

UNC Greensboro CyberInfrastructure Plan

Introduction

The University of North Carolina at Greensboro recognizes an increasing need for CyberInfrastructure (CI) capabilities to support growing scientific research computational and data storage needs. This CyberInfrastructure plan outlines the set of CI initiatives for the University's Information Technology Services (ITS) division to support these growing needs in alignment with both divisional and University strategic plans. The plan is divided into 3 primary areas:

1. Core Infrastructure
2. Collaboration Enablement
3. Cloud Computing Infrastructure

Core Infrastructure (1) is the foundational component of University computing. Collaboration Enablement (2) is the key technology components supporting the success of collaborative research both within and outside the University. Cloud Computing Infrastructure (3) could be categorized as (1) and/or (2), but the extent and rapid acceleration of cloud development merits treatment of this area as its own entity.

Information Security is a critical component to the CyberInfrastructure Plan. In addition to existing policies and procedures, additional security requirements and guidelines will be developed by the Chief Information Security Officer to address security considerations for high speed data transfers within the Science DMZ.

The UNC Greensboro Information Technology Services division is responsible for operating and maintaining the campus CyberInfrastructure identified in this plan under the direction of the University Chief Information Officer.

1 - Core Infrastructure

The Core Infrastructure encompasses the set of technologies that provide the foundational capabilities for network and computation at the University. These technologies are often considered utility or "must have" services that all other platforms are built upon and provide the network components for access to both on campus and off-campus network resources. Due to ubiquitous campus reliance on the core infrastructure all components must be highly available and have a defined hardware lifecycle to protect against degradation of services.

As the data and computational research has grown at UNCG the core infrastructure components need to be enhanced to continue supporting University research needs. The initiatives described below have been identified as critical to the success of the core infrastructure, some new and some ongoing.

Initiatives

Access Layer Networking

The campus access layer network is on a 7-year refresh cycle. Information Technology Services completed the last refresh in 2018, deploying more than 450 Cisco Catalyst 3850 switch stacks now supporting 1Gbps client network connectivity. Building connectivity is currently 10Gbps with a 40Gbps core. Connectivity upgrades will be evaluated 6-12 months ahead of each refresh cycle.

Campus and Datacenter Core

Both the campus and datacenter core distribution are on a 5-year incremental refresh cycle and 10-year full refresh cycle. The campus core distribution backplane throughput will be upgraded to support additional 40G capacity as part of the next refresh cycle and allow for future upgrades to a 100G backbone.

IPv6

All existing network hardware is currently capable of supporting IPv6 dual stack functionality. UNCG has been allocated an /47 IPv6 address block. A plan will develop a 3 year implementation plan this block on the campus network with a focus of on high profile/high visibility websites and the joint Science DMZ which will also serve as the first end to end IPv6 deployment on campus.

Network Storage

The previous generation network file services were developed in 2008 and was used to meet both administrative and academic needs. Beginning in 2016 the campus began undergoing a migration of primary files services to cloud technologies while at the same time making a distinction in the storage services offered to administrative and academic units. The current network storage offering is dedicated to supporting academic unit needs, governed by stakeholders from academic units, and operated by ITS. This service is primarily used for applications in which cloud storage is not intended and is organized by research groups rather than academic units. Additional storage needs in support of Big Data will be implemented as part of the Science DMZ Initiative, including Data Transfer Nodes (DTNs) in support of high-speed data transfers.

Wireless Connectivity

The current wireless standard deployed across campus is 802.11ac. Wireless networking continues to grow at a significant pace and growth is anticipated for research activities conducted over wireless infrastructure as well as increasing need to support a wider range of wireless device types. A technology evaluation and next generation wireless technology deployment plan will be developed and implemented with the next refresh cycle.

2 - Collaboration Enablement

UNCG has experienced an increase of external collaboration with other universities, community partners and industry partners. Growth in collaboration requires enhancement of existing collaboration enabling technologies as part of a comprehensive CyberInfrastructure plan.

Initiatives

HPC Institutional Partnerships

UNC Greensboro has partnered with North Carolina State University for access to the Henry 2 HPC platform and UNC Chapel-Hill for access to the Longleaf and Dogwood clusters. The campus will continue to develop additional partnerships to meet HPC needs, including a partnership with NC A&T State University as part of the Science DMZ initiative. UNCG will also continue to support computing clusters in the campus datacenters.

Identity and Access Management

Accurate Identity and Access Management is a key component to safe and effective collaboration. Ensuring timely access to resources and supporting proper authorization is a vital component to providing secure collaboration services. As part of the effort to replace the existing Identity Management System, ITS will develop a robust identity and access management strategy that minimizes institutional risk by enforcing proper authorization and access to digital resources. Components of the Internet2 TIER model will be used when possible, including use of UNCG's existing Shibboleth and Grouper implementations.

InCommon Federation

UNCG is a member of the InCommon federation and participates in the release of metadata with InCommon. One of the benefits of membership is the ability to offer users access to shared CyberInfrastructure resources using UNCG iSpartan credentials through Shibboleth Single Sign On. UNCG also accepts trusted credentials of collaborators and researchers from other institutions when there is a need to use UNCG network resources via its Shibboleth identity provider.

Internet2

Internet2 operates the nation's largest and fastest, coast-to-coast research and education network that serves 319 U.S. universities, 60 government agencies, 43 regional and state education networks and through them supports more than 100,000 community anchor institutions, close to 1,000 InCommon participants, 64 leading corporations, and 70 national research and education network partners that represent more than 100 countries. UNCG has been a member of Internet2 since the late 2000's and participates in multiple Net+ service offerings, service advisory boards and service validations programs in partnership with Internet2. UNCG is a member of the InCommon Identity Federation with support for the Research and Scholarship category and the International eduGain Federation for federated authentication and ease of onboarding

Science DMZ

ITS will complete design and implementation of a joint Science DMZ for use at UNCG and NC A&T. The Science DMZ will become the primary network for scientific compute activities and will include a Data Transfer Node (DTN) to facilitate high speed data transfers between other research institutions. The existing fiber infrastructure between UNCG and NC A&T will be used to extend the Science DMZ for use by both institutions including the Gateway University Research Park and Joint School of Nanoscience and Nanoengineering.

3 - Cloud Computing

A Cloud First strategy is one of the pillars of the ITS 2017 – 2022 Strategic Plan. The infrastructure scalability and agility afforded by leveraging cloud computing resources can accelerate CyberInfrastructure change at UNCG, but also requires significant modification to underlying technologies. The initiatives outlined below are considered the primary initiatives to develop the foundation and move the needle towards a cloud first world.

Initiatives

Cloud Datacenter

ITS currently operates two (2) on campus datacenters, one located in an academic building. ITS will build connectivity to a strategic cloud datacenter partner, including site-to-site VPN, as an extension of the current datacenter environment and deploy shared services capable of providing service in the event of a campus network outage. Infrastructure will then be migrated to the cloud datacenter in order to reduce the on-campus datacenter to one (1) that primarily serves the needs of research and technologies that cannot be run on cloud infrastructure. Once this first phase completes ITS will evaluate the use of multiple cloud infrastructure platforms.

Cloud CyberInfrastructure Innovation Lab

A Cloud CyberInfrastructure Innovation Lab will be established to with a mission to develop innovative and sustainable frameworks for managing cloud infrastructure to advance research, pedagogy and scalable infrastructure at UNCG. The lab will serve as a University-wide location to explore usage of cloud CyberInfrastructure, provide professional expertise, and capacity planning to better inform researchers about cloud CyberInfrastructure capacity planning requirements.

Cloud Storage

UNCG has multiple cloud storage services including Box, Google Drive and Microsoft OneDrive, as part of the storage services portfolio. Box includes unlimited storage and advanced file preview capabilities in order to meet growing storage needs at the University. Cloud storage usage was more than 4x on premise storage before the cloud storage migration and continues to outpace on premise storage usage. Additional types of cloud storage, including hybrid cloud network file services will be evaluated for implementation.