

# OOKAMI

User Group Meeting  
Th 2/10/2022 2-5pm EST

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# Ookami - 狼

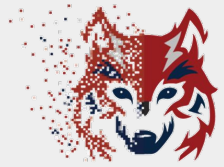


- Ookami is Japanese for wolf
  - Homage to the origin of the processor and the Stony Brook mascot
- A computer technology testbed supported by NSF
- Available for researchers worldwide  
(excluding ITAR prohibited countries & restricted parties on the EAR entity list)
- Usage is free for non-commercial and limited commercial purposes



# Fugaku #1

## Fastest computer in the world



First machine to be fastest in  
all 5 major benchmarks:

- Green-500
- Top-500 – 415 PFLOP/s in double precision – nearly 3x

Summit!

- HPCG
- HPL-AI
- Graph-500



- 432 racks
- 158,976 nodes
- 7,630,848 cores
- 440 PF/s dp (880 sp; 1,760 hp)
- 32 Gbyte memory per node
- 1 Tbyte/s memory bandwidth/node
- Tofu-2 interconnect

<https://www.r-ccs.riken.jp/en/fugaku>

# Ookami



Node	
Processor	A64FX
#Cores	48
Peak DP	2.76 TOP/s
Memory	32GB@1TB/s
System	
#Nodes	176
Peak DP	486 TOP/s
Peak INT8	3886 TOP/s
Memory	5.6 TB
Disk	0.8 PB Lustre
Comms	IB HDR-100

# What is Ookami

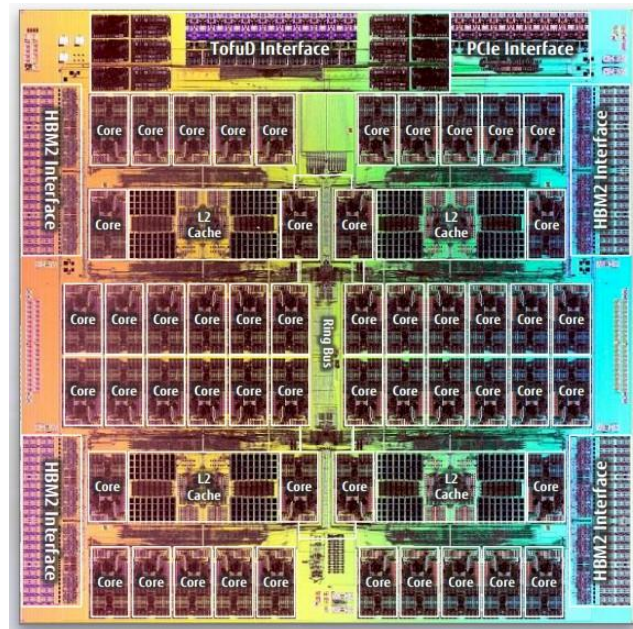


- 176 Fujitsu **A64FX** compute nodes each with 32GB of high-bandwidth memory and a 512 Gbyte SSD
  - Same as in currently fastest machine worldwide, Fugaku
  - First deployment outside Japan
  - HPE/Cray Apollo 80
- Ookami also includes:
  - 1 node with dual socket AMD Rome (128 cores) with 512 Gbyte memory
  - 2 nodes with dual socket Thunder X2 (64 cores) each with 256 Gbyte memory and 2 NVIDIA V100 GPU
  - 1 node Intel Sky Lake Processors (32 cores) with 192 Gbyte memory
- Delivers ~ 1.5M node hours per year

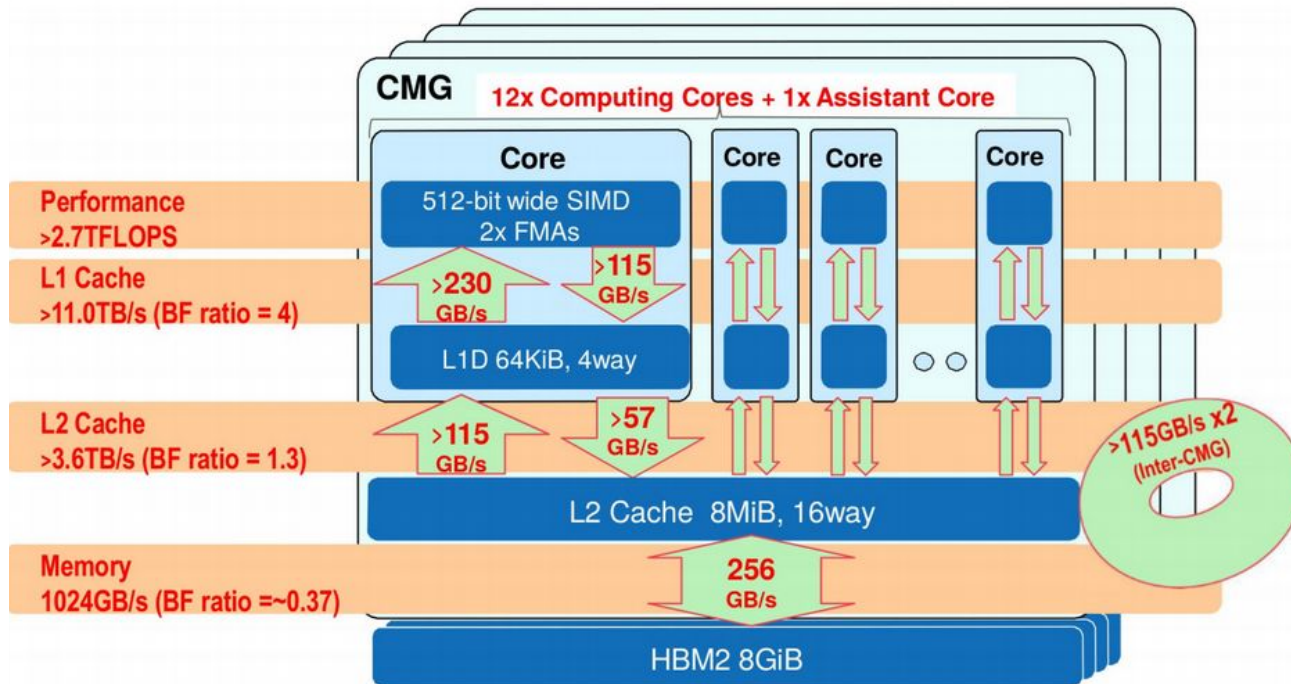
# A64FX NUMA Node Architecture



- Arm V8-64bit
- Supports high calculation performance and low power consumption
- Supports Scalable Vector Extensions (SVE) with 512-bit vector length
- **4 Core Memory Groups (CMGs)**
  - 12 cores (13 in the FX1000)
  - 64KB L1\$ per core - 256b cache line
  - 8MB L2\$ shared between all cores - 256b cache line
  - Zero L3\$
- 32 (4x8) GB HBM @ 1 TB/s
- PCIe 3 (+ Tofu-3) network



# A64fx Core Memory Group



# What else



- CentOS 8 operating system
- DUO Authentication
- High-performance Lustre file system (~800TB of storage)
- Slurm workload manager
- Compilers: GNU, Arm, Cray, Fujitsu, Intel, Nvidia
- Continuous growing stack of preinstalled software
  - MPI implementations
  - Math libraries
  - Performance analysis & debugging:  
(Arm Forge, Cray, GNU, TAU, ..)

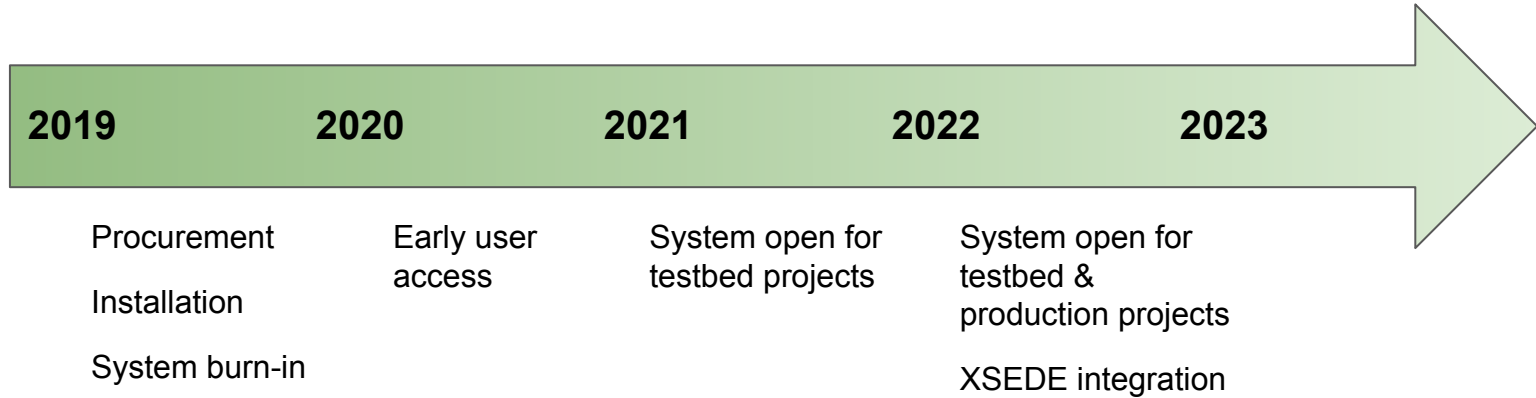


# Key Findings



- Compiler makes a huge performance difference
- In general Cray and Fujitsu deliver best performance
- Arm delivers competitive performance and fully support current language standards
- GCC optimizes for SVE and A64FX and sometimes generates best performance, but lack of vector math library

# Project Timeline

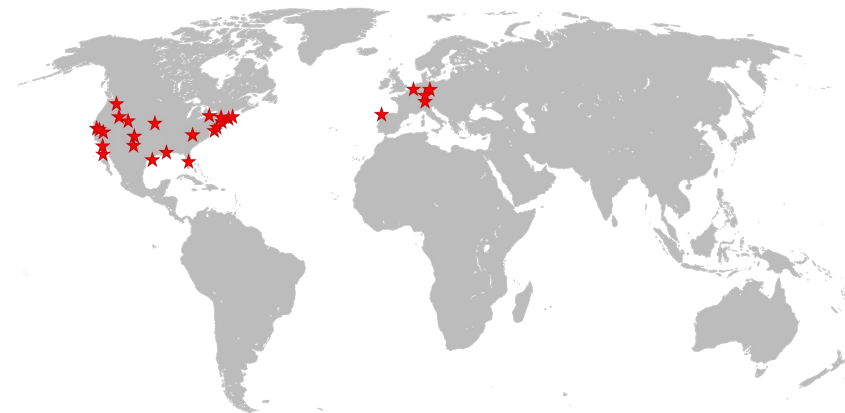


# Projects



- Total: 211 users & 71 projects
- 90% projects from within the US
- 10% from Europe
- 93% from academia
- Complete list of projects:

<https://www.stonybrook.edu/ookami/projects/>



# User Support



- Slack channel
- Ticketing system
- Regular webinars
  - Vectorization hackathon, TAU, likwid, XDMoD, etc.
  - All recordings and slides on our website
- Virtual office hours twice a week
  - Tu, 10 - noon EST, and Th 2 - 4 pm EST

Informal meetings

Join and drop whenever you want

We are happy to help or just chat with you

# Allocations



- Currently all allocations through Stony Brook (details next slide)
- Accounts have to be renewed every year
- Ookami is in the process of becoming an XSEDE level 2 service provider
- From October 2022 onwards 90% of allocations will be through XSEDE
- Current testbed projects will still have access though at reduced priority

# Getting Accounts



- Submit a project request (templates on our website)
  - Testbed:
    - Porting and tuning software
    - Limited benchmarking
    - less than 15,000 node hours per year
    - First two project years
  - Production:
    - Less than 150K node hours per year
    - Lower priority during the first two project years
- Requests will be reviewed & published
- Allotted projects get free access

# Get in Contact



- <https://www.stonybrook.edu/ookami/>
- Ticketing system: <https://iacs.supportsystem.com/>
  - Technical questions / issues
  - Project / account requests
- [Ookami\\_computer@stonybrook.edu](mailto:Ookami_computer@stonybrook.edu)
  - For general questions
- Bi-weekly office hours (Tue 10am – noon, Thu 2 – 4pm EST)
- Slack Channel