Dylan Denning South Carolina Department of Transportation Network Services Intern

May 13th – August 16th

ITEC 495 – Integrated Information Technology (IIT) Department College of Engineering and Computing (CEC) – USC Main Campus

Overview

- Plans, constructs, maintains, and operates the state highway system, including Interstates, U.S. highways, state highways, and secondary roads
- Develops statewide mass transit consistent with public needs.
- Coordinates state and federal highway programs.
- Around 4,500 staff (2023 Annual Report) to maintain more than 41,000 miles of the state's 60,000-mile roadway network. (FAQ)

Justin P. Powell Secretary of Transportation

Pamela L. Christopher <u>Commissioner Chair</u>

Jim Remsey
Chief Information Officer

SCDOT Organization Chart



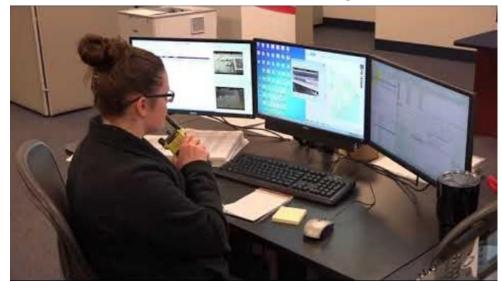
Overview

"We connect supply chains and must efficiently move people, goods and services throughout our vast infrastructure network" (Senate





Short video about statewide Traffic Management Centers (TMCs)



7 Districts

Office of Public Transit

SHEF

Assistance to emergency response and motorists with car problems

511SC

Interactive, voiceactivated Roadway and traffic camera information system



Strategy and Goals

5 Goals: (Strategic Plan - 2020)

- Goal 1: Improve safety programs and outcomes in our high-risk areas.
- Goal 2: Maintain and preserve our existing transportation infrastructure.
- Goal 3: Improve SCDOT program delivery to increase the efficiency and reliability of our road and bridge network.
- Goal 4: Provide a safe and productive work environment for SCDOT employees.
- Goal 5: Earn public trust through transparency, improved communications and audit compliance

Overall Goal:

Ensures the provision of safe, adequate, and efficient transportation services for the movement of people and goods.

On-going revenue stream via Roads Bill/Gas Tax passed in 2017.



Strategy and Goals

10 Year Plan (SCDOT projects)

- Highway Safety: Plans to improve the "worst-ofthe-worst" roads by enhancing 100 miles each year in ten-mile segments.
- **Bridges**: Targeting replacement of about 375 of the 750 structurally deficient bridges.
- Road Resurfacing: Allocating 50% of new revenues to resurface 80% of the state's 42,000 miles needing attention, aiming to achieve a "good" rating for half of these within ten years.
- Interstate Widening: 11-12 interstate widening projects to enhance traffic flow and safety.

Completed construction shows reduction in serious crashes.

Paving projects are underway in every county.

Bridges are a priority as there is a "looming bride crisis."

Nearly every interstate has road work underway.



Strategy and Goals

Technology:

SCDOT is putting continued effort into its IT Services by establishing new data governance standards and policies for the Agency, while also investing in an asset management system- both efforts to ensure data reliability and structure within multiple processes and systems throughout the Agency's departments.

(2023 Accountability Report)

Transportation Systems

Management and Operations

Program: (*Engineering Directive*)

Expanded ITS network and technology

Expand deployment of statewide fiber and wireless connections, cameras, DMS, and other ITS devices

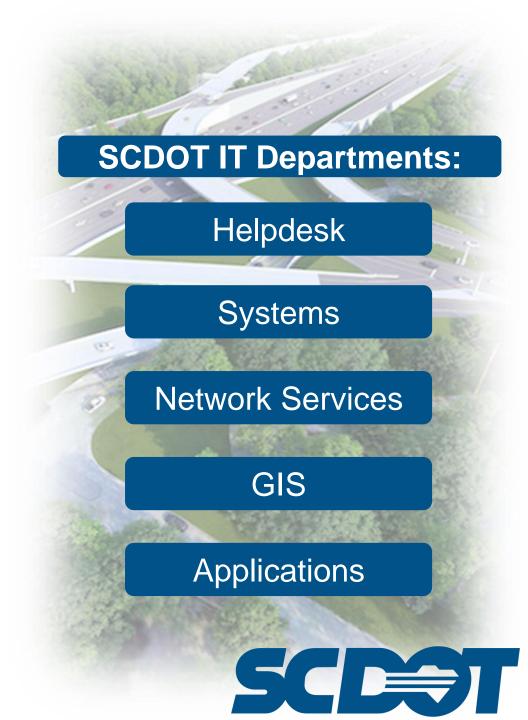
TMC improvements to increase system and operation management



IT Network Services

- In recent decades, SCDOT's IT infrastructure developed reactively, resulting in a complex array of systems and shadow IT practices.
- Management has begun restructuring IT governance through the Technology Advisory Steering Committee (TASC) to centralize oversight and align IT decisions with strategic goals. (<u>Capability Assessment</u> - 2021)





IT Network Services

- Network Services is responsible for the statewide maintenance and support of complex network systems.
 - HQ Data Center, Colocations, Demarcation points etc.
- Configures, installs, maintains networking devices such as:
 - o Routers, Switches, Firewalls, Wireless etc.
- Ensures Connectivity between networking devices and networked devices such as:
 - o PC, Servers, IP phones, IP cameras etc.

Network Administration
Design & Engineering



Internship

Title: Network Services Intern:

Description:

- Managing enterprise networking device inventory and repair.
- Assisting with equipment disposal including equipment collection, preparation, documentation, and management of equipment surrender.
- Documenting and monitoring network outages, changes and configurations.
- Maintenance of all system documentation, monitoring all system maintenance, and maintaining records of equipment and replacement plans.



Internship Summary

- Started immediately with tasks and contributing.
- I travelled to various locations to see the remote sites and colocations we support and maintain.
- Hands on experience in our various data centers installing and removing devices, cable tracing, and testing LAN connection points.
- Shadowed and assisted Network Admins and Engineers configuring enterprise data networks.
- I transferred 2 years' worth of inventory shipments from Excel into our asset management system, Drakewell.
- Contribute to our network monitoring in SolarWinds Orion.
- Configured lab with enterprise switches and routers to supplement my CCNA studies.

Projects:

Drakewell Inventory:

Receive thousands of networking devices. All need a fixed asset number and tracked in Drakewell asset manager.

ExacqVision Server:

Configured and installed Network Video Recorder.

Data Center Management:
Removing and installing
devices, cable management,
facility management

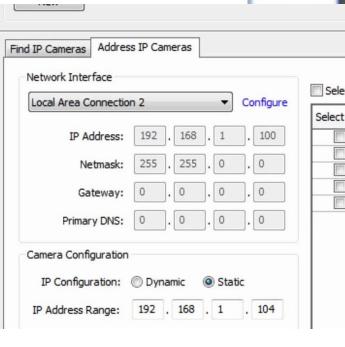




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Select	MAC		
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	00-30-46-01-42-AA		
	00-40-8C-DC-0B-FD		
	90-59-AF-39-0A-4C		

exacq\/ision



🕈 Dashboard 🗏 System 🗸 🛢 Storage 🗸 🛄 Configu

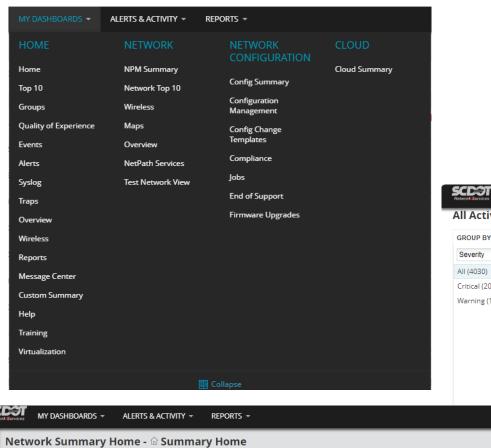
iDRAC9: Dell PowerEdge Server

Maintenance

Lifecycle Log Job Queue System Update System Eve

■ Lifecycle Log

	Life by one Log			
	Severity	Date and Time	Message ID	Description
+		2019-10-24 02:40:12	USR107	The operation GetAttachStatus of the DCIM_OSDeploymentService was performed by
+		2019-10-24 02:39:21	USR0030	Successfully logged in using root, from 172.12.12.1 and GUI.
+		2019-10-24 02 21 00	USR0032	The session for root from 172.12.12 using GUI is logged off.
+		2019-10-24 01 28 02	USR0030	Successfully logged in using root, from 172.12.12.1 and GUI.
+		2019-10-18 17:27:33	USR0032	The session for root from 176.16.0.20 using GUI is logged off.
+		2019-10-18 17:27:27	USR0030	Successfully logged in using root, from 176.16.0.20 and GUI.
+		2019-10-12 10:27:43	DISO02	Auto Discovery feature disabled
+		2019-10-12 10:27:40	RAC0182	The IDRAC firmware was rebooted with the following reason: watchdog.
+		2019-10-12 10:26:51	PSU0800	Power Supply 2: Status = 0x1, IOUT = 0x0, VOUT= 0x0, TEMP= 0x0, FAN = 0x0
+		2019-10-12 10:26:51	PSU0800	Power Supply 1: Status = 0x1, IOUT = 0x0, VOUT= 0x0, TEMP= 0x0, FAN = 0x0
+		2019-10-12 03:03:56	USR0032	The session for root from 176.16.0.33 using RACADM is logged off.
+		2019-10-12 03:03:46	SRV088	The SupportAssist Save to Local operation is successfully completed.
+		2019-10-12 03:03:45	SRV002	The SupportAssist Save to Local operation is started
+		2019-10-12 03:03:38	SRV108	The SupportAssist job JID_708671997698 is completed.
+		2019-10-12 03:03:38	SRV088	The SupportAssist Collection operation is successfully completed.
+		2019-10-12 03:03:38	SRV096	The SupportAssist Collection TSR20191012030330_3S8LDH2 zip is successful
+		2019-10-12 03:03:30	SRV007	The SupportAssist System information collection operation is successfully cor
+		2019-10-12 03:03:29	LOG009	The current Lifecycle Log is successfully created for the view or export operation
+		2019-10-12 03:01:55	SRV011	The SupportAssist Storage Controller Logs collection operation is completed.



Network Services' Down Nodes

Core Down Nodes

■ GSP-I185-93K CC

WandoE

GSP-I85SHEP-3750X CC

RHILL-177-JE5K.SCDOT.ORG

CYBERSECURITY Down Nodes

THE FOLLOWING NODES ARE NOT RESPONDING

THE FOLLOWING NODES ARE NOT RESPONDING

CHS DANI526BR IE2K.SCDOT.ORG

CHS_MTP526BR_IE2K.SCDOT.ORG

CHS_DANI526BR_P16_IE2K.SCDOT.ORG

CHS MTP526BREAST IE2K.SCDOT.ORG

Search Nodes

*.SolarWinds.Net

▶ ▲ Core Transport

▶ ▲ Core Transport CC

CYBERSECURITY
 Network Services

Servers

Signals

All Nodes

Search By

Examples: Cisco*, 10.15.*.*, W?ndows, Site-*,

GROUPED BY MANAGEMENT GROUP, DISTRICT AND CITY

GROUPED BY MANAGEMENT GROUP, DISTRICT AND CITY

Node Name

✓ SEARCH

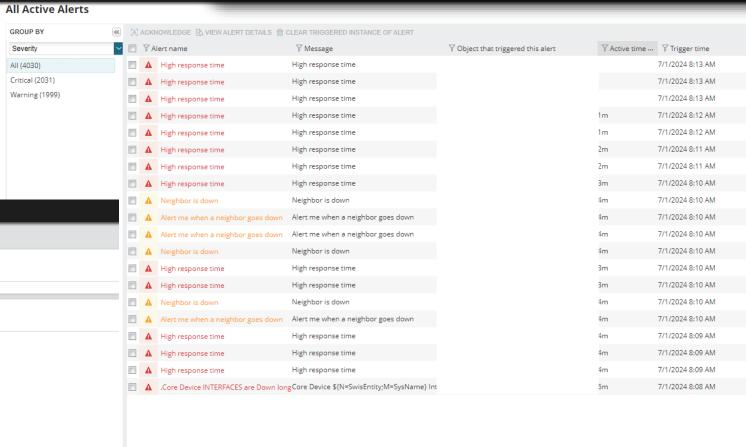
HELP

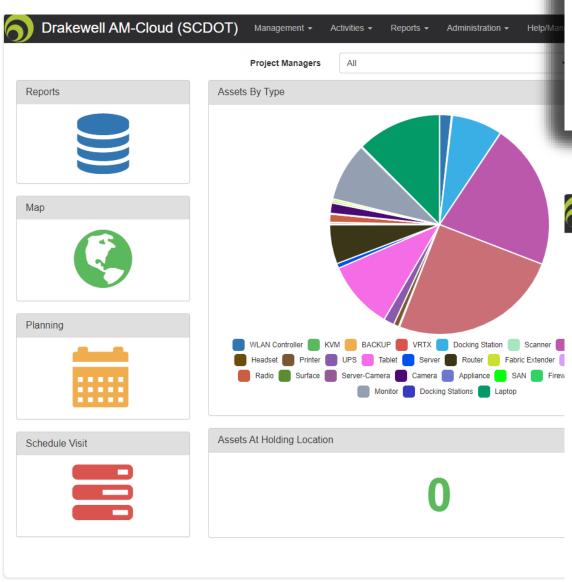
Find

MY DASHBOARDS 🔻

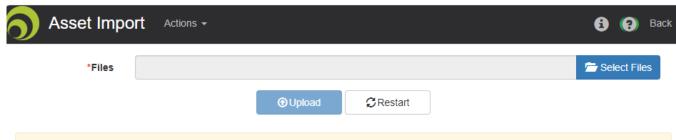
ALERTS & ACTIVITY -

solarwinds





6 DRAKEWELL



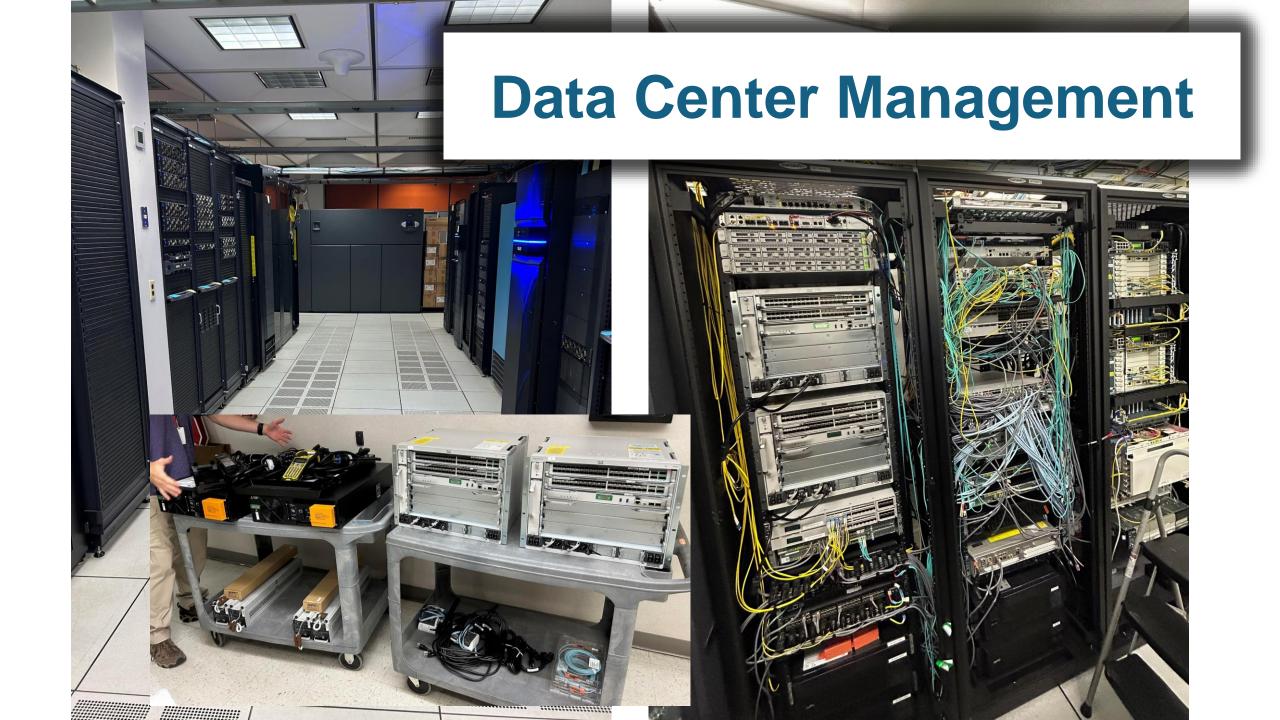
? The Asset Importer is an upload tool used to add or update assets of any type in bulk using a Comma Separated Values (CSV) format.

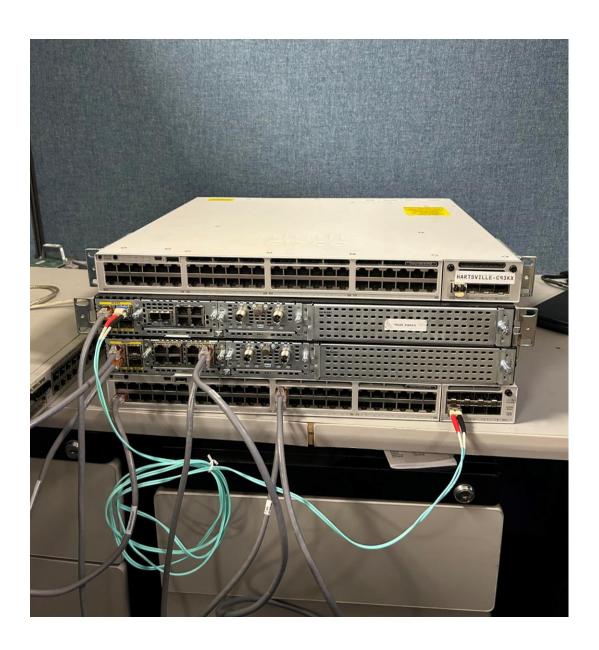
A CSV template containing the available headers is available for download from Actions -> Download Template. Any asset attribute types can be included in the CSV and the option to select which types you would like included in the template is available from within the dialog.

- Asset Type Required The type of the asset being uploaded. * It is a prerequisite that any asset types used must already exist.
- Identifier Required The asset identifier. If matched with an existing asset, that asset will be updated. If no match is found, a new asset will be created.
- PO Number An optional purchase order number.
- · Location Required The location the asset will be transferred to.
- Customer The customer the asset is assigned to. * It is a prerequisite that the customer must already exist.
- Attributes Any number of asset attribute can been added. * It is a prerequisite that any attribute types used must already exist.

If creating a shipping assignment

When the CSV has been populated it can be uploaded using the Select files button.





My CCNA Lab

PuTTY Configuration	×
Category:	Basic options for your PuTTY session Specify the destination you want to connect to Serial line COM5 Connection type: Raw o Telnet Rlogin o SSH o Serial Load, save or delete a stored session Saved Sessions Default Settings
Telnet Flogin SSH Serial	Close window on exit: ○ Always ○ Never ● Only

Internship Summary

- I have made the most contributions to our inventory management and network monitoring.
 To perform these tasks, I had to learn how to use Drakewell asset manager and SolarWinds Orion Platform, respectively.
- Responsible for network administration duties such as troubleshooting issues, decommissioning devices, and upgrading devices. Maintained my own lab environment. These tasks have greatly improved my expertise with Cisco CLI, network troubleshooting and administration.
- Shadow and assist with some advanced network administration duties such as troubleshooting WAN issues. This has equipped me for future roles in the discipline I want to pursue.

Rewarding Experiences:

Growth: Allowed me to ask questions which helped make connections to my CCNA studies and apply what I have learned.

Travel: Seeing the state and travel to the various locations we support.

People: SCDOT has great employees and offers the chance to socialize, meet new people and network.



Challenges

- Learned how to navigate the cisco ASA CLI to decommission firewalls. I identified the exact device and looked through the user manual and online forums to make sure I knew the correct commands to decommission the device.
- Had to trouble shoot issues with ExacqVision server. I coordinated with support to troubleshoot the issue. I monitored the device for a time afterward to ensure consistent connectivity.
- Sometimes when shadowing upper-level managers, engineers and administrators. It was hard trying to understand everything they discuss. Although it was good being exposed to these new concepts, sometimes I could feel lost or foolish. Thankfully, my team was great at reassuring me and answering any questions I had for them.



Previous Courses

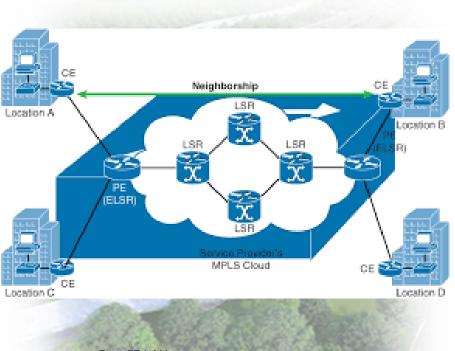
- ITEC 245 and 445 Advanced Networking and Security: These courses covered computer networking fundamentals and aligned with CCNA standards. This knowledge was crucial during my internship, helping me understand the OSI model, TCP/IP protocols, and network design concepts.
- ITEC 264 Computer Applications in Business: This Excel focused course was invaluable during asset inventory integration. It allowed me to efficiently transfer data from Excel to our asset management system by utilizing VLOOKUP's, Conditional Formatting, and data exportation.
- SPCH 140 Public Communications:
 This class enhanced my presentation skills. It was particularly beneficial during our team's Monday morning meetings, where I had to discuss my completed tasks and upcoming plans to the team.



Key Insights - WAN

- Remote Connectivity
 - o 5G SIM modules in devices, Cellular modems, VPN
- Topologies
 - L2 MLPS VPN, redundancy
- Demarcation
 - Understanding Fiber, ISP services

Understanding WAN technologies and concepts was essential. Observing how different locations were connected provided insights that were not covered in depth in my coursework, such as wireless 5G connectivity using SIM cards, WAN topologies, and demarcation points. With this experience, I am better equipped to learn about and deploy complex enterprise data networks.





Key Insights - Data Center Management:

- Installing network devices
 - Switch, Router, UPS, Firewall, Server, ISP handoff and Temperature/Humidity/Altitude requirements
- Cable management
 - Patch panel, Fiber optics, SFPs, Raised flooring, Network drops, DWDM etc.
- Electrical requirements.
 - Wattage/Voltage requirements, Redundancy, Split power etc.

This experience is beneficial to my career because the foundational knowledge I gained can be leveraged to learn more about advanced topics or help me with my future certification studies and therefore job opportunities.



Key Insights - Advice

I received a lot of great advice. Many of my superiors emphasized the importance of being willing to learn about actual job duties and gaining hands-on experience. They explained that many new IT professionals prioritize grades and certifications, but tangible experience is much more beneficial for both learning and future career prospects.



