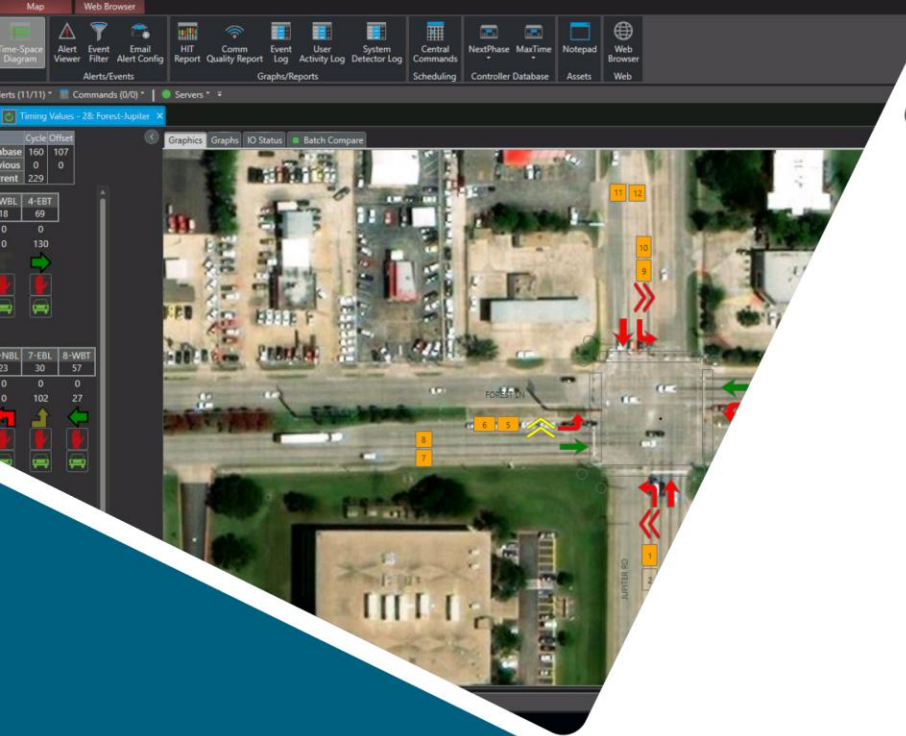




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VDOT KITS Migration to Azure

Jon Chambers & Mike Clements

»»KITS

A Kimley-Horn Software Solution

»»Kadence

A Kimley-Horn Software Solution

»»Traction

A Kimley-Horn Software Solution

Tour of VDOT JSOC

VDOT JSOC Tour

- Facility Highlights
 - State Police Dispatch in VDOT Control room
 - How maintenance is coordinated/dispatched
 - Unique attributes
- Control Room
- Server Room

VDOT Azure Migration

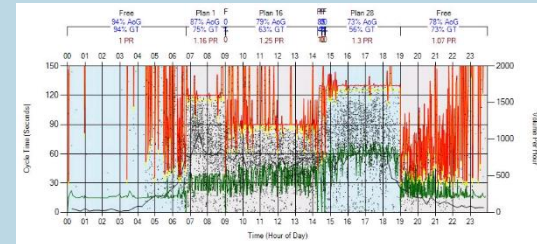
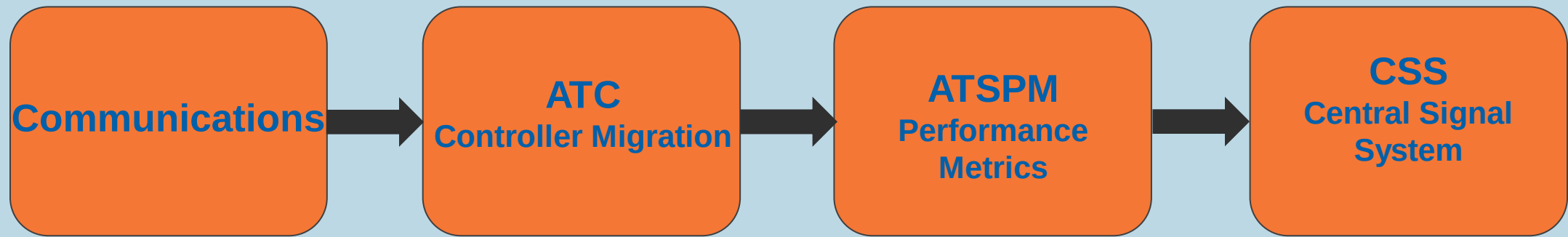
KITS Statewide Deployment

- EO#19 was so new, VITA needed time to adapt and establish new policies and platform standards
- Interim Architecture Solution identified
 - Primary servers in one regional data center
 - Communication server edge devices in each region
 - MPLS and fiber network connecting the regions together
- VDOT/VITA began working on establishing a private Cloud environment for hosting Operational Technology (OT) applications and asset management
 - Vision... migrate primary KITS systems to the Cloud

KITS Statewide Deployment

- Migrating from 5 individual Regional Systems to a Single Statewide Solution
 - Developing consistency from disparate data sources across each region
 - Standardizing naming conventions
 - Access control permissions across regional/district lines
 - Different Intersection layout preferences

Signal & Arterial System Technology

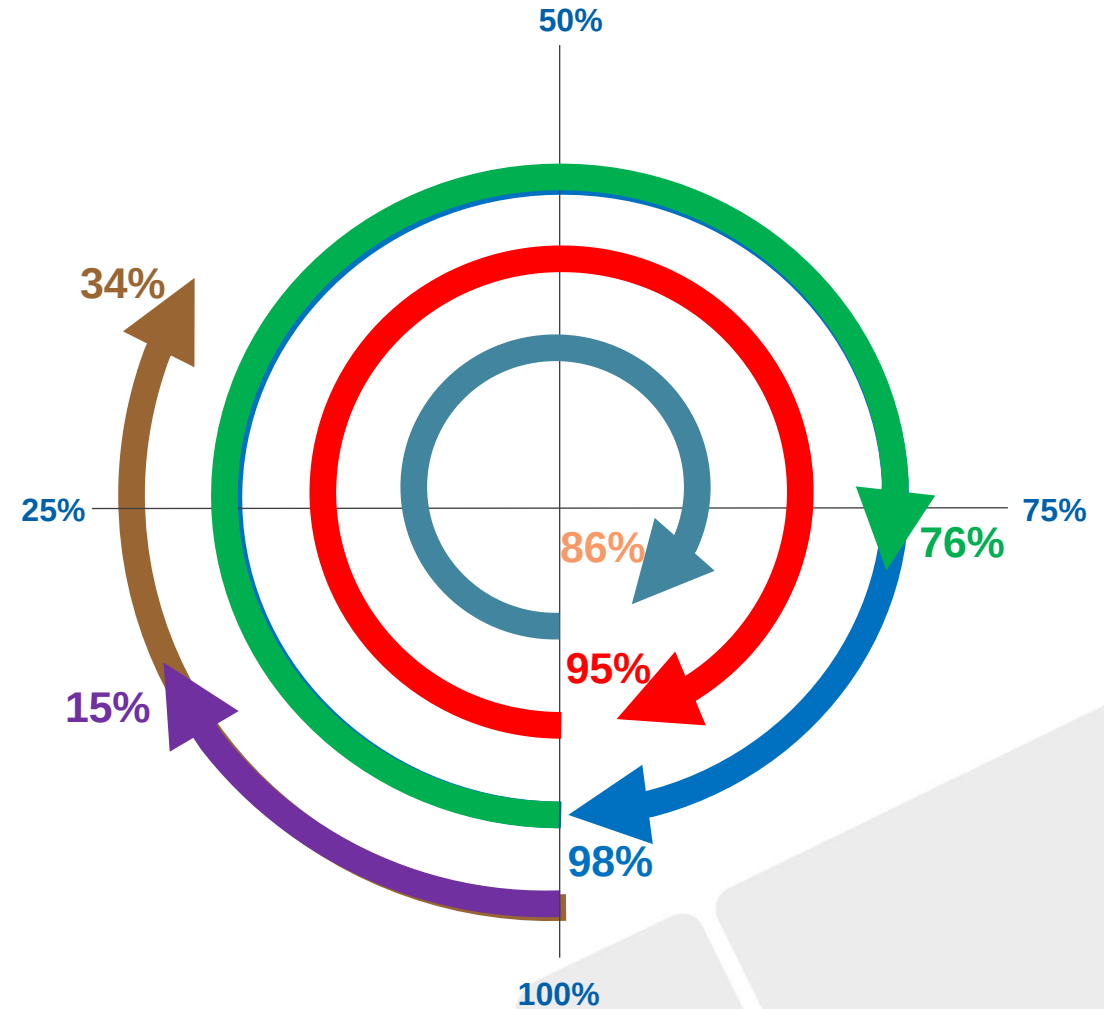


CYBERSECURITY

Statewide Traffic Signal System Status

3,153 Traffic Signals Statewide

- High Speed Communications (2699 – 86%)
- ATC / D4 Migration (2992 – 95%)
- KITS Configured (3102 – 98%)
- KITS Live (2410 – 76%)
- ATSPM Configured (1057 – 34%)
- ATSPM Active (485 – 15%)



VDOT Azure Migration

- *Initial Deployment*

- On-prem Comm servers in each District TOC
- On-prem Database and App servers in NOVA District
- On-prem Center-to-Center (C2C) Server for data links and handling Variable Speed Limit (VSL) algorithm processing
- MPLS network between TOCs
- Mixed media for field communications in each District with IPsec encrypted connections
- KITS UI running on On-prem laptops/workstations

VDOT Azure Migration

- *Azure Deployment*

- Established separate Operations Technology (OT) environment and User credentials isolated from the IT enterprise environment
 - Separate Identity Management platform
- App Server and DB Server migrated to Azure
 - SQL Managed Instance instead of Virtual Machine managed by VDOT
- Comm servers remain on-prem in each District TOC, as well as C2C Server at the present time
- Statewide Fiber Backbone linking TOCs to each other and to Azure Data Center
- KITS UI running on Virtual Desktop Interface (VDI) in Azure

VDOT Azure Migration – Process Overview

- ***Prior to Cutover***

- Configure the Azure environment (*that could be a chapter unto itself*)
- Training users on accessing VDI
- Testing/verifying new user credentials
- KITS UI testing by users in VDI on Test and Pre-Production Environments

- ***Cutover***

- Conducted after hours to minimize disruption to end users
- Back up DB on-prem and copied DB to Azure blob storage
- Redirect Comm Servers in each District to point to the Azure DB
- Restore DB from blob to Azure SQL Managed Instance
- Turn on Services on District servers and the Azure App Server
- Test KITS functionality across a range of features

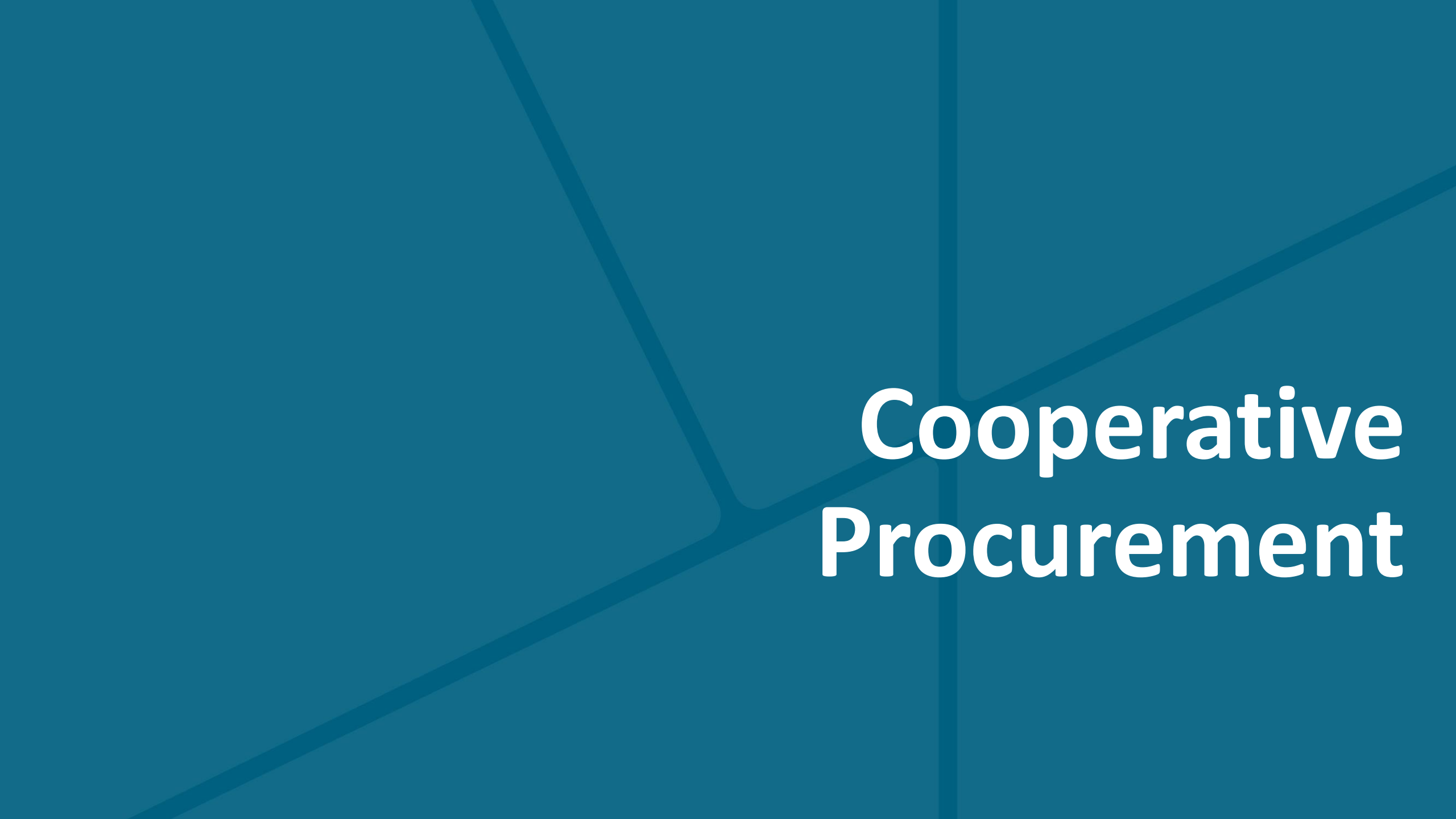
VDOT Azure Migration – the journey continues

- *the journey continues*
 - Continuing to load test the VDI environment
 - Testing to isolate data latency with some functions in the new environment
 - Data Extraction for third-party data sharing of signal data; migrating from XML to JSON format
 - Preparing updates for additional D4 NTCIP features, and FOIA Report utility
 - Detector Input Screen improvements for Turning Movement Count, ATSPM, and Kadence enhancements
 - Interconnection of some locality signals parallel to interstates for coordinated response plans

Lessons Learned and Q&A for VDOT

VDOT Cloud Deployment- Lessons Learned thus far

- Plan for Extensive Collaboration... Networking, Computing Environment, Software Deployment, Training
- Many moving parts and complex integrations
 - Azure Active Directory, DB environment, VDI accessibility
 - Factor in network capacity and Firewall throughput capacity
 - Balancing act between remote servers managed by others vs minimizing security holes to your network
- Have a backup plan ready.... What's your tolerance for outages?



Cooperative Procurement

VDOT Cooperative Procurement Contract

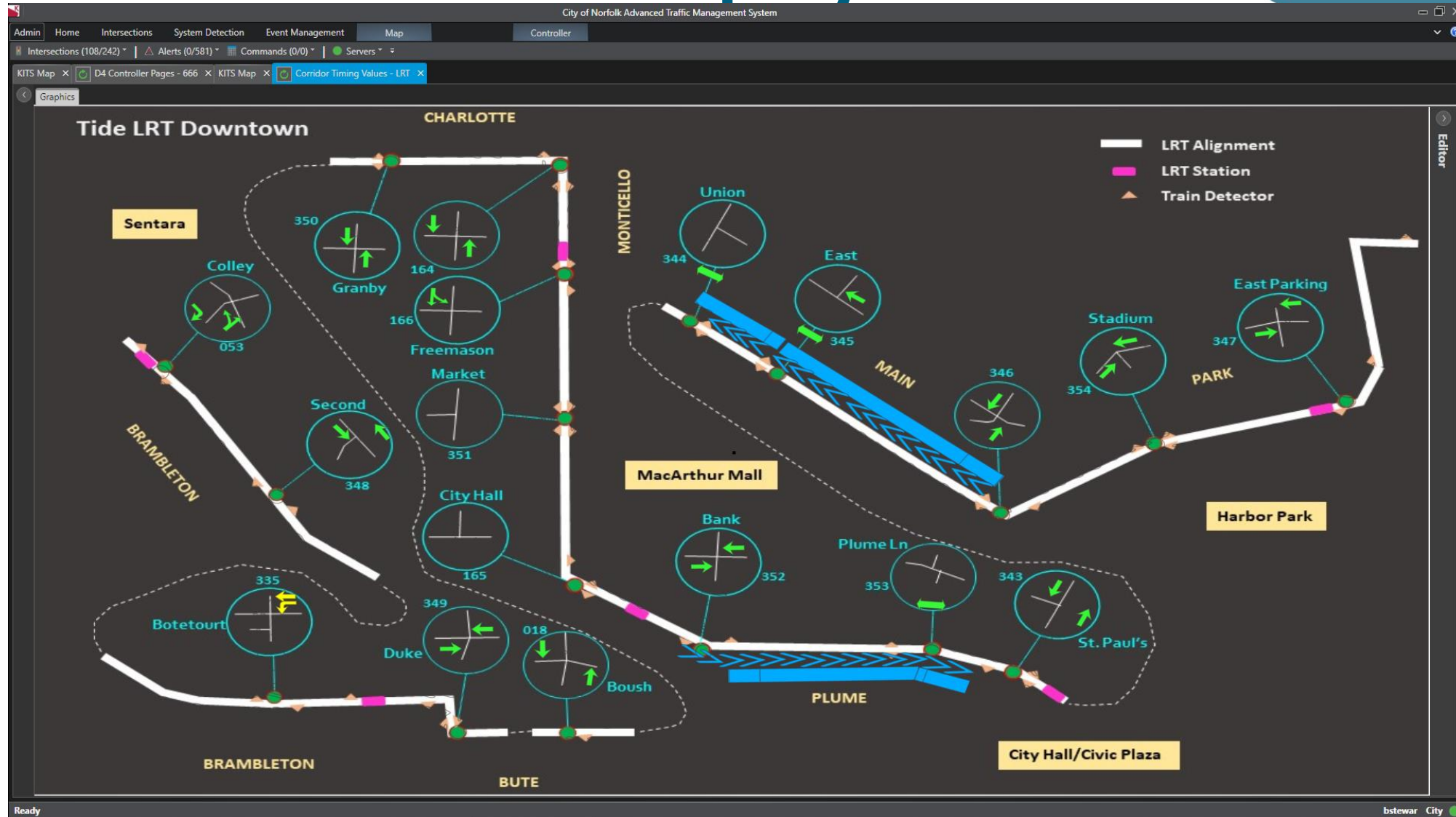
- Allows Other Public Bodies to Purchase from the Contract
- Some Localities are already leveraging this for KITS as well as VDOT's Statewide Signal Controller Master Contract
- Virginia's IT Agency (VITA) has the delegated authority to oversee these types of Technology procurements with a Cooperative Clause
 - [§ 2.2-4304. Joint and cooperative procurement \(virginia.gov\)](#) the first two paragraphs note that:
 - A. Any public body may participate in, sponsor, conduct, or administer a joint procurement agreement on behalf of or in conjunction with one or more other public bodies, or public agencies or institutions or localities of the several states, of the United States or its territories, the District of Columbia, the U.S. General Services Administration, or the Metropolitan Washington Council of Governments, for the purpose of combining requirements to increase efficiency or reduce administrative expenses in any acquisition of goods, services, or construction.
 - B. In addition, a public body may purchase from another public body's contract or from the contract of the Metropolitan Washington Council of Governments or the Virginia Sheriffs' Association even if it did not participate in the request for proposal or invitation to bid, if the request for proposal or invitation to bid specified that the procurement was a cooperative procurement being conducted on behalf of other public bodies, except for:
 - 1. Contracts for architectural or engineering services; or
 - 2. Construction. This subdivision shall not be construed to prohibit sole source or emergency procurements awarded pursuant to subsections E and F of § [2.2-4303](#).

Localities/Other Public Bodies leveraging Cooperative Clause Purchasing

- Peoria, AZ (KITS/software solutions)
 - Portsmouth, VA (KITS/software solutions)
 - Newport News, VA (KITS/software solutions)
 - Others on the horizon
-
- Norfolk, VA (controllers and local software)

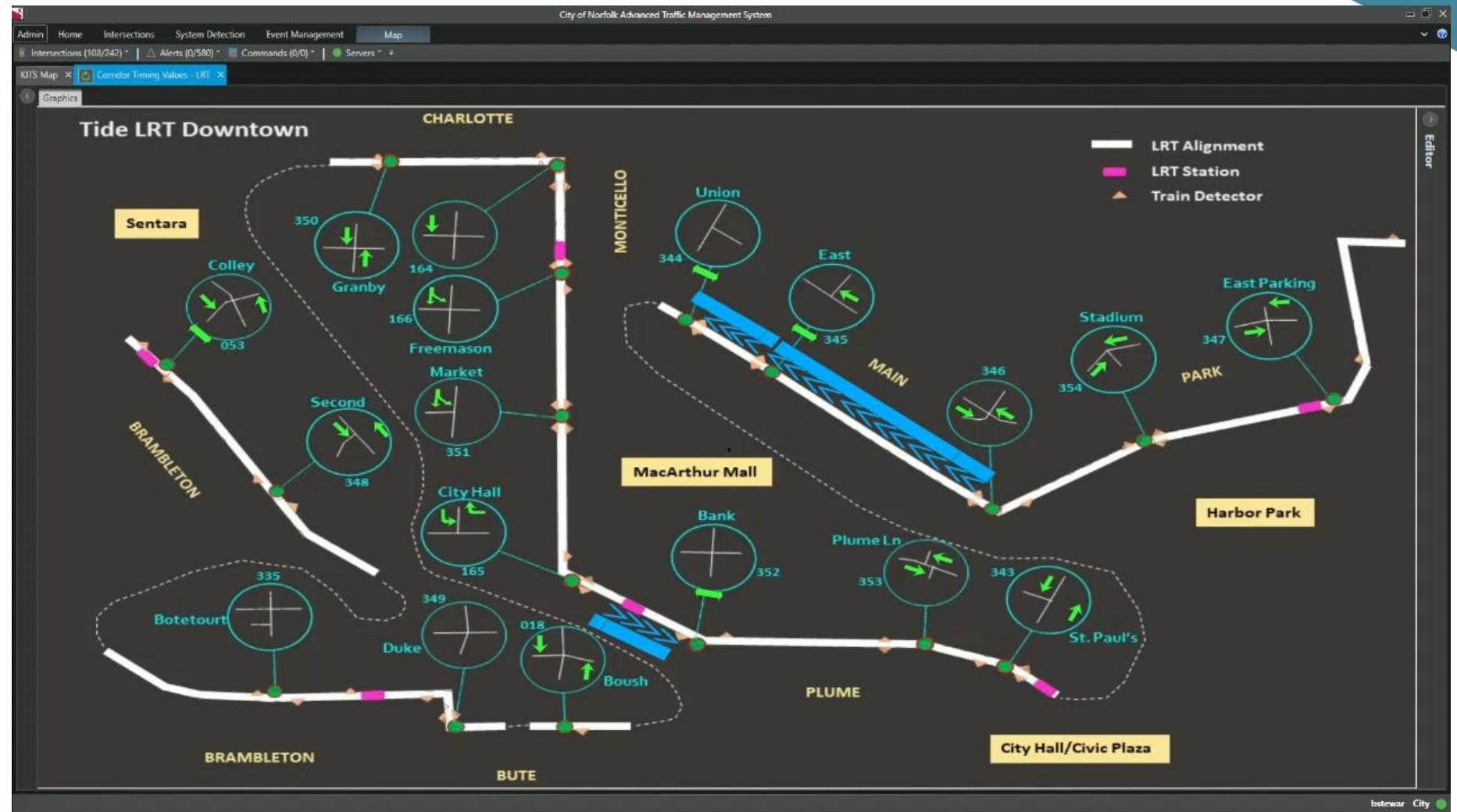
Norfolk VA – KITS Software Deployment

- Light Rail Corridor



Norfolk VA – KITS Software Deployment

- Light Rail Corridor
(operational video)



The background is a solid teal color with several thin, darker teal lines intersecting to form a geometric pattern. One line runs diagonally from the top-left towards the bottom-right. Another line runs diagonally from the top-right towards the bottom-left. A third line runs vertically down the center-right. A fourth line runs horizontally across the middle, intersecting the other three.

OT and IT... a Partnership story

VDOT OT and Partnering with IT

- Developed a Security Plan and vetted with IT for connecting Localities and others to the OT environment
- Coordinated with IT Support for standing up the dedicated OT Azure Environment
 - Identity Management platforms
 - Virtual Desktop Interface pools
 - Azure Server VMs
 - Azure SQL Managed Instance
 - Azure Firewall rules management
- Connectivity with Data Exchange Platform for disseminating data (one-to-many)
- Connectivity with TTS for real-time traffic signal data to connected vehicle owners

High-Level Architecture

- Purdue Security Model
 - Isolating the field networks from the Application/DB server environment
 - On-Prem Comm Servers for controlling/polling signal system devices
 - Minimize TOC firewall holes/configurations
- Private fiber connection to Cloud data center(s)
 - Primary and secondary connections and redundant statewide fiber network
 - Initially relied upon MPLS leased circuits

