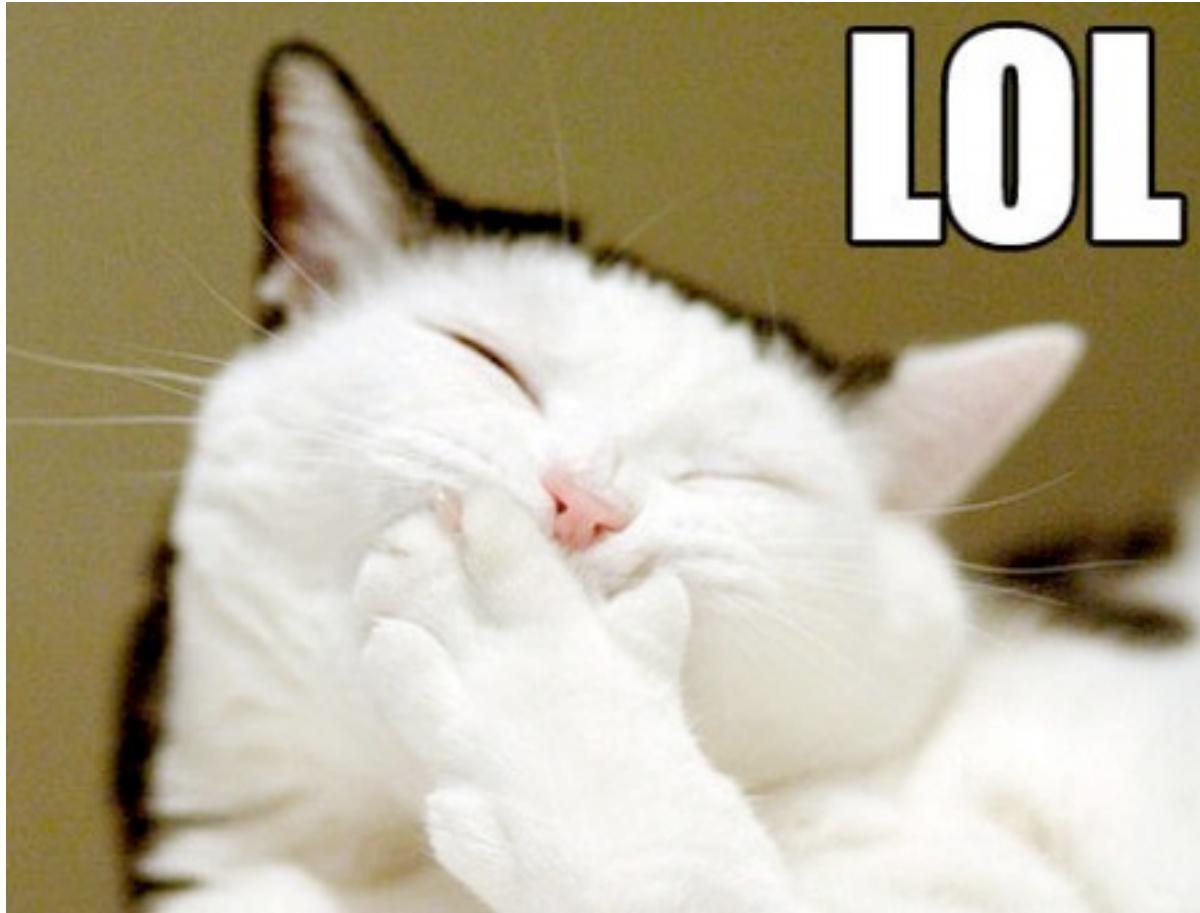
Thursday, November 12, 2009

Current





Thursday, November 12, 2009



LOL

> Site 1 – Internet Archive



> Site 2 – MBL, Woods Hole



> Site 3 – NHM, London

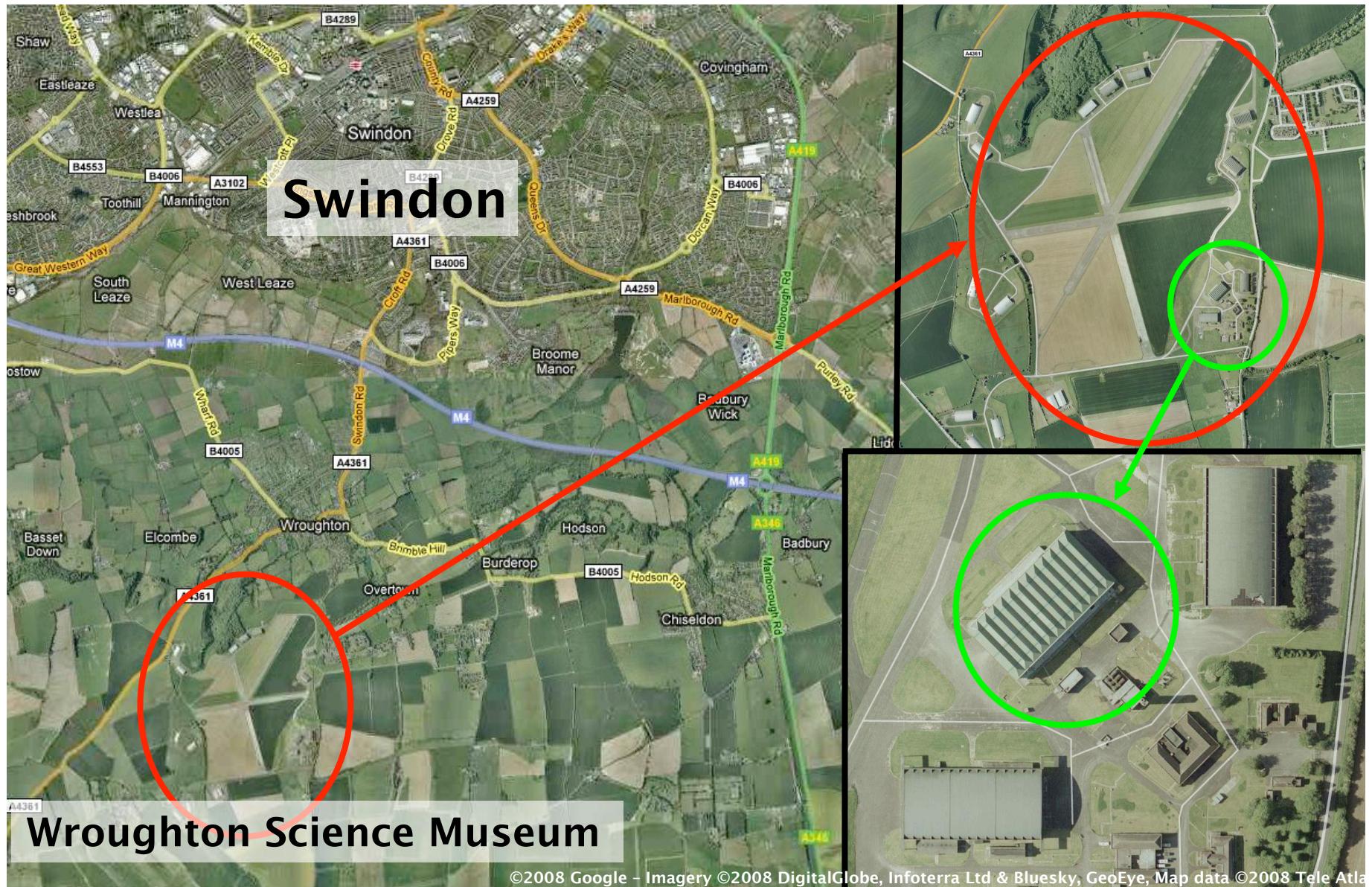


...followed by new Data center

Data Centre – “Darwin Repository”

- €600,000 Funding secured from eContentPlus
- Suitable location found with very good development potential in collaboration with Science Museum.
- Economy of scale provides additional avenues for co-development of services.
 - Disaster Recovery and Business Continuity for all Museums (help with ongoing and running costs)
 - DCMS funding sought to help with development.
 - e-Infrastructure European initiative
 - Building Digital Repositories for Scientific Communities
 - PESI (Biodiversity)

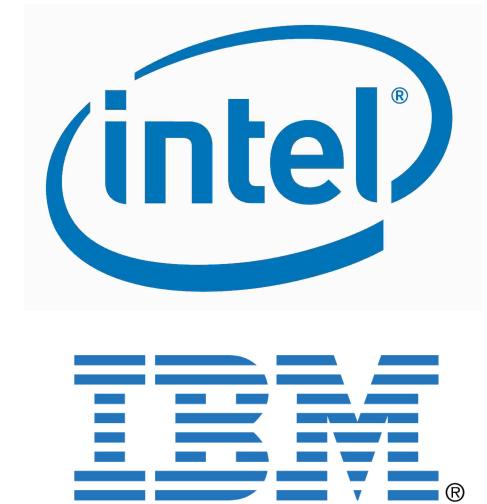
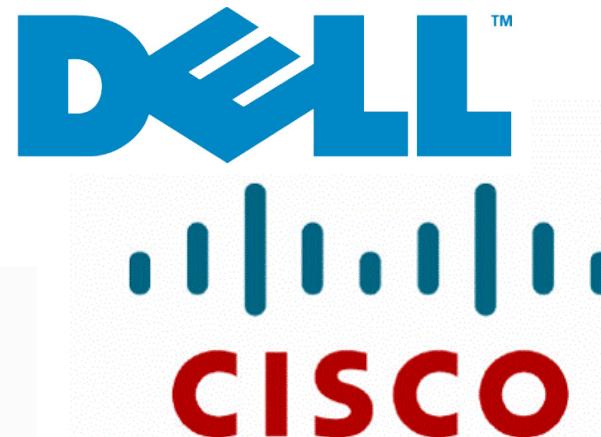
Proposed Data Centre Location



N NATURAL HISTORY MUSEUM

Vendor Stakeholders / Partners

- Identified Technology Partners*



- Additional Funding Partners*



department for
culture, media
and sport



co-funded by the
Community programme
eContentplus



*Note: Discussions are ongoing with all Partners and may be at different stages

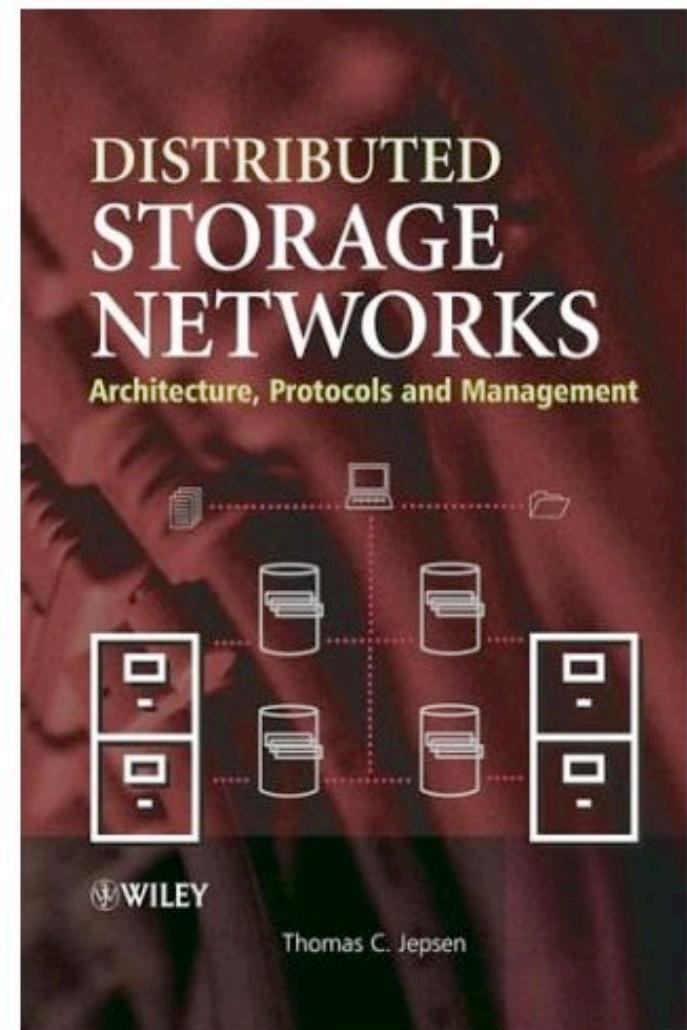


Long Term Sustainability

- No Dripping Tap
 - Business case should provide for significant self funding opportunities.
- Diversity
 - Darwin Repository (Data Centre) will provide an economy of scale that will provide significant efficiency gains.
- Green technology to minimise carbon footprint and provide industry leadership.

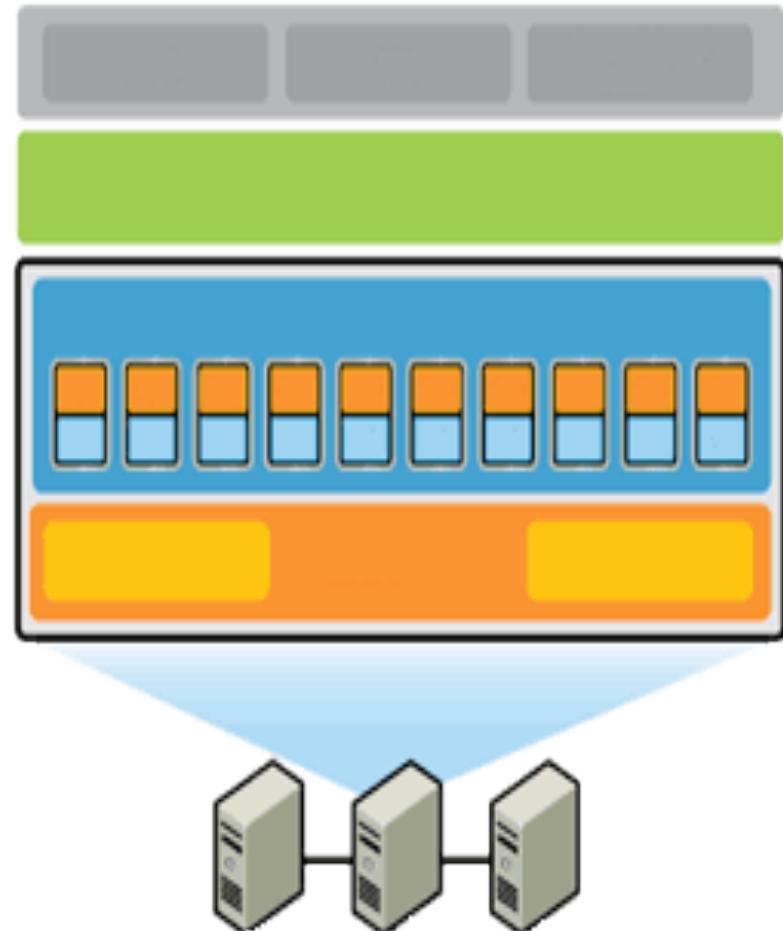
> Distributed storage

- write once, read anywhere
- **replication and fault tolerance**
- error correction
- automatic redundancy
- scalable horizontally



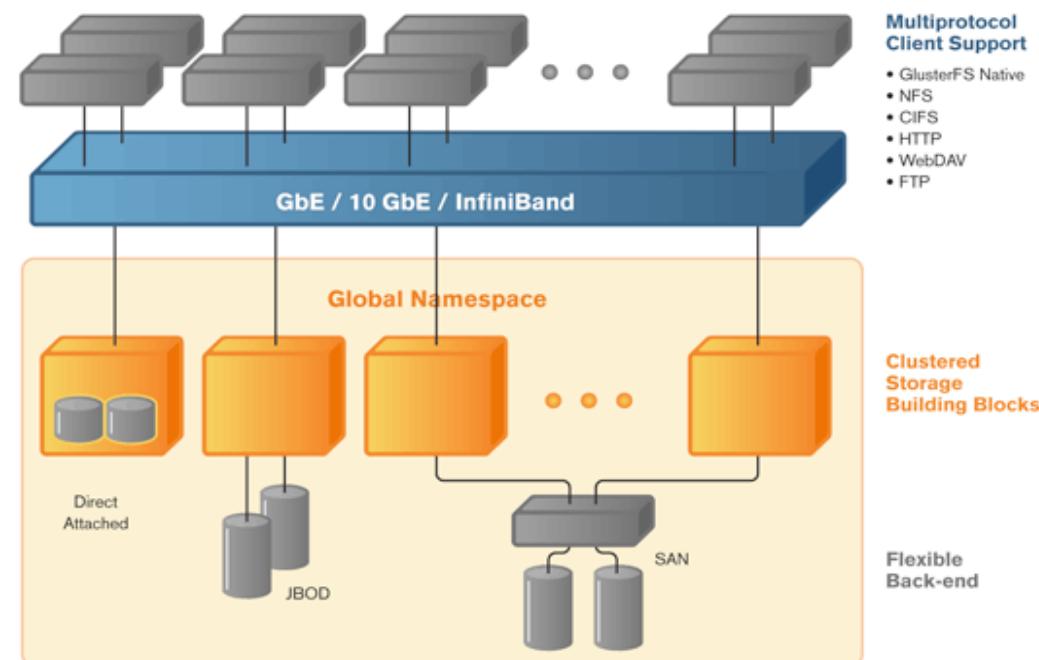
> Distributed storage – Options

- fully hosted storage (cloud)
- hosted with own storage (private cloud)
- self hosted with proprietary hardware (Sun Thumper)
- self hosted with commodity hardware



> Distributed storage – GlusterFS

- GlusterFS: a cluster file-system capable of scaling to several petabytes
- open source software on commodity hardware
- tunable performance
- simple to install and manage
- offers seamless expansion



> Distributed storage – Archival

- Fedora-commons is an open source repository
- accounts for all changes, so built-in version control
- provides disaster recover
- open standards to mesh with future file formats
- provides open sharing services such as OAI-PMH



> Distributed storage – Mirrored data

- now we have redundancy
- in fact, **multiple redundant copies**
- provides fault tolerance
- offers load balancing
- gives us future geographical distribution



> Now we have lots of computers...



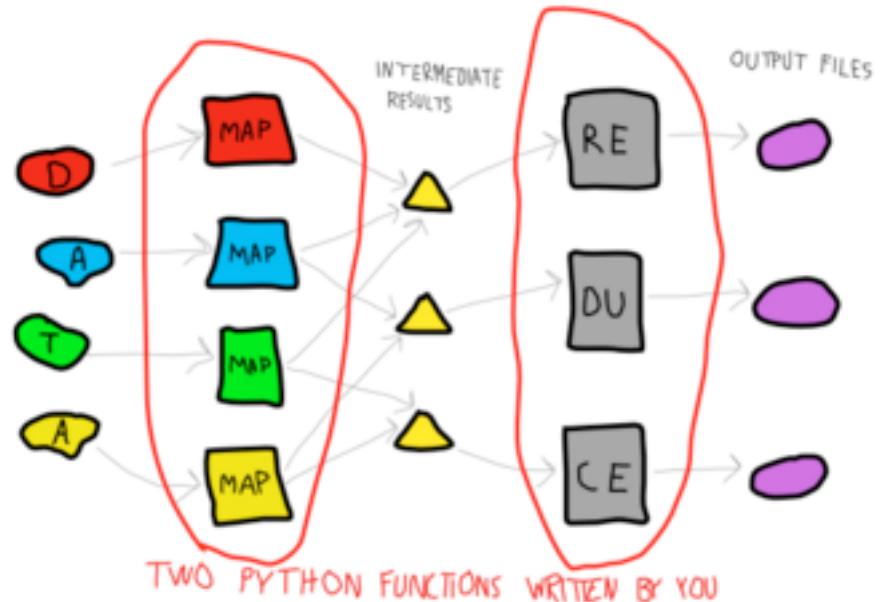
> Distributed processing

- more abilities available than just storing data
- with distributed storage comes distributed processing
- distributed processing means faster answers
- faster answers mean new questions
- lather, rinse, repeat

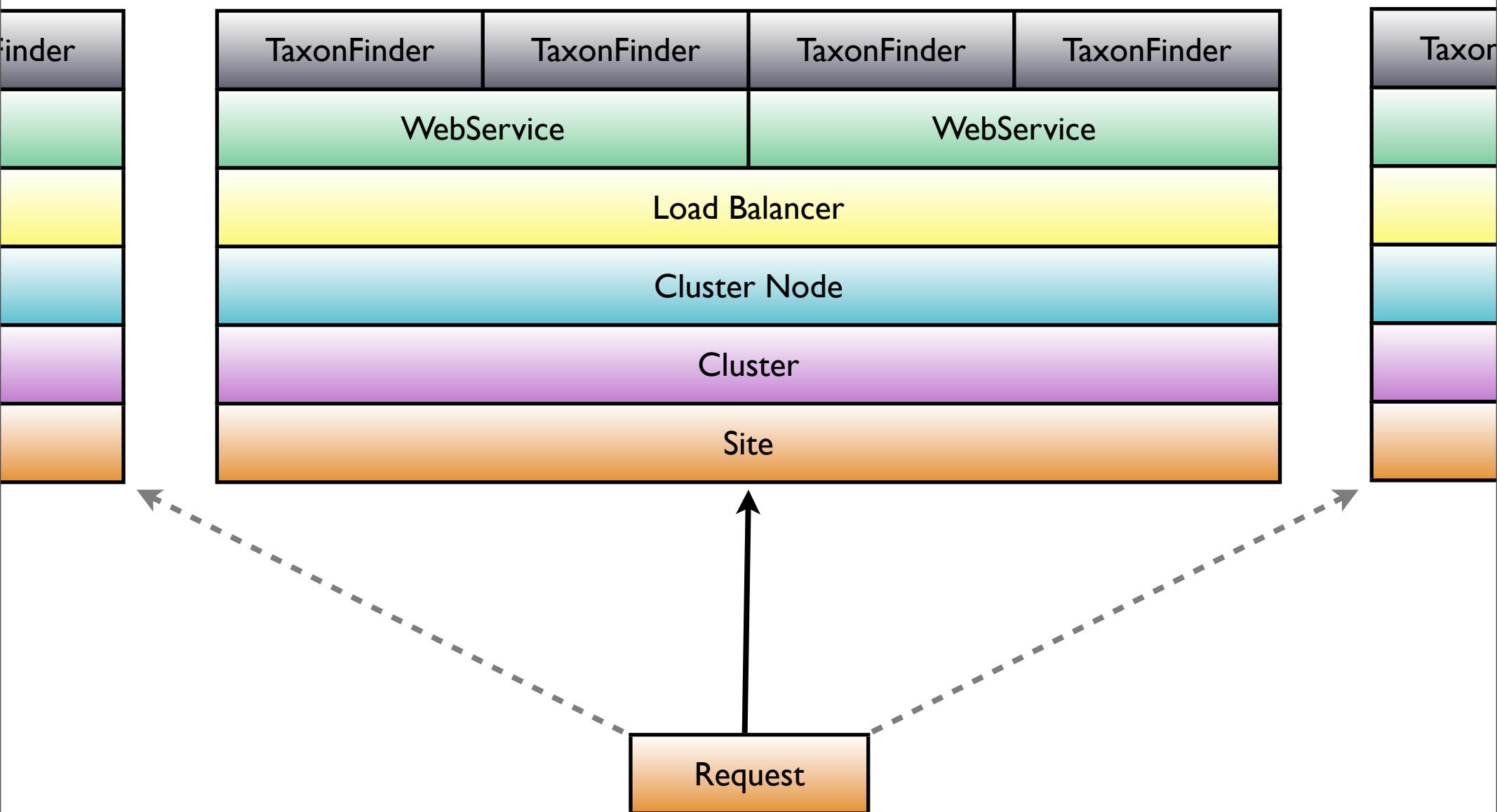


> Distributed processing

- make your data more useful
- image and OCR processing
- distributed web services
- identifier resolution pools
- map/reduce frameworks
- generate new visualizations, text mining, NLP

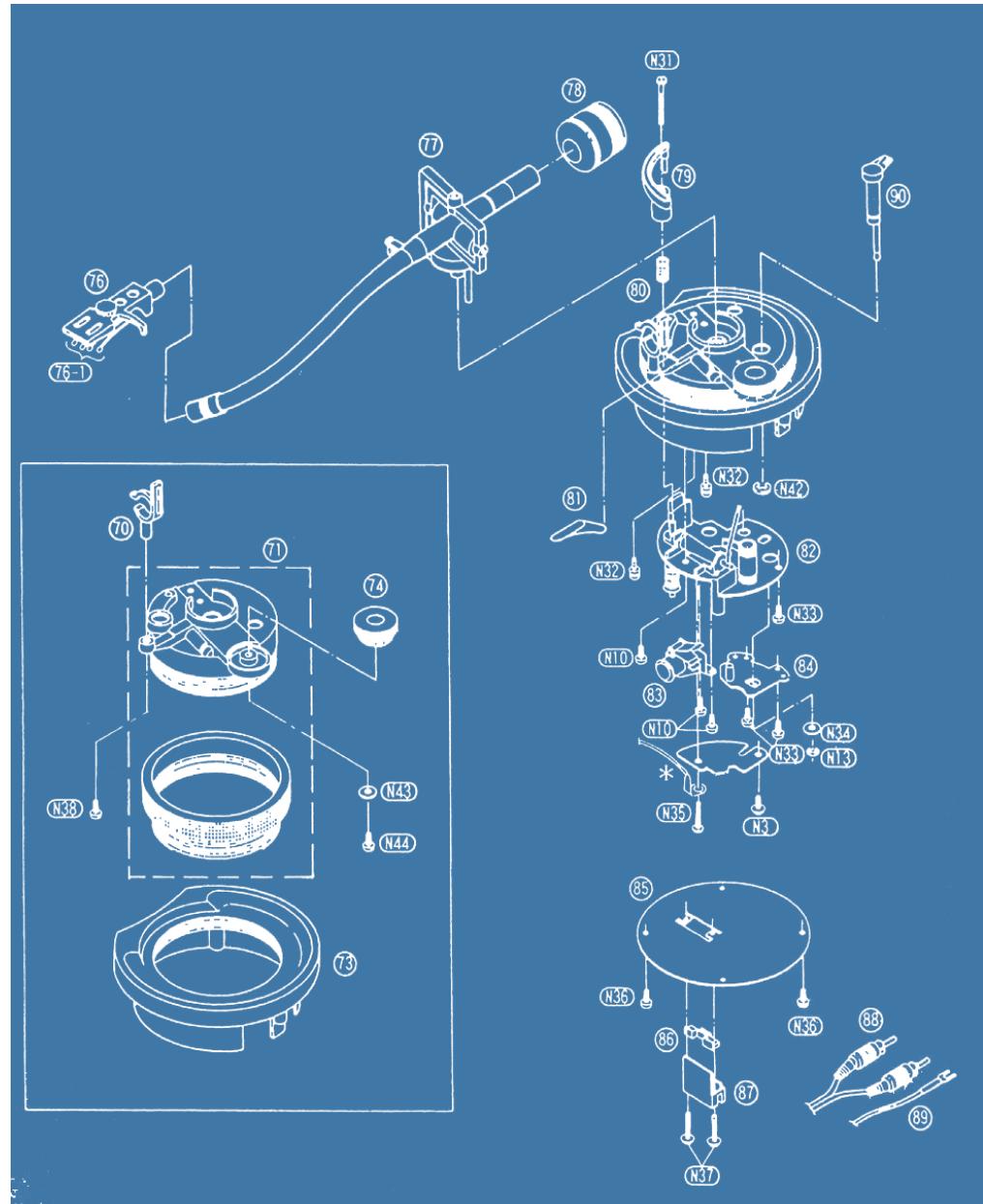


> Distributed processing



> Some assembly required (optional)

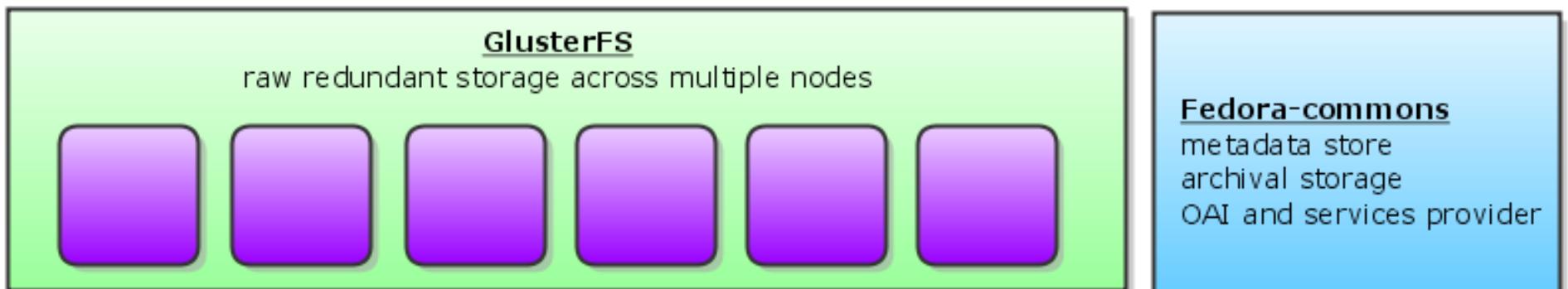
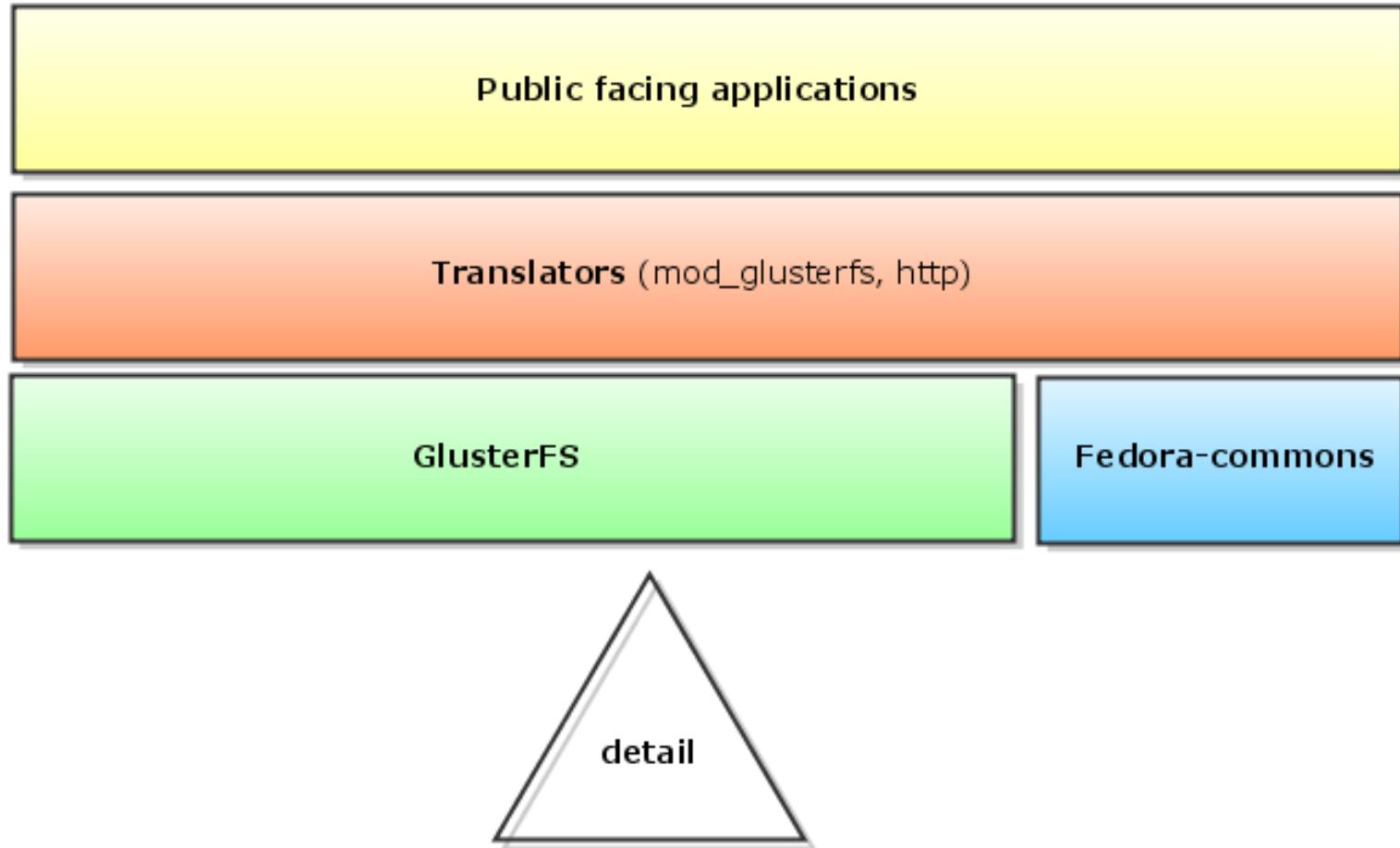
- our example uses new, faster commodity hardware
- but it could run on any hardware that can run Linux
- you could **chain old "out dated" computers together**
- build your own cluster for next to nothing (host it in your basement)
- solves some infrastructure funding issues
- hardware vendor neutrality

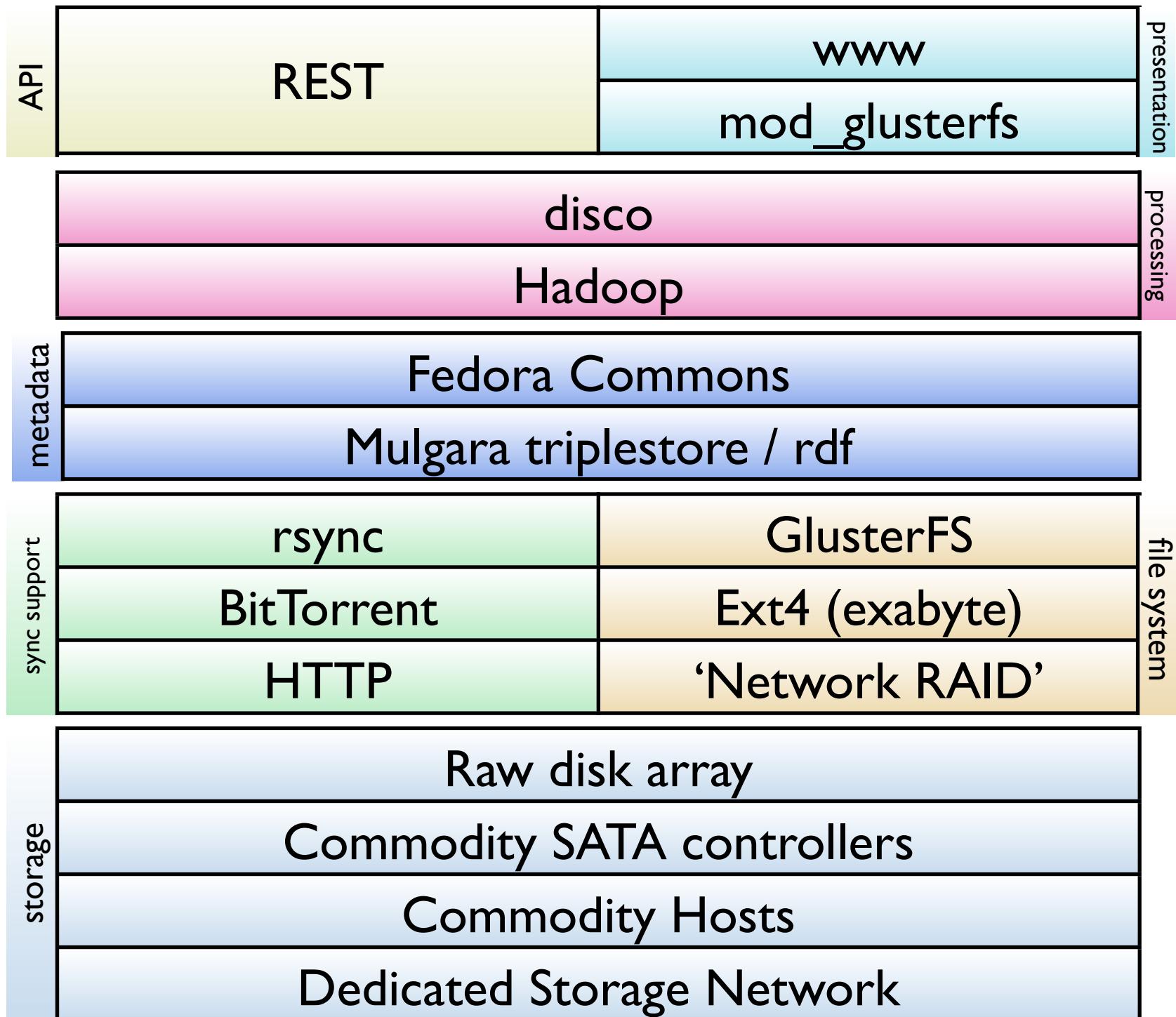


> Our proof of concept

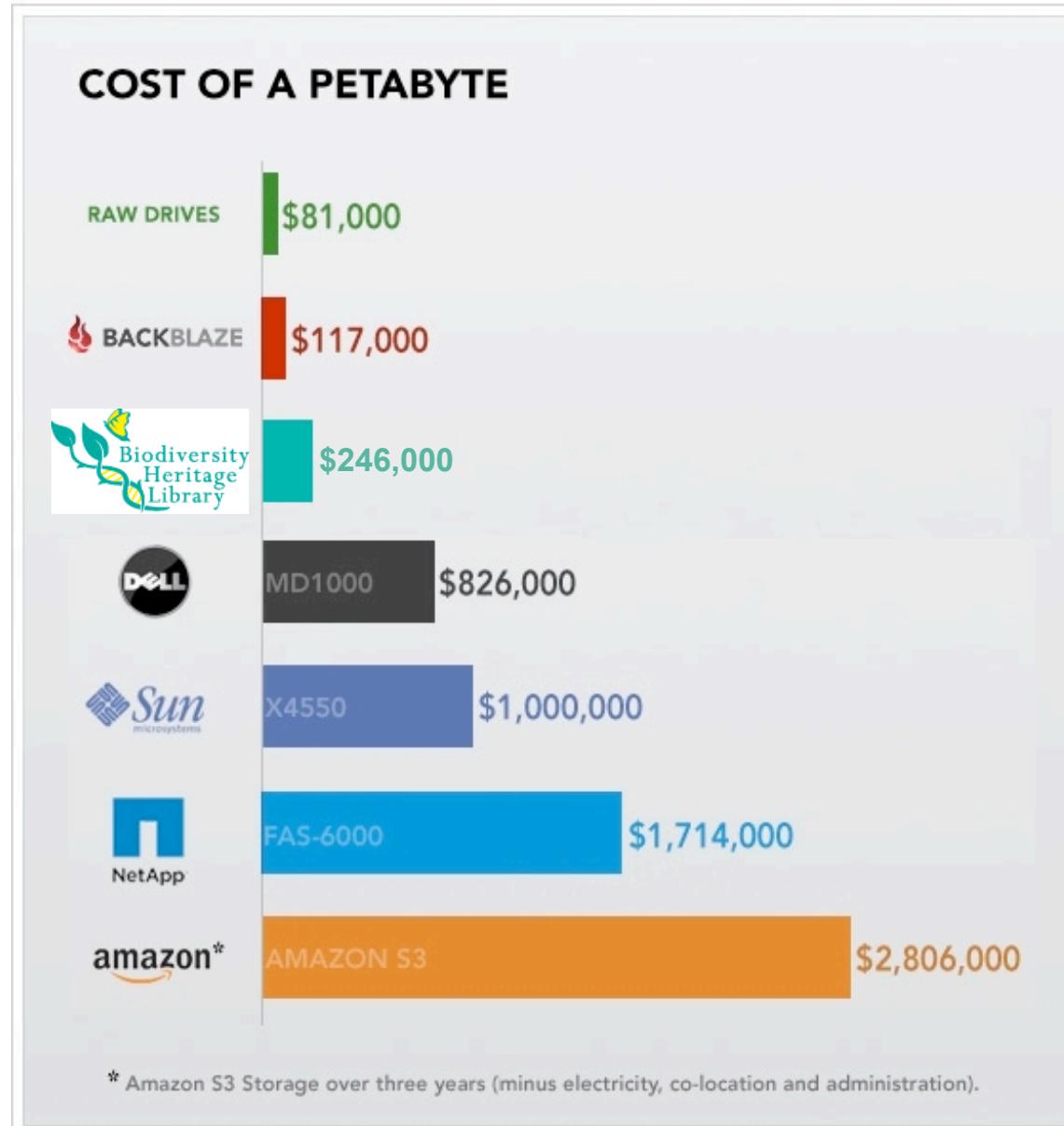
- we ran a six box cluster to demonstrate GlusterFS
- ran stock Debian/GNU Linux
- simulated hardware failures
- synced data with a remote cluster
- ran map/reduce jobs
- defined procedures, configurations and build scripts







> Distributed storage – Projected costs



Graph from Backblaze (<http://www.backblaze.com>)

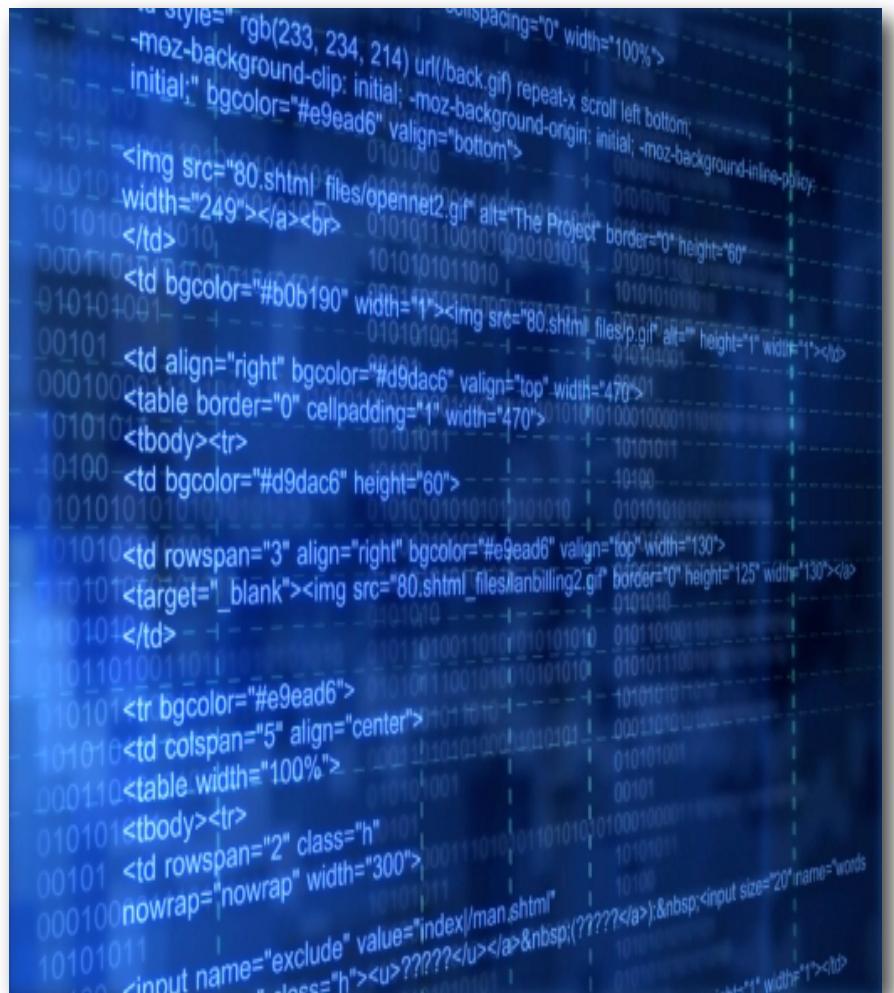
> Other avenues – Cloud pilot

- BHL is participating in a pilot with New York Public Library and Duraspace
- Duraspace would provide a link to cloud providers
- pilot to show feasibility of hosting
- testing use of image server, other services in the cloud
- cloud could seed new clusters



> Code (63 6f 64 65)

- all of our code and configurations are open source
- hosted on Google Code
- get involved
- join the mailing-lists
- follow us on Twitter
- ask questions, we'll help!



> It's your turn...

- similar projects?
- distributed services and processing?
- where can this be best applied?
- resilient services on top of storage
 - names processing?
 - LSID resolution pools?
 - image processing?
 - text-mining / NLP?
 - #biodiv webservices?





Web: <http://www.biodiversitylibrary.org/>
Code, Support: <http://code.google.com/p/bhl-bits>
Twitter: @BioDivLibrary (tag #bhl)



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