North Florida Smart Region Integrated Data Exchange Proof of Concept Report

(UPWP Task No. 5.21)

June 29, 2018

North Florida TPO
Transportation Planning Organization
PLAN • FUND • MOBILIZE

Table of Contents

List of Figures

List of Tables

1. Introduction

1.1 Project Purpose

The Integrated Data Exchange (IDE) will develop a concept, vision, system level architecture and procurement requirements for the North Florida integrated data exchange. Information from multiple transportation sources will be aggregated on a single central server, and access will be provided to authorized agencies and individuals for developing applications and broadcast to the public.

The purpose of this document is to provide an overview of the IDE for use by the North Florida TPO in the development of the IDE. This document is intended to provide an initial concept for the IDE, building on the work that was done as part of the North Florida Smart Region plan. It provides a brief review of similar deployments, gives an overview of a proposed high-level architecture and requirements, a vision for the foundations of a developer network and recommendations for procurement, implementation and funding.

Much of the work done in the development of this report is the result of industry meetings in the Jacksonville area including one-on-one meetings with industry experts and meetings with the Smart Region Coalition and other stakeholder groups. The development team also coordinated with work done in other Smart City and Big Data programs. Finally, the development team researched the work done by the City of Columbus Smart City program to build off any early lessons learned from that effort.

1.2 Smart Region[1]

In 2016, the North Florida Transportation Planning Organization (North Florida TPO) facilitated development of a Smart Region Master Plan. The need for a plan evolved from the North Florida Regional ITS Coalition (formed in 2004), comprises of more than 80 participants from the public and private sector to coordinate and deploy Intelligent Transportation Systems (ITS) within the region. After the development of the Smart Region Master Plan, the ITS coalition was rebranded as the Smart Region Coalition.

Most of the priority ITS projects identified by the ITS Coalition and formalized in a Regional ITS Master Plan in 2010 are complete. These projects include freeway and incident management systems, integrated corridor management, arterial management systems, road weather information systems, regional fiber optic communication systems and constructing a new regional traffic management center. With this plan nearing completion, a path forward for leveraging technology to better manage and operate the transportation system needed to be defined.

A smart region utilizes innovative and emerging technologies to collect, analyze and utilize data from many sources to enhance the region's livability. While many of these technologies have been deployed

[1] http://northfloridatpo.com/its/smart-cities/

independently with great success, integrating them and harnessing the power of coordinated data will provide new and innovative means to improve the quality of life for citizens throughout the region.

A smart region has many pieces, including waste, water, energy, healthcare and transportation. The true power of a Smart Region is realized when the silos between each piece are broken down and data is fully integrated with different systems into one data management system. With a diverse and widespread dataset, in-depth analyses can be conducted and new connections can be made. Thus, a smart region is also a catalyst for technology innovation that can create economic growth.

The Smart Region Master Plan focuses on transportation related infrastructure and services. The plan's goals are as follows:

- Eliminate fatalities
- Improve travel time reliabilities
- Reduce greenhouse gas emissions
- Provide ladders of opportunity to the disadvantaged
- Grow North Florida

From these goals, 33 regional project priorities have been identified and grouped into four categories – local intelligence, electrification services and data management services. The projects are summarized in Table 1.

Table 1. North Florida TPO Smart Region Plan Projects

Projects
Local Intelligence
Connected Vehicle Corridor Deployments
Regional Greenwave Data
Bicycle and Pedestrian Warning System
Truck Priority System on Heckscher Drive
Baptist Hospital Rail Crossing Alert System
Regionwide Rail Crossing Data Management and Information System
Critical Bridge Failure Detection System
Street Flooding Sensors and Notification System
Automatic Vehicle Locators in Public Vehicles
Bus Rapid Transit Crash Avoidance System
Transit Signal Priority
Smart Truck Parking at Talleyrand and Blount Island Marine Terminals
JAXPORT Gate Closure Notification System
Integrated Corridor Management
Smart Delivery Truck Parking and Availability System
Parking Management and Information System
Electrification
Smart Street Lighting Upgrades
Expand Electric Vehicle Network
Solar Road Pilot
Smart Kiosks

Services
Ultimate Urban Circulator (U2C) Expansion
Electric Autonomous Vehicle Shuttles
Automated Vehicle Smart Parking Lot
Intermodal Container Transfer Facility (ICTF) Connector for Trucks
Special Event Traffic Management System
Smart Card for Multiple Uses
Mobility as a Service First Mile/Last Mile (FMLM) Partnership
Car Sharing Incentives for Low Income Neighborhoods
FMLM Connectors in Special Neighborhoods
Data Management System
Upgrade Regional Fiber
North Florida Integrated Transportation Data Exchange
Enhanced Interagency Data Sharing System
North Florida Region Traffic Application and Total Trip Planner

Since the development of the Smart Region Master Plan, new partnerships have been formed and projects are starting implementation. The University of North Florida is partnering with the Florida Department of Transportation (FDOT) to develop a Big Data Systems class that will use the FDOT's regional traffic management center data warehouse as part of graduate research projects. Students will assist the FDOT in data analytics and mining the data for new insights into mobility, sustainability and economic development issues. The plan also demonstrates support for other local agency programs such as the Jacksonville Transportation Authority, which plans to demonstrate the feasibility of automated vehicle technologies for transit shuttles and to develop an automated vehicle deployment that modernizes the downtown Skyway. The City of Jacksonville is working to complete their smart lighting conversion program.

The Smart Region Master Plan is a foundation for future regional efforts to seek innovative technology or smart city grants by demonstrating a proven record of success through regional cooperation, a clear vision and plan to advance smart city technologies. Funding is being annually programmed to design and implement the projects outlined in the Smart Region Master Plan.

1.3 Integrated Data Exchange Vision

The IDE is the web based solution being developed to meet both the open and controlled access data needs of the North Florida Smart Region program as envisioned by the North Florida TPO, FDOT and partners. The IDE platform is at the heart of the North Florida Smart Region data environment that integrates data and data services from multiple sources and tenants, including the planned smart region technologies, traditional transportation data and data from other community partners, such as food pantries and medical services. The IDE embodies open-data, best of breed technologies including open-source and commercial off the shelf concepts to enable better decision-making and problem solving for all users to support a replicable, extensible, sustainable platform for data ingestion and dissemination. The IDE drives performance metrics for program monitoring and evaluation; serves the needs of public agencies, researchers, and entrepreneurs; provides practical guidance and lessons learned to other potential deployment sites; and assists health service providers, human service organizations and other agencies to provide more effective services to their clients.

1.3.1 Purpose of the IDE

The IDE will provide a **governed** platform for the ingestion and **dissemination** of data from sources both internal and external, open and controlled access, that are used by Smart Region and related applications.

- **Provide source for data** used and produced by North Florida Smart Region projects and applications
- **Provide data** collected by smart region applications **to users** in the form of Application Programming Interfaces (API)s, performance metrics and reports
- Allow a **framework for smart region** sources to be made available through the IDE to advance broader TPO, FDOT, City and citizen needs
- Enable **visualization and analysis** of data

1.3.2 Operating Assumptions

The IDE will be designed with the following operating boundaries.

- The exchange of data is a shared responsibility between the IDE Development Team and the other North Florida Smart Region Engineering and Development Teams. The IDE Development Team will provide the North Florida Smart Region Engineering and Development Teams open tools and API's for data exchange with the IDE. For project specific API needs, the North Florida Project Engineering and Development Teams will develop open APIs, interfaces and data pipelines within the framework provided by the IDE in cooperation with the IDE Development Team. Where feasible, the North Florida Smart Region Project Engineering and Development Teams should default to non-proprietary and open protocols.
- The IDE is not architected to support mission critical or life critical applications and systems built on the data pipelines in such a way that if the IDE does not respond quickly enough, or fails to respond, the application or system would cause a significant increase in the safety risk for the people and/or environment involved. The IDE may provide master data, configuration changes and other data to applications or systems to support operations, but the data provided by the IDE should not be necessary for mission critical or life critical operations.
- Integration points for command and control stacks may be needed, but will be developed separately from the IDE.
- The IDE will not operate as a payment processor or manage Payment Card Industry's Data Security Standard (PCI DSS) transaction data such as credit card information.

1.3.3 Providers and Consumers of Data (Users)

This list of providers and consumers of data are not prioritized and will be refined over time.

- Researchers (academic, non-profit, USDOT, independent evaluators)
- Regional Partners
- Other public agencies
- In-house city developers
- Third-party application developers
- Public

Figure 1 shows the relationships between the data elements and sources that are envisioned as part of the Smart Region Collation. This is not intended to be a comprehensive or exhaustive list but representative of the data that will likely be incorporated into the IDE over time. This list has been developed to assist the development team – North Florida TPO, stakeholders and Smart Region Coalition and IDE development team – in the understanding of the breadth, depth and volume of potential data sources that will ultimately be integrated into the IDE. The data is broken down into three primary categories:

- Existing data sources. These are data sources and data sets that are currently being collected and used by the agencies in the North Florida Region for transportation purposes.
- Non-Traditional data sources. These are data sources and elements that are currently being collected and used for non-transportation purposes.
- Smart Region data sources. These are data sets that will be generated by projects that are proposed as part of the North Florida Smart Region plan.

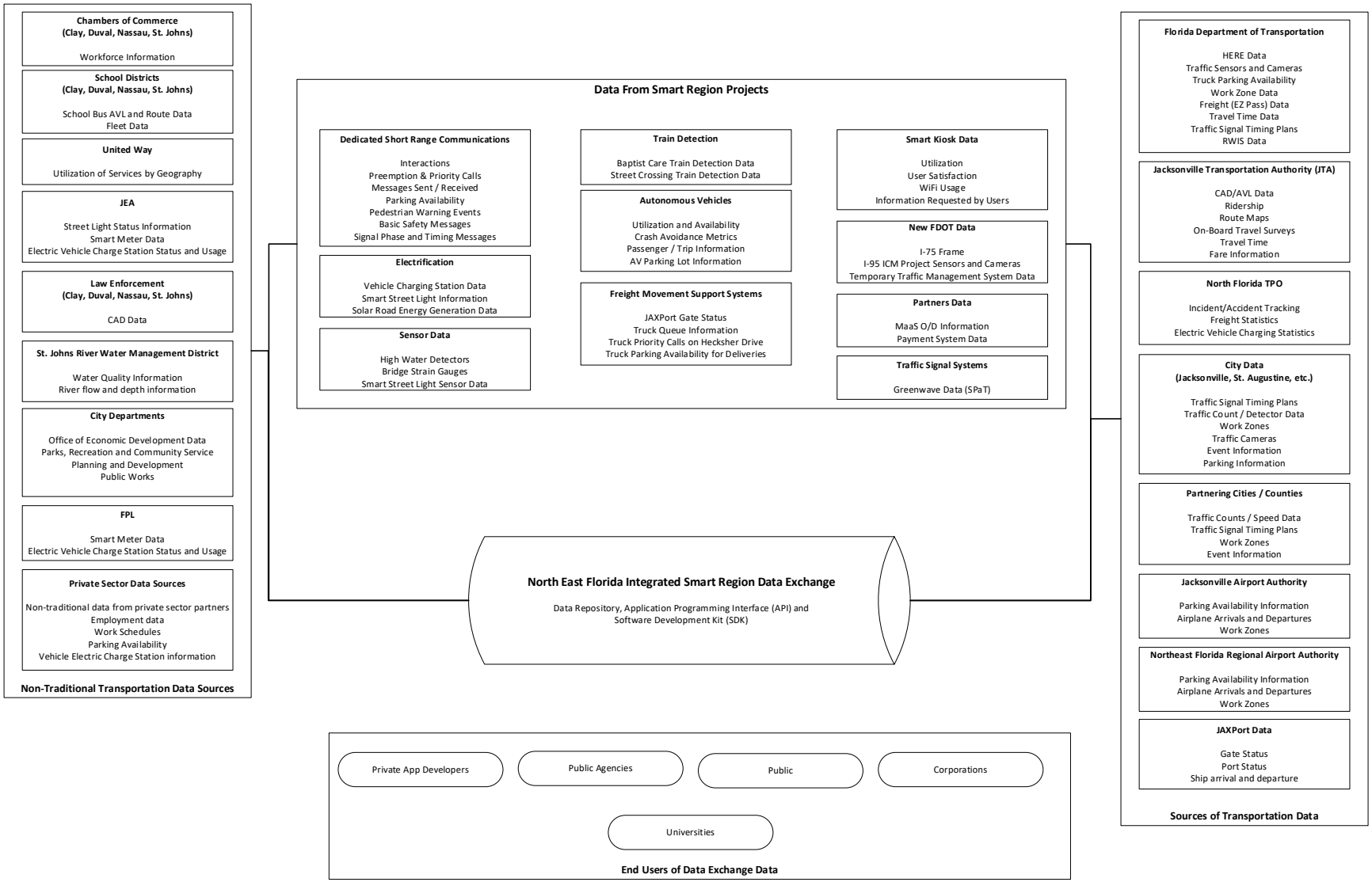

Figure 1. North Florida IDE Potential Data Partners

2. Industry Scan

The North Florida IDE is innovative in the vision that it holds for sharing and distributing data from multiple public and private sector partners, essentially becoming a central data repository and access point for all data related to the Smart Region initiative. To minimize risk, the North Florida system will build upon the efforts of these other programs, either through lessons learned or, depending on how procurements play out, actual code. The following sections provide a sample of similar systems being developed or currently operational. This is not an exhaustive scan as it only addresses four (4) public sector implementations and two private sector solutions.

2.1 Public Sector Solutions

2.1.1 Smart Columbus Operating System[2],[3]

The Smart Columbus Operating System (SCOS) is funded by USDOT's under the Smart City Challenge initiative. SCOS is an online data host intended to provide improved logistical information to the Columbus area by integrating transportation data from local sources such as the Ohio Department of Transportation (ODOT), Mid-Ohio Regional Planning Commission (MORPC), the City of Columbus and Geotab.

ODOT, MORPC and City of Columbus collect traffic data through detection cameras and Automated Traffic Recorders (ATRs), and ODOT is planning to incorporate INRIX traffic data into their database in near future. Geotab collects data from vehicle on-board units. All this hardware is maintained by the respective agencies and organizations, and the data feeds from these devices are delivered through each organizations' open data portal.

The SCOS team currently evaluates the data manually to assess the accuracy and completeness of the data and metadata. At the time of this report, the team does not perform any analytics or visualization of the data.

The projects for Smart Columbus are anticipated go live in January 2019. The infrastructure and project related data will be maintained by the SCOS.

Technical working group meetings are held monthly to discuss the progress and goals of the SCOS. These meetings are comprised of experts from data, technical and policy backgrounds.

2.1.2 RITIS Probe Data Analytics Suite[4]

The Probe Data Analytics Suite is a feature of the Regional Integrated Transportation Information System (RITIS), developed by the CATT Lab at the University of Maryland and developed through grant

[2] https://www.columbus.gov/smartcolumbus/projects/

[3] https://www.smartcolumbusos.com/

[4] http://www.cattlab.umd.edu/?portfolio=ritis

funding from the I-95 Corridor Coalition member agencies. RITIS is an archiving and dissemination data system that includes many tools for agencies to visualize the data to gain situational awareness and communicate this information to the public.

RITIS receives, fuses, translates and standardizes the real-time data from multiple agencies and provides this information to traveler information sites (such as Florida 511), the media and third parties. This real-time data includes incident, event, detector, probe, weather, transit and ITS device status. Each agency that provides data to RITIS can choose, through the RITIS platform, which data elements they would like to provide in the data feed and which elements they would like to keep secure from the public and other agencies.

The data provided to RITIS is archived indefinitely, and this historical data can be analyzed and queried with many tools in the RITIS archive. The data from the archive can also be downloaded.

The Probe Data Analytics Suite provides real-time and historic speed, travel time index, travel time reliability metrics, queue measurements, bottleneck ranking and congestion. The tools available in the suite allow to visualize the data during certain days and times and set your own color thresholds to identify traffic hot spots, trends and patterns. In addition, the Maryland State Highway Administration funded a series of features that allow users to derive vehicle hours of delay, user costs and fuel consumption based on volume measurements from probe data readings. The tools available in the suite also allow users to create their own personal dashboard for monitoring, plot charts, create tables and trend maps and produce performance summary reports.

2.1.3 City of Dallas Open Data Portal[5],[6]

The City of Dallas Open Data Portal (Dallas OpenData) is an online platform allowing citizens to easily obtain public information without the need for a formal application process. It includes over 180 data sets such as public safety, code compliance, 311[7], Geographic Information System (GIS), financial transparency and performance measures. The goal of the portal is to have data from every City Department within the City of Dallas available to the public.

Citizens using the platform can review, compare, visualize and analyze real-time data. This allows citizens to effectively work and collaborate with each other and policy-makers and service providers to make informed decisions and improve governance based on data. The City of Dallas is also using the data portal as an incentive to create new innovative products, services and businesses by engaging entrepreneurs. Every dataset has an easy-to-use API for adding Dallas OpenData to applications.

Dallas OpenData is subject to Terms of Use, which the user agrees to by accepting the Terms of Use or accepting by downloading data. The terms also discuss that the accuracy of the data may be subject to

[5] http://www3.dallascityhall.com/smart-cities/

[6] https://www.dallasopendata.com/

[7] 311 is the mechanism for City of Dallas residents and visitors to get information and make non-emergency service requests. http://dallascityhall.com/services/311/Pages/default.aspx

error and that the City is not liable. Users of the data are additionally not granted any title or right to patent, copyright or other intellectual property rights that the City and others may have in the data.

2.1.4 City Data Exchange Copenhagen[8]

The City of Copenhagen is undergoing several Smart City initiatives to become a smart, carbon-neutral city by 2025. To do this, Copenhagen Solutions Lab has created a data exchange called the City Data Exchange Copenhagen. The City Data Exchange Copenhagen platform ties together multiple types of data users to purchase, sell and share their data.

Through the data platform, the City wants to leverage the data for potential business or societal ventures that may not have been realized before, when the data was housed within individual silos. By having the data from these silos in one location, various parties can easily share information with one another and innovation can be fostered. This also allows developers to use copious quantities of data without having to personally invest in data gathering and the data storage infrastructure.

2.2 Private Sector Solutions

2.2.1 Buddy

The Buddy Cloud Smart City platform[9] creates an open data platform by consolidating data from businesses', cities' and governments' IoT (Internet of Things) devices. The platform can connect devices that may not otherwise be compatible by using scalable data intake, management and processing.

The Buddy Cloud Smart City platform serves as the backbone of the Buddy Ohm[10] to enable processing, streaming and storing of data with real time capabilities such as an alerts and rules engine. Buddy Ohm is a base unit used in infrastructure monitoring applications to measure real-time utility usage and manage HVAC and elevator systems for optimal resource consumption.

The Buddy Cloud Smart City platform and Buddy Ohm utilize real-time dashboards for data-driven decisions. A mobile version of the Buddy Cloud platform is Parse, which pushes real-time notifications when anomalies are detected or thresholds are met. This allows the operators to quickly respond to events and will incentivize conservation by showing the negative impact on the environment and the positive impact on net profit.

[8] https://www.europeandataportal.eu/en/news/city-data-exchange-copenhagen

[9] https://buddy.com/smart-cities/

[10] https://www.prnewswire.com/news-releases/buddy-platform-aims-to-simplify-smart-city-efforts-with-next-generation-resource-monitoring-solution-300426558.html

2.2.2 IBM[11]

The IBM Intelligent Operations Center for Smart Cities is an online platform meant to reduce the difficulty of municipal operations. Data for many cities has typically been stored on multiple systems across multiple departments. The IBM Intelligent Operations Center for Smart Cities platform collects operational data from all the individual departments and agencies and combines it on one network, so city leaders will be more informed on the current city status and can efficiently allocate resources.

The IBM Intelligent Operations Center for Smart Cities mainly collects data from systems that manage video cameras and sensors throughout the city. When the data is integrated into a singular platform, agencies can work more closely and collaboratively. The IBM Intelligent Operations Center for Smart Cities provides a unified view across all the city agencies and allows supervisors to monitor and manage a range of services. This enables real-time collaboration and situational awareness to allow agencies to respond quickly to incidents or disasters and manage the response resources properly. First responders and other officials at incidents can quickly send repots via a web-based portal to the operations room and receive information from operations simultaneously. Agency representatives can view the reports collaboratively and accelerate a plan to resolve the problem, reduce further impacts and avoid using unnecessary resources.

The IBM Intelligent Operations Center for Smart Cities also offers near real-time key performance indicators. The raw data from sensors, existing applications, historical databases and other sources are compared for insight into the performance of department systems. These metrics can then be published for evaluation of the city's progress towards set goals.

The asset management capabilities of the IBM Intelligent Operations Center for Smart Cities allow managers to track what assets are available, which assets are ready for use and which assets need maintenance. Overall, the platform can streamline the management of critical city assets and resources for those assets by quickly assessing the status of the assets and prioritizing projects. The progress during construction of projects can also be monitored through the platform until project completion.

Tools such as dashboards, charts, reports and geospatial maps are utilized to receive and disseminate asset and performance measure information. This interface can also be used on mobile devices for quick access to information.

The IBM Intelligent Operations Center for Smart Cities has multiple deployment models. Cities with a strong Information Technology (IT) resources and capabilities can deploy the platform in their own data centers. Cities that may not have the resources or capabilities to maintain the platform can use the IBM Intelligent Operations Center for Smart Cities as a software-as-a-service option that resides on the IBM SmartCloud.

[11] http://public.dhe.ibm.com/software/solutions/soa/pdfs/IBM_Intelligent_Ops_Center_Solution_Brief.pdf

The IBM Intelligent Operations Center for Smart Cities runs on IBM System x® workload-optimized systems, and IBM intends to expand deployment options to support more server platforms, including IBM Power Systems™ and IBM zEnterprise™ Systems.

3. IDE Design Concept

The overall design concept is shown in Figure 2. The IDE will incorporate data from multiple sources, store the data in a data lake and make the data available for use in multiple applications. Figure 2 depicts how the different data sources can be used for different core sets of transportation applications. It is the objective of the IDE to enable these new applications through the availability of new data and the integration of those new data sets.

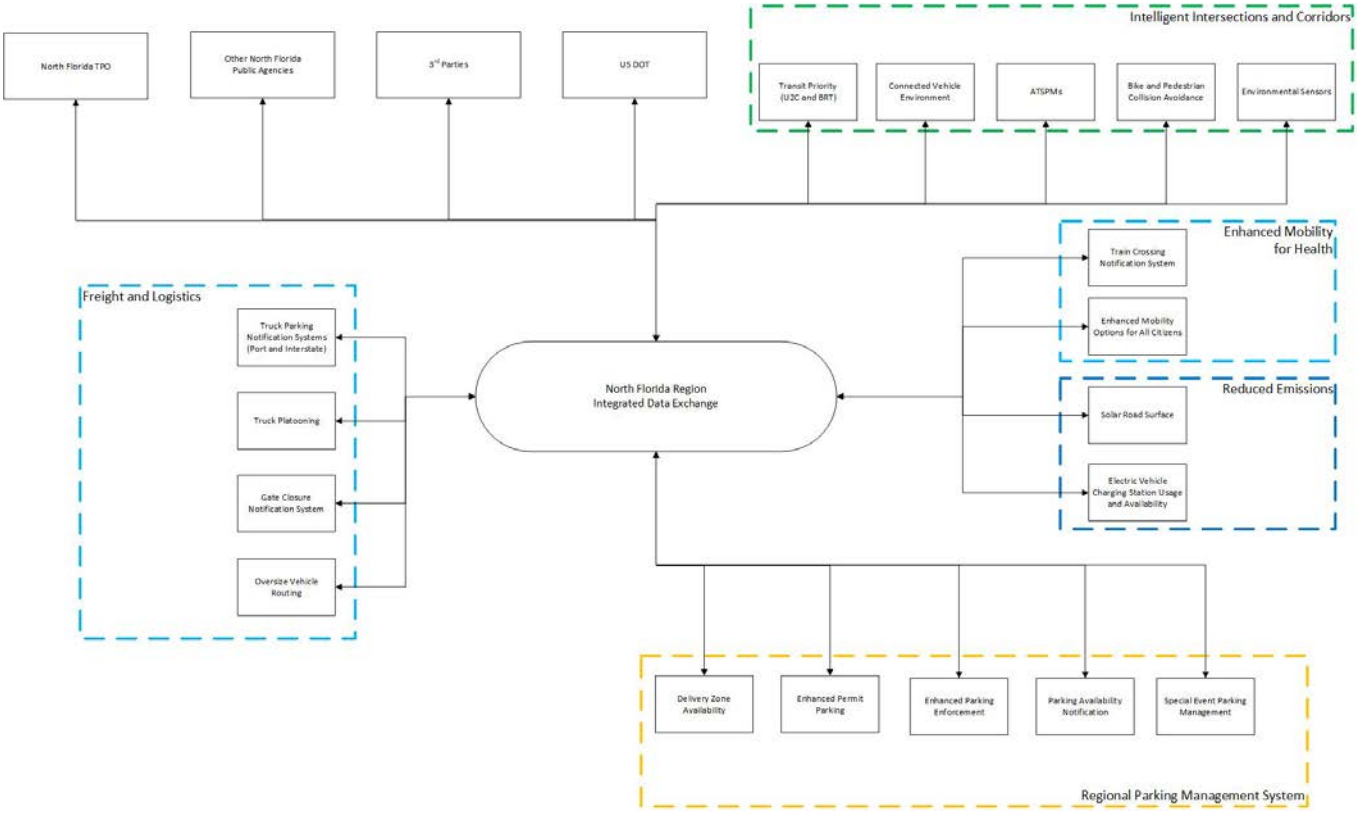

Figure 2. Conceptual System (Data) Relationships

3.1 Architecture

The initial conceptual North Florida Region IDE architecture is shown in Figure 3. A data-centered architecture featuring a repository capable of storing big data in various format, a data lake, is recommended for the IDE. Components of the system are described below:

- **Source System:** Data from other data warehouses, managed document repositories, file shares, databases, and other cloud/external sources including social media and third-party can act as data source. The raw data from these sources can be in its native format including structured, semi-structured, and unstructured data. The raw data can flow into the data lake by either batch processing or real-time processing of streaming data through APIs.
- **Enterprise Data Lake**: The data from multiple source systems are stored in the data lake in its native format. Curation takes place through capturing metadata and lineage and making it available in the data catalog. Security policies and data quality are also applied. Business rules

and dictionaries are applied on the data repository. Models and dictionaries are developed as necessary.

- **Data Analytics and Reporting:** Stakeholders and users can self-service their data and analytics needs. Users browse the data lake's data catalog to find and select available data to work with. Once data is provisioned, users can use the analytical tools of their choice to develop models and reports.
- **Consumption Zone:** Users can gain valuable information from the models and reports, which can be accessed through web browser, mobile web, apps, and other business user interfaces.

It is anticipated that this architecture will change over time as the design and requirements are refined.

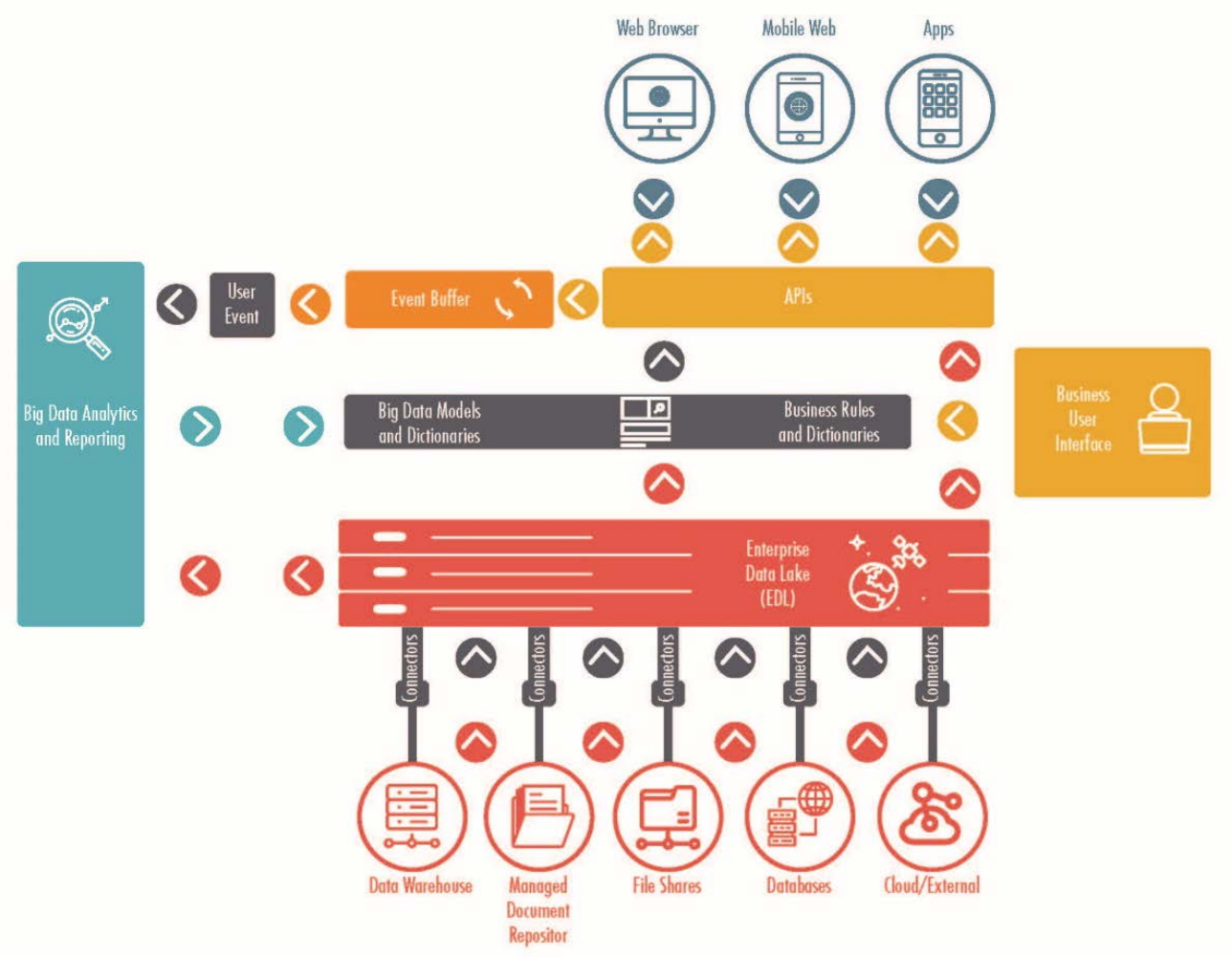

Figure 3. Concept for North Florida Region IDE Architecture.

3.2 Privacy and Data Security[12]

A key consideration in implementing the IDE is to ensure that proprietary data or data containing Personally Identifiable Information (PII) is not released to the public and, preferably, not posted to the IDE. Any data provider must ensure that PII is removed before the data is transmitted to the IDE.

3.2.1 Key Privacy Terms

Data Owner: by default, the owner is the agency or organization that originally generated the data and transmitted the data to the IDE. The IDE will need to tag each data element with a flag, identifying the original owner of the data so that end users can properly attribute the data and, if necessary, the data can be stripped from the IDE.

Privacy: control over the extent, timing, and circumstances of sharing oneself (physically, behaviorally, or intellectually) with others.

PII: the information that can be used to distinguish or trace an individual's identity, such as their name, Social Security number, driver's license number, license plate number, biometric records, etc., alone, or when combined with other personal or identifying information.

SPII: is a subset of PII, which if lost, compromised or disclosed without authorization, could result in substantial harm, embarrassment, inconvenience, or unfairness to an individual. Sensitive PII (SPII) requires stricter handling guidelines because of the increased risk to an individual if the data are compromised. The following PII is always (de facto) sensitive, with or without any associated personal information:

- Social Security number (SSN)
- Passport number
- Driver's license number
- Vehicle Identification Number (VIN)
- Biometrics, such as finger or iris print
- Financial account number such as credit card or bank account number
- The combination of any individual identifier and date of birth, or mother's maiden name, or last four digits of an individual's SSN

In addition to de facto Sensitive PII, some non-sensitive data may be deemed sensitive based on context, as discussed next. Sensitive PII should never be imported into the IDE.

Non-sensitive Data as PII: data that, by itself is non-sensitive or anonymous, but when combined with other available or discoverable data, can become PII and even SPII. Care needs to be taken within the IDE that data from any one source cannot be combined and converted to PII. It is possible that data from multiple sources within the IDE may be combined to create PII or SPII. Care needs to be taken by

[12] These principals are adapted from the Data Privacy Plan developed for the THEA (Tampa) Connected Vehicle Pilot program. https://rosap.ntl.bts.gov/view/dot/32034

the IDE operator to monitor new data sources to try to prevent these data sources from being integrated into the IDE.

Published Data: data that is considered "public data" and, therefore has no expectation of privacy or protection from exposure/exploit. Data may be imported into the IDE from existing public data sources. If that data is already available to the public and it contains PII, the IDE can accept and make that data available to all users. The documentation for the IDE will need to include the source of the data and the justification for including PII data in the IDE.

3.2.2 Collected PII/SPII Data Categories

Data to be imported into the IDE should not include any PII unless that data is considered Published Data and the source is documented as part of the data integration. The following data is not to be included in the IDE, and the IDE data ingest engine should be designed to identify and preclude these data types from being entered into the IDE.

Participant Background Information

- Individual Identifiers;
- Full Name (First, Middle, Last);
- Socio-demographic information, including age, gender, marital status, and income;
- Driver's license number, issuing state, and qualifiers.

Vehicle Identifiers

- Personal VIN and registration information;
- VIN of government issued vehicles; and,
- Identifiers for equipment installed by Pilot in personal or participant vehicle.

Contact Information

- Mailing/Residential Address;
- Phone number(s);
- Email address(es);
- Institutional or organizational affiliation;
- Work/Business related contact information; and,
- Occupation and work schedule.

Eligibility Information

- Driver history and habits;
- Proof of insurance;
- Proof of Florida vehicle registration; and,
- Completion of Pilot participant training.

3.2.3 Controls

The IDE will need to include security methodologies to protect sensitive data. Those security methodologies are referred to as "Controls".

Types of Controls

Security controls can be classified by three types and three means. The three types of controls are:

- Preventive: Are put in place to "inhibit" harmful events.
- Detective: Are put in place to "discover" harmful events
- Corrective: Are put in place to restore systems after a harmful event.

The IDE will utilize a balance of these controls to accomplish the best solution based on multiple factors to prevent these events from occurring or to minimize the impacts of those events should they happen. Given that no PII is anticipated to be included in the data sets within the IDE, the potential impacts should be minimized, but the design needs to take the potential for these events to occur and implement mechanisms to protect the systems and data sets.

3.2.4 Intellectual Property Issues

For the prototype IDE, the data sets that will be incorporated will be pubic data sets and as a result, Intellectual Property (IP) issues associated with the IDE should be minimized. Data will be made freely available to all users to avoid any appearances of favoritism from the IDE owner and operator. If a data source includes IP issues or use restrictions, those restrictions will need to be noted by the data owner prior to submission to the IDE, and the IDE operator and owner will need to address those issues. In the absence of such notice, all data released for publication including data shared with the IE or published to the RDE, will be considered as free of IP.

4. High-Level System Requirements

4.1 Purpose

The purpose of this System Requirements section is to specify the overall system requirements that will govern the development and implementation of the system. The section will also establish initial security, training, capacity and system architecture requirements agreed upon be the project sponsor and key stakeholders.

4.2 General System Requirements

The general system requirements are the high-level requirements that must be present in the prototype and final iteration of the IDE.

4.2.1 System modes and states

The IDE system could exist in various modes. Table 2 identifies these potential modes for the system:

Table 2. System Modes and States

Mode	Definition
Operational (regular)	Normal operating condition, the System is operating as designed and all processes are running as intended. The system is intended to function during all hours of the day.
Degraded Conditions	Represents a situation where primary functionality is lost due to nonfunctioning process or equipment, but an alternative (though less precise) means of accomplishing the function exists. This could be from back-up servers or processes.
Failure Conditions	Represents a situation where the application is not operating as designed and processes are not performing as intended. This could be from diminished communications between one or more external systems, diminished data quality, or the inability to process data in a timely manner. Failure conditions include situations that require temporary shutdown of the System (includes maintenance scenario as well). Watchdog processes will provide alerts for these failure conditions. This condition also includes Offline mode, a situation where internet connection is lost and the application is unable to retrieve real-time updates or operate as intended.

4.2.2 Major System Capabilities

This section specifies the major system capabilities in terms of availability, target deployment environment(s), device accessibility, and/or technical capability.

- **On-Demand Self-Service:** Users (with proper account authentication) must be able to provision resources without any interaction with the service provider's staff. System shall be

available 24 hours a day.

- **Broad Network Access**: Uses must be able to access resources over networks such as the internet using a ubiquitous client (e.g., a web browser) from a range of client devices (e.g. smartphones, tablets, laptops)
- **Resource pooling:** System shall use a cloud architecture. The service provider's computing resources may be pooled to serve multiple customers. Virtualization technologies may be used to facilitate multi-tenancy and enable computing resources to be dynamically assigned and reallocated based on customer demand.
- **Scalable:** Resources must be quickly provisioned and released, sometimes automatically, based on demand. Users can easily increase or decrease their use of a cloud service to meet their current needs.
- **Measured Service:** Users pay only for the resources they use within the service. Service providers must supply users with a dashboard so that they can track their usage.
- **Ensure Security/Privacy:** The systems shall have high level of security and provide privacy for the users.

4.2.3 System Conditions

The system shall comply with the following major system assumptions and/or constraints. These assumptions and constraints will limit the options available to the designer/developer.

- System shall use the FDOT Enterprise GIS Framework
- System must use FDOT Enterprise Document Management System

4.2.4 System Interfaces

The system shall provide a common interface for application developers and researchers using data.

4.2.5 System User Characteristics

This section identifies each type of user of the system by function and the nature of their use of the system

- **Researchers (academic, non-profit, USDOT, independent evaluators):** The researches will most likely access the data through APIs for research purposes.
- **Regional Partners:** Regional partners will both be the source of data and access data from other resources to better their planning, operations and/or maintenance activities.
- **Other public agencies:** Public agencies will both be the source of data and access data from other resources to better their planning, operations and/or maintenance activities.
- **In-house city developers:** In-house city developers will develop application that the City could use for their planning, operations and/or maintenance activities.
- **Third-party application developers:** Third-party application developers will develop applications that could be used by public or other stakeholders. They may potentially collect revenue from the use of data/application.
- **Public:** Public will generally be the source of data and the consumer of information provided by application developers/public agencies to better their quality of life.

4.3 Functional Requirements

- The system shall allow the data provider to generate a data source package
    - The system shall manage the seamless and bi-directional transfer of data and control information among member agencies.
- The system shall allow the dataset package to be registered within the IDE.
- The system shall allow the raw data to be ingested in to the IDE.
    - The system shall tag each data element with a flag, identifying the original owner of the data so that end users can properly attribute the data and, if necessary, the data can be stripped from the system.
    - The system shall ensure that the proprietary data or data containing PII is not released to the public and, preferably, not posted to the IDE. (It is the responsibility of the data provider to ensure that no proprietary or PII data are shared with the IDE.)
    - The system shall accept the data that is already available to the public even if it contains PII. (The documentation for the IDE will need to include the source of the data and the justification for including PII data in the IDE.)
    - The system shall allow storage of structured and unstructured data
    - The system shall reliability store a large amount of data
    - The system shall have scalable data storage
    - The system shall not dictate a data storage format i.e., the storage system shall support arbitrary data formats that are understood by the applications that use the data.
    - The system shall allow compression of data files to improve space and network bandwidth utilization
    - The system shall provide tools for getting data (in different formats/sources) into and out of the storage platform.
    - The system shall provide interface for logging data
- The system shall extract metadata from package
    - The system shall maintain metadata (updates, access requests, schema)
- The system shall allow data improvement and enrichment processes
    - The system shall allow for ETC (Extract, Load, Transform)
    - The system shall allow discovery and preparation through web-based interfaces and/or command line with scripting languages (for investigating raw data and then devising strategies for cleansing and pulling out relevant data)
    - The system shall allow the prepared data to be delivered to traditional relational database (so that conventional business intelligence tools can directly query it).
    - The system shall allow for simple transformations including data preparation, data cleansing and filtering.
    - The system shall allow for machine-learning algorithms for data analytics
    - The system shall allow for analytic queries (that can be used to provide a summary view of a data set cross referencing other data sets
        - The system shall allow for querying and transforming relational data on the stored data
        - The system shall allow for queries on non-relational data
    - The system shall allow ad-hoc computation to support variety of algorithms.
        - The system shall allow for employing iterative machine learning algorithms and other arbitrary computations.

- The system shall allow streaming that can be used to analyze data in real time as well as to ingest data for batch processing.
- The system shall allow the data to be staged, reviewed, stored, and buffered
    - The system shall allow scheduling i.e., launching jobs at specified times or in response to an external trigger.
    - The system shall allow workflow i.e., specifying job dependencies and providing a means to execute jobs in a way that the dependencies are respected.
    - The system shall allow scheduling and workflow definition via graphical user interface (and not command line)
- The system shall allow API Access point to be created and processed
- The system shall allow the data to be released to IDE Open Data Portal

4.4 Non-Functional Requirements

4.4.1 Registration

- The system shall have a user-friendly, web-based registration process.
- The system shall include a high-level graphical user interface.
- A password protected login process shall be included.

4.4.2 Security

- The system shall require proper approved credentials for accessing the system.
- The system shall have backup storage in case of emergency, corruption and other forms of data loss.
- The system shall be protected by antivirus software
- The system shall have customizable permissions and security settings
- The system shall be subject to privacy and security regulations, certifications and restrictions
- The system shall identify 99% of the intrusions within 10 seconds

4.4.3 Availability, Scalability, Reliability, Performance and Usability Requirements

- The system shall be available for use at 99.999 percent of the time.
- The system shall be scalable to the needs of the users.
- The system shall have high Mean Time Between Failures (MTBF) and Mean Time to Repair (MTTR) (to be determined).
- The system shall respond to customer queries within a reasonable period (to be determined).
- The system shall have at least 90 percent of the users polled after a 3-months usage period rate their satisfaction with the system at eight (8) and more on a scale of one to 10
- The system shall be able to handle up to 100 concurrent users when satisfying all their requirements.

4.4.4 Training Requirements

- The users shall be provided training on the administrations, operations, and maintenance of the system based on their User Class.
- The system shall maintain operator and administrator training materials.

- The system shall include readily accessible training materials developed for all custom-built components.
- The system shall include training materials on the IDE user interfaces.
- The system shall have updated documentation (training materials and system manuals) for all IDE components (updated as part of IDE configuration management.)

5. Documentation to Support Use

The success of the IDE is dependent on the use of the data stored in the IDE by third parties to perform analytics and develop insights and applications with the data. Successfully engaging this community will require that the IDE development, implementation and operations include a developer portal and sufficient documentation through SDKs and APIs for those developers to effectively access and use the data.

For the purposes of the IDE, third party developers are defined broadly to include any agency, organization or person, whether in the public sector, part of a private organization or academia. By creating a broad developer community and supporting it with the appropriate tools, the IDE will reach the broadest available audience to derive benefits from the IDE.

The creation of a developer community is a common program throughout the information technology industry. Large companies such as Google, Facebook and Twitter all have their own developer portals that are freely accessible. Likewise, an increasingly larger number of public agencies are making their data available through developer portals, including Washington Metropolitan Area Transportation Authority (WMATA), the State of California and the City of San Francisco.

5.1 Developer Portal[13]

The Developer Portal is the primary access point for third party developers for the IDE. It is essentially a content management system (CMS) that lets the operator of the IDE create Application Programming Interfaces (APIs) documentation, support blogging and provide threaded forums. Most organizations that have a developer program use the developer portal as the primary access point and communications hub for communications with those developers.

Developer portals are increasingly being used for communication with the developer community. This includes communicating static content, such as API documentation and terms-of-use, as well as dynamic community-contributed content such as blogs and forums.

The developer portal provides a way to expose APIs and Software Development Kits (SDKs), educate developers about those APIs and SDKs, sign up developers, and let developers register apps. Exposing

[13] Portions of this page are modifications of the web page "What is a Developer Portal" authored by Apigee and based on work created and shared by Google and used according to terms described in the Creative Commons 3.0 Attribution License. The original content can be found at https://docs.apigee.com/api-platform/publish/drupal/what-developer-portal .

those APIs, SDKs and the underlying data sets to developers is only part of creating a truly dynamic community. The portal must also provide a mechanism for the developer community to provide feedback, make support and feature requests and submit their own content that can be accessed by other developers.

At the forefront of the developer portal are the administrative services and controls. Administration controls the process where developers request access to the portal, how developers register the apps that access the APIs, how the system assigns developers specific roles and permissions related to the APIs and when to revoke developer access to APIs.

Should the opportunity ever arise to monetize the data or develop a marketplace for the applications and analytics developed by the third-party developers, the administrative services can also use the developer portal to configure and control the monetized components. Monetization would give the developers self-service access to Billing & Reports, Catalog & Plans and monetization-specific settings through the developer portal if the portal is used in that manner.

There are two types of users that will be using the IDE – developers and the API team.

Developers make up the community of users that build apps by using the IDE supplied APIs. App developers use the portal to learn about the APIs through documentation, to register an account on the portal, to register apps that use the APIs, to interact with the developer community and to view statistical information about their app usage on a dashboard.

API team is the owner and operator of the IDE, specifically the team that coordinates with the data providers and generators throughout the region, creates portal content, makes APIs available to app developers, provides API documentation, and provides a mechanism for developers to register apps and obtain API keys. The API team performs basic configuration of the developer portal to:

- Configure automatic or manual requests for API keys
- Maintain API documentation, forums, and blogs and optionally revision all changes
- Add API call tracing in real time
- Handle user comments and forum moderation
- Provide role based access control to control access to features on the portal. For example, an administrator can enable controls to allow a registered user to create forum posts or use test consoles
- Customize email notifications to both administrators and developers for user creation and approvals
- Customize web forms such as "contact us" pages

As the IDE continues to evolve and mature, the portal will need to be flexible to support those changes and the needs of the community. Some enhancements that may need to be made over time include:

- Ease of access to APIs and data
- Documentation, such as how-to guides and reference documents
- Community-contributed content such as blogs and discussion forums

- Sample code
- An easy sign-up process where new developers, apps, and APIs can be approved quickly
- Managed rights and credentials
- Tiered access control

The back end of the portal requires active management for the users of the portal. The intent is not to limit access, but to provide a user experience that supports those users, such as providing keys for access and notification of updates.

An example registration process may include the following four steps:

1. The developer registers through the developer portal. In response, the portal sends an email to administrators to approve the account.
2. An administrator approves the account, and an email is sent to the developer letting them know that they can now log in.
3. The developer registers an app and selects the API products used by the app. In response, the portal assigns a unique API key to the app.
4. The developer passes the API key when making requests to the API.

This is shown as one example of the registration process. Other examples include a registration process where the developer is automatically approved and logged in after registration or that the developer to accept a set of terms and conditions before they can log in for the first time.

Overall, the developer portal is a critical component to the ultimate success of the IDE. Proper maintenance and administration is critical to the success of the IDE, as is proper promotion, which is discussed in a later section.

5.2 SDKs and APIs

The developer portal is the front end for those who are accessing the IDE and the contents of the IDE, including documentation, updates and sample code. The portal, however, is limited in its utility without basic tools, including SDKs and APIs which are both used to support developers in automating access to the contents of the IDE.

SDKs are sets of tools that can be used to develop software applications that utilize the IDE. These tools could include libraries, documentation and sample code that would help a programmer to develop an application and are available for free download by users of the IDE. SDKs make the life of a software developer easy, since there is no need to look for components/ tools that are compatible with each other. Over the life of the IDE, it is anticipated that the developer portal will include SDKs that are provided for developer use and that there is a forum for users of the IDE to post additional sample code and other tools to support overall development activity and use of the IDE.

APIs, for the sake of the IDE, are the interfaces used to deposit or access data within the IDE. These include data definitions that will be used by the developers to access the data within the IDE and potentially sample software code that can be used by the developers to facilitate their use of the IDE. The API will include high level information, such as which data set is being accessed, which data within that set and what parameters of the data set are requested (date range, geographic range, etc.). APIs

are documented interfaces, that are typically complete (for certain data sets, however, the documentation may be intentionally incomplete and/or unavailable for the public). It is the documentation of the interface that allows and encourages third party developers to use the data sets. The APIs will be developed for each data set to support the users of the IDE. This documentation is critical to ensuring that developers ultimately use the data. Over the life of the IDE, as new data sets are introduced or existing data flows into the IDE are changed, the APIs will need to be developed or updated as well.

6. Outreach Program

While the proper tools and documentation are important to the success of the IDE, a user outreach program is critical to ensure that potential users know about the data within the IDE, the objectives of the North Florida Smart Region Program and how to access the site and present results to key stakeholders and partners. As a result, an explicit outreach effort will need to be developed to support the program.

6.1 Promotion

The primary outreach component is the promotion of the IDE and the portal. Promotion takes multiple forms, including presentations, press releases, web advertisements and promotional flyers and brochures. While not needed on day-one, these elements should be implemented long-term to ensure success.

6.1.1 Local

Local promotion is already underway with the IDE. These efforts should be continued. Local promotion done to date includes:

- Presentations to TPO boards and committees
- Development of the Smart Region web site
- Flyers for distribution at the TPO offices and other sites
- Presentation and coordination to the JaxChamber and various committees
- Presentations to the Smart Region Coalition
- Inclusion in newsletters, including FDOT D2 and others
- Coordination with UNF Big Data classes

6.1.2 National

National promotion will be used to expand the reach of the IDE data sets and potential users of the data. While there is a thriving community in North Florida of data users and technologists, there are many companies and individuals looking to develop Smart City solutions across the US and around the globe. While the intent of the outreach efforts is not to go global, the Smart City community is inherently international, with solutions providers and technologists participating in events and developing global solutions. These technologists and developers are looking for data sets from which to develop solutions – data sets that may be offered in North Florida from which a solution could be developed that can be implemented across the globe. National promotional efforts should include:

- Presentations at national conferences including ITS America, ITE and TRB as well as non-traditional conferences, such as IoT World, Smart Cities and Connected Cars
- Articles in national publications
- Blog posts in transportation, IoT, Big Data and other appropriate internet sites

6.2 Hackathons

One of the most effective ways to generate both interest in a set of data and to quickly develop prototype applications that put that data to use is for an agency to host a hackathon. A hackathon is typically a multi-day event, usually occurring over a weekend, where developers gather in one location with a specific objective and an award is given to the most innovative application developed at the end of the event. The IDE operator should plan on an annual hackathon once there is sufficient data that is hosted by the IDE from multiple data sources. The purpose of having an annual event is to take advantage of what is expected to be additional data in the IDE and the ability of users of that data to develop more innovative applications as a result. This includes both the breadth of the data which would allow more innovative analytics and depth, or history, of data which may allow more predictive capabilities.

Hackathons have been used successfully by public sector agencies in the past, including the Virginia Department of Transportation[14], WMATA[15], and the City of Houston[16]. These events have generated prototype applications that have become either part of the operating system for the primary agency or an application that has generated business opportunities for the developers.

6.3 Agreements

The final component of outreach for the IDE is the need for agreements between the IDE operator and the provider of the data. These agreements are needed to protect all the parties and to ensure that the data remains available to users and developers over time. Components of a formal agreement that are likely to be needed by the IDE developer include:

- Data definition – what data is being provided
- Data use restrictions
- Confirmation that the data set does not include any PII
- Indemnification for both parties
- Limitations and expectations for data access (e.g. longevity)

[14] https://smarter-roads-hackathon-vb.devpost.com/

[15] https://www.meetup.com/node-dc/messages/boards/thread/49526149

[16] http://houstonhackathon.com/

7. Implementation and Operational Issues

The previous sections have all identified key requirements that need to be addressed in the development of the IDE. This includes funding, procurement, implementation and operations of the IDE. A phased and scalable implementation approach is likely due to the complexity of the implementation, the availability of the data from the various partners and the availability of funding. A phased approach, however, will help the North Florida IDE be more successful in the long term, as it will allow lessons to be learned by the developer and the local agencies in terms of implementation, data normalization, access to new or evolving data sources, expected use and cost.

7.1 Funding

The most similar Smart City data management system is the Smart Columbus Operating System (SCOS) which is designed and planned to accept data from 1100 sources and provide data feeds to the public and private sector. The implementation of this data portal is estimated to cost $2.5 million[17], and it will serve as the baseline for the overall smart data portal for the City of Columbus system. This cost does not include the final design, operations or the outreach activities identified in the previous section. While an initial implementation at a reduced cost can be done, to fully realize the potential benefits of the IDE, funding that includes a full implementation, outreach and operations needs to ultimately be identified.

The Columbus implementation was solely funded as a public investment. The North Florida Data Exchange should consider potential funding options, including a public-private partnership or coordination with other similar efforts by FDOT or Jacksonville Transportation Authority (JTA).

7.1.1 Initial Implementation

An initial, or prototype, implementation of the North Florida IDE has been discussed to get the project off the ground, develop momentum for the program within the region and serve as a data gateway for an initial data intensive project. The initial implementation will be focused around the data needed for the region's Congestion Management Program (CMP). While this implementation will be focused on a specific project, it will lay the foundation for future enhancements. Specifically, the initial implementation will focus on batch data input and output as the data needed for the CMP is derived from static data set. The initial implementation will also not include a graphical front end, user approval, API/SDK support, or a real-time method for data input or access.

A second regional initial implementation is being implemented in St. Augustine as part of their Parking and Mobility program and is occurring independently of the work being done by the North Florida IDE. The St. Augustine data will ultimately be ingested into the North Florida IDE when it's implemented. The St. Augustine system is integrating static data regarding the number and location of parking spaces from the City Geographic Information System (GIS), data from the City parking meters and pay stations, data from the new City mobile parking application and data from the new parking enforcement system. The

[17] http://www.dispatch.com/news/20180416/council-hires-local-firm-to-create-operating-system-for-smart-columbus-project

data management system will integrate data from metered on-street parking, permit on-street parking, surface parking lots and the parking structure that supports downtown St. Augustine. Over time, the data will be used to develop and manage parking policy in the City, support a regional traffic management system to direct vehicles to available parking and, ultimately integrate into a full regional system that can support overall traffic management by integrating the parking data into traffic signal system data, a drawbridge status notification system and the freeway management system along I-95.

7.1.1.1 Asset Management

Aside from initial funding for implementation through traditional means, there is significant potential to use the IDE as a data repository and analytic tool for asset management through an innovative partnership with agencies throughout the region. By incorporating the data from the local transportation agencies into the IDE, applications can be developed that make the management of those assets more efficient. Though the data sharing and operations agreements, a portion of the savings associated with more efficient management of the assets can be applied to the operations of the IDE.

Funding the IDE through the efficiencies gained through the asset management program will require an investment to determine the actual cost savings. This will require a before and after study and an agreement between the operator of the IDE and the owner of the assets that puts a value on the asset management efforts. Funding the IDE through savings in asset management may also require additional contracts between the IDE operator and each agency.

7.1.1.2 Initial Potential Data Partners

As part of the initial prototype IDE, the following agencies have been identified as likely sources of data:

- City of Jacksonville
- Florida Department of Transportation
- City of St. Augustine
- JAX Port
- Jacksonville Airport Authority
- CSX
- Local parking operators

7.1.2 Operations and Maintenance

While there is a significant effort required to develop the IDE, a budget must also be established to support the operations and maintenance of the IDE. Since the IDE is intended to be hosted in the cloud, the operations costs will essentially be limited to the costs associated with data storage and CPU cycles for the could service. These costs can be estimated for the initial or prototype system once the data sets for the initial deployment are identified.

The operations costs will also require system administration costs to manage the day-to-day operations. This may include developing and coordinating agreements, ensuring data quality, security and privacy and responding to technical questions and issues. The operations costs will also include developing

reports as needed and providing general oversight, as well as all the financial project accounting, such as paying the bills associated with the cloud service.

For the IDE, the maintenance costs fall into three primary categories. The first category has to do with improvements made to the IDE as a result of new requirements. The improvements in this category are typically minor in nature, such as modifying the user interface, adding a new data source or implementing a new report that documents system usage. Major improvements, such as converting from a system that manages only static data to one that includes real-time data or adding a new, planned feature, are considered part of the development costs and would need to be budgeted separately from maintenance.

The second category of maintenance costs is for the diagnosis and repair of errors in the original software. These errors could be identified by the development team or users.

The third category of maintenance costs is associated with external components that impact the IDE. For example, the underlying operating system could be updated to fix a bug or a security patch and that update could impact the IDE requiring a modification to the IDE. While these software changes are often minor, there is time required to identify any potential issues and repair them.

As a preliminary estimate, the operations and maintenance costs for the IDE will likely fall between five (5) to 10 percent of the implementation cost per year.

7.2 Procurement

There are several procurement methods available under Florida Statute (F.S.) that may be used for acquisition of commodities or services related to the IDE.

- Use of Department of Management Services (DMS) or Federal General Services Administration (GSA) Contracts
- Competitive solicitation processes authorized by F.S. 287.057
  - Invitation to Bid (ITB)
  - Request for Proposals (RFP)
  - Invitation to Negotiate (ITN)

7.2.1 Department of Management Services (DMS)[18]

The DMS was established under Chapter 287 of F.S. as the business arm of the Florida State Government. It uses a prequalification process to identify vendors and professional services to negotiate statewide contracts. These statewide contracts have predefined types of services and establish a schedule of rates with the intent of reducing costs for all agencies. DMS also allows for the acquisition of commodities or services through GSA contracts which follow a similar process for federal contracts.

[18] Adapted from https://www.dms.myflorida.com/

The schedule where services could be acquired for this project will be through the Information Technology Equipment, Software, and Services252-GSA Schedule 70 (Commodity Codes 43000000, 45000000).

This alternate contract source includes commercial information technology equipment, software and services, including electronic credentials, digital certificates, e-authentication hardware tokens, remote identity and access management services, purchase of used or refurbished equipment, public key infrastructure shared service providers program, PIV solutions, purchase of new IT equipment, maintenance and repair services, software, training courses, IT professional services, eCommerce services and wireless services.

The anticipated procurement of an IDE is estimated to fall within the GSA guidelines for procurements at $150,000 to $10 million. In these cases, the Buyer must provide an Request for Qualification (RFQ) to more than three (four or more) GSA Schedule 70 vendors. GSA Schedule 70 vendors without the cooperative purchasing designation may be counted for purposes of this requirement, provided vendor responds with a quote. The Buyer should ultimately select the Cooperative Purchasing vendor that offers the best value.

When determining the best value, the Buyer must ensure that all quotes received are fairly considered and award is made in accordance with the RFQ and Chapter 287, F.S. and consider the following:

- Price
- Past performance
- Special features of the supply or service required for effective program performance
- Probable life of the item selected as compared with that of a comparable item
- Warranty considerations
- Maintenance availability
- Environmental and energy efficiency considerations
- Delivery terms
- Trade-in considerations

Approved vendors in each of the following categories may provide commodities or services in the following areas

- IT Research and Advisory Services
    - White papers
    - Research reports
    - Subscription services
    - Strategic analysis reports
    - Advisors
    - Planning assumptions
    - Industry trends/issues and best practices
    - Research, summaries, and bulletins

- Cyber Security
    - Incident Response Agreements
    - Assessments

  - Preparation
  - Developing Cyber-Security Incident Response Plans
  - Training
  - Mitigation Plans
  - Identity Monitoring, Protection, and Restoration

- Commercial off-the-shelf products through Carahsoft Products. A list of the products available is provided at http://www.carahsoft.com/buy/slg-contracts/florida-state-contracts/state-of-florida.

7.2.2 Competitive Selection Methods

There are three (3) competitive solicitation processes authorized by Florida law: the invitation to bid (ITB), request for proposals (RFP), and invitation to negotiate (ITN). Refer to Section 287.057(1)(a), F.S., for ITB requirements and guidelines, Section 287.057 (1)(b), F.S., for RFP requirements and guidelines, and Section 287.057 (1)(c), F.S., for requirements and guidelines unique to the ITN.

Invitation to Bid: The invitation to bid shall be used when the agency is capable of specifically defining the scope of work for which a contractual service is required or when the agency can establish precise specifications defining the actual commodity or group of commodities required.

- All invitations to bid must include:
  - A detailed description of the commodities or contractual services sought; and
  - If the agency contemplates renewal of the contract, a statement to that effect.
- Bids submitted in response to an invitation to bid in which the agency contemplates renewal of the contract must include the price for each year for which the contract may be renewed.
- Evaluation of bids must include consideration of the total cost for each year of the contract, including renewal years, as submitted by the vendor.
- The contract shall be awarded to the responsible and responsive vendor who submits the lowest responsive bid.

Request for Proposals: An agency shall use a request for proposals when the purposes and uses for which the commodity, group of commodities, or contractual service being sought can be specifically defined and the agency can identify necessary deliverables. Various combinations or versions of commodities or contractual services may be proposed by a responsive vendor to meet the specifications of the solicitation document.

- Before issuing a request for proposals, the agency must determine and specify in writing the reasons that procurement by invitation to bid is not practicable.
- All requests for proposals must include:
  - A statement describing the commodities or contractual services sought;
  - The relative importance of price and other evaluation criteria; and
  - If the agency contemplates renewal of the contract, a statement to that effect.
- Criteria that will be used for evaluation of proposals must include, but are not limited to:
  - Price, which must be specified in the proposal;
  - If the agency contemplates renewal of the contract, the price for each year for which the contract may be renewed;

  - Consideration of the total cost for each year of the contract, including renewal years, as submitted by the vendor; and
  - Consideration of prior relevant experience of the vendor.
- The contract shall be awarded by written notice to the responsible and responsive vendor whose proposal is determined in writing to be the most advantageous to the state, taking into consideration the price and other criteria set forth in the request for proposals. The contract file shall contain documentation supporting the basis on which the award is made.

Invitation to Negotiate: The invitation to negotiate is a solicitation used by an agency which is intended to determine the best method for achieving a specific goal or solving a problem and identifies one or more responsive vendors with which the agency may negotiate to receive the best value.

- Before issuing an invitation to negotiate, the head of an agency must determine and specify in writing the reasons that procurement by an invitation to bid or a request for proposal is not practicable.
- The invitation to negotiate must describe the questions being explored, the facts being sought, and the specific goals or problems that are the subject of the solicitation.
- The criteria that will be used for determining the acceptability of the reply and guiding the selection of the vendors with which the agency will negotiate must be specified. The evaluation criteria must include consideration of prior relevant experience of the vendor.
- The agency shall evaluate replies against all evaluation criteria set forth in the invitation to negotiate to establish a competitive range of replies reasonably susceptible of award. The agency may select one or more vendors within the competitive range with which to commence negotiations. After negotiations are conducted, the agency shall award the contract to the responsible and responsive vendor that the agency determines will provide the best value to the state, based on the selection criteria.
- The contract file for a vendor selected through an invitation to negotiate must contain a short plain statement that explains the basis for the selection of the vendor and that sets forth the vendor's deliverables and price, pursuant to the contract, along with an explanation of how these deliverables and price provide the best value to the state.

In all three methods, an agency may conduct a conference or written question and answer period prior to the time for receipt of bids, proposals, or replies, for purposes of assuring the vendor's full understanding of the solicitation requirements. The vendors shall be accorded fair and equal treatment.

7.2.3 Unsolicited Proposals

Based on a review of the potential for consideration of an unsolicited proposal in the procurement of the IDE through a public-private partnership (P3), no authority to procure the types of commodities or services could be found. F.S. 337.251 addresses lease of right of way for transportation project, F.S. 334.30 addresses P3 for transportation projects but the types of projects eligible are for construction projects that are included in the FDOT's Strategic Intermodal System Plan, and F.S. 343.962 addresses P3 procurement for transit authorities and other regional transportation authorities, but does not address information technologies.

If an unsolicited proposal were received for the IDE, the agency should consult the DMS to establish the authority and procedures to consider the proposal.

7.2.4 Sunshine (Florida Public Records Law, Chapter 119 F.S.)

To ensure competitive procurement, care should be made to provide protection for materials that were submitted by the proposer identified as trade secrets or other properties identified in F.S. 288.9627 (Exemptions from public records and public meetings requirements for the Institute for Commercialization of Florida Technology) and F.S. 119.084 (Copyright of data processing software created by governmental agencies; sale price and licensing fee).

7.3 Ownership of the IDE

The ownership of the IDE is partially dependent on the contract under which the IDE is developed. The prototype IDE is being developed through a contract with the North Florida TPO. The current contract language gives the North Florida TPO ownership of the IDE. However, the TPO has the option of waiving the ownership requirement. Through this model, the developer of the prototype IDE would maintain rights to the IDE and be permitted to continue development efforts and the TPO would not have any responsibilities for operations or maintenance.

7.4 Timeline

The IDE will be developed in multiple phases that are dependent on funding and data availability. The primary phase, the prototype IDE, will be developed as part of the Congestion Management Plan. Following phases that enhance the IDE to accept and distribute data in real-time, as well as enhancements to the data portal that include the development of APIs and SDKs. The components of the prototype development schedule are shown in Figure 4.

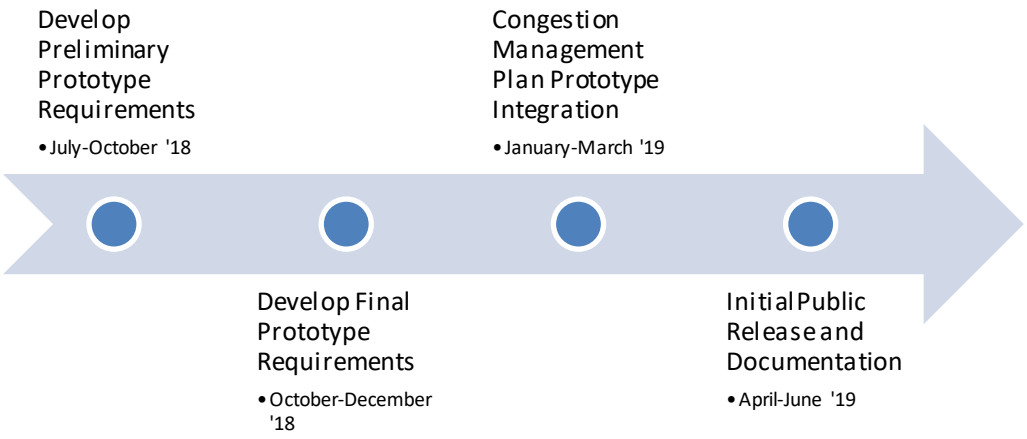

Figure 4. Prototype IDE Milestones

The process of development of the prototype IDE will serve as a model for development of future phases of the IDE as shown in Figure 5. The future phases will follow a model of stakeholder involvement to identify both available and appropriate data sources for that phase, along with developing agreements to integrate that data into the IDE, database design and normalization, IDE updates and documentation. It is anticipated that this process will continue as new data sources are

developed or identified and users are taking advantage of the IDE by using the data to develop new applications and use existing applications.

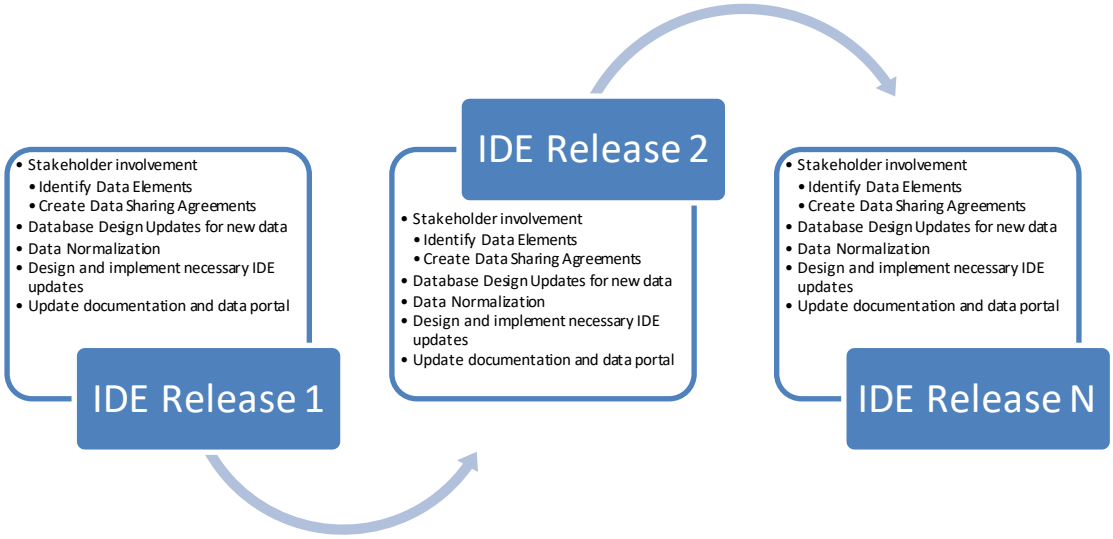

Figure 5. Future IDE Development Process