

The Virtual Institute of I/O



Limitless Storage
Limitless Possibilities

<https://hps.vi4io.org>

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Introduction



Goals of the Virtual Institute for I/O

- Provide a platform for I/O enthusiasts for exchanging information
- Foster training and collaboration in the field of high-performance I/O
- Track and encourage the deployment of large storage systems storage systems
 - ▶ Hosting information about high-performance
 - ▶ Supporting the IO-500 and the Data Center List

<https://www.vi4io.org>



Introduction



Philosophical cornerstones of the institute

- Treat every member and participant equally
- Allow free participation without any membership fee inclusive to all
- Be independent of vendors and research facilities

Open Organization



- The organization uses a wiki as central hub
 - ▶ Everybody (registered users) can edit the content
 - ▶ Major changes should be discussed (see below)
 - ▶ The wiki uses tag clouds to link between similar entities
- Supported by mailing lists
 - ▶ Call-for-papers
 - ▶ Announce list for relevant information
 - ▶ Contribute list to discuss and steer organizational issues
- Major changes should be discussed on the contribute mailing list
- Members can vote for changes

Everybody is welcome to participate

Wiki Content



- Groups involved in high-performance storage
Overview of research groups (evtl. companies involved in research)
 - ▶ Product development the group is involved in
 - ▶ Research projects (with links to their source)
 - ▶ Tags for layers, products and knowledge
- Tools: *Overview of relevant tools with small descriptions*
 - ▶ Types of tools: analysis, benchmarking, I/O middleware
 - ▶ Tags for layers and features
- Data Comprehensive Center List (CDCL) / High-Performance storage list
Characteristics of data center systems
 - ▶ Editable and owned by the community
- Internal section
Provides templates and describes rules for editing the page

Outline



- 1 Overview
- 2 Comprehensive Data Center List (CDCL)**
- 3 Next Generation Interfaces
- 4 Summary

Comprehensive Data Center List (CDCL)



The CDCL contains system characteristics for sites, supercomputer and storage

System Model

- Based on an extensible JSON schema, optimized editor
- Supports now (all) logical components and subcomponents
- Characteristics and peak values
- Measured values *-500

Components with characteristics

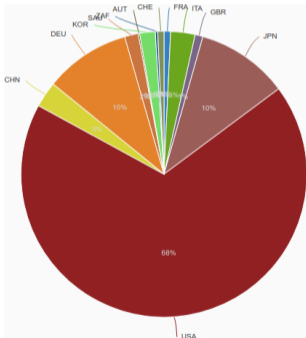
- Site, supercomputer, online storage, tape archives
- Compute nodes, storage nodes, local storage, accelerators, ...
- Supporting: e.g., CPU type, memory available, ...

CDCL Storage List 2019

Features

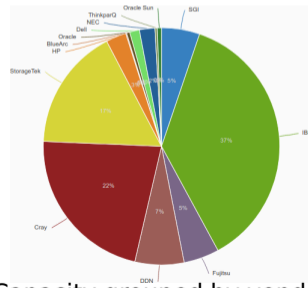
- Table view with selectable columns
- Flexible metrics and aggregation

#	site.institution	site.storage.system.net	site.supercomputer.compute	site.supercomputer.memory
		capacity	peak	capacity
		in PIB	in PFLOPS	in TB
1	Oak Ridge National Laboratory	250.04	220.64	3511.66
2	National Energy Research Scientific Computing Center	197.65	37.71	857.03
3	Los Alamos National Laboratory	72.83	11.08	2110.00
4	German Climate Computing Center	52.00	3.69	683.60
5	Lawrence Livermore National Laboratory	48.85	20.10	1500.00
6	RIKEN Advanced Institute for Computational Science	39.77	10.62	1250.00
7	National Center for Atmospheric Research	37.00	5.33	202.75
8	National Center for Supercomputing Applications	27.60	13.40	1649.27
9	Global Scientific Information and Computing Center	25.84	17.89	275.98
10	Joint Center for Advanced HPC	24.10	24.91	919.29
37	Pacific Northwest National Laboratory	2.40	3.40	184.00
38	Navy DoD Supercomputer Resource Center	2.11	2.05	0.00
39	Vienna Scientific Cluster	1.81	0.68	42.18
40	Center for Scientific Computing	0.75	0.51	77.57
41	University of Bristol	0.44	0.38	43.01



Capacity grouped by country

37	Pacific Northwest National Laboratory	2.40	3.40	184.00
38	Navy DoD Supercomputer Resource Center	2.11	2.05	0.00
39	Vienna Scientific Cluster	1.81	0.68	42.18
40	Center for Scientific Computing	0.75	0.51	77.57
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Capacity grouped by vendor

Status



CDCL: What's New

- Form to create stubs for pages: <https://www.vi4io.org/cdcl-add>
 - ▶ This simplifies the addition of new systems significantly

Started: Unified data center representation in Webpages

- Provide a Javascript for embedding into any data center web page
 - ⇒ Towards a **standardized presentation** of systems!
 - ▶ Allowing the site to describe and visualize their system
 - ▶ Hosted by the site directly
 - ▶ Allowing a simple export into VI4IO data center list
- Polish presentation of site's information
- Ongoing: Student works on it

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Community Development of Next Generation Interfaces



Towards developing a new I/O stack API considering:

- Cover storage and data-flow computation together
- Utilizing heterogeneous storage and compute landscapes
 - ▶ Scheduler optimizes plans; beyond tiering; liquid computing
- Smart hardware and software components
 - ▶ Self-aware system instead of unconscious
 - ▶ Improving over time (self-learning, hardware upgrades)
- User metadata, ILM, and workflows as first-class citizens



Indeed many research prototypes address subproblems

- But we have to work together to resolve the aspects together
- Competing approaches; the standardization does not compete!

Pursued Community Strategy



- The **standardization** of a high-level *data model & interface*
 - ▶ Lifting semantic access to a new level (e.g. NetCDF + X)
 - ▶ Targeting data intensive and HPC workloads
 - ▶ To have a future: must be beneficial for Cloud/Big Data + Desktop, too
- Supporting a reference implementation of a **smart runtime system**
 - ▶ Implementing key features
 - ▶ Build on top of the available solutions!
- Demonstration of benefits on socially relevant data-intense apps

Visit the BoF *Data-Centric Computing for the Next Generation* tomorrow at 09:30, room Konstant

Summary



- The Virtual Institute for I/O is a community hub
 - ▶ Open to everybody and free to join
- It contains information about
 - ▶ Tools, benchmarks
 - ▶ Research groups
 - ▶ Standardization efforts
- It supports the IO-500 and the Comprehensive Data Center List (CDCL)
 - ▶ Covers many metrics and allows flexible visualization
 - ▶ Will track metrics across years
 - ▶ Can be updated by members
- Towards **standardization** of system presentation and APIs
 - ▶ We have various white-paper drafts; join mailinglist/Slack now to participate!