



ESnet
ENERGY SCIENCES NETWORK

Data Portals

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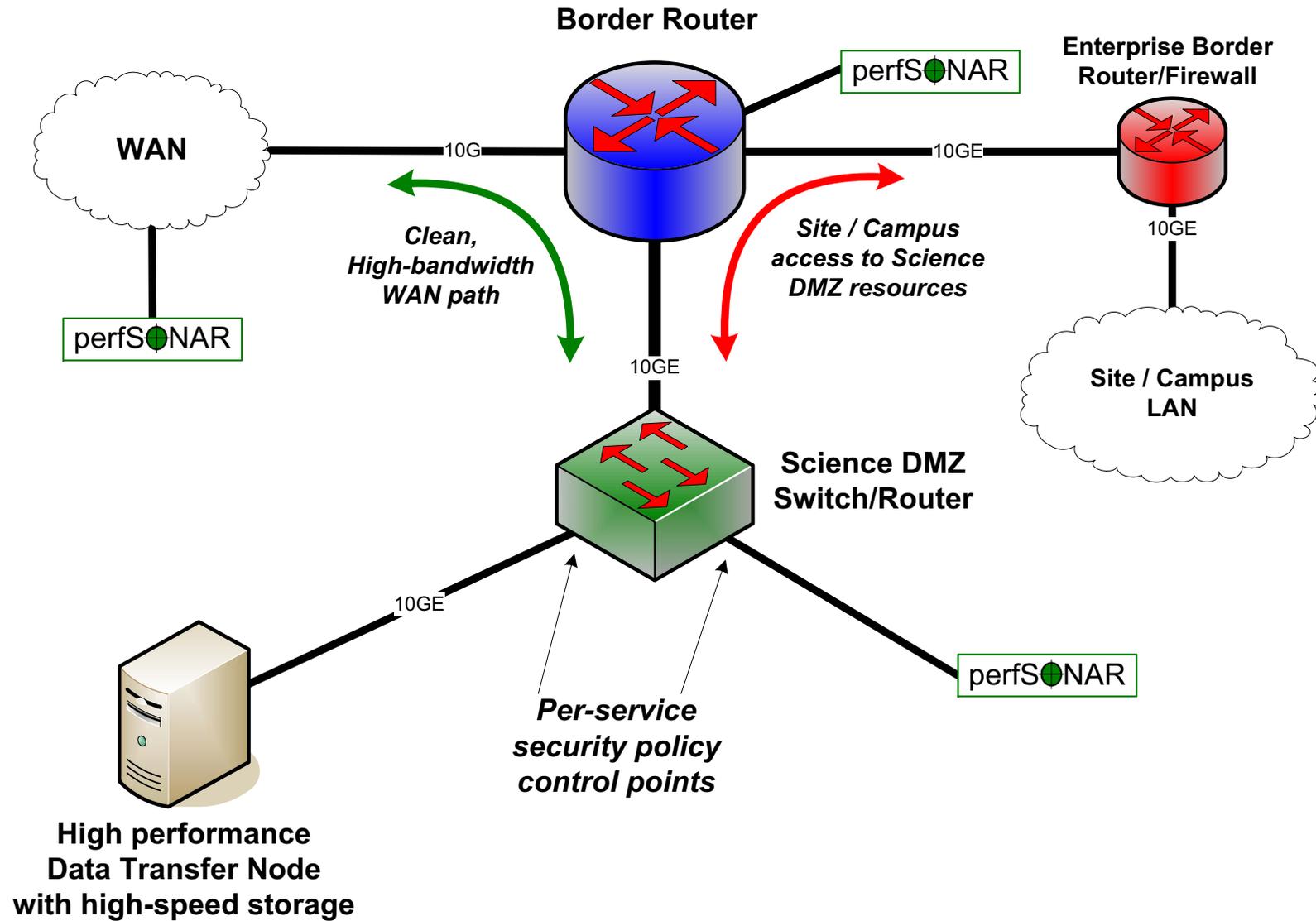
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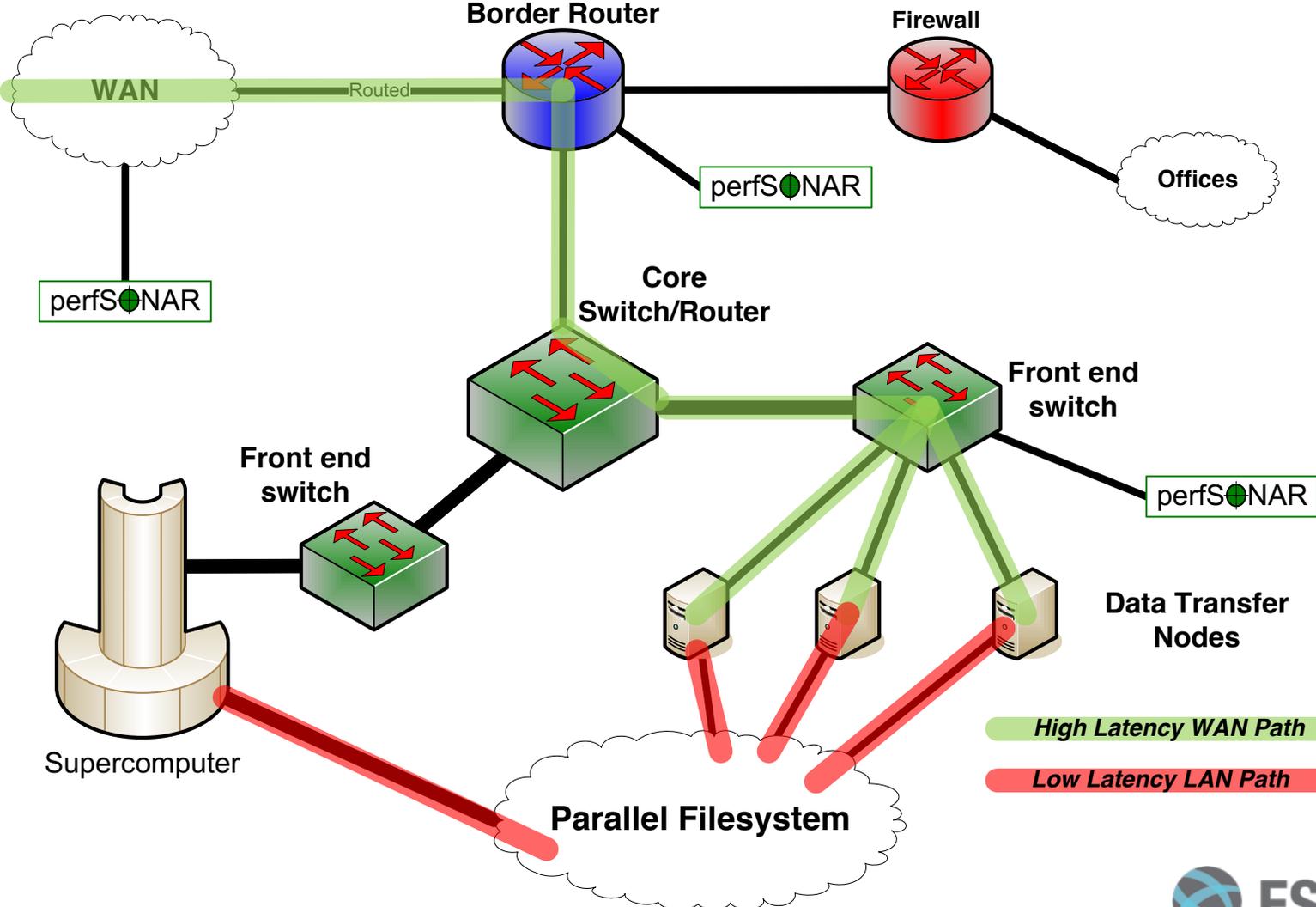
Overview

- Science DMZ and Data Portals
- This assumes you already have a Science DMZ
 - If you don't have one, we can chat about how you might build one
 - If it would be helpful, I can talk to your systems and networking folks
 - Or check out the fasterdata knowledgebase:
 - <http://fasterdata.es.net/science-dmz/>

Science DMZ Design Pattern (Abstract)



HPC Center Data Path



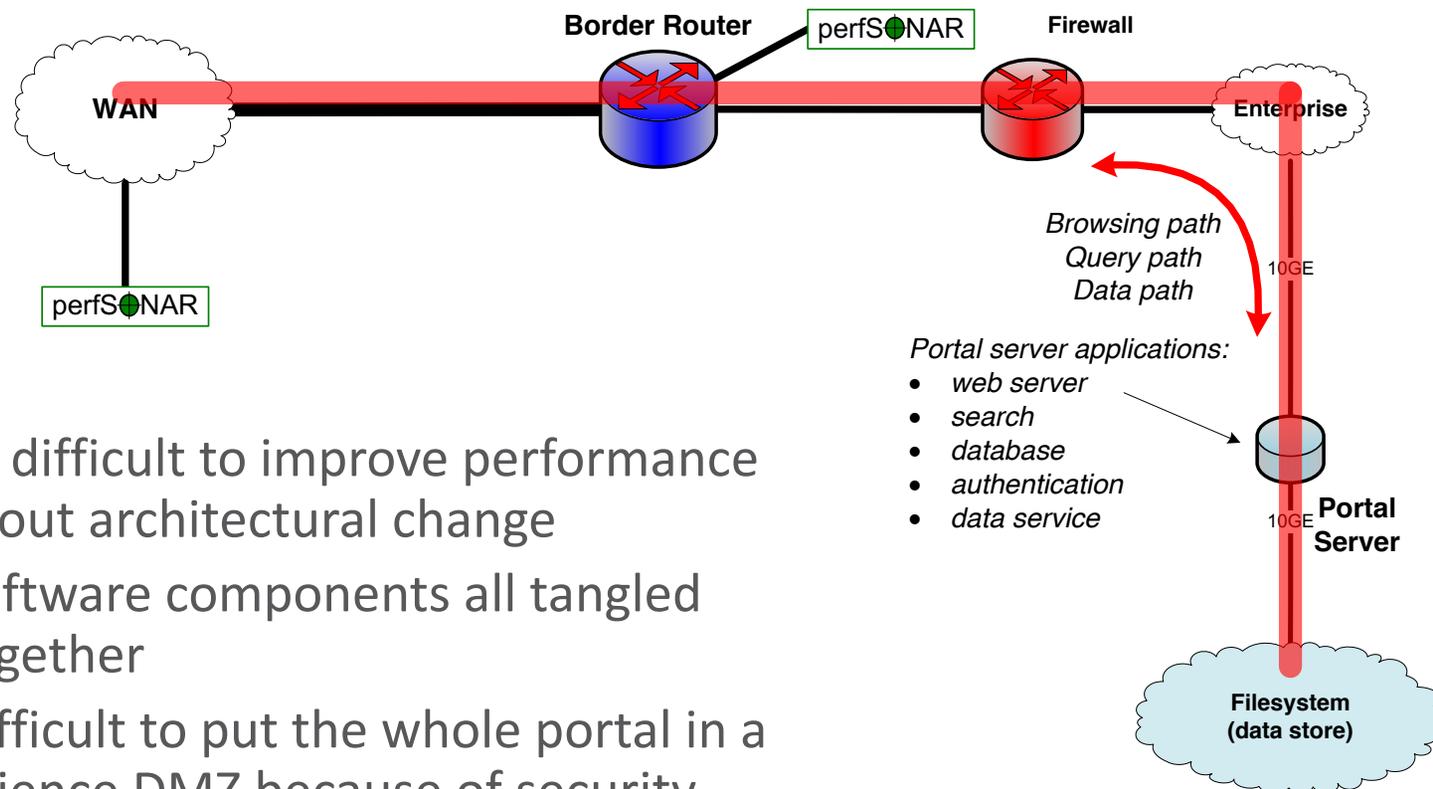
Next Steps – Building On The Science DMZ

- Enhanced cyberinfrastructure substrate now exists
 - Wide area networks (ESnet, GEANT, Internet2, Regionals)
 - Science DMZs connected to those networks
 - DTNs in the Science DMZs
- What does the scientist see?
 - Scientist sees a science application
 - Data transfer
 - Data portal
 - Data analysis
 - Science applications are the user interface to networks and DMZs
- Large-scale data-intensive science requires that we build larger structures on top of those components

Science Data Portals

- Large repositories of scientific data
 - Climate data
 - Sky surveys (astronomy, cosmology)
 - Many others
 - Data search, browsing, access
- Many scientific data portals were designed 15+ years ago
 - Single-web-server design
 - Data browse/search, data access, user awareness all in a single system
 - All the data goes through the portal server
 - In many cases by design
 - E.g. embargo before publication (enforce access control)

Legacy Portal Design



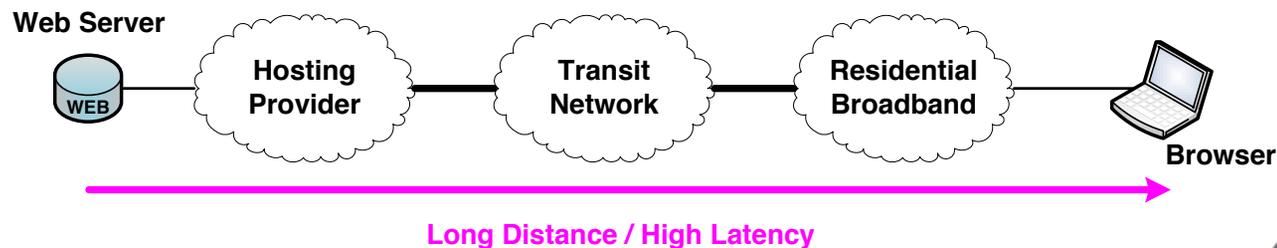
- Very difficult to improve performance without architectural change
 - Software components all tangled together
 - Difficult to put the whole portal in a Science DMZ because of security
 - Even if you could put it in a DMZ, many components aren't scalable
- What does architectural change mean?

Example of Architectural Change – CDN

- Let's look at what Content Delivery Networks did for web applications
- CDNs are a well-deployed design pattern (Netflix, etc)
- What does a CDN do?
 - Store static content in a separate location from dynamic content
 - Complexity isn't in the static content – it's in the application dynamics
 - Web applications are complex, full-featured, and slow
 - Data service for static content is simple by comparison
 - Separation of application and data service allows each to be optimized

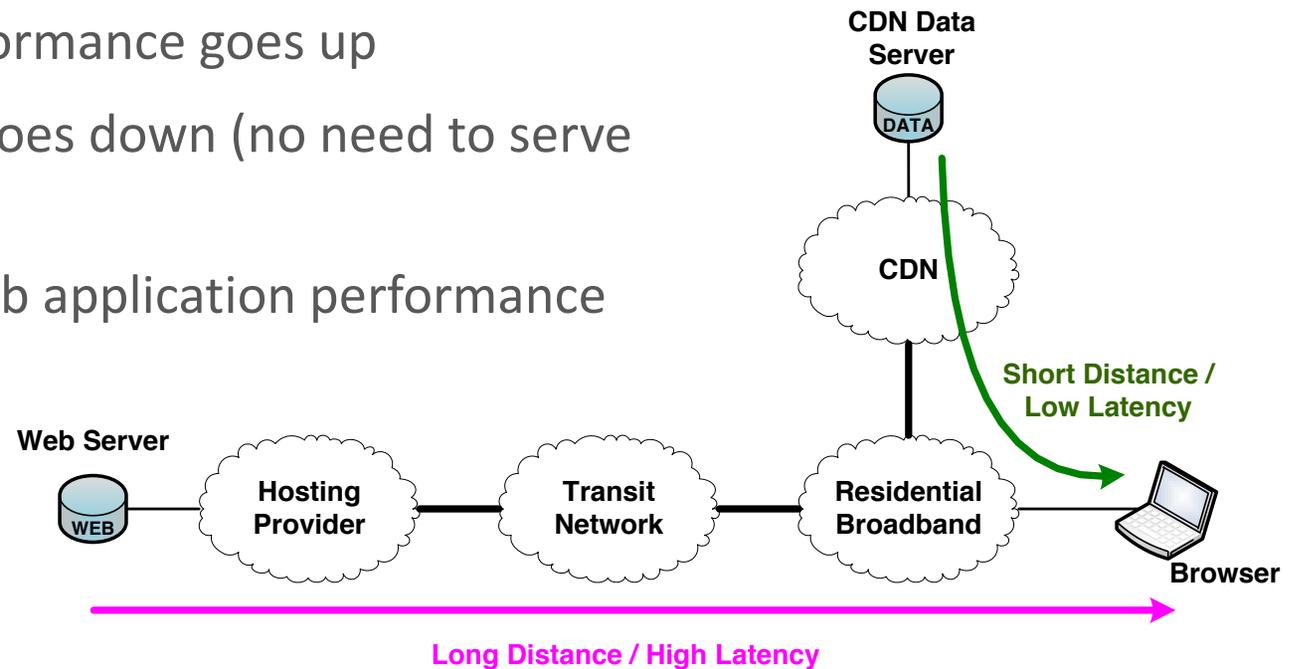
Classical Web Server Model

- Web browser fetches pages from web server
 - All content stored on the web server
 - Web applications run on the web server
 - Web server sends data to client browser over the network
- Perceived client performance changes with network conditions
 - Several problems in the general case
 - Latency increases time to page render
 - Packet loss + latency cause problems for large static objects



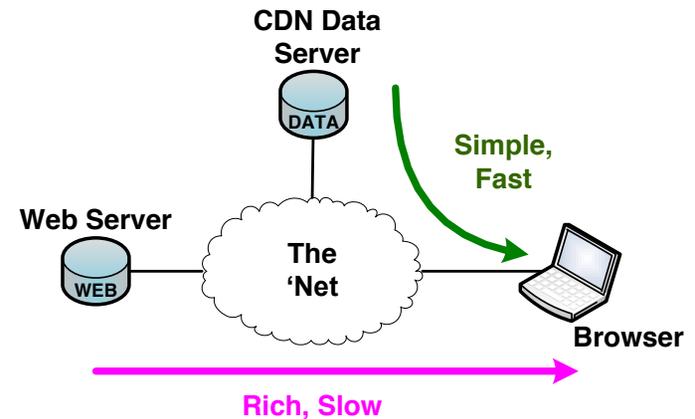
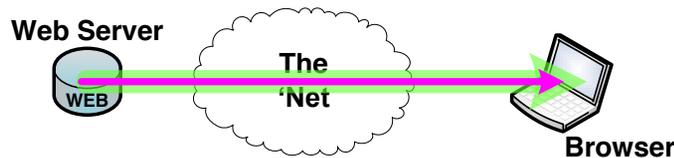
Solution: Place Large Static Objects Near Client

- CDN provides static content “close” to client
- Web server still manages complex behavior
- Latency goes down
 - Time to page render goes down
 - Static content performance goes up
- Load on web server goes down (no need to serve static content)
- Significant win for web application performance



Client Simply Sees Increased Performance

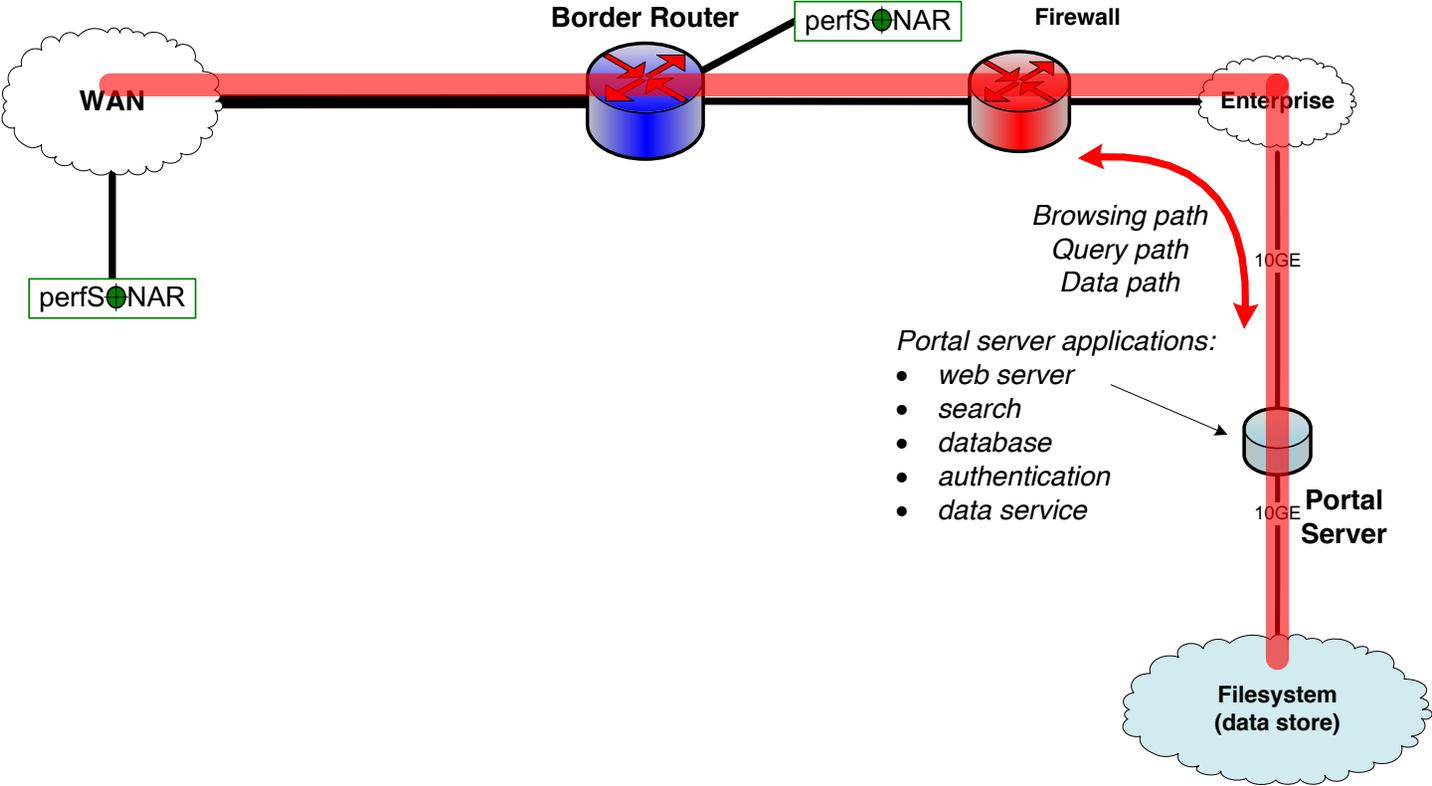
- Client doesn't see the CDN as a separate thing
 - Web content is all still viewed in a browser
 - Browser fetches what the page tells it to fetch
 - Different content comes from different places
 - User doesn't know/care
- CDNs provide an architectural solution to a performance problem
 - Not brute-force
 - Work smarter, not harder



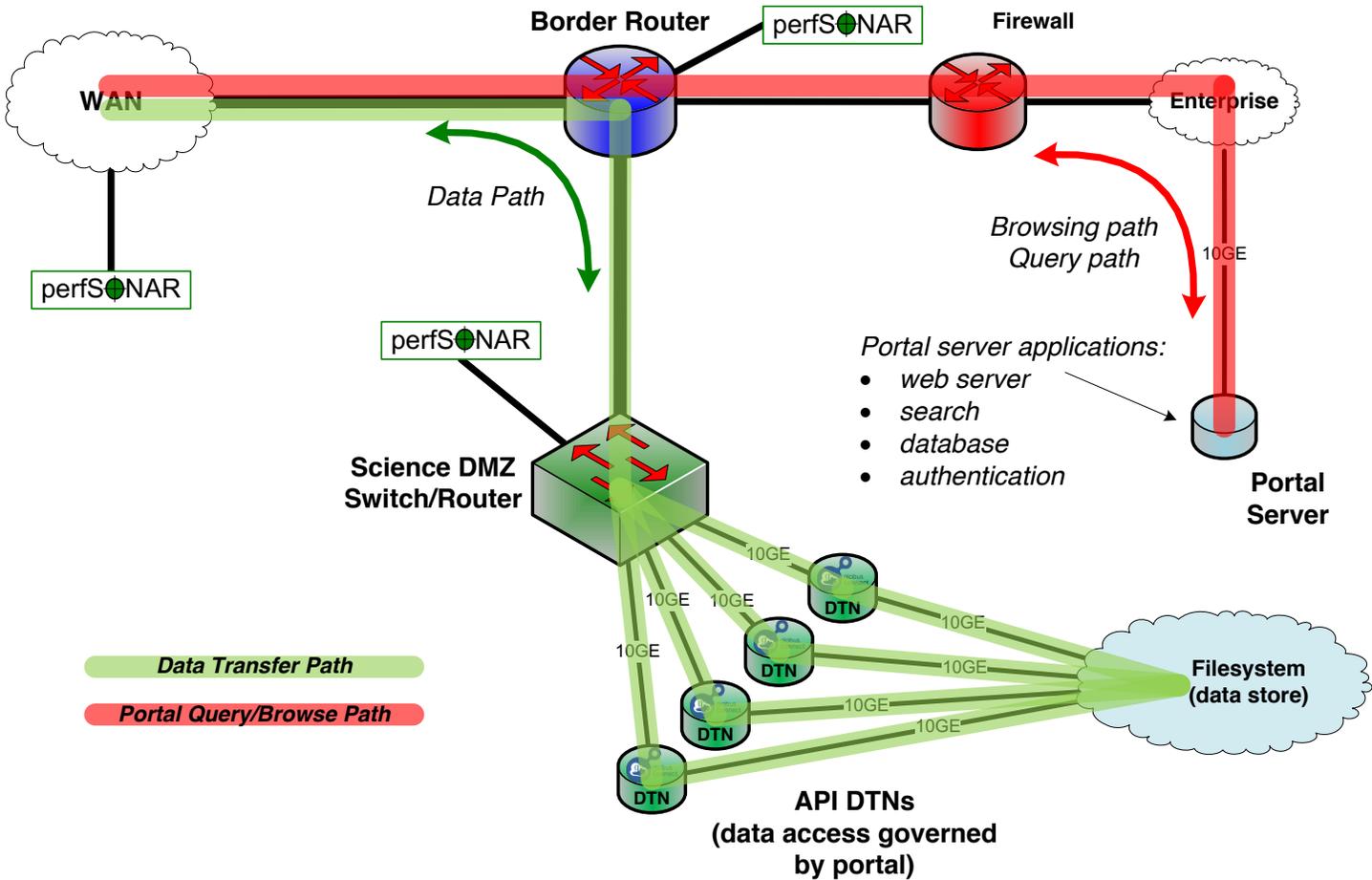
Architectural Examination of Data Portals

- Common data portal functions (most portals have these)
 - Search/query/discovery
 - Data download method for data access
 - GUI for browsing by humans
 - API for machine access – ideally incorporates search/query + download
- Performance pain is primarily in the data handling piece
 - Rapid increase in data scale eclipsed legacy software stack capabilities
 - Portal servers often stuck in enterprise network
- Can we “disassemble” the portal and put the pieces back together better?
 - Use Science DMZ as a platform for the data piece
 - Avoid placing complex software in the Science DMZ

Legacy Portal Design



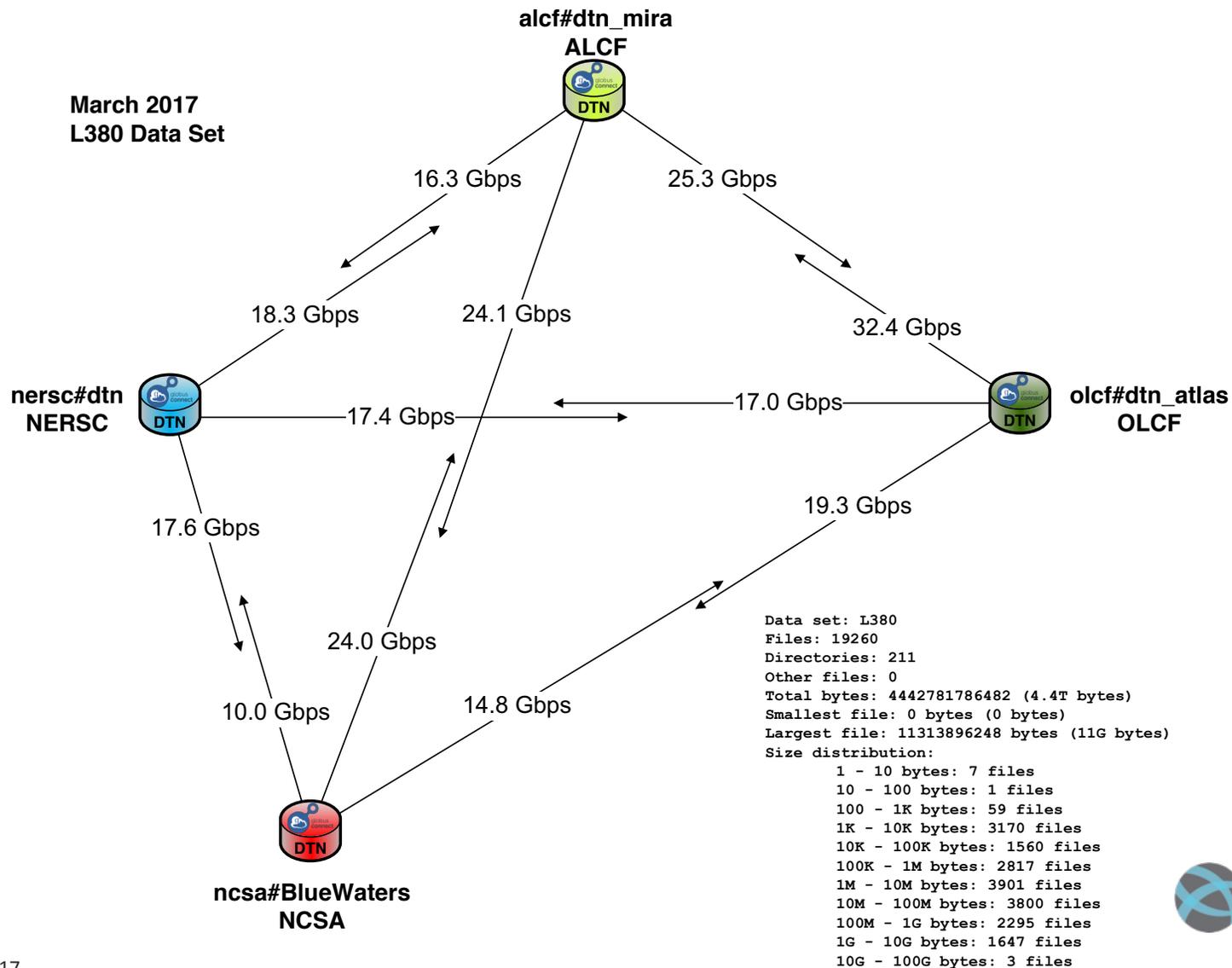
Next-Generation Portal Leverages Science DMZ



Put The Data On Dedicated Infrastructure

- We have separated the data handling from the portal logic
- Portal is still its normal self, but enhanced
 - Portal GUI, database, search, etc. all function as they did before
 - Query returns pointers to data objects in the Science DMZ
 - Portal is now freed from ties to the data servers (run it on Amazon if you want!)
- Data handling is separate, and scalable
 - High-performance DTNs in the Science DMZ
 - Scale as much as you need to without modifying the portal software
- Outsource data handling to computing centers
 - Computing centers are set up for large-scale data
 - Let them handle the large-scale data, and let the portal do the orchestration of data placement

Scalability Example – Petascale DTN Project



Links and Lists

- ESnet fasterdata knowledge base
 - <http://fasterdata.es.net/>
- Science DMZ paper
 - http://www.es.net/assets/pubs_presos/sc13sciDMZ-final.pdf
- Science DMZ email list
 - Send mail to sympa@lists.lbl.gov with subject "subscribe esnet-sciencedmz"
- perfSONAR
 - <http://fasterdata.es.net/performance-testing/perfsonar/>
 - <http://www.perfsonar.net>
- Globus
 - <https://www.globus.org/>





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Thanks!

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<http://fasterdata.es.net/>

<http://my.es.net/>

<http://www.es.net/>

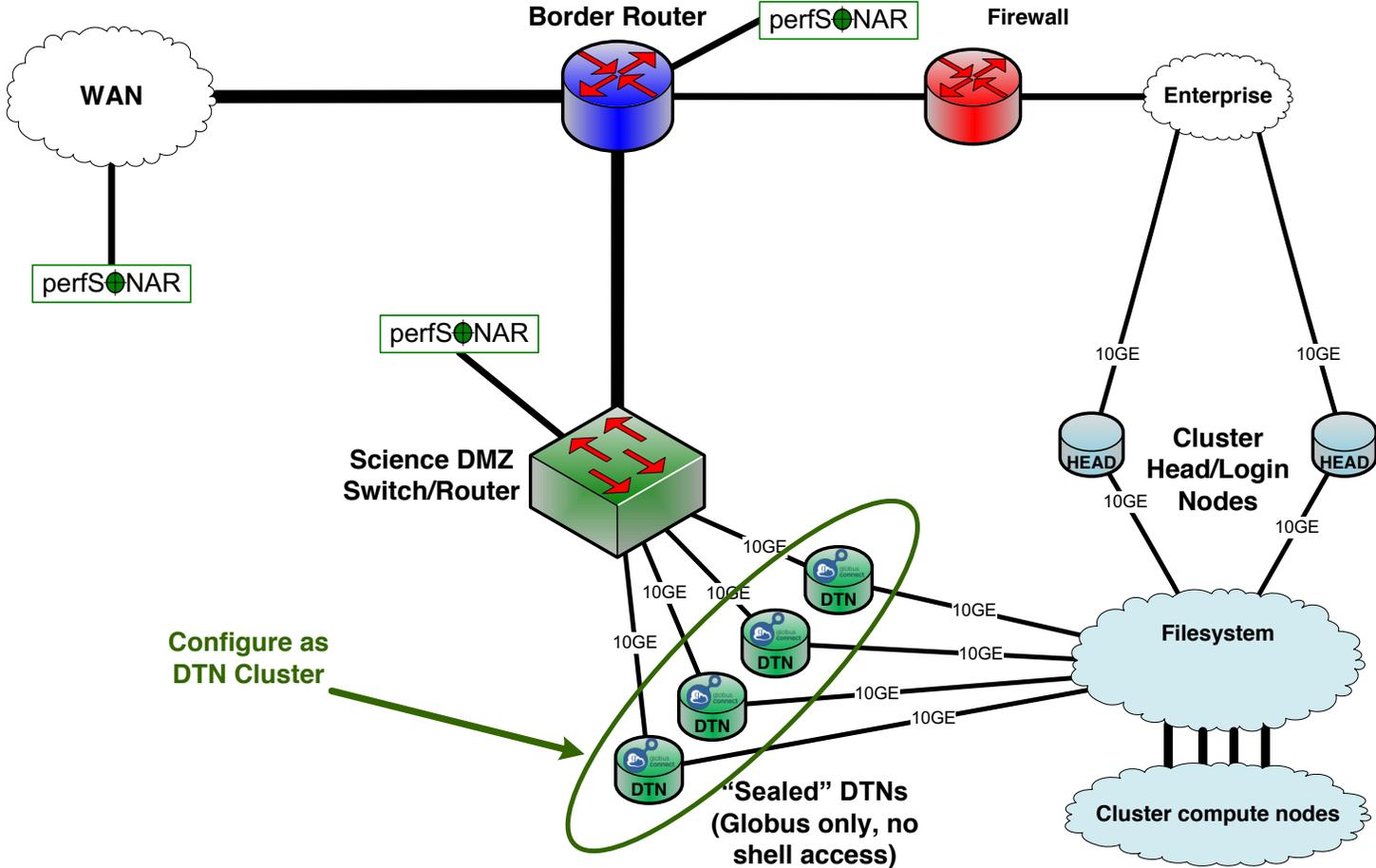


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Extra Slides

DTN Cluster Detail



DTN Cluster Design

- Configure all four DTNs as a single Globus endpoint
 - Globus has docs on how to do this
 - <https://support.globus.org/entries/71011547-How-do-I-add-multiple-I-O-nodes-to-a-Globus-endpoint->
- Recent options for increased performance
 - Use additional parallel connections
 - Distribute transfers across multiple DTNs (Globus I/O Nodes)
 - Critical – only do this when all DTNs in the endpoint mount the same shared filesystem
- Use the Globus CLI command **endpoint-modify**
 - Use the --network-use option
 - Adjusts concurrency and parallelism
 - More info at globus.org (<http://dev.globus.org/cli/reference/endpoint-modify/>)