

IO500: The High-Performance Storage Community

Committee

- **George Markomanolis - AMD**
- Jean Luca Bez - NERSC
- Andreas Dilger - Whamcloud/DDN
- Dean Hildebrand - Google
- Julian Kunkel - Georg-August-Universität Göttingen/GWDG
- Jay Lofstead - Sandia National Laboratories

IO⁵⁰⁰

BoF Agenda

1. **Welcome** – George Markomanolis
2. **The New IO500 List Analysis** – Andreas Dilger
3. **Award Presentations** – George Markomanolis
4. **Roadmap**
 - **Website Update and Rules** - Jay Lofstead
5. **Community Presentation**
 - I/O performance in CLAIIX23 infrastructure - Radita Liem
 - IOR Mockup for testing alternative interfaces with IO500 - Julian Kunkel
6. **Submission system changes** - Jean Luca Bez
7. **Community Discussion** - Julian Kunkel

IO500 Organization Status

- A US non-profit, public charity organization: IO500 Foundation
 - Domain, mailing list, servers, GitHub belongs to IO500 Foundation
- Website contains results with links to details, CFS, BoF slides, etc.
 - io500.org
 - Contribute fixes at github.com/IO500/webpage
- Please join our mailing list for announcements:
 - io500.org/contact
- Please join our Slack for discussions:
 - io500workspace.slack.com/
 - Join link: rb.gy/sn8esm



Welcome to the new member of IO500 committee



Jean Luca Bez! LBNL

IO500 List Analysis

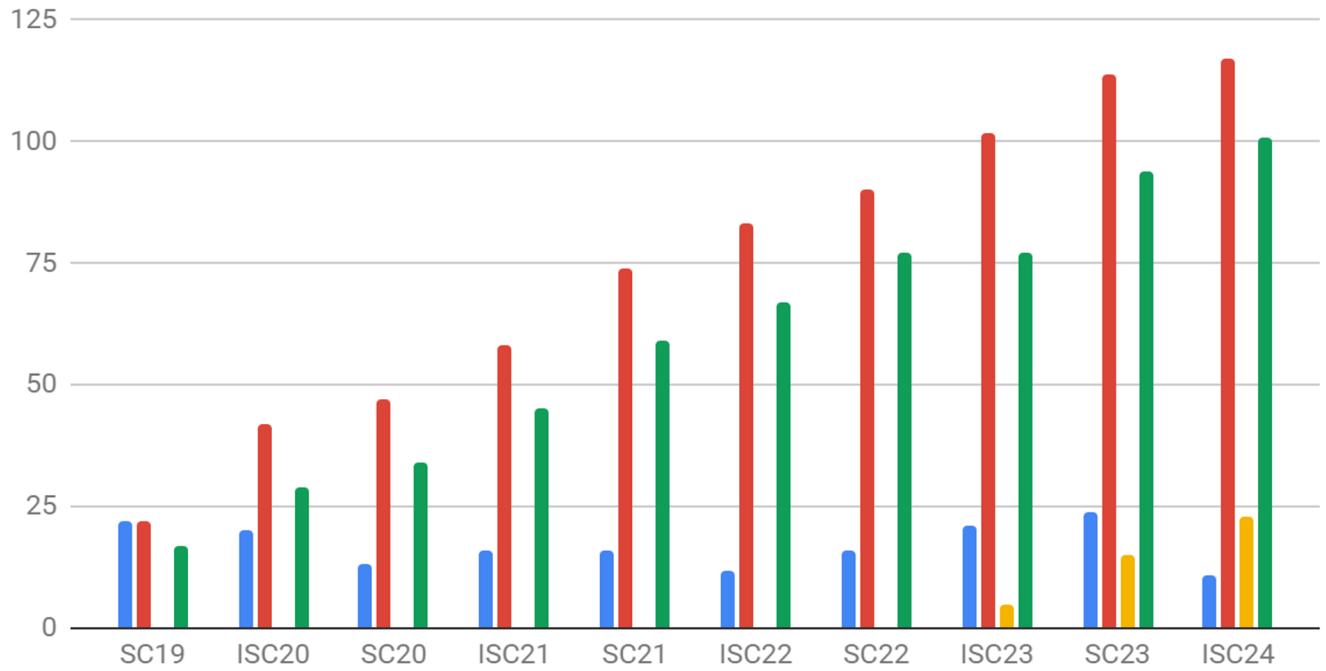
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Overall Thoughts

- Production lists submissions had a great boost
- We really appreciate the detailed information in the schema and questionnaire
 - We know it is a lot of work...
 - The questionnaire is really becoming the best source for a quick overview of the submissions
- Really great to see submissions from various HPC systems
 - Starting to realize IO500's mission to build a wealth of data on HPC storage systems
 - Interesting to see advances in systems with submissions over multiple lists
- 248 entries across the 4 lists (half-way to 500)

IO500 List - Growth in Entries and Institutions

■ Number of Submissions ■ Research List Length ■ Production List Length
■ Number of Institutions/Organizations



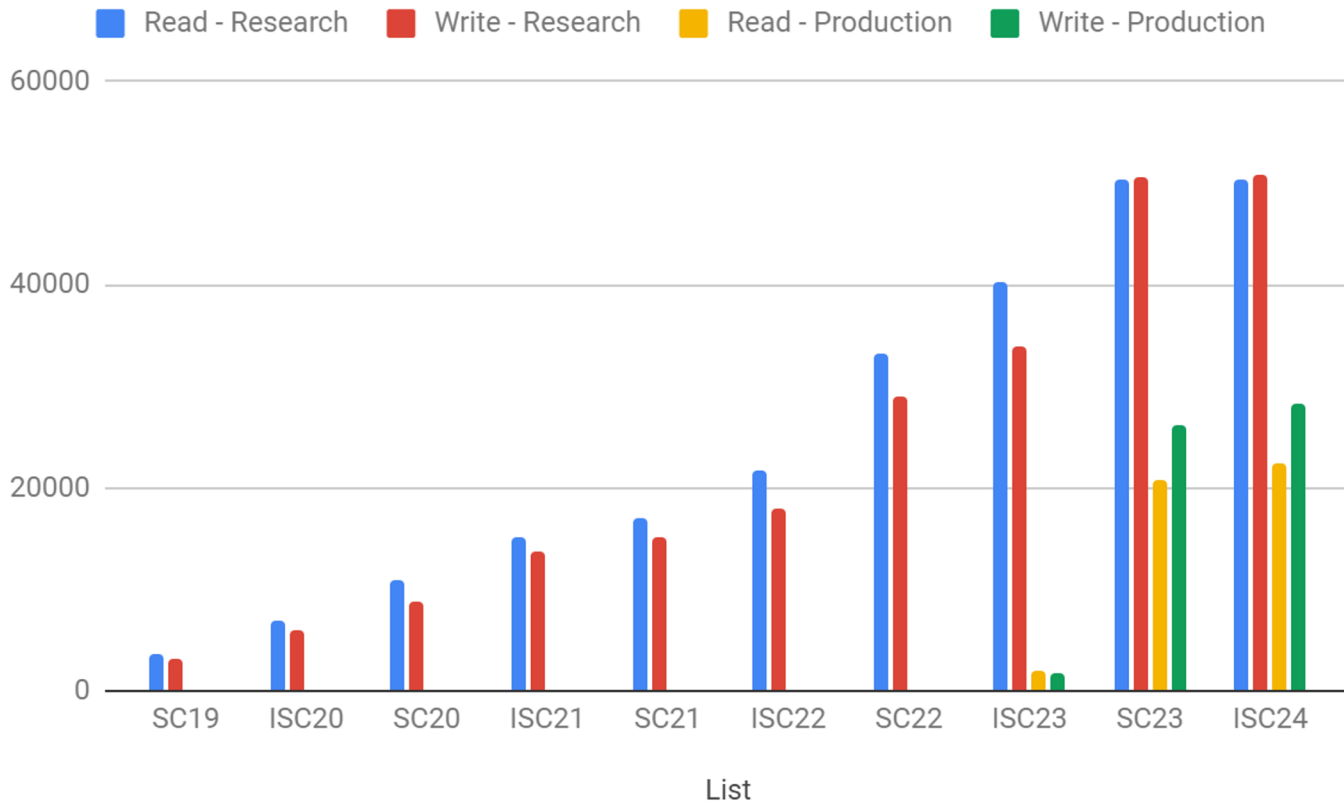
13 submissions (with overlap)

- 7 for 10-Client Research
- 4 for 10-Client Production
- 7 for IO500 Research
- 4 for IO500 Production

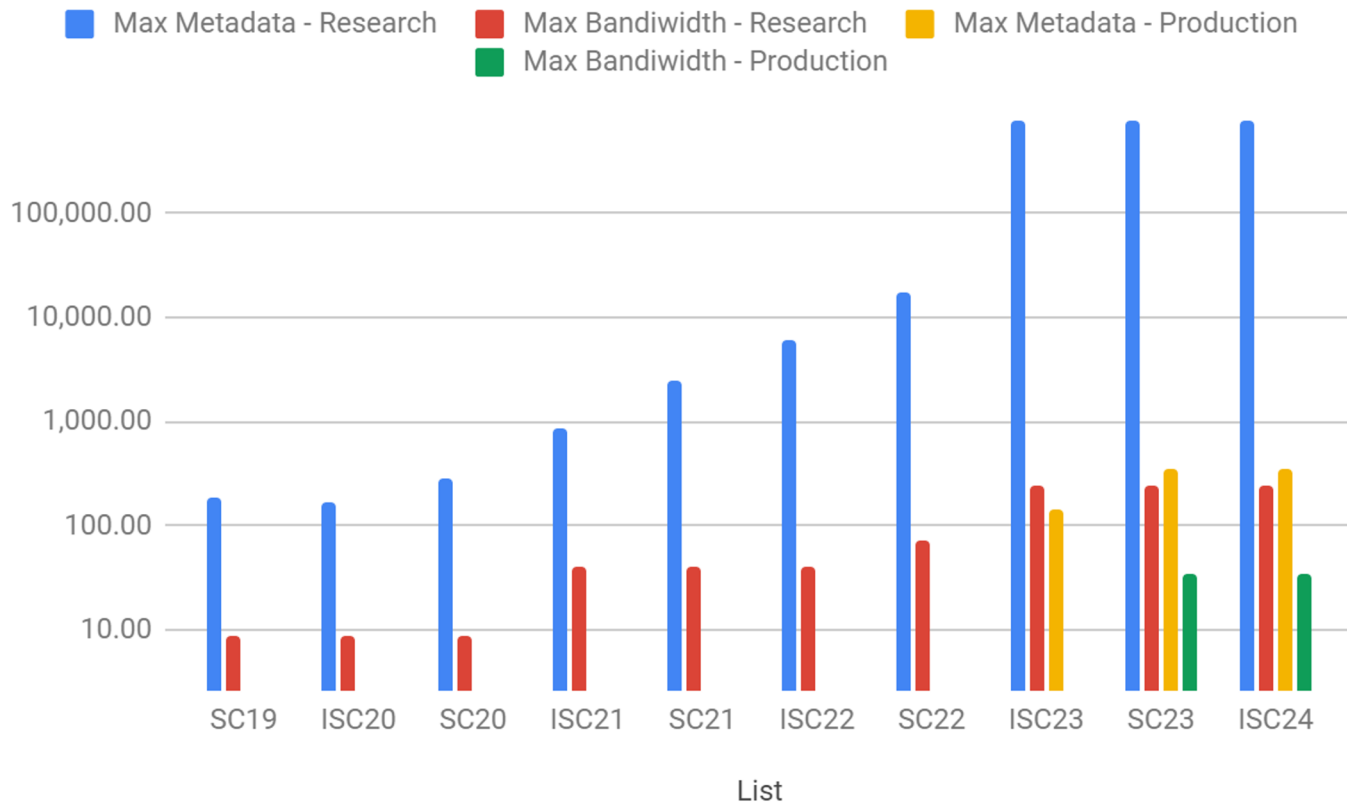
Production: 21
Production-10: 11
Research: 117
Research-10: 104

Institutions: 101

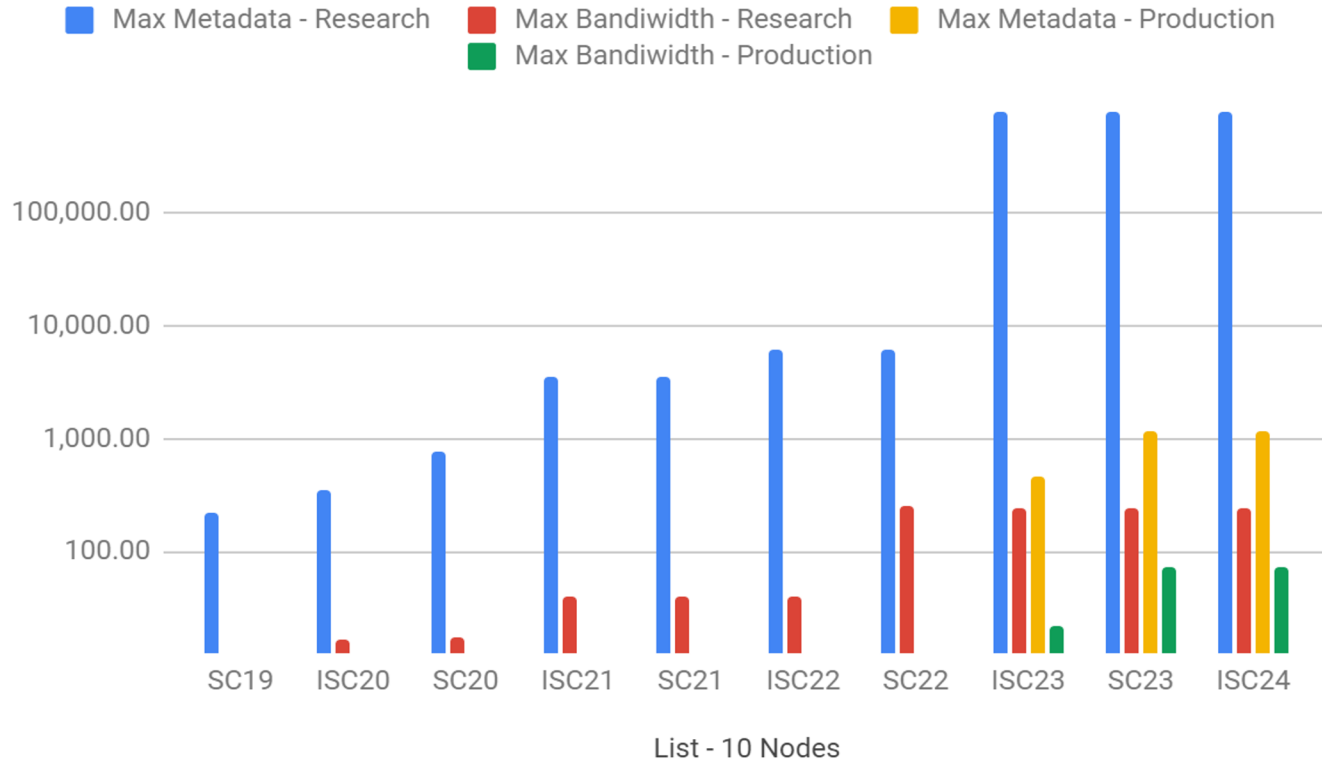
IO500 List - Aggregate List Bandwidth (GB/s)



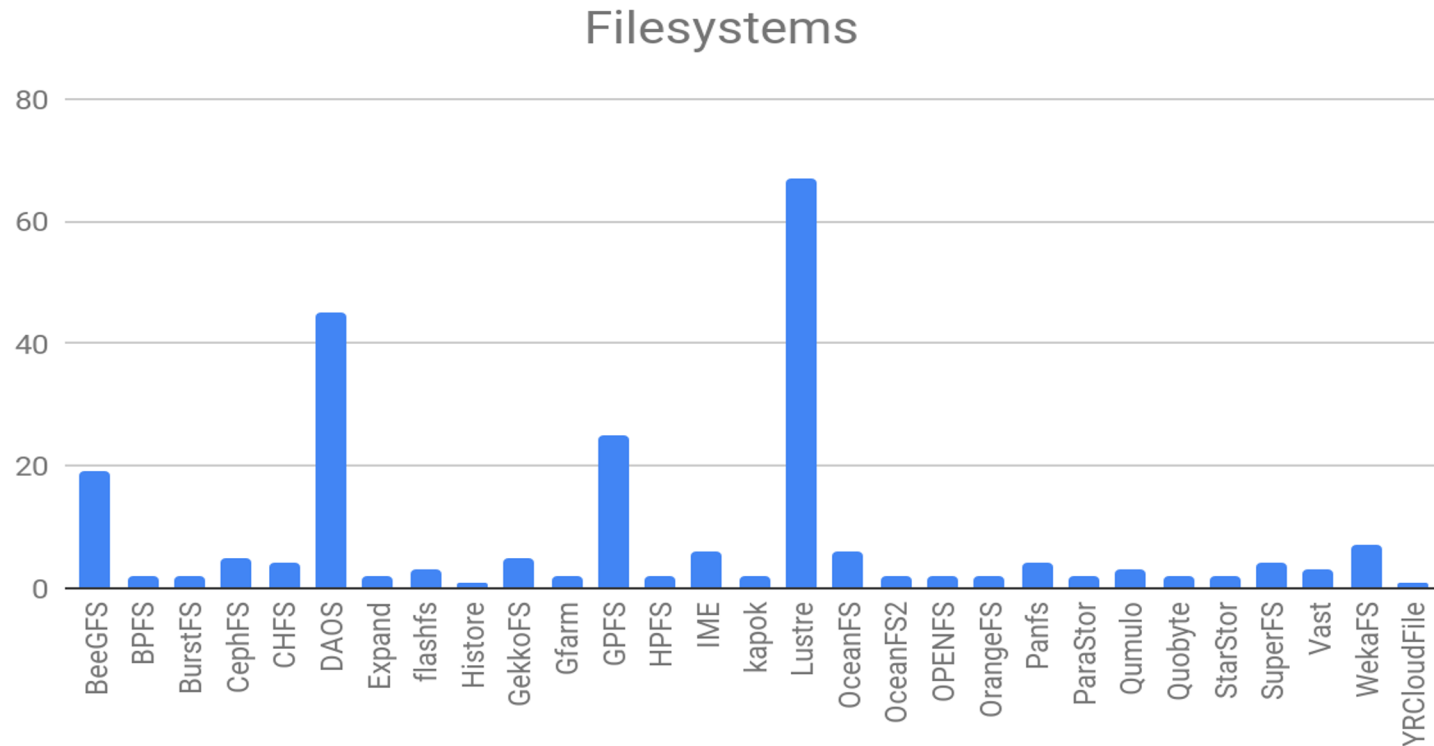
IO500 List - Growth in Max Score per Client



10-Client List - Growth in Max Scores per Client



IO500 List - Number of File System Entries



Award Ceremony

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Five Awards

Aggregate awarding of Bandwidth, Metadata, Overall for same winner

- 10-Client Node Production List
 - Overall
- 10-Client Node Research List
 - Overall
- IO500 Production List
 - Overall
- IO500 Research List
 - Overall, Bandwidth

10 Client Node Production - Overall Winner

# ↑	RELEASE	SYSTEM	INSTITUTION	FILESYSTEM TYPE	SCORE ↑	BW (GIB/S)	MD (KIOP/S)
1	SC23	Aurora	Argonne National Laboratory	DAOS	2,885.57	734.50	11,336.27
2	ISC23	SuperMUC-NG-Phase2-EC-10	LRZ	DAOS	1,008.81	218.38	4,660.23
3	ISC24	Lise	Zuse Institute Berlin	DAOS	324.54	65.01	1,620.13
4	ISC24	NHN CLOUD GWANGJU AI	NHN Cloud Corporation	EXAScaler	176.57	62.58	498.22
5	ISC24	Afton	University of Virginia	WEKA	105.94	33.28	337.29
6	SC23	Earth Simulator 4	Japan Agency for Marine-Earth Science and Technology	EXAScaler	101.88	48.19	215.38
7	ISC24	Altair	Poznan Supercomputing and Networking Center	Lustre	73.50	15.24	354.60
8	SC23	Randi	Center for Research Informatics at University of Chicago	Spectrum Scale	60.88	31.05	119.36
9	SC23	Orion	Mississippi State University High Performance Computing Collaboratory	Lustre	20.83	5.01	86.67
10	SC23	Orion	Mississippi State University High Performance Computing Collaboratory	Lustre	17.57	6.43	48.03

Certificate

IO500 Performance Certification

This Certificate is awarded to:

**Argonne National Laboratory
(Aurora DAOS EC)**

#1 in the 10 Client Node Production Overall, Bandwidth and
Metadata Score

IO 500



May 2024

IO500 Steering Board

<https://io500.org/list/ISC24/ten-production>

10 Client Node Research - Overall Winner

# ↑	RELEASE	SYSTEM	INSTITUTION	FILESYSTEM TYPE	SCORE ↑	BW (GIB/S)	MD (KIOP/S)
1	ISC23	Cheeloo-1 with OceanStor Pacific	JNIST and HUST PDSL	OceanFS2	137,100.00	2,439.37	7,705,448.04
2	ISC23	Pengcheng Cloudbrain-II on Atlas 900	Pengcheng Laboratory	SuperFS	11,516.40	263.97	502,435.85
3	SC22	ParaStor	Sugon Cloud Storage Laboratory	ParaStor	8,726.42	718.11	106,042.93
4	SC22	StarStor	SuPro Storteck	StarStor	6,751.75	515.15	88,491.65
5	SC22	SuperStore	Tsinghua Storage Research Group	SuperFS	5,517.73	179.60	169,515.95
6	SC23	Aurora	Argonne National Laboratory	DAOS	3,748.85	934.00	15,046.98
7	ISC22	Shanhe	National Supercomputing Center in Jinan	flashfs	3,534.42	207.79	60,119.50
8	SC21	Athena	Huawei HPDA Lab	OceanFS	2,395.03	314.56	18,235.71
9	SC21	OceanStor Pacific	Olympus Lab	OceanFS	2,298.69	317.07	16,664.88
10	ISC21	Endeavour	Intel	DAOS	1,859.56	398.77	8,671.65
11	ISC23	SuperMUC-NG-Phase2-10	LRZ	DAOS	1,533.28	266.73	8,813.96
12	ISC24	Songshan	Institute of Computing Technology Chinese Academy of Sciences and National Supercomputing Center in Zhengzhou	HiStore	1,349.22	43.78	41,580.79

Certificate

IO500 Performance Certification

This Certificate is awarded to:

**JNIST and HUST PDSL (Cheeloo-1)
with OceanStor Pacific from Huawei**

#1 in the 10 Client Node Research Overall, Bandwidth, and
Metadata Score

IO 500



May 2024

IO500 Steering Board

<https://io500.org/list/ISC24/ten>

IO500 Production List - Overall Winner

# ↑	RELEASE	SYSTEM	INSTITUTION	FILESYSTEM TYPE	SCORE ↑	BW (GiB/s)	MD (KiOP/s)
1	SC23	Aurora	Argonne National Laboratory	DAOS	32,165.90	10,066.09	102,785.41
2	SC23	SuperMUC-NG-Phase2-EC	LRZ	DAOS	2,508.85	742.90	8,472.60
3	SC23	Shaheen III	King Abdullah University of Science and Technology	Lustre	797.04	709.52	895.35
4	ISC23	Leonardo	EuroHPC-CINECA	EXAScaler	648.96	807.12	521.79
5	ISC24	Lise	Zuse Institute Berlin	DAOS	324.54	65.01	1,620.13
6	SC23	IRIS	Memorial Sloan Kettering Cancer Center	WekaIO	308.94	104.79	910.80
7	ISC22	CTPAI	China Telecom Research Institute	DAOS	187.84	25.29	1,395.01
8	ISC24	NHN CLOUD GWANGJU AI	NHN Cloud Corporation	EXAScaler	176.57	62.58	498.22
9	ISC24	Helios	ACC Cyfronet AGH	Lustre	153.39	122.31	192.36
10	ISC23	Imperial - hx cluster	Imperial College London	Spectrum scale	119.56	44.63	320.31

Certificate

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(Aurora DAOS EC)**

#1 in the IO500 Production Overall, Bandwidth, and
Metadata Score

IO500



May 2024

IO500 Steering Board

<https://io500.org/list/ISC24/production>

IO500 Research List - Overall Winner

# ↑	RELEASE	SYSTEM	INSTITUTION	FILESYSTEM TYPE	SCORE ↑	BW (GIB/S)	MD (KIOP/S)
1	ISC23	Pengcheng Cloudbrain-II on Atlas 900	Pengcheng Laboratory	SuperFS	210,255.00	4,847.48	9,119,612.35
2	ISC23	Cheeloo-1 with OceanStor Pacific	JNIST and HUST PDSL	OceanFS2	137,100.00	2,439.37	7,705,448.04
3	SC23	Aurora	Argonne National Laboratory	DAOS	43,218.80	11,362.27	164,391.73
4	SC22	ParaStor	Sugon Cloud Storage Laboratory	ParaStor	8,726.42	718.11	106,042.93
5	SC22	StarStor	SuPro Storteck	StarStor	6,751.75	515.15	88,491.65
6	SC22	SuperStore	Tsinghua Storage Research Group	SuperFS	5,517.73	179.60	169,515.95
7	SC23	SuperMUC-NG-Phase2	LRZ	DAOS	4,585.68	1,054.72	19,937.45
8	ISC22	Shanhe	National Supercomputing Center in Jinan	flashfs	3,534.42	207.79	60,119.50
9	SC22	HPC-OCI	Cloudam HPC on OCI	BurstFS	3,033.03	278.48	33,033.54
10	SC21	Athena	Huawei HPDA Lab	OceanFS	2,395.03	314.56	18,235.71

Certificate

IO500 Performance Certification

This Certificate is awarded to:

Pengcheng Laboratory (Cloudbrain-II)
with SuperFS from Tsinghua University
#1 in the IO500 Research Overall, and Metadata Score

IO500



May 2024

IO500 Steering Board

<https://io500.org/list/ISC24/io500>

Certificate

IO500 Performance Certification

This Certificate is awarded to:

**Argonne National Laboratory
(Aurora DAOS EC)**

#1 in the IO500 Research Bandwidth Score

IO500



May 2024

IO500 Steering Board

<https://io500.org/list/ISC24/production>

List of Awarded Systems in the Ranked Lists

10 Client	Bandwidth Metadata Overall	Argonne National Laboratory	DAOS	734,50 11,336.72 2,885.57	GB/s KIOPS/s score
10 Client Research	Bandwidth Metadata Overall	JNIST and HUST PDSL	OceanFS2	2,439.37 7,705,448.04 137,100.00	GB/s KIOPS/s score
IO500 Production	Bandwidth Metadata Overall	Argonne National Laboratory	DAOS	10,066.09 102,785.11 32,165.90	GB/s KIOPS/s score
IO500 Research	Bandwidth Metadata Overall	Argonne National Laboratory Pengcheng Laboratory Pengcheng Laboratory	DAOS SuperFS SuperFS	6,048.49 9,119,612.35 210,255	GB/s KIOPS/s score

Roadmap

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Roadmap for the IO500

- New committee rules
 - Streamlined from founding organizational rules
 - Decision process centralized in the document to keep clear process for all actions
 - Shifted to majority/supermajority for decisions
 - A bit of trust when acting in the best interest of IO500
- New phase submission process/requirements
 - Intended workload represented and how it represents it
 - Where in the phase list to insert and how it affects other phases

SC 24 (Nov 17-22, 2024)

- Call for submission: Sept 27th
- Testing phase ends: October 11th
 - Code freeze, but please test before!
- Submission deadline: Nov 8th
- List release: BoF date TBD (SC'24 during Nov 17-22)
- Looking forward to many more Production and Research submissions

Presentations

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IO500 Submission Form

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IO500 Submission Platform

- Migrate platform to new framework version
 - Improve stability and security
- Bug-fixes on mandatory fields
- Additional options on selection fields
 - e.g. interconnect and architecture
- Storage schema given higher visibility
- Website:
 - Fixes on JSON system details visualization
 - Allow full list download (including historical)

IO500

STORAGESYSTEM

SUPERCOMPUTER

IO500

EXCLUSIVE_CLUSTER_USAGE

VERSION

NODETYPE NAME

NUMBER_CLIENTNODES

PROCESSOR NODE

NUMBER_SERVERNODES

STORAGE TYPE

STORAGE NET CAPACITY

CLIENTS NETWORK BANDWIDTH

SERVERS NETWORK BANDWIDTH

TYPE OF FILESYSTEM

NOTE

IO500 Submission Platform Roadmap

- Make Research/Test vs. Production submission selection more prominent
- Finalize migration of historical submissions data
- Allow JSON submission for Reproducibility Questionnaire
- Fine-tune mandatory fields
- Improve description of input fields (on hover)
- Improve notification of calls/submissions/decisions (email)
- Claim submissions to profile (before new system was in place)

Soliciting volunteers to help with ongoing maintenance and improvements

Voice of the Community & Open Discussion

IO⁵⁰⁰

Open Floor

- How to collect storage system metadata more easily?
 - Soliciting volunteers to write storage-specific scripts to generate this
 - Would simplify filling out forms and improve metadata accuracy
- Can we encourage vendors to support tool and schema development?
- How to improve the reproducibility submission?