

Research Computing Support at the University of Utah: An Overview of CHPC

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CHPC's Mission

In addition to deploying and operating high performance computational resources and providing advanced user support and training, CHPC serves as an expert team to broadly support the increasingly diverse research computing needs on campus. These needs include support for big data, big data movement, data analytics, security, virtual machines, Windows science application servers, protected environments for data mining and analysis of protected health information, and advanced networking.



CHPC can help if:

- You need parallel processing
- You need access to a single high-powered computer
- You need the ability to run many individual jobs simultaneously
- You have a large amount of data to store and/or process
- You need an application you don't have on your computer
- Your data is IRB-governed PHI
- You have other computing needs your local resources cannot meet

Sources of Useful Information

- Getting Started Guide
 - https://www.chpc.utah.edu/documentation/gettingstarted.php
- CHPC policies
 - https://www.chpc.utah.edu/documentation/policies/index.php
- Cluster Usage Guides
 - https://www.chpc.utah.edu/documentation/guides/index.php
- Application Documentation
 - https://www.chpc.utah.edu/documentation/software/index.php
- Programming Guide
 - https://www.chpc.utah.edu/documentation/ProgrammingGuide.php
- How to Videos
 - https://www.chpc.utah.edu/documentation/videos/index.php



Downtown Data Center

- Came online Spring 2012
- CHPC completed move to DDC Spring 2013
- Shared with enterprise (academic/hospital) groups
- 92 racks and 1.2MW of power with upgrade path to add capacity for research computing
- Metro optical ring connecting campus, data center, & internet2
- 24/7/365 facility









CHPC Resources & Services

- Computational Clusters Notchpeak, Kingspeak, Lonepeak, Ember, Ash, Tangent
- Storage home, group, and scratch storage along with tape backup and archive storage options
- Windows Servers mainly statistics usage and windows only applications
- Virtual Machines for needs not met with cluster and windows server
- Protected Environment computational cluster Redwood, storage, VMs, and Windows Server
- Networking Support support compute environment; work with researchers on data movement etc
- User Support assistance with use of resources; installation of applications; training sessions



Notchpeak – New Cluster - growing 33 nodes/1056 cores Infiniband (EDR) and GigE General 15 nodes/480 cores

3 general GPU nodes (V100)

Tangent - dynamic provisioning up to 64 nodes/1024 cores

Lonepeak – No Infiniband General 99 nodes/1124 cores Owner 20 nodes/400 cores

Ash (417 nodes/7448 cores)

Administrative Nodes

Frisco 8 nodes

Switch

Kingspeak
382 nodes/8000 cores
Infiniband (FDR) and GigE
General 48 nodes/832 cores

4 general GPU nodes (K80, TitanX) 4 owner GPU nodes (P100)

> Ember 159 nodes/2880 cores Infiniband (QDR) and GigE General 70 nodes/852 cores

8 general GPU nodes (M2090)

NFS

Home

Directories &

Group

Directories

Parallel FS /scratch/general/lustre

NFS

/scratch/kingspeak/serial_

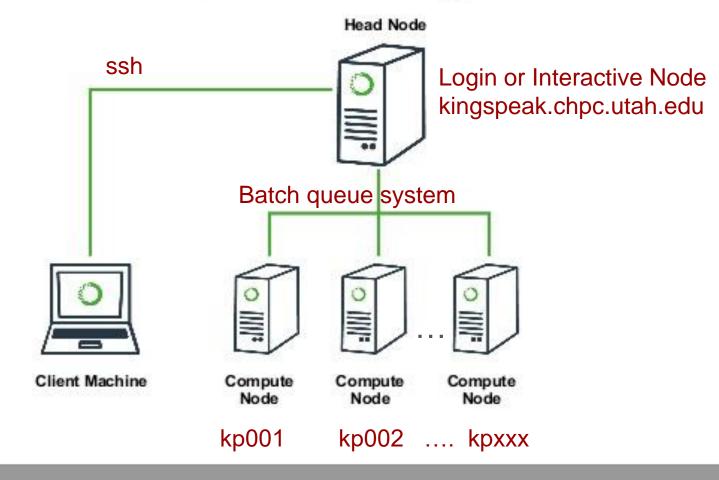




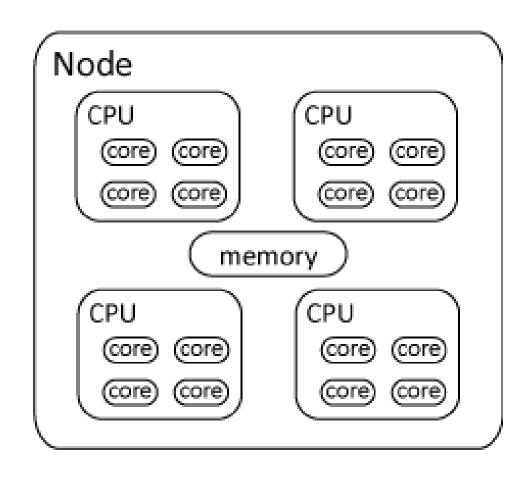




Cluster Architecture Diagram









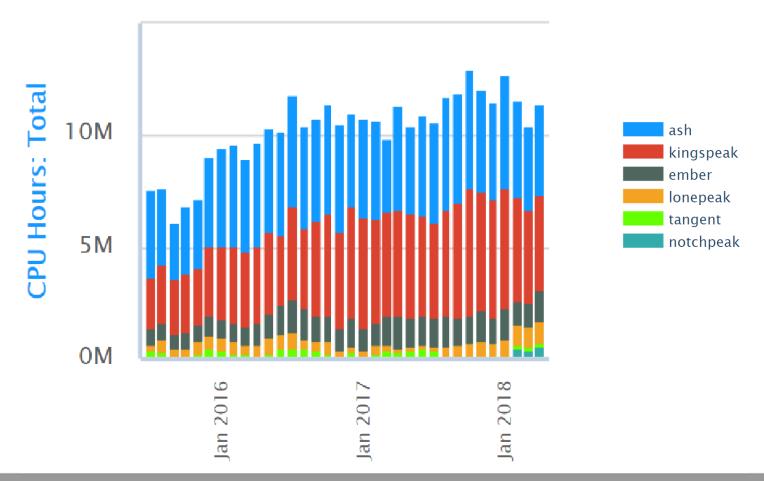
CHPC Clusters - Condominium Model

- Notchpeak, Kingspeak
 - General resources Allocation process for cycles
 - Out of allocation freecycle allowed (with preemption)
- Owner nodes new purchased added to notchpeak
 - 32 core Intel XeonSP(Skylake) @ 2.1GHz cpu speed, 96GB RAM, 2TB local hard drive, 5 year warranty, EDR IB connectivity @ ~\$7950/node; with 192GB RAM ~\$9150/node
 - Users from all groups allowed on as owner-guest when not in use (preemption)
 - Found on notchpeak, kingspeak, ember, lonepeak
- Ember, Lonepeak
 - no allocation and no preemption
- Tangent
 - dynamically provisioned cluster resource; no allocation and no preemption
- Ash Owner cluster
 - All users have guest access as smithp-guest (preemption)



Core Hour Usage

Over 134M core hours provided in 2017



CHPC Provides Core Infrastructure

- Physical needs (racks, power, cooling)
- Core ethernet and IB fabric; IB to ethernet bridging
- Login/head/management nodes
- Scheduling, batch and allocation systems
- HPC scratch space
- Some application and licensing costs
- High speed data transfer nodes (DTNs)
- 'Science DMZ' network
- CHPC Staff



Storage Options

- Home Directories -- /uufs/chpc.utah.edu/common/home/<uNID>
 - Home directories 50GB, not backed up
 - Groups can purchase 1TB max home directory per group at \$1250/TB for hardware lifetime; this comes with backup (nightly incremental, weekly full, 2 week retention)
 - New Compellent solution on-line and all home directories have been migrated
- Group Level File Systems
 - Group space @\$150/TB; can get quarterly archives with purchase of tapes
- Scratch File Systems
 - For use by all users; scrubbed of files older than 60 days
 - 700TB Lustre Parallel file system (/scratch/general/lustre)
 - 175TB NFS mounted file system (/scratch/kingspeak/serial)
- Disk Based Archive Storage
- Tape Backups as discussed above

File Systems

- Access speed based on connectivity
- Local disk fastest local to each node; varies in size
 - /scratch/local
- Network mounted scratch file systems
 - /scratch/general/lustre
 - /scratch/kingspeak/serial
 - home directories and group spaces (don't use for large i/o!)

Remember NFS mounted spaces – including file systems of group spaces – are a shared resource!

Protected Environment

- Just refreshed with award of NIH Shared instrumentation grant
 - New cluster redwood
 - New VM farm prismatic
 - New storage mammoth
 - New windows compute narwhal
 - New policies
- See https://www.chpc.utah.edu/resources/ProtectedEnvironment-new.php
- Dedicated protected resources for handling of data/projects with protected information
- Currently HIPAA, looking at FISMA & FERPA
- Also for projects with other types of sensitive data/restrictions
- Significant area of growth for CHPC
- Preferred location for human genomic meets NIH dbGaP requirements



Other Recent Changes

Service Now for issue tracking (more at end)

Coming Soon

Working on new backup strategies to move from tape



Getting a CHPC Account

- CHPC uses campus uNID and password
- Pls must have account and will need to approve accounts for any members of their research group (can delegate)
- Account Application Procedure Online process
 - Complete CHPC account form at https://www.chpc.utah.edu/role/user/account_request.php
 - For collaborators outside of University of Utah must complete affiliate form with HR to get uNID https://www.hr.utah.edu/forms/affiliate.php and then use account application



Security Policies

- No clear text passwords, use ssh and scp
- You may not share your account under any circumstances
- Don't leave your terminal unattended while logged into your account
- Do not introduce classified or sensitive work onto CHPC systems unless on Protected Environment
- Do not try to break passwords, tamper with files etc.
- Do not distribute or copy privileged data or software
- Report suspicions to CHPC (<u>security@chpc.utah.edu</u>)
- See http://www.chpc.utah.edu/docs/policies/security.html
 for more details



Accessing Clusters

- Login or interactive nodes with each cluster
 - ssh –Y *cluster*.chpc.utah.edu where *cluster* is notchpeak,
 kingspeak, ember, tangent, ash-guest, lonepeak (redwood in PE)
- Interactive nodes only used for short compiles, editing and very short test runs
- No more than 15 minutes and no jobs of any length that make heavy use of cpu or memory!
- Have script which watches running processes and notifies users when in violation of the acceptable usage policy

Accessing Login nodes

- Use FastX from Mac, Windows, or Linux desktops -- preferred
 - https://www.chpc.utah.edu/documentation/software/fastx2.php
- Alternatively:
 - From windows need ssh client
 - PuTTY http://www.chiark.greenend.org.uk/~sgtatham/putty/
 - Xshell http://www.netsarang.com/products/xsh_overview.html
 - For X forwarding applications also need
 - Xming http://www.straightrunning.com/XmingNotes/
 - Look for "mesa" version
 - From mac/linux use terminal ssh (with –Y for X forwarding)
- Access to protected environment needs Duo two factor authentication (and VPN if off campus)



FastX – Tool for Remote X

- https://www.starnet.com/fastx
- Used to interact with remote linux systems graphically in much more efficient and effective way then simple X forwarding
- Graphical sessions can be detached from without being closed, allowing users to reattach to the session from the same or other systems
- Server on all interactive nodes as well as the frisco nodes;
 some servers have graphics cards and support OpenGL
- Clients for windows, mac and linux; can be installed on both university and personal desktops.

FastX

- For FastX see "To Use" section of documentation at https://www.chpc.utah.edu/documentation/software/fastx2.php
- Download client following directions on page
- Do install
- Start program
- Set host to kingspeak1.chpc.utah.edu OR kingspeak2.chpc.utah.edu OR other interactive node OR one of the frisco nodes (frisco1frisco8.chpc.utah.edu)



Login scripts

- CHPC provides login scripts ("dot" files) when creating account for both tcsh and bash shells
- These files set the environment so that applications are found, batch commands work – *Do not remove*
- Choose shell at account creation can change at <u>www.chpc.utah.edu</u> (sign in, select edit profile)
- Four files: .bashrc, .tcshrc, .custom.sh, .custom.csh
 - The first two should not be edited
 - The second two is where to add custom module loads
- Will automatically execute an .aliases file if it exists

CHPC Uses Modules for Setting Environment

- CHPC provides login scripts ("dot" files) when creating account for both tcsh and bash shells
- These files set the environment so that applications are found, batch commands work – Do not remove or edit!
- https://www.chpc.utah.edu/documentation/software/modules.php for information
- Presentation on Modules Thursday, June 14



Batch System Information

- Used to access compute nodes which must be used for any extensive use
- Use SLURM Simple Linux Utility for Resource Management
- https://www.chpc.utah.edu/documentation/software/slurm.php
 for information
- Presentation on Slurm Tuesday June 19

Software on Clusters

- Have a variety of compliers, mpi packages, math libraries and applications installed
- Some licensing restrictions may apply
- If you need a package we do not currently have installed ask us!
- Currently we place installations at:
 - /uufs/chpc.utah.edu/sys/installdir
- Have a searchable application database
 - https://www.chpc.utah.edu/software/chpc/

Allocation

- General Allocation Process Information
 - https://www.chpc.utah.edu/documentation/policies/1.4AllocationPolicies.php
- Regular allocation form
 - https://www.chpc.utah.edu/apps/profile/allocation_form.php
 - Requests due Sept 1, Dec 1, Mar 1, and Jun 1
 - Allocation in core hours
- Quick allocation
 - https://www.chpc.utah.edu/apps/profile/allocation_quick_form.php
- Check usage -- https://www.chpc.utah.edu/usage/cluster/current-project-general.php
- Simplified quick allocation requests & general allocation requests for up to 20,000 core-hours per quarter



Windows Statistics Server

- Kachina/Swasey each 48 core, 512TB memory
 - New PE Swasey being replaced by Narwhal
- Presently has the following software installed
 - SAS 9.4 with text miner
 - SPSS
 - R
 - STATA
 - Mathematica
 - Matlab
- If you need other software, please contact us to discuss

Virtual Machine Farm

- For needs and applications that do not fit in compute cluster or Windows server
- Multiple VM servers with failover
- VM storage
- Have community mysql/mssql VMs, git repositories, web servers, etc
- New user VMs (not use of community ones) will have a cost, both for the VM and for any customization needed.
 - Already charging for VMs in protected environment
 - Will start to charge for VMs in general environment later this year
 - Cost depends on size of VM
 - In PE size is multiple of blocks with 1 block = 2 cores, 4GB RAM, 50GB storage, cost is \$350/block for 5 years
 - Price yet to be determined in general



CHPC Summer Presentation Series

In INSCC Auditorium at 1-2pm unless otherwise noted – can join remotely via skype for business – *1-3pm: **9am-3pm

DATE	TIME	PRESENTATION TITLE	PRESENTER
Thursday, May 17th	1-2pm	Introduction to HPC & CHPC *	Anita Orendt
Tuesday, May 22nd	1-3pm	Hands-on Introduction to Linux, part 1 **	Brett Milash and Wim Cardoen
Thursday, May 24th	1-3pm	Hands-on Introduction to Linux, part 2 **	Brett Milash and Wim Cardoen
Thursday, May 31st	1-3pm	Hands-on Introduction to Linux, part 3 **	Brett Milash and Wim Cardoen
Mon-Thur, June 4-7th	9-3pm (break 11am-Noon)	XSEDE Summer Boot Camp ***	Wim Cardoen
Tuesday, June 12th	1-3pm	Hands-on Introduction to Linux, part 4 **	Wim Cardoen and Brett Milash
Thursday, June 14th	1-2pm	Module Basics *	Anita Orendt
Tuesday, June 19th	1-2pm	Slurm Basics *	Anita Orendt
Thursday, June 21st	1-3pm	Introduction to Python, Part 1 **	Brett Milash and Wim Cardoen
Tuesday, June 26th	1-3pm	Introduction to Python, Part 2 **	Brett Milash and Wim Cardoen
Thursday, June 28th	1-3pm	Numpy/Scipy (Python, Part 3)**	Wim Cardoen and Brett Milash
Tuesday, July 10th	1-2pm	Using Git (Details TBA)*	Robben Migacz

https://www.chpc.utah.edu/presentations/Summer2018CHPCPresentationSchedule.php

If you would like training for yourself or your group, CHPC staff would be happy to accommodate your request. Please contact anita.orendt@utah.edu or helpdesk@chpc.utah.edu



Getting Help

- CHPC website
 - www.chpc.utah.edu
 - Getting started guide, cluster usage guides, software manual pages, CHPC policies
- Ticketing System
 - Email: <u>helpdesk@chpc.utah.edu</u>
- Help Desk: 405 INSCC, 581-6440 (9-5 M-F)
- Mailing Lists:
 - chpc-hpc-users@lists.utah.edu used to send messages to users



Issues to Incidents

CHPC recently migrated from JIRA to Service Now

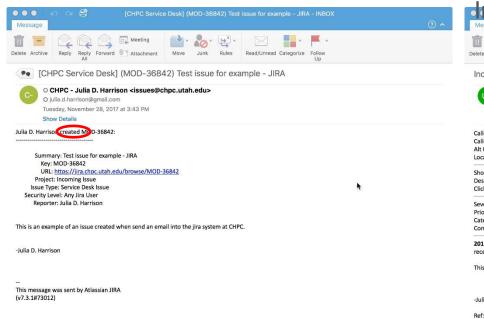


Main differences and points of interest:

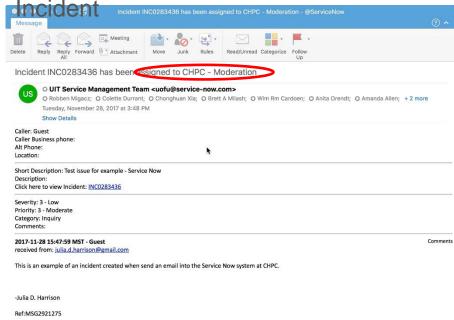
- For testing send emails to sntest@chpc.utah.edu
- When we go live on January 29th we will have <u>issues@chpc.utah.edu</u> go directly into Service-Now.
- Using your Umail email address is strongly suggested
- To use the portal, go to https://uofu.service-now.com/it
- Currently JIRA tickets are called "issues". In Service Now, they are called "incidents".
- The process of closing incidents in Service Now is two steps:
 - Resolved (you will receive and email that it is resolved) respond if you think it is still issue
 - 2. Closed AUTOMATICALLY in 24 hours (may change to 72 hours). Note that it is not possible to re-open incidents once closed. New incidents will need to be created.



JIRA – email on New Issue

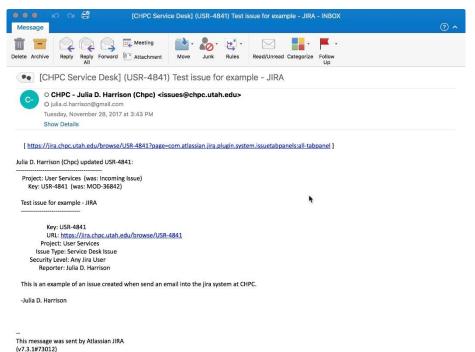


Service Now – email on New





JIRA – email for moderation

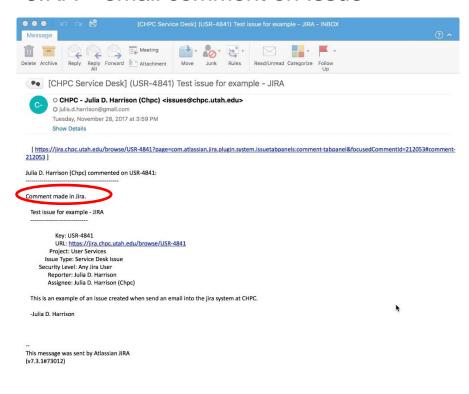


In the current JIRA system, when a new issue is moderated (assigned to the relevant group of CHPC staff), you receive an email similar to the left. In this case it was changed from "MOD" to "USR" (from moderation to user services).

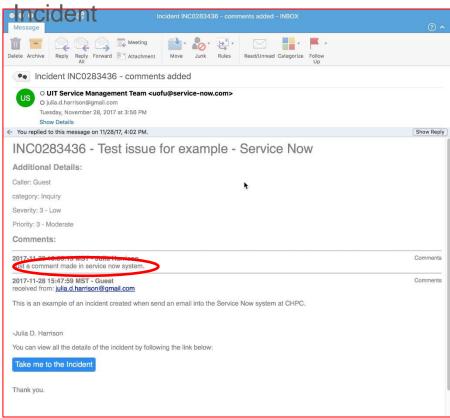
In Service Now, you will not get this notification.



JIRA – email comment on Issue



Service Now – email comment on



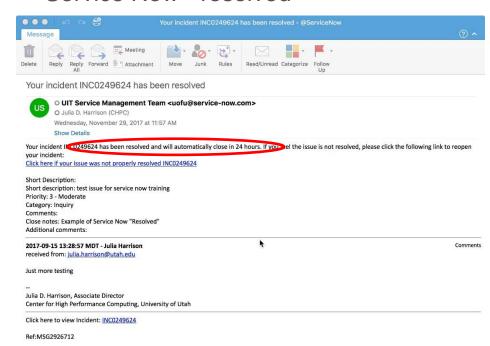


This step doesn't happen in JIRA.

In Service Now, if you don't reply within 24 hours, the ticket will be permanently closed.

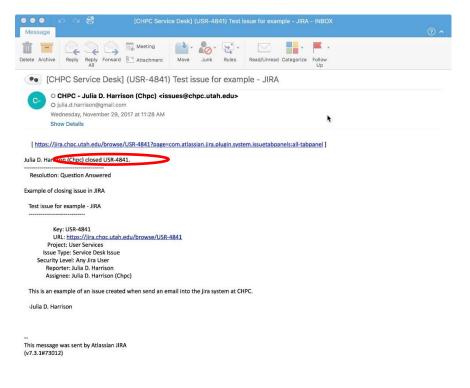
If the problem persists and there is no response within the 24 hour period, a new ticket will need to be created. We are hoping to change this to 72 hours.

Service Now - resolved

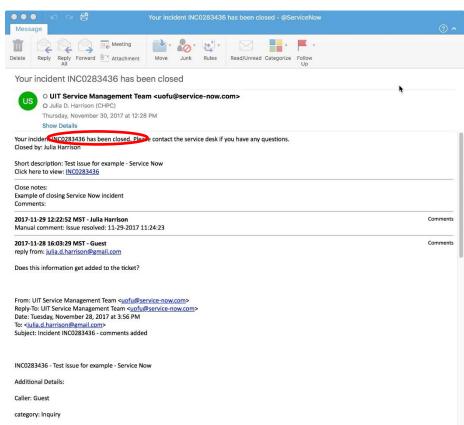




JIRA – email for close Issue



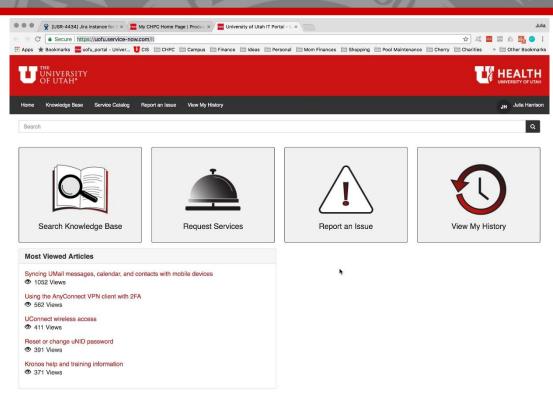
Service Now - email for close Issue





JIRA Portal

https://uofu.servicenow.com/it







Reporting Issues through the Portal

https://uofu.service-now.com/it

Click on



We have requested a checkbox or some indication it should be routed to CHPC. In the meantime please mention this is for CHPC somewhere in the description of the issue.

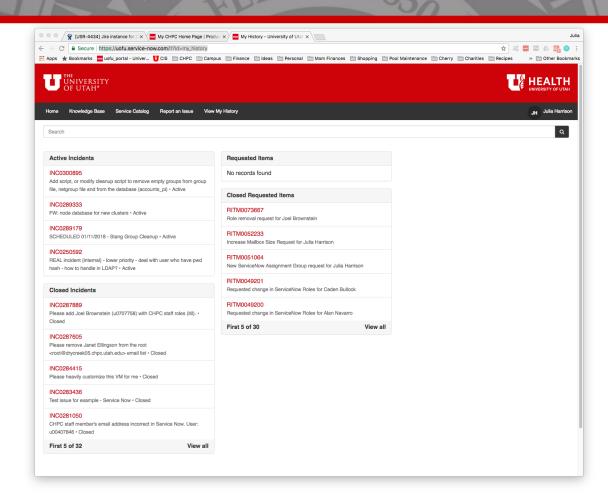
UNIVERSITY OF UTAH*		
e Knowledge Base Service Catalog R	oport an Issue View My History	JH Julia Har
urch		
Report an issue		
s something broken? Please use this form	to report the issue.	
We're happy to help resolve any issues as	soon as possible. However, if you need an immediate response, please call your IT support team below.	
 Campus employees may reach the C 		
 All other individuals should reach out f you would like to request a service change 	to their II support group. ge or addition, please use the Service Catalog. Thank you.	
*Please enter your uNID, or the name	or uNID of the person we need to contact. Only incidents submitted under your name will appear in the "My	y History" section.
		*
*Best number to call:		
How urgent is this issue?		
Medium (should be looked at soon)		*
Please provide the barcode number from	um the equipment's University ID label.	
Where is the issue located? Please pro	ovide building, floor and room number if possible.	
*Please describe the issue in a senten	ce or two.	
Does this affect your phone?	s possible, including error messages, when the issue occurs or when the issue started.	
Prease provide as much miormation as	possible, illululing et of illessages, when the issue occurs of when the issue stated.	
Submit		Add attachments
Required information Please enter your unit	D, or the name or uNID of the person we need to contact. Only incidents submitted under your name will appear in the "My History" section.	Best number to call:
Please describe the issue in a sentence or two.		



Viewing your History and Active Incidents through the portal

https://uofu.servicenow.com/it

Click on an incident to see the details.





Viewing details of an incident in the portal

https://uofu.servicenow.com/it

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