Viterbi New Faculty Orientation  August 18 2022

BD Kim, PhD
Associate Chief Research Information Officer
USC Center for Advanced Research Computing (CARC) aims to provide advanced computational research support to USC faculty and students.

CARC aims to be an institutional resource and a long-term research partner of USC research community.
REBUILT IN 2020: ADVANCED RESEARCH COMPUTING

- **Center for High-Performance Computing is now Center for Advanced Research Computing (CARC)**
  The new name captures the research-focused direction of the new program.

- **4 major service areas:**
  - High-Performance Computing
  - Data Solutions
  - Education and Outreach
  - Research Partnership

- **New Systems**
  - Discovery & Endeavour HPC Cluster
  - 10PB Project file system
  - Hybrid Cloud Computing system (Artemis)

- **New Website** ([carc.usc.edu](http://carc.usc.edu))
  CARC website provides intuitive user guides, system specifications, service descriptions, news, workshop information and other comprehensive, user-support resources.
CARC SYSTEMS OVERVIEW

CARC systems include the Endeavour condo cluster as well as the Discovery shared cluster.

Endeavour (Condo Cluster)
- Login node: endeavour.usc.edu
- Data Transfer Nodes: hpc-transfer1/2.usc.edu
- Storage:
  - /home: 100 GB/user
  - /project: 10 PB ($40/TB/Yr)

Discovery (Shared Cluster)
- Login node: discovery.usc.edu
- Storage:
  - /scratch: 700 TB
  - /scratch2: 800 TB
# CARC SYSTEM USAGE STATUS

**Discovery HPC cluster usage status in a quick glance**

<table>
<thead>
<tr>
<th># OF PROJECTS</th>
<th># OF NODES ON DISCOVERY</th>
<th>FY22 PURCHASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>768</td>
<td>518</td>
<td>$1M</td>
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**On Discovery**
- 873 PI’s
- 4,000 users
- 250M SU’s have been allocated since inception
- 130M active SU’s used on the system

**System Specs**
- Total 15.4K cores
- 300+ applications
- 300 GPUs
  - 24 x A100
  - 24 x A40
  - 58 x V100
  - 78 x P100
  - 116 x K40

**New System Purchase**
- 70 new compute nodes (4480 cores)
- 30 GPU nodes
  - 24 x A100
  - 36 x A40
- HIPAA cluster
The Center for Advanced Research Computing (CARC) launched the Condo Cluster Program (CCP) in December 2020 to allow researchers a flexible way to purchase computing resources for their own dedicated use.

The CCP has two pricing models:

**Annual Subscription Model**
- Allows research groups to subscribe to their selected number of compute and storage resources on a yearly basis
- Compute resources can be requested via CARC User Portal
- Allocated nodes get provisioned automatically within a week

**Traditional 5-year System Purchase Model**
- A useful option when research groups need to make a bulk purchase using a research grant or departmental budget
- Compute/GPU system configurations by CARC
- System purchases can be requested via CARC User Portal
STATE OF THE NEW CONDO CLUSTER PROGRAM

Current usage for CARC’s Endeavour condo cluster

# OF PROJECTS: 61

# OF NODES IN USE: 868

FY22 PURCHASE: $1.2M

Contributions:
- Viterbi: 11 PI’s, 389 nodes
- Dornsife: 12 PI’s, 223 nodes
- Keck: 7 PI’s, 156 nodes
- Others: 15 PI’s, 183 nodes
  - Not including subscription nodes

System utilization:
- 20K cores
- 36/50 subscription nodes
- More than 1,000 old compute nodes have been decommissioned

New nodes purchased:
- 60 CPU nodes
- 2 GPU nodes (A40)
- DURIP award cluster (24-node)
- DOE cluster (36-node)
The Center for Advanced Research Computing (CARC) offers comprehensive user support services.

- Outreach
- User Portal
- Education
- Online Resources
- User Forum
- Tickets

Social Media
News Stories
Newsletter
Project Mgmt
Allocation Mgmt

Workshops
Video Learning

User Guides
System Info
FAQ

Knowledgebase
User Community Engagement

Carc User Tickets
Weekly Office Hours

User Services

University of Southern California
GOVERNANCE MODEL

The USC Center for Advanced Research Computing (CARC) established a program governance model that is structured to engage USC faculty, IT professionals, and senior leadership of the university with respect to the direction of the CARC.

ADVANCED RESEARCH COMPUTING - PROGRAM ADVISORY COMMITTEE (ARC-PAC)

A faculty-led governance structure that coordinates with stakeholders (faculty, students, IT professionals, and university leadership) for discussions concerning research cyberinfrastructure, facilities, and services.

- Vice President of Research (or a designated representative)
- Chief Information Officer (or a designated representative)
- Vice/Associate/Divisional Deans for Research from USC Schools
- Representatives of USC Research Centers and Institutes
- Associate Chief Research Information Officer/Director of the CARC (ex officio)

CONDO CLUSTER PROGRAM – EXECUTIVE STEERING COMMITTEE (CCP-ESC)

Current HPC infrastructure at USC needs continuous upgrades, including data center power and cooling, storage and network, GPU resources and the scale of HPC systems, etc.

- Vice President of Research (or a designated representative)
- Chief Information Officer (or a designated representative)
- Faculty investors of the Condo Cluster Program
- Associate Chief Research Information Officer/Director of the CARC (ex officio)
BUILDING PARTNERSHIP

CARC aims to be an institutional resource and a long-term research partner of USC research community

01 $400K NSF CC* AWARD: COLLABORATION WITH INFORMATION SCIENCE INSTITUTE (ISI)
CARC and Information Science Institute (ISI) have been collaborated on multiple NSF proposal developments. The collaborative effort resulted in multiple NSF CC* awards. This is the first one we received in 2020 for the development of Hybrid Cloud Computing system.

02 $1M NSF CC* AWARD: COLLABORATION WITH ISI & LOS NETTOS
Working with Los Nettos R&E Network Consortium and ISI, another CC* proposal has been awarded ($1MM) in 2021, aiming to build a regional Science DMZ network for local institutions.

03 CRYO-EM PROJECT: SUPPORTING DONRSIFE/AMGEN/ITS
CARC is developing a full research ecosystem including user interface, data and computational workflow management platform, with special GPU cluster deployment.

04 NSF CC* REGIONAL COMPUTING ($1M)
CARC is working with ISI for planning and building computational infrastructure for local institutions in SoCal region
FUTURE PLAN

CARC aims to become a regional leadership computing facility in SoCal

01 IMPROVING RESEARCH CYBERINFRASTRUCTURE AT USC
Current HPC infrastructure at USC needs continuous upgrades, including data center power and cooling, storage and network, GPU resources and the scale of HPC systems, etc.

02 DEVELOPING ADVANCED RESEARCH SUPPORT CAPACITY
In addition to the system infrastructure improvement, developing advanced computational and data expertise is critical to provide adequate support the research community and enable scientific breakthroughs at scale.

03 BECOMING REGIONAL LEADERSHIP COMPUTING FACILITY
We aim to become a regional leadership research computing facility, supporting and promoting multi-disciplinary, multi-institutional research collaborations.

04 STRATEGIC PLAN DEVELOPMENT
CARC is currently developing long-term strategic plan. This involves with multiple surveys and interviews with peer research computing programs at R1 universities and Sr Leadership at USC.
THANK YOU & FIGHT ON!