GFDL Model Data Requirements and ESGF

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GFDL Simulation Data -> Publishing Trend

- GFDL holds big archive of model simulation data - 66 PB (270 millions files)
- Whole amount of data published: 215 TB (10% annual growth)
- Last 5 years the publishing data/archive acquisition proportion achieved ~0.5%
- It will grow in CMIP6 to 2% as computing capability will show the same growth trend (10 PB/Yr)
- With a current average file size (230 MB) we will have growth of 1 million files per year in a system.

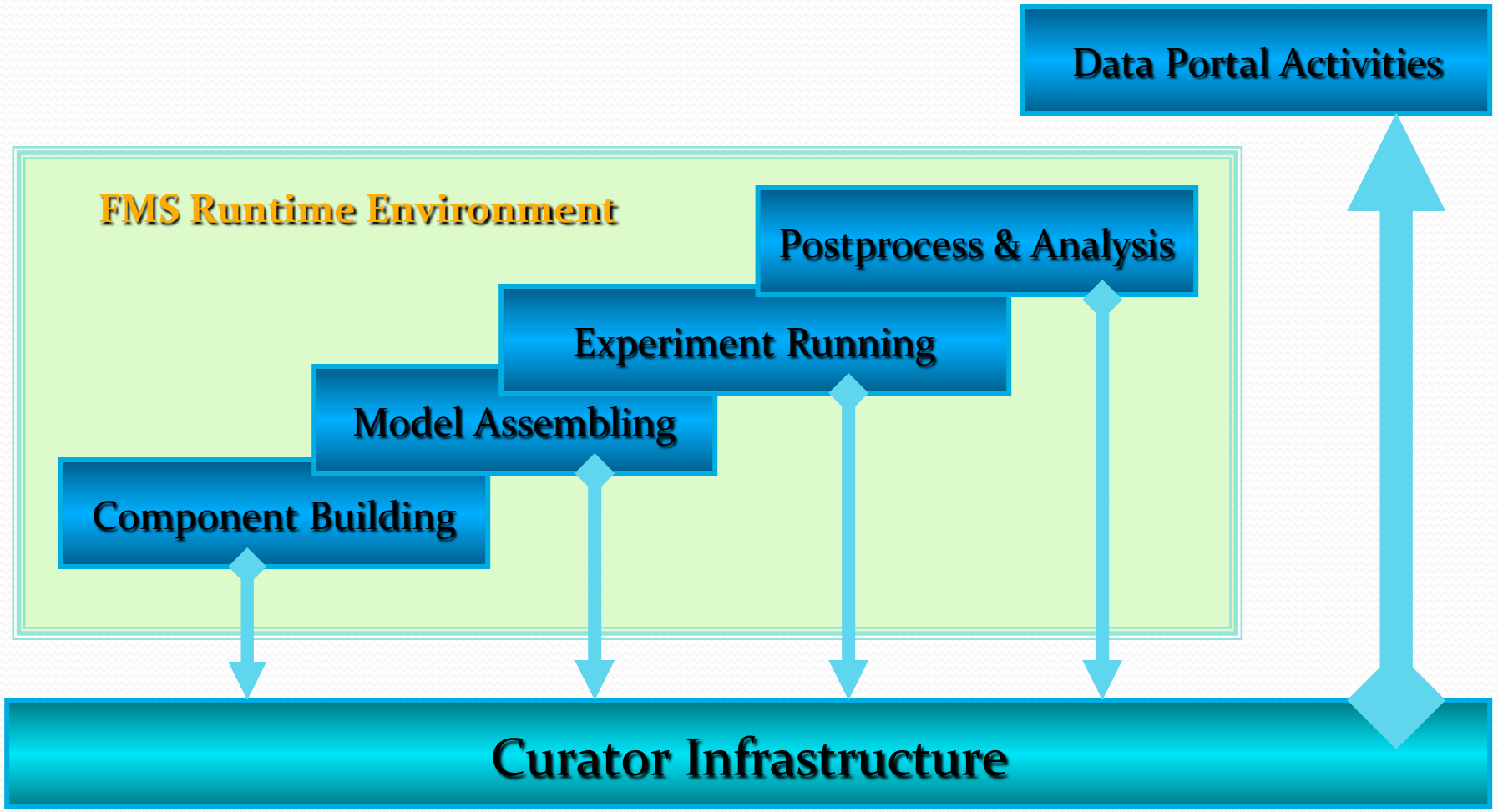
GFDL 2 parallel data portal infrastructures

- GFDL has been running data portal about 15 years
- Last 5 years we have 2 data portal infrastructures running: GFDL grown Curator system and ESGF
- Full ESGF Node installed on dedicated machine (Dell R510 1 hex-core 2.8GHz CPU, 48GB RAM, 1Gb Ethernet)
- ESGF Node holds 5800 datasets and connected to RAID shared with GFDL Data Portal (no any data duplication)
- ESGF Node works independently of GFDL Data Portal

GFDL Curator/Data Portal Infrastructure

- Curator is a part of modeling workflow and Data Portal
- It consists of metadata database and set of tools (XML/SQL mapper server, Web Interface with set of services, CMOR-analogue metadata rewriter, publishing, maintenance tools, etc.)
- Data Portal is run on separate machine (Dell R900 2 quad-core 2.93GHz CPUs, 32GB RAM, 10Gb Ethernet)
- It uses the same storage as ESGF of a total space 360 TB
- Should be increased to 1.2 PB for CMIP6 data

Curator Role In GFDL Workflow



Metadata <-> Data Binding

- Curator database holds all essential metadata for rerunning simulations
- Experiment metadata is coupled with data generated by given experiment
- Metadata from DB is used directly for CMORizing (fremetar tool) Quality Control and publishing data
- Community metadata standards for any specific project are stored in DB
- Published data can be prepared following wide variety of metadata standards (NCDF metadata section, naming conventions, directory structure) which are configurable in DB

Data Holdings Numbers & Downloading Statistics

- Whole amount of data published: 215 TB (10% annual growth)
- Number of files records in Curator DB (CMIP3,5 NCPP, NMME, etc.) : 1 160 000
- ESGF content: (CMIP5, NCPP) 190 TB, 840 000 files
- Total volume downloaded for whole DP history: ~1.3 PB, 250 TB from them via ESGF Node
- Total number of successful requests: ~6.3e+6; ESGF: ~1.3e+6)
- Distinct files: 810 000, distinct hosts: 6100
- Roughly, every GFDL file is downloaded 6 times and it means GFDL has 6 complete copies of published data over the world
- Very uneven demand - from 1 TB/month to 400 TB/month (1 Gbps). Expected at least quadrupled rate for CMIP6

Global Download Statistics

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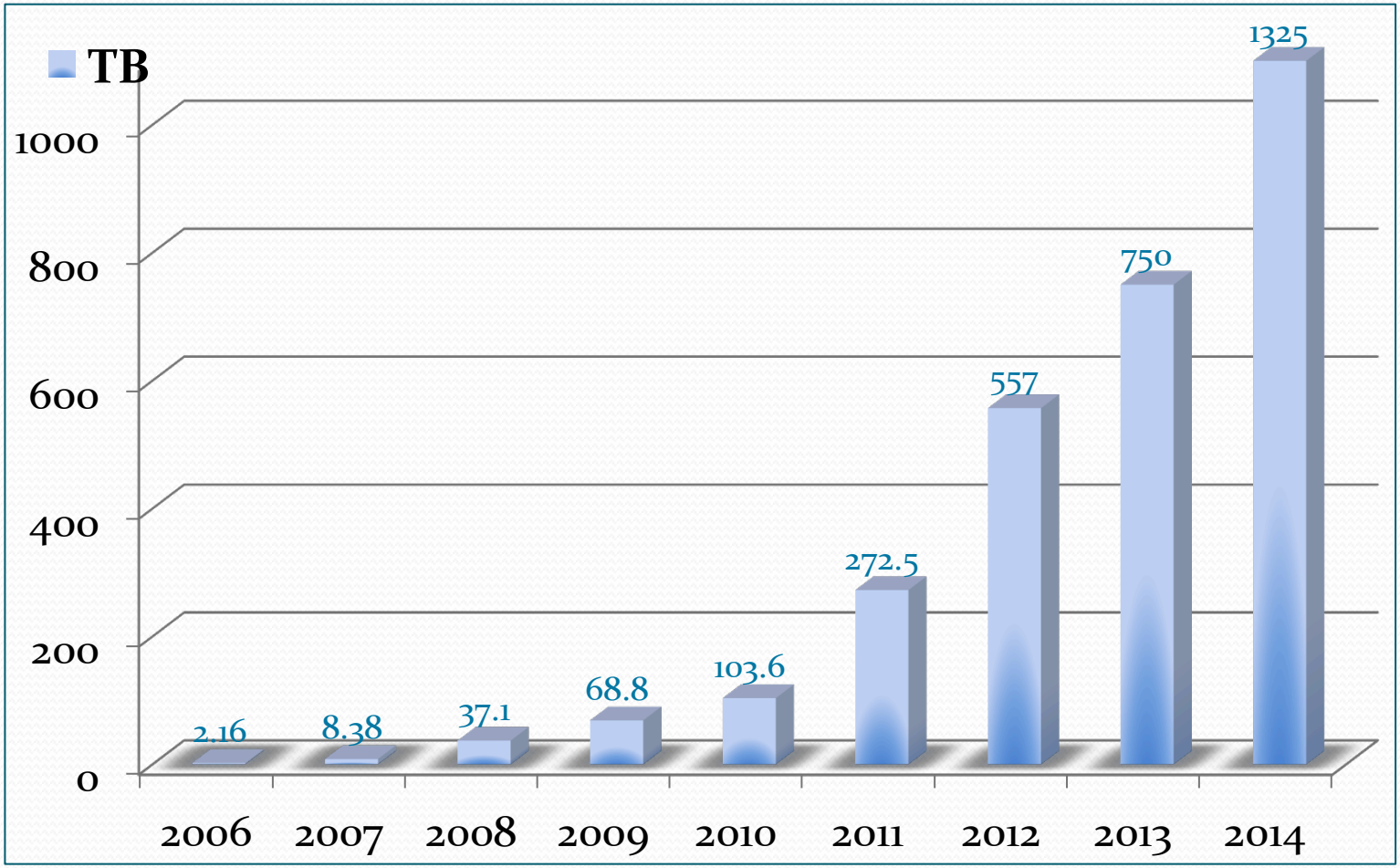
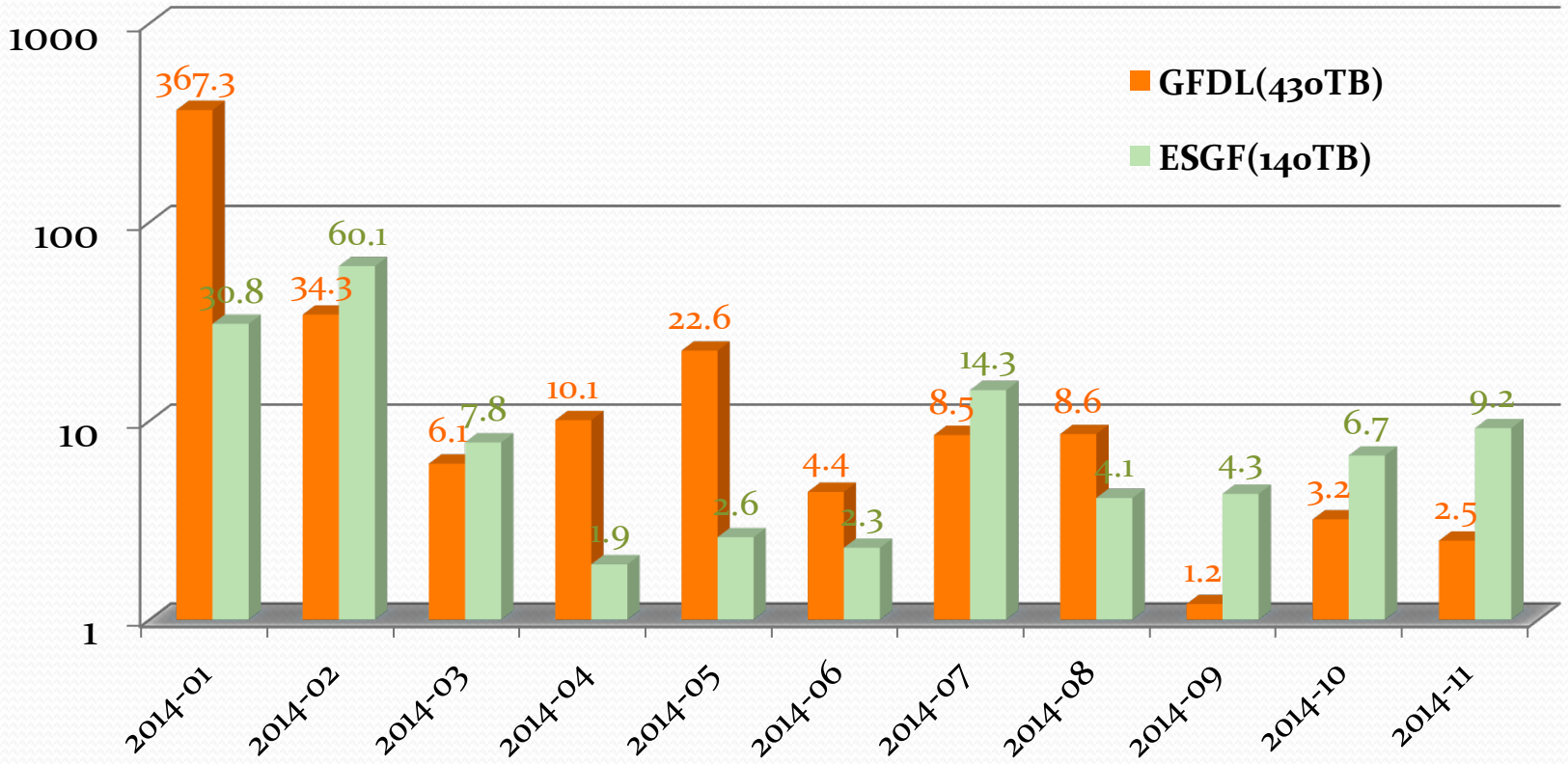
Cumulative Download 2006-2014



Monthly Distribution Download

(logarithmic scale)



ESGF Administration/Maintenance Experience

- Need method to limit requests per IP address to prevent anyone from monopolizing system resources
- Configured all data to be accessible without OpenID authentication
- Large amount of RAM needed for THREDDS operation; ~5700 datasets needed ~16GB and CMIP6 data volume expected to need ~64GB
- Mostly relied on PCMDI's *esg-node* script for managing ESGF software stack, need more tools for system health diagnostics
- Sometimes components (such as related to certificates) broke during upgrades and community support was needed to resolve them
- More detailed installation and upgrade instructions in a wiki would be helpful, particularly what to do when components break

Summary

- Number of files to keep (~1e+7)
- Bandwidth should be 10 Gbps at least
- Download limitation per IP address
- Open access to data (NOAA policy) installation option
- Using local resources (DB, metadata, checksums) by ESGF
- Flexibility in publishing data in different standards (non DRS) without serious implementation efforts
- Rudimental QC doing (checking limits, variants, averages)
- Publish Bookkeeping – having Web interface for controlling the files published already would be very useful
- Intercomparison analysis tools
- Wiki page with help for admins and more diagnostics tools