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NASA'S EARTH OBSERVING SYSTEM
DATA AND INFORMATION SYSTEM

Hosting Hyrax in the Cloud While Preserving the User Experience

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James Gallagher, contractor
EED-2 Role: Technical lead – OPeNDAP
jgallagher@opendap.org

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Outline

- Hosting Hyrax Server in the Cloud
- Preserving User Experience
- Retaining Existing Data Organization
- Mitigating Object Store Latency
- Summary

The Hyrax Server in the Cloud

- Part of the EOSDIS Evolution and Development (EED-2) contract
- Serve data (mostly HDF5) from S3
- Keep the current User Experience (Ux)
- I'll describe two important aspects to this that apply to any software moving from traditional hardware to the cloud
  - Retaining existing data organization
  - Mitigating object store latency

Why Preserve User Experience?

- When there's no new functionality…
  - People expect the same Ux
  - … unless benefits are substantial
- But when new concepts are added…
  - There is an implied new Ux
  - … but preserve existing features

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Simple Web APIs too?

- Yes! Even simple web APIs present a UX
- Data organization
  - People expect data to ‘look the same’
  - Programs are even less flexible
  - Changes in organization disrupt established workflows
- Access latency
  - People expect quick responses
  - Machines require that response not time-out

Preserving hierarchies

- Cloud Object APIs* use Key-Value
- These are flat – no hierarchies
  - There are ways to fake hier using names…
- To provide a hierarchical view
  - Encode the hierarchy
  - Bind into that encoding the Keys
  - Present the view with links

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Example: THREDDS Catalogs

- Use XML to build a linked set of catalogs
- Store these on the object store or not
- Can be transformed to HTML
  - In cloud or in client's browser
- Not just THREDDS – generic XML too
- Supports browsers; more software for Web API
- Web architecture friendly

Example: NASA EED-2 CMR

- Use a service – query about:
  - Collections
  - Specific levels
  - Individual files/granules
- Support browsers and Web API
- Central store of information – can be used by many different applications

Why Response Latency Matters

- Existing software, low-latency storage (reuse; *caveat emptor*)
- Users expect similar responsiveness
  - … unless new capabilities are added
- Worst case: Latencies compound and lead to outright failure

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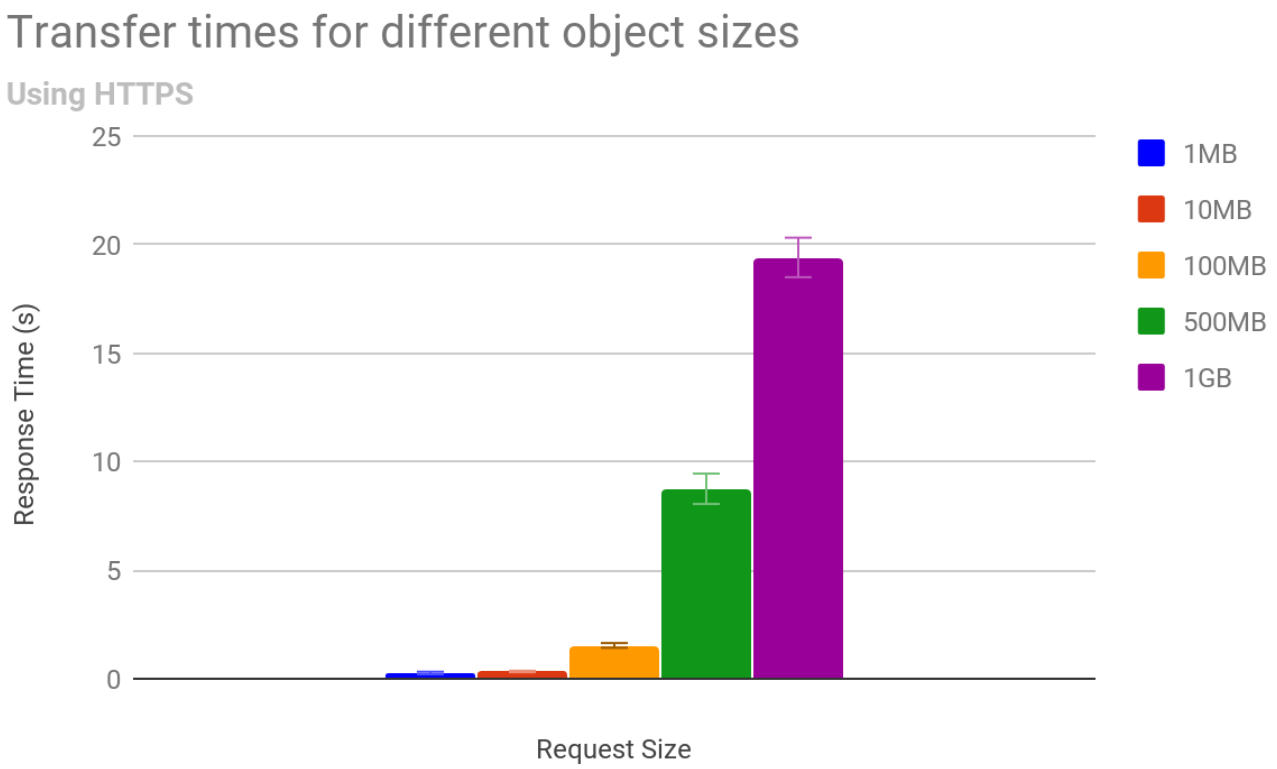
Response Latency (S3-centric)

- HTTP access involves inherent latencies
  - Amazon S3: 70ms HTTP and 270ms HTTPS
- HTTP Keep-Alive can mitigate cost of many accesses
- Parallel transfers can boost transfer speeds

Accessing Data From the S3 Object Store: Baseline Data



- Smaller objects' transfer times are dominated by S3 overhead
- Objects 100MB and greater show linear relationship between size and time

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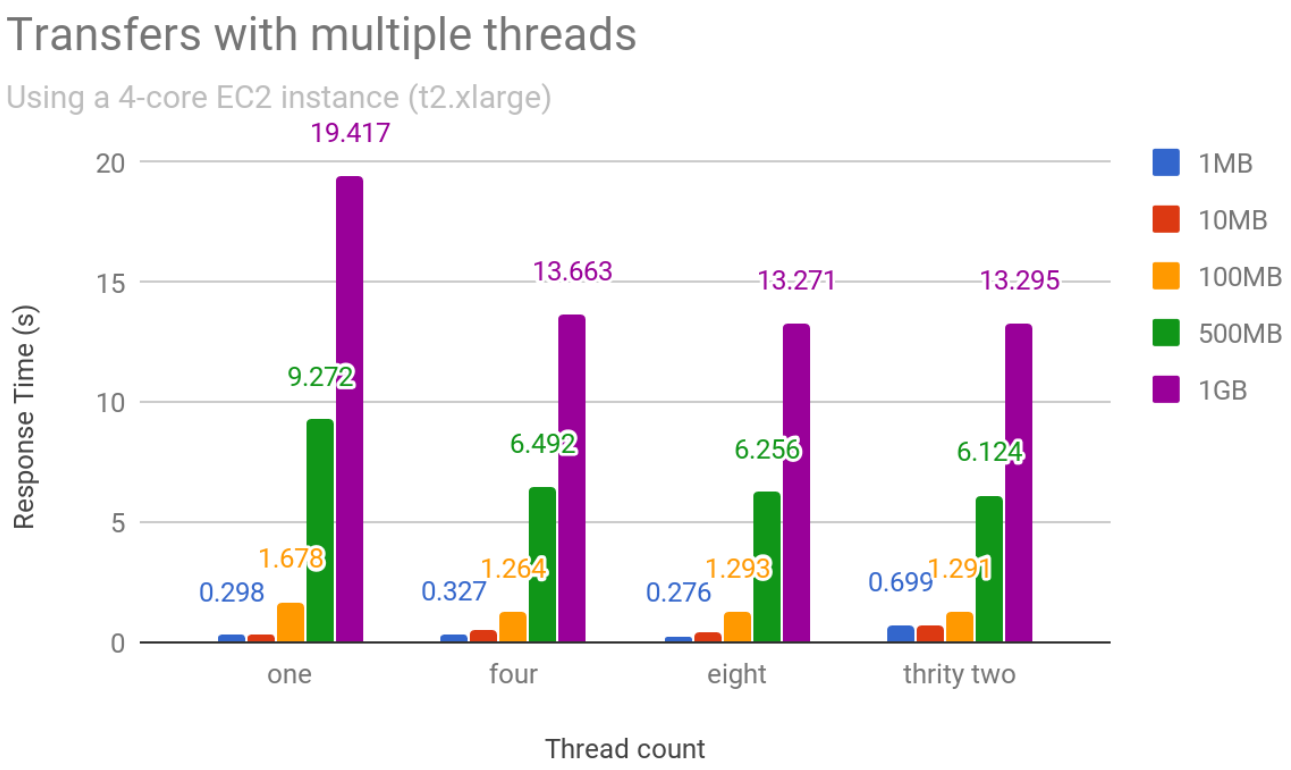
Parallel access to shards decreases response time



- Parallel access using shards improves response time for large objects
- But, it does not improve response time for small objects

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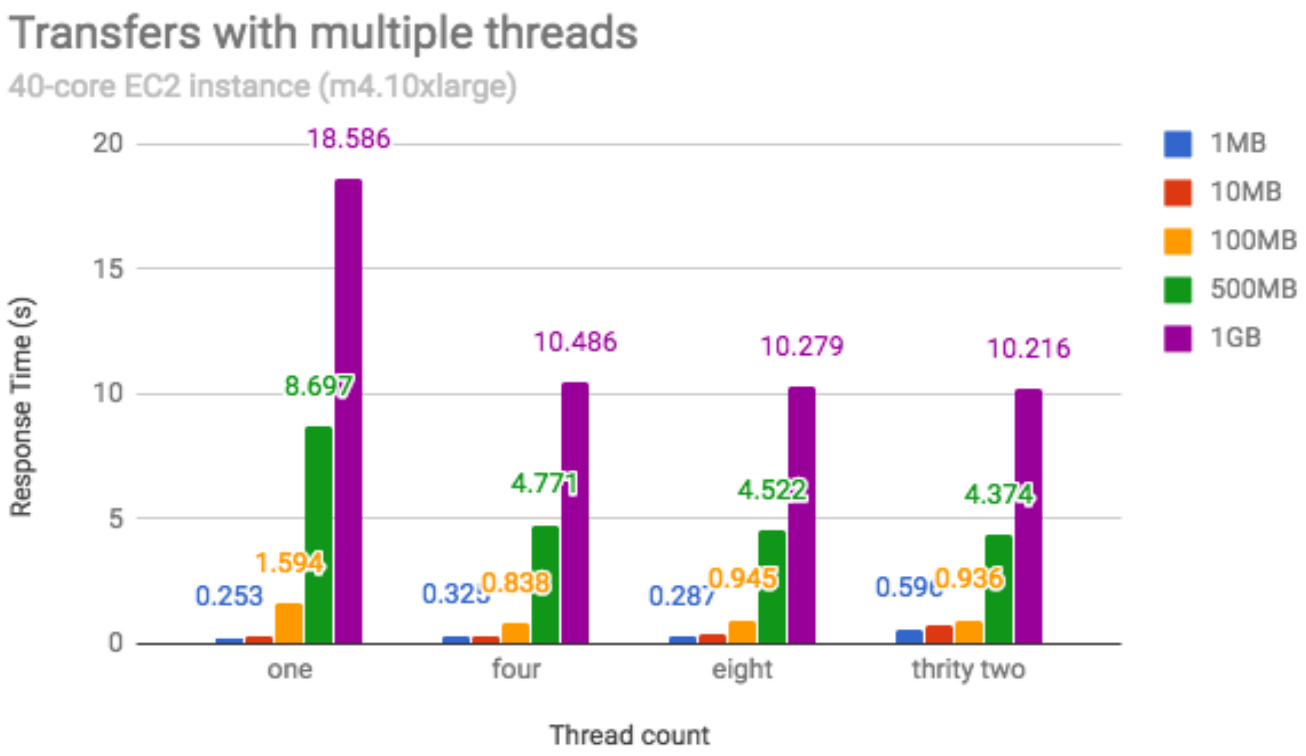
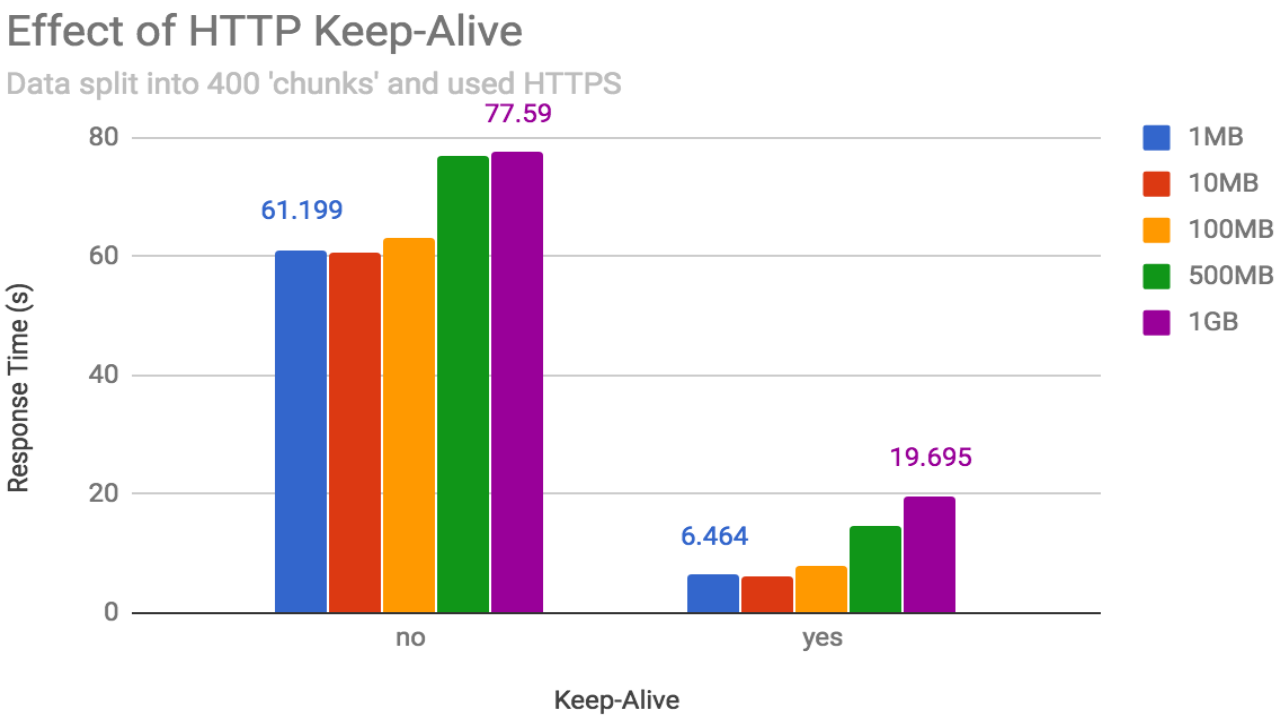
Do bigger EC2 instances alter this?



- Increasing the number of cores does not radically alter the shape of the response curve
- (note that the somewhat faster m4 machine achieves better performance over all)

HTTP connection reuse is important when using sharding



- 400 shards and accessed them with and without connection
- Note that for the small responses there is a significant penalty in performance even with connection reuse while for the large responses there is negligible cost

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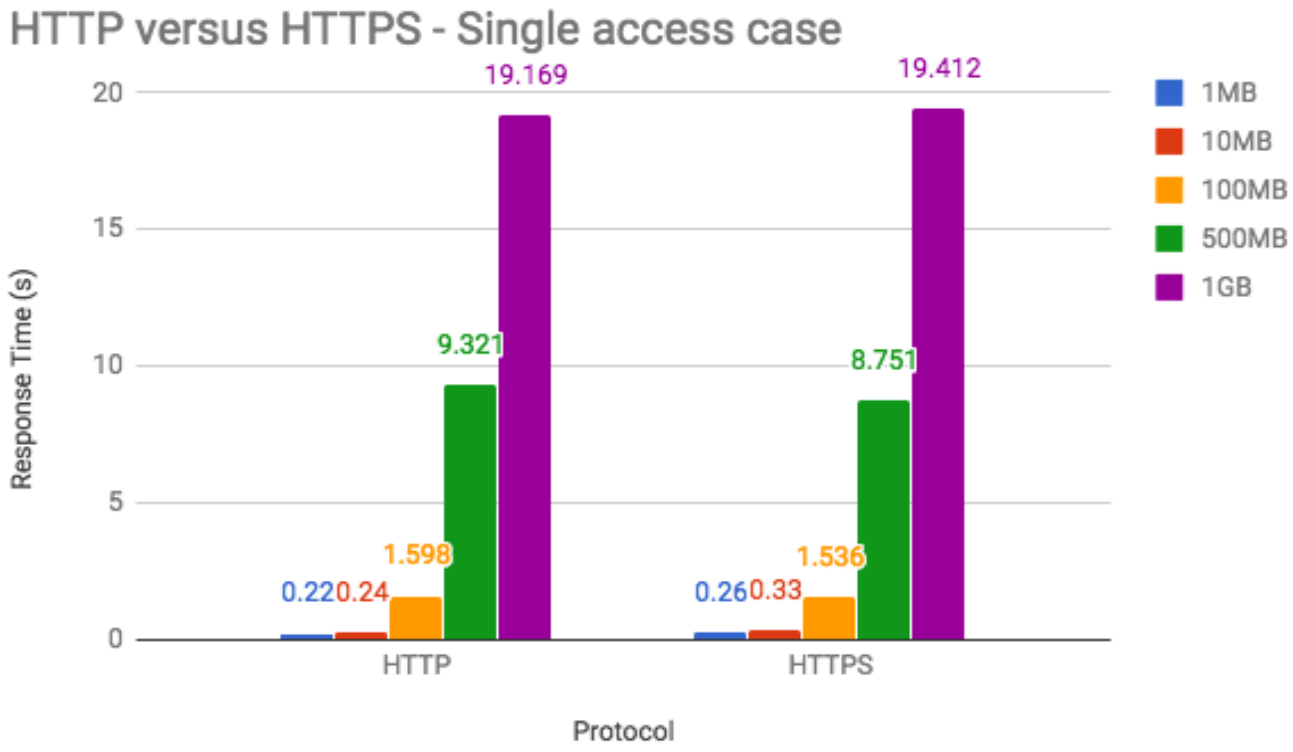
HTTP versus HTTPS?
The Single access case



- Using HTTP instead of HTTPS makes no difference for large objects and negligible difference for small ones

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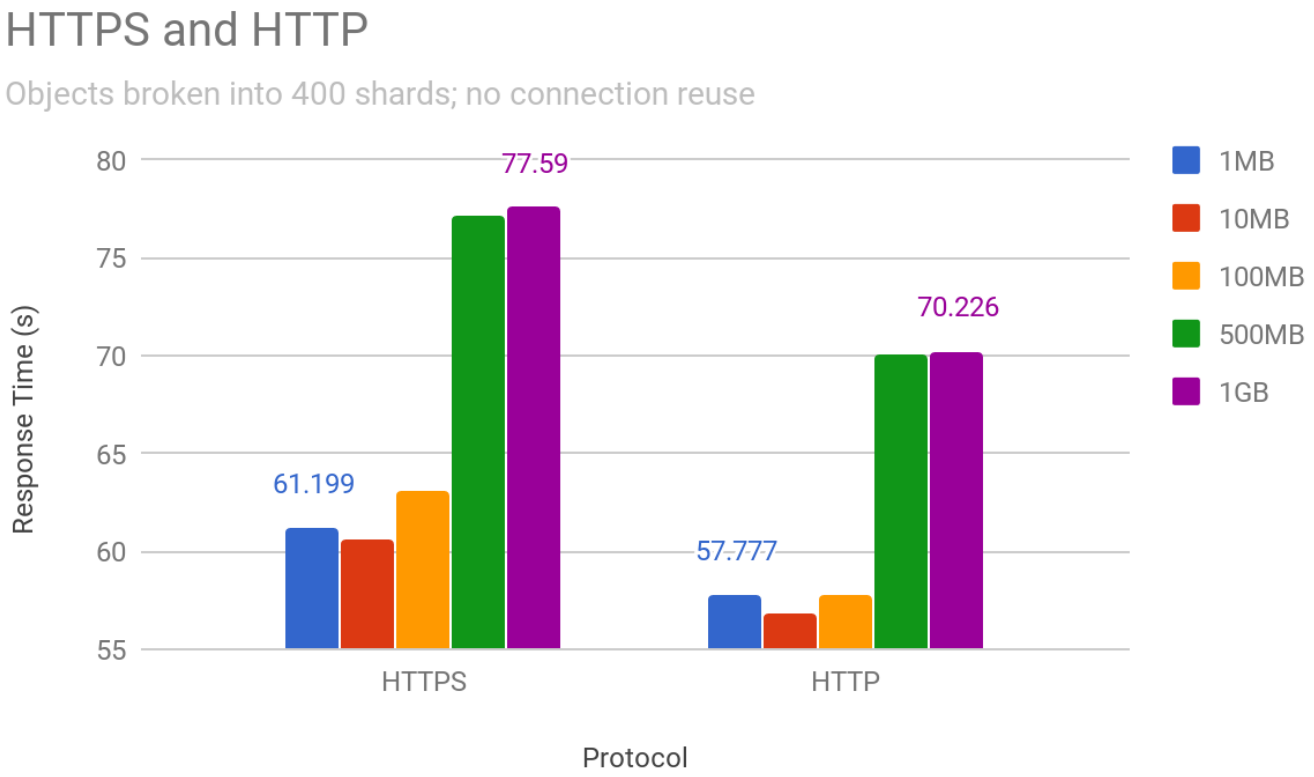
HTTP versus HTTPS
But with shards...



- With shards (e.g., 400), the cost of the HTTPS over HTTP does become noticeable.
- *Where is the cost*? It is primarily the cost of establishing the secure connection.

Summary

- Preserving hierarchies is important
  - Can be done using static ‘catalogs’
  - Or, using a dynamic service
  - Model the hierarchy, Encode the keys, Present the view
- Minimizing response latency
  - Parallel access increases transfer rate
  - Connection reuse reduces Tx startup time
  - HTTP is faster than HTTPS for small Txs

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