LYNX 2022 ITS Strategic Plan Update

Final Draft

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1.1   ITS Definitions and History at LYNX

Transportation technology has been evolving at a rapid pace, in line with innovations throughout the technology industry. This has enabled transit and other transportation agencies to provide increasingly more sophisticated Intelligent Transportation Systems (ITS) that enable more cost effective and convenient operations.

ITS are the digital technologies that support transit operations. These systems include technologies such as Computer-Aided Dispatch/Automatic Vehicle Location (CAD/AVL), Closed-Circuit Television (CCTV), Automatic Passenger Counters (APC), Transit Signal Priority (TSP), Interactive Voice Response (IVR), and advanced fare collection equipment. While Information Technology (IT) systems may be a part of and support ITS systems, they are distinct in that IT systems are generally used to support administrative and business functions through the use of spreadsheets, word processing, presentation, accounting, and human resource applications.

LYNX has embraced ITS since 1997, with the advent of initial ITS applications on its LYMMO system (most notably Transit TV and TSP). LYNX's initial ITS Strategic Plan was completed in 2003, followed by updates to that plan in 2011 and 2016. LYNX is committed to regularly updating their ITS development activities and applications by developing ITS plan updates every five years, thus leading to the current 2022 ITS Strategic Plan Update. The U.S. Department of Transportation (USDOT) requires all transit agencies requesting federal funds for ITS enhancements to have such an updated plan in place.

1.2   Document Overview

This document is an update to LYNX's 2016 ITS Strategic Plan. The plan is being updated to reflect the current state of LYNX technologies, present LYNX's vision of the ITS systems and technologies that should be implemented in the future, and prepare the ITS work program to achieve this vision. The vision should be based upon the needs of LYNX customers as well as the departments and divisions of LYNX, support the regional vision of local jurisdictions, and position LYNX to continue to be recognized as a leader in ITS implementation.

ITS systems and other key technology advancements are necessary for LYNX to operate and maintain a secure and safe transit system. This Strategic Plan should provide a roadmap for implementing dynamic software and hardware systems and services in keeping with state, local, and federal standards and requirements associated with the delivery of efficient transit services.

The needs assessment and existing and prospective technology overview provided in this document are intended to provide a baseline for ITS recommendations for the agency. For each department, existing conditions, gaps in technology to meet existing and future needs, and best practices involving ITS systems to address the gaps have been assessed.

Upon completion of a draft of the needs assessment, interviews were conducted to review and confirm improvements. The content was subsequently updated, and updates were utilized for ITS Strategic Plan and program development. The intent of the recommendations provided herein is to have proposals for shovel-ready projects prepared, so they can be used to seek Federal or other funding.

The following documents were reviewed and integrated during the creation of this document:

- LYNX 2016 ITS Strategic Plan Update
- LYNX Fleet Management Program (FMP), 2020-2021
- LYNX Transit Development Plan (TDP), 2021 Annual Update
- LYNX Transportation Disadvantaged Service Plan (TDSP), 2018-2023
- LYNX Transit Asset Management (TAM) Plan, 2021

This ITS Strategic Plan is organized into the following two sections followed by three appendices providing analysis and backup documentation:

Section 1: Executive Summary

Section 2: ITS Strategic Plan Vision, Goals, and Recommendations

Appendix A: Review and Summary of Past ITS Strategic Plans

Appendix B: Overview of Existing and Prospective ITS Technologies

Appendix C: Agency-wide and Department Needs Assessment

1.3 ITS Strategic Plan

This ITS Strategic Plan has been developed and updated based on guiding principles of the agency's leadership. LYNX's primary mission is to provide safe and effective transit service to its customers. It is able to do so by deploying workable solutions, some of which are ITS-based. This mission is supported by the following four goals, identified in the latest LYNX TDP document:

- Deliver a seamless network of transportation services for the region
- Advance an equitable, safe, dynamic, and performance driven transit system
- Enhance customer experience and communications
- Promote economic competitiveness, sustainability, and quality of life

The ITS Strategic Plan's vision statement includes focusing on applications of ITS to provide enhanced services and communication to transit riders, increase the efficiency of vehicle operations and maintenance, and streamline internal organizational practices, in particular workflow processes and paperless documentation. Additional and updated principles were obtained through staff interviews with LYNX management during the needs assessment process. These discussions have resulted in the following seven goals of the ITS program at LYNX:

1. Focus on LYNX's core mission of providing transit services.
2. Increase coordination with regional agencies on facilitation of LYNX operations.
3. Develop enhanced performance monitoring of all aspects of LYNX operations.
4. Any data used or provided by LYNX meets applicable industry standards, so that it can be used to support third-party applications that customers are already using to meet their needs.
5. Improve operations and maintenance practices to increase fleet readiness and increase cost effectiveness.
6. Minimize risk to the extent possible by integrating the safety and security of projects as a top priority, including cybersecurity.
7. Develop enhanced IT systems and training to achieve a reduction in paper processing and improved access to databases.

1.4 Existing and Prospective Technologies

Appendix B reviews the latest applications in ITS technology, some of which LYNX has already deployed, and some of which LYNX is interested in potentially deploying in the coming years. These trends include:

- Voice and Data Communications
- Mobile Applications
- Real-Time Passenger Information
- Transit Signal Priority
- Security Systems
- Maintenance Systems
- Electric Vehicles
- Bus Technology/Connected and Automated Vehicles
- Fare Collection
- Internal Management Systems

LYNX's experience with many of these technologies lays a strong groundwork for future innovation. For example, good progress has been made with respect to regional implementation of TSP, with the Florida Department of Transportation (FDOT) taking the lead in funding signal system improvements and LYNX responsible for any on-bus equipment. The focus going forward should be on expanding the number of signals and buses with TSP-activating equipment, and LYNX may need to take the lead on determining which locations would be best suited for a TSP implementation that meets the agency's needs, rather than the needs of individual jurisdictions within its service area.

1.5 Needs Assessment

In the review of past ITS plans, it became apparent that many of the identified projects were not implemented, to a large extent because of limited funding being available, and also due to concerns with technology evolving so quickly, that it is difficult to determine when the best option will become available. In the interviews with the different LYNX departments, there was a general interest in trying out the ITS applications available, but also a desire to better understand the full capabilities of existing software and hardware in-house. In general, staff felt a critical need to reduce the amount of paper processing within the organization, and to develop more streamlined communication channels between departments and with regional partners. At the same time that these needs were identified, there was consensus that LYNX has been a cutting edge agency in applying ITS, and was recognized as a transit agency willing to conduct demonstration projects to test the latest in ITS technology.

In some cases, LYNX has multiple different applications either under development or being considered to provide a solution to meet different department needs. In the needs assessment interviews, LYNX staff felt that fewer, more consolidated applications would be easier from a software development, maintenance, and customer understanding perspective, as well as to enhance communication and integration across departments.

Individual department updates are included in Appendix C. It is worth noting that because LYNX does not have a dedicated operations funding source, departments generally plan within just a 1 to 2-year time frame. While there are some exceptions, like Maintenance (which has a 10-year fleet plan), for departments with shorter planning time frames, the department summaries and

interviews have included more informal discussions on ITS needs and plans that look beyond their typical planning period.

2 ITS Strategic Plan

2.1 Stakeholder Involvement Process

An online survey and virtual interviews were conducted with management staff from each LYNX department. A discussion guide was prepared prior to each interview, to enable an interactive discussion with the project team to identify department characteristics and needs and assist the department in identifying potential ITS applications and technologies that may be useful. These interviews were based on how LYNX does and should do business from the viewpoint of each department, and were not intended to be limited to technology solutions. The expectation was that the outcomes would not be exclusively ITS recommendations, and could also be "lower" levels of technology or non-technology solutions that solve a need at a lower cost and complexity.

Invitees were encouraged to bring representatives from their department that can provide meaningful input to the interview. They were also provided with any responses previously received to the online survey that was developed as a precursor to the ITS interview, to obtain insights related to achievements, resources required, data needed, and system coordination involving ITS applications. Interviewees generally reflected on and came prepared with answers to the questions asked in the survey, which provided useful information at each interview.

The interview discussions were intended to form an understanding of not just what current processes and systems can do, but of needs that can be solved. During the interviews, the project team shared the existing data flow diagrams shown in the 2016 ITS Strategic Plan and asked for comment, while also presenting known information on each department that was summarized prior to the interview. The discussions are intended to be relatively informal rather than following a pre-defined script.

Meeting summaries have been prepared for each interview session. These summaries have been submitted to LYNX for review and updated accordingly. Relevant content has been integrated into the appropriate sections and appendices of the ITS Strategic Plan.

2.2 Vision Statement

The 2022 LYNX ITS Strategic Plan will provide a road map for the implementation of ITS to facilitate all aspects of LYNX operations, planning, and administrative functions. The focus of enhanced ITS applications will be to provide enhanced services and communication to transit riders, increase the efficiency of vehicle operations and maintenance, and streamline internal organizational practices, in particular workflow processes and paperless documentation. These applications will also allow for greater connectivity among bus, paratransit, SunRail, and bike share services, while at the same time providing for safer and more secure operations and facilities for transit riders and LYNX personnel. Specific projects within the LYNX ITS Strategic Plan will need to be achievable over a 20-year time frame given realistic estimates of available funding sources, including contributions from local agency partners.

2.3 Goals and Objectives

Seven goals were created to guide the development of the 2022 LYNX ITS Strategic Plan Update. Specific objectives associated with these goals were also created. The goals and objectives were identified from input received from the various LYNX stakeholder interviews, and a review of the goals and objectives and the extent of their achievement from the 2016 LYNX ITS Strategic Plan Update.

Table 1: Goals and Objectives Framework for 2022 ITS Strategic Plan Update

Goal	Objective
1. Focus on LYNX's core mission of providing transit services.	Objective 1A: Provide the services requested by regional funding partners in support of their programs. Objective 1B: Perform a needs and systems analysis for any proposed technology solution that clearly and convincingly shows a valid operational need exists, with a feasible approach to fill that need at an affordable cost and acceptable level of risk.
2. Increase coordination with regional agencies on facilitation of LYNX operations.	Objective 2A: Implement a singular regional fare payment system, including improved fare coordination between LYNX and SunRail services. Objective 2B: Increase the application of transit signal priority on the regional street system, particularly the most heavily used and congested bus routes. Objective 2C: Continue with coordination with FDOT on integration of LYNX ITS architecture into overall regional ITS architecture.
3. Develop enhanced performance monitoring of all aspects of LYNX operations.	Objective 3A: Create a system-wide performance monitoring and tracking system for operations and fixed assets. Objective 3B: Develop new Standard Operating Procedures (SOPs) for different LYNX functions.
4. Any data used or provided by LYNX meets applicable industry standards, so that it can be used to support third-party applications that customers are already using to meet their needs.	Objective 4A: Support mobile applications related to providing real-time information to LYNX passengers. Objective 4B: Increase the number of real-time information displays at LYNX Superstops and other major bus stops, including the use of digital technology. Objective 4C: Provide real-time information and advertisements on vehicles and at stops.
5. Improve operations and maintenance practices to increase fleet readiness and increase cost effectiveness.	Objective 5A: Develop a more automated parts retrieval system for vehicle maintenance.

Goal	Objective
	Objective 5B: Develop an automated system to conduct maintenance health checks in real time.
6. Minimize risk to the extent possible by integrating the safety and security of projects as a top priority, including cybersecurity.	Objective 6A: Procure state-of-the-industry IT and physical safety systems to support enhanced safety and security at LYNX. Objective 6B: Continue to pursue risk management strategies and procedures to minimize risk to the agency and its customers. Objective 6C: Update the methods for communicating urgent information to all LYNX staff.
7. Develop enhanced IT systems and training to achieve a reduction in paper processing and improved access to databases.	Objective 7A: Develop automated vendor and consultant solicitation and payment processes. Objective 7B: Increase LYNX staff training on the application of existing and new software to increase their application to facilitate LYNX activities.

2.4 Potential Funding Sources

There are several funding sources available to LYNX which could be used to implement the recommendations laid out in this ITS Strategic Plan. Additional funding opportunities are expected to be available over the short-term planning period with the recent passage of the Bipartisan Infrastructure Law. The following programs are particularly considered applicable.

2.4.1 Federal

At the federal level, the primary funding programs for transit ITS projects include FTA Section 5303 (Metropolitan Transportation Planning), Section 5307 (Urbanized Area Formula), Section 5312 (Mobility on Demand Sandbox), Section 5314 (Human Resources and Training) and Section 5339 (Grants for Buses and Bus Facilities Formula) programs. The Department of Homeland Security also has a Rail and Transit Security Program that could be used for some eligible projects.

FTA Section 5303 – Metropolitan Transportation Planning
This program funds regional planning for transit improvements including the development of performance monitoring and tracking systems, and Transit Signal Priority.

FTA Section 5307 – Urbanized Area Formula Grants
Eligible activities under this program include the planning, engineering, design, and evaluation of transit ITS projects and other ITS studies; capital investments in bus and bus-related activities such as replacement, overhaul, and rebuilding of buses; and crime prevention and security equipment where ITS enhancements are incorporated. In addition, associated transit

improvements and certain expenses associated with mobility management programs such as Access LYNX are eligible under this program.

FTA Section 5312 – Mobility on Demand (Sandbox) Demonstration Program

FTA's Mobility on Demand (MOD) Sandbox Demonstration Program, part of the larger MOD research effort at FTA and the USDOT, provides a venue through which integrated MOD concepts and solutions – supported through local partnerships – are demonstrated in real-world settings. FTA seeks to fund transit agencies to innovate, explore partnerships, develop new business models, integrate transit and MOD solutions, and investigate new, enabling technical capabilities such as integrated payment systems, decision support, and incentives for traveler choices.

FTA Section 5314b – Human Resources & Training

Under this new program, FTA may make grants or enter into contracts for human resource and workforce development programs as they apply to public transportation activities. Such programs may include employee training and research on public transit personnel and training needs.

FTA Section 5339 – Grants for Buses and Bus Facilities Formula Program

This program provides funding to states and transit agencies through a statutory formula to replace, rehabilitate, and purchase buses and related equipment and to construct bus-related facilities, which could have ITS components. In addition to the formula allocation, this program includes two discretionary components: The Bus and Bus Facilities Discretionary Program and the Low or No (LoNo) Emissions Bus Discretionary Program. The LoNo program provides funding to purchase or lease low or no emission transit buses and related equipment, or to lease, construct, or rehabilitate facilities to support low or no emission transit buses. The program provides funding to support the wider deployment of advanced propulsion technologies within the nation's transit fleet, including the integration of ITS elements.

DHS Rail and Transit Security Grant Program

This program provides funding for transit facility security improvements to transit systems that serve designated Urban Area Security Initiative jurisdictions, which includes the Orlando metro area. For a transit system to be eligible for funding, it must have a recent security assessment.

2.4.2 State

The Florida Department of Transportation has multiple funding programs for transit capital projects that could be used by LYNX to obtain funds for ITS enhancements. The most notable example is the Public Transit Service Development Program, where funds for service development projects involving the use of new technologies to improve operations, maintenance, and marketing are eligible. The State also serves as a pass-through of ITS funding to LYNX through the Federal Highway Administration and its ITS Research and Development and Integration programs.

2.4.3 Local

Local and regional partners support the operations LYNX provides in their service areas, through both financial and planning support. ITS projects that are deployed to support LYNX operations may continue to be supported by local jurisdictions, either indirectly through LYNX's general fund or with specific in-kind contributions for grant proposals and/or infrastructure support. For example, infrastructure deployed specifically for LYNX use would likely be operated by LYNX with funding provided by the local jurisdiction(s) requesting the service. There is the potential for FTA

grant and other funding sources to be considered, such as those presently used for BRT and other premium bus projects.

2.5 Prioritized ITS Improvement Program

The ITS Improvement Program proposed in this strategic plan includes short-term (next 5 years), mid-term (6-10 years) and long-term (11-20 years) strategies. Cost estimates, based on experiences that other agencies have had deploying the same technology and on department feedback, are provided for the first five years of projects. The noted initiation years are all fiscal year (October 1 through September 30) and all costs are in current U.S. dollars.

Table 2: ITS Improvement Program

Initiation Year	Project	Lead Department	Estimated Capital Cost	Estimated Annual Operating Cost	Potential Funding Source	Completion from Notice to Proceed
Short-Term Strategies (2022-2026)						
2022	Continue internal process flow mapping	Information Technology	Within staff resources	Nominal	Local	Ongoing
2022	Make data available through standards	Innovation & Sustainability	Within staff resources	Nominal	Local	Ongoing
2022	Leverage barcoded maintenance assets	Material Control	$50,000	$10,000 (system maintenance)	FTA Section 5307	1 Year
2022	Procure a new, cloud-based call center phone system	Mobility Services	$100,000	$75,000	Local	1 Year
2022	Set up automated call attendants	Mobility Services	$115,000	$100,000	Local	1 Year
2022	Procure a new software for NeighborLink	Mobility Services	$300,000	$200,000	FTA Section 5307	1 Year
2022	Continue participation in Regional TSP Program	Planning	$1,000,000	$50,000 (emitter maintenance)	FDOT or FTA Section 5303/5307	5 Years
2022	Streamline and improve NTD reporting and information sharing with other local agencies	Planning	Within staff resources	Nominal	Local	Ongoing
2022	Improve data flow between systems	Planning/ Information Technology	Within staff resources	Nominal	Local	Ongoing
2023	Complete agency-wide adoption of Standard Operating Procedures	All Departments	Within staff resources	Nominal	Local	Ongoing
2023	Conduct systems engineering training	Engineering and Information Technology	Within staff resources	Nominal	NTI	Ongoing
2023	Implement a system for tracking fixed assets	Finance	$50,000	$10,000 (system maintenance)	FTA Section 5339	1 Year
2023	Enhance paperless document management	Finance	Within staff resources	Nominal	Local	Ongoing

Initiation Year	Project	Lead Department	Estimated Capital Cost	Estimated Annual Operating Cost	Potential Funding Source	Completion from Notice to Proceed
2023	Enable in-vehicle credit card payments	Finance	$1,255,000	$120,000	Local or FTA Section 5307	1 Year
2023	Automate processes for employee management	Human Resources/ Training	$50,000	Nominal	FTA Section 5307	1 Year
2023	Support an AV pilot	Innovation & Sustainability	$500,000	$600,000	Federal grant or vendor support	2 Years
2023	Implement automated maintenance health checks	Maintenance	$200,000	$20,000 (system maintenance)	FTA Section 5307	1 Year
2023	Improve the fare media system for demand response service	Mobility Services	$500,000	$25,000 (system maintenance)	FTA Section 5307	1 Year
2023	Continue to enhance current routing, scheduling, and dispatching methods	Transportation	Within staff resources	Nominal	Local	Ongoing
2024	Procure an endpoint detection and response (EDR) system	Information Technology	$125,000	$25,000	Local	6 Months
2024	Add kiosks, TVs, and other enhancements at strategic locations	Marketing & Communications	$125,000	$25,000	FTA Section 5307	1 Year
2024	Implement IVR system at call center	Mobility Services	$200,000	$10,000 (system maintenance)	FTA Section 5307	2 Years
2024	Create a system wide performance monitoring and tracking system	Planning	$10,000	Nominal	FTA Section 5303	1 Year
2024	Procure an enhanced RMIS system	Risk Management	$300,000	$10,000 (system maintenance/ licensing)	FTA Section 5307	1 Year
2024	Update the methods for communicating urgent information to all LYNX staff	Safety & Security	$50,000	Nominal	Local	1 Year
2025	Procure a project management software	Finance (Engineering)	$100,000	$5,000 (system maintenance/ licensing)	FTA Section 5307	1 Year
2025	Procure a contract management and procurement software	Finance (Procurement)	$200,000	$10,000 (system maintenance/ licensing)	FTA Section 5307	1 Year
2025	Continue to improve the grant reconciliation system with financial data	Grants	Within staff resources	Nominal	Local	Ongoing

Initiation Year	Project	Lead Department	Estimated Capital Cost	Estimated Annual Operating Cost	Potential Funding Source	Completion from Notice to Proceed
2025	Procure a DBE compliance database software	Legal and Compliance	$100,000	$5,000 (system maintenance/ licensing)	FTA Section 5307	6 Months
2025	Implement a Safety Management System (SMS)	Safety & Security	$500,000	$50,000	Local or FTA Section 5307	2 Years
2026	Create an Integrated LYNX and SunRail payment system	Finance	$300,000	$100,000 (equipment maintenance, fare card replenishment)	FTA Section 5303	2 Years
Mid-Term Strategies (2027-2031)						
	Continue regional integration with SunRail and other regional partners	Executive				
	Streamline grant reporting	Grants				
	Pursue crowdsourcing for vehicle and facility maintenance needs	Maintenance				
	Implement real-time advertising on buses as a potential revenue source	Marketing & Communications				
	Bring handling of claims in house	Risk Management				
	Acquire next-generation of buses, focusing on electric vehicles	Transportation				
	Implement new technology to help with point-to-point directions for fixed route passengers	Transportation				
	Continue to monitor collision avoidance system technologies	Transportation				
Long-Term Strategies (2032-2041)						
	Implement connected vehicle technology for all buses in fleet	Transportation				
	Complete bus retrofit to include latest in automated vehicle technology	Transportation				
	Monitor and pursue the benefits of an automated bus yard	Transportation				

2.5.1 Short-Term Strategies

In the next five years, emphasis should be placed on ITS investment to include affordable, off-the-shelf, new technologies. The estimated capital costs of the short-term strategies is just over $6 million, with annual operating costs at slightly less than $1.5 million.

Continue Internal Process Flow Mapping

As part of this ITS Strategic Plan Update, and the concurrent GIS Strategic Plan Update, communication and data flows within LYNX were identified and mapped. This process was very useful to understand the required and desired interrelationships between different departments, and to identify where ITS applications could improve coordination. It is recommended that the IT Group continue to develop these process flows more specifically and work with departments on required software and hardware enhancements.

Make Data Available Through Standards

LYNX intends to continue to make data available through standards to support externally-developed applications, for both data that is already provided and any newly emerging standards, rather than developing additional applications in house or contracting out the ability to create a LYNX-specific application.

Leverage Barcoded Maintenance Assets

Maintenance assets at LYNX have been barcoded, and could be leveraged to enable an automated process for work order and parts list generation. An organized system for tracking the location and condition of all of LYNX's fixed assets should be pursued, using appropriate coding and inventory programming. This system would be implemented over several years, with assets including vehicles, new parts used for maintenance, and shelters and other passenger amenities at stops and stations.

Procure a New, Cloud-Based Call Center Phone System

The implementation of an Internet cloud-based Contact Center service will augment customer communication with LYNX Mobility Service Representatives by using different methods of communication including voice calls, SMS messaging, and web-based chat. This project is currently out to bid, with vendor selection in the process of being finalized.

Set Up Automated Call Attendants

Call attendants often answer the same questions, including those on bus scheduled arrival times and route alerts, which are available in text form and could be communicated automatically in audible form over the phone system as well. This would enable call attendants to help with reservations and responses to less common information requests, rather than spending their time providing information that is otherwise easily accessible automatically.

Procure a New Software for NeighborLink

The scheduling, dispatching, and reservation software for NeighborLink is currently outdated, and could be updated. A potential solution would incorporate both paratransit and NeighborLink to further streamline the two systems.

Continue Participation in Regional TSP Program

LYNX's participation in transit signal priority (TSP) to date has focused on the acquisition and installation of bus emitters and cabling to connect with the mobile data terminal (MDT) related to a portion of the bus fleet. This relates to initial TSP implementation on designated LYNX routes accessing existing SunRail stations. Further retrofit of the LYNX bus fleet to more broadly

implement TSP has been proposed over the years, with TSP application on added roadways as identified in coordination with FDOT and local cities and counties. Expanding the TSP program with LYNX-led initiatives (including new applications and locations) will require LYNX to take a more active role in a program that has largely been led by FDOT in the past.

Streamline and Improve NTD Reporting and Information Sharing with Other Local Agencies

LYNX is required to report certain operational, cost, and maintenance information to the federal government through the National Transit Database (NTD). Much of this reporting is currently done manually, through department-specific spreadsheets and similar, so the ability to automatically collect, validate, and report this information will reduce redundant work between departments and improve the standard flow of information.

Improve Data Flow Between Systems

Individual departments need to understand their processes and where they can make process improvements for data flow or data usability. Building in systems that capture the flows that are more manual in nature, and identify what could be more automated, would be a big help to move towards better utilizing staff time and eliminating redundancies in data collection, sharing, and management between departments across the agency.

Complete Agency-wide Adoption of Standard Operating Procedures

Some departments have completed their SOPs, but not all departments at LYNX have. This has created a bit of a disconnect within the agency, as departments are responsible for reviewing and referencing each other's SOPs. The SOPs that do exist provide guidance on specific tasks and initiatives, but they need to be fully adopted and integrated with other department SOPs to be most successful.

Conduct systems engineering training

Systems engineering, described in further detail in Section 2.6, is an important planning process for high-technology systems. While many at LYNX are familiar with the concept, direct training and engagement on how and when to utilize it successfully will be essential to the seamless deployment and integration of the many projects outlined within the ITS program.

Implement a System for Tracking Fixed Assets

Facilities Maintenance would benefit from a system to track the state of good repair of fixed assets, as recommended in LYNX's Transit Asset Management (TAM) Plan. This may necessitate the procurement of a separate software system, but it will greatly enhance the ability to understand more clear and accurate data.

Enhance Paperless Document Management

LYNX staff across the agency have indicated that there is too much paper transfer between departments related to vendor solicitation and procurement, invoice processing, employee management functions such as timesheets, payroll, and training, and other tasks. To better automate such processes, enhanced IT applications are recommended, and modifications to existing LYNX ITS system architecture would be needed to facilitate this. This improvement has the potential to great enhance workflows for approvals and requisitions, especially with remote work.

Enable In-Vehicle Credit Card Payments

Implementation of the mobile payment system is complete. The next step to making the payment system even more user-friendly is to add in the ability to take credit card payments on vehicles.

Automate Processes For Employee Management

HR currently has to pull and refile personnel files to get any information, which can be an especially onerous process as new employees are hired. A more sophisticated computerized employee file storage system that includes timesheets, payroll, and training, and would house all HR documents and manage all applications, employee change forms, FMLA paperwork, in one, paperless place would simplify and streamline this process.

Support an AV Pilot

A study was commissioned by LYNX in December 2019 to develop a Concept of Operations for a future AV application on the LYNX system, and identify a potential location and configuration for an initial AV pilot project to supplement fixed route service and enable LYNX to experience the technology first hand. This includes assessing the feasibility and configuration for an initial AV pilot project on the Orange Line in downtown Orlando as well as a decision-making framework for determining if, when and how AVs could be applied on other parts of the system in the future. This would include assessing opportunities for introduction of AVs to circulator, NeighborLink, and even line-haul services over time.

The next step to operationalizing these recommendations is to identify potential funding sources and strategies, and use these to support a Request for Proposal (RFP) process for vendor support for an initial pilot, prior to more widespread implementation of AVs throughout the services that LYNX provides. Maintaining a consistent understanding of the technology, by conducting research and hands-on pilot projects while also monitoring what is happening elsewhere, will help ensure that the Central Florida region continues to play a part in how this technology is developed and ultimately deployed to benefit the local public.

Implement Automated Maintenance Health Checks

An enhanced vehicle diagnostic system should be implemented over time that would allow for real-time health checks on the operation of LYNX buses and preventive maintenance scheduling when needed. This would involve enhanced mobile data terminals as well as monitoring capability at the LYNX dispatch center.

Improve the Fare Media System for Demand Response Service

Improvements made to the fixed route fare payment system should also be implemented on demand response service, including paperless and Smart Card fare payment options. This will require additional costs, but will ultimately improve consistency across the agency and improve the cost efficiency of demand response service.

Continue to Enhance Current Routing, Scheduling, and Dispatching Methods

Systems for calculating estimated times of arrival (ETA's) and improving routing, scheduling, and dispatching are constantly being innovated, and LYNX should take advantage of these innovations to continuously enhance the systems it has and provide more accurate information to customers.

Procure an Endpoint Detection and Response (EDR) System

Cybersecurity has become even more important with more people working remotely. To enhance cybersecurity, LYNX will be needing an EDR system. There already plans to add this request to the next budget proposal cycle.

Add Kiosks, TVs, and Other Enhancements at Strategic Locations

Adding additional sources of information at strategic locations will enhance passenger experience and readiness. LYNX could use these tools to broadcast information and potentially as an advertising revenue source. Real-time advertisements would be installed at all LYNX Superstops and other major designated stops.

Implement IVR System at Call Center

This project would implement an Interactive Voice Response (IVR) system to assure that prospective LYNX customers can receive information if a call center representative is not available. This would supplement the interactive mobile information application that was already developed.

Create a System Wide Performance Monitoring and Tracking System

LYNX does not currently have a total, holistic tracking system in place for monitoring systemwide trends and characteristics, beyond some individual department tools and static monitoring of parameters for system wide performance on a periodic basis. Real-time performance monitoring and creation of a dashboard for key performance indicators, enabled by systems across the agency that can talk to each other, are essential to a structured performance monitoring system that can be used in real-time to enhance agency performance. This system should be developed related to LYNX goals, objectives, and policies, and link to the organization's system architecture and National Transit Database reporting system.

Procure an Enhanced RMIS System

While LYNX does currently have an RMIS system, it is not sufficient for agency needs. Needs of a new system include a dashboard and good analytics to track key performance indicators the agency is currently tracking manually.

Update the Methods for Communicating Urgent Information To All LYNX Staff

The Safety and Security department is considering new methods to communicate with all staff in the event of an emergency or the need to communicate other immediate information. Not all employees have email access, so this should include a mobile or phone option. Lime Alert is still active, if an email or phone number is active in the system, but emerging ITS technologies could be used to provide enhanced information related to emergency communication.

Procure a Project Management Software

There is a current lack of project management software at the agency. Project management software would provide a better project register with a comparison of estimated vs. actual scope, time, and costs from all departments that can serve as project history information and be openly shared with all departments.

Procure a Contract Management and Procurement Software

There is an agency-wide need for a proper project, contract, and document tracking and management software. There may be some legal hurdles that need to be considered, but overall this software would enable the agency to better manage contract services and purchase orders, and enable additional benefits such as automatically flagging the sunset date for contracts in advance to reduce any delays with extensions or re-bids.

Continue to Improve the Grant Reconciliation System with Financial Data

Federal and state grants require different types of information, including on the GIS side. Obtaining this information is currently a manual process that involves taking the reports from

Great Plains and developing Excel worksheets for individual grants. The planning team will then follow up with project managers based on reconciliation to see if a project is still ongoing and how long it'll take to complete. If these reports were automatically developed, they could be sent directly to a project manager for verification on a regular basis, streamlining information sharing and reporting. A central location would also save data space since files wouldn't be saved by multiple departments in multiple locations.

Procure a DBE Compliance Database Software

The Legal team would benefit from a dedicated software for monitoring DBE compliance. LYNX is required to categorize and regularly report this information, and having a dedicated software to do so would remove the risk of receiving deficiencies from FTA for compliance with DBE requirements.

Implement a Safety Management System (SMS)

In the coming years, a SMS will be mandated by the FTA. An SMS is an agency-wide safety program that explains to all departments their roles related to safety. One of the major components is employee reporting of incidents that take place. Implementation will require training across the agency, both initially and as the system is integrated into additional agency processes.

Create an Integrated LYNX and SunRail Payment System

LYNX and SunRail have increased their coordination over the years, and this project would complete the fare payment system integration between LYNX bus and SunRail operations. The first step is to resolve any differences between the existing payment systems that support LYNX and SunRail operations.

2.5.2   Mid-Term Strategies

In the next 6 to 10-year period, emphasis should be placed on continuing short-term projects and pursuing some additional projects as the technology becomes more sophisticated and cost constraints allow. Costs and funding sources for these mid-term projects will be developed in the next LYNX ITS Strategic Plan Update in 2026.

Continue Regional Integration with SunRail and Other Regional Partners

The biggest impact on LYNX ITS applications in the mid-term, if it were to occur, would be the integration of SunRail into LYNX operations. Under such a scenario, LYNX would inherit the different ITS applications applied by SunRail to date, in particular its fare payment and real-time information systems, and internal operations and maintenance facility ITS systems. Further application of ITS technology by LYNX would require consideration of its impact on SunRail operations.

Streamline Grant Reporting

Building on the short-term project, an automatic process to enable automatic reporting within the agency and to regional partners, for grant reporting and other needs, should continue to be developed in the mid-term, as it would be beneficial to many departments across the agency.

Pursue Crowdsourcing for Vehicle and Facility Maintenance Needs

LYNX has expressed an interest in the adoption of crowdsourcing options, or enabling customers and the general public to report incidents and issues to LYNX directly, rather than LYNX having to collect all that information itself. This would engage customers and provide an additional mechanism for collecting critical information such as the conditions of wayside infrastructure (e.g.,

bus stop signs, bus shelters, and trash receptacles), safety concerns, and overall ridership concerns. The use of crowdsourcing can provide LYNX with a cost-effective information and data gathering option that can at the same time enhance customer involvement with the agency.

Implement Real-Time Advertising on Buses as a Potential Revenue Source
This project would be a staged implementation of real-time video information and advertisements on the LYNX bus fleet, a reestablishment of the former "Transit TV" concept on the original LYMMO bus fleet. Priority should be given to bus routes with higher ridership.

Bring Handling of Claims in House
Currently, small claims are handled in house by the Legal team. Bringing larger claims in house would require additional staffing and expertise, but there could be substantial cost savings, an increase in the follow up of subrogation, and better documentation of claims.

Acquire Next-Generation of Buses, Focusing on Electric Vehicles
LYNX's goal is transition the fleet to 50% low-emission compressed natural gas (CNG) and 50% zero-emission electric in the next 8 years. Charging options are a major need to enable this transition, and will probably be in place by 2023, and then more electric buses could be introduced into the fleet.

Implement New Technology to Help with Point-To-Point Directions for Fixed Route Passengers
Beyond the systems that LYNX already manages and supports, an applications that is particularly designed for passengers with cognitive disabilities could enable enhanced independence by providing personalized, step-by-step instructions that would likely otherwise require the guidance of a chaperone.

Continue to Monitor Collision Avoidance System Technologies
With the development of vehicle collision avoidance systems, LYNX should begin retrofitting existing buses to include some critical avoidance features, including pedestrian detection in particular, as these systems become more reliable and have measurable safety impacts. All new bus procurements should consider whether a basic set of collision avoidance features need to be included. Potential systems currently available and under development include devices to prevent collisions with other vehicles, stationary objects, and pedestrians.

2.5.3 Long-Term Strategies
In the 11 to 20-year period, emphasis should be placed on completing programs started in the mid-term and even short-term, and on decisions that need to be made as the next generation of buses are acquired. Specific cost estimates and funding sources for such projects will be developed in future ITS Strategic Plan Updates.

Implement Connected Vehicle Technology for all Buses in Fleet
Connected vehicles are equipped with wireless communication devices that allow them to share information with other vehicles and roadside equipment such as traffic signals. This can enable operational benefits for a transit agency as well as safety benefits related to the interactions of buses with other vehicles. As this technology continues to evolve, LYNX should consider when it will become part of its standard fleet procurement specifications, as there may be federal requirements and/or significant safety benefits of doing so once the technology is fully developed.

Complete Bus Retrofit to Include Latest in Automated Vehicle Technology

Automated vehicles (AV) use on-board sensors, such as cameras, radar, and light detection and ranging (LiDAR), and software to take over a portion of the driving function from the human driver. An autonomous (driverless) vehicle has a high level of automation. AV technologies are being developed by a number of private technology companies, and many are focused on applications that are directly applicable to transit systems. Based on the outcomes of the AV pilot, and lessons learned from other sources, LYNX should be able to create an informed perspective on whether, when, and in which cases to implement AVs to support its operations.

Monitor and Pursue the Benefits of an Automated Bus Yard

An Automated Bus Yard involves the deployment of buses equipped with AV equipment programmed to safely operate within the operational design domain of a bus yard. This limited, controlled environment has been seen as a starting point to introduce and demonstrate transit automation solutions to advance the evolving capabilities of the technology, increase safety within the yard, and explore the many ways to increase operational efficiency by testing AV-equipped buses on private property. With LYNX already planning to build a new bus yard, there could be the opportunity to either convert an existing facility into an Automated Bus Yard or include design concepts in the development of this new facility.

2.6 Systems Engineering Approach

It is highly recommended that LYNX use a Systems Engineering approach in undertaking all projects in this ITS Strategy Plan. Systems Engineering provides a framework for approaching and successfully implementing projects that, if followed, can lead to more successful projects. Implementing professional project management coupled with a Systems Engineering capability that employees a collaborative but rigorous systematic approach to ITS projects will be critical as LYNX transitions into multimodal operation. As defined by the Systems Engineering for Intelligent Transportation Systems Guide released in January 2007,

> *"Systems Engineering… focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem. Systems Engineering integrates all the disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation. Systems Engineering considers both the business and the technical needs of all customers with the goal of providing a quality product that meets the user needs."*

While the US DOT does not mandate regional transit authorities to use the System Engineering approach, it does require that ITS projects that use highway trust funds, including the Mass Transit Account, use a Systems Engineering approach. There are multiple, sequential steps in the ITS Systems Engineering process that need to be followed. Agency-wide training can help ensure staff are aware of and able to conduct this process effectively.

2.7 Regional ITS Architecture

The Florida Department of Transportation is responsible for maintaining the regional ITS architecture for each district and statewide. When the LYNX ITS Strategic Plan was last updated in 2016, a separate effort was conducted to update the regional ITS architecture integrating the latest LYNX projects and information flows applicable to the then identified architecture structure

using the Turbo software. Since then, FDOT has moved to the RAD-IT (Regional Architecture Development for Intelligent Transportation) software to create future updates. Updates are coordinated through the FDOT Central Office in Tallahassee, with a consultant onboard to do the actual work. Updates in projects and new projects are submitted via a new form, shown in Figure 1.

ITS ARCHITECTURE CHANGE REQUEST FORM

Instructions for Submitting Form:

Agency representative requesting changes to the Statewide, Regional or Project ITS Architectures must submit completed form electronically to FDOT District TSM&O Program Engineer, and FDOT TSM&O Program State ITS Software Engineer (sysandarch@dot.state.fl.us).

Financial Project ID (If Available): _____

Agency: _____

Agency contact's name, phone and e-mail:

Affected architecture: ☐ Statewide   ☐ District 1   ☐ District 2   ☐ District 3   ☐ Districts 4 & 6
☐ District 5   ☐ District 7   ☐ Florida's Turnpike Enterprise

Title of proposed change(s):

Detailed description of proposed change(s):

Rationale for proposed change(s):

Additional stakeholder(s) impacted by proposed change(s) (if any):

Comments or additional information (if needed):

List of attachments:

Figure 1: ITS Architecture Change Request Form

The current District 5 ITS architecture is divided into eight components, which are interrelated:

- Stakeholders
- Role and Responsibility Areas
- Elements
- ITS Services
- ITS Projects
- Information Flows
- Standards
- Agreements

The current provision for LYNX in each of these areas is summarized below.

2.7.1 Stakeholders
Over 100 agencies are identified as stakeholders in the District 5 ITS architecture, including all cities and counties in the LYNX service area, FDOT, CFX, SunRail, and other special organizations or districts.

2.7.2 Roles and Responsibilities
Stakeholder roles and responsibilities provide insights on how stakeholders participate in the ITS system. For LYNX, the role of Transit Management is identified.

2.7.3 Elements
Elements are the building blocks that are used to define ITS services. For LYNX, ten elements are identified:

- CAV Field Equipment
- Maintenance Center
- Road Ranger Vehicles
- Security Operations Center
- Transit Autonomous Vehicle
- Transit Vehicles
- Transportation Center
- Van Pools
- Virtual Travel Planning Center
- Website

A list of services with service diagrams in which the element is included is provided in each element web page.

2.7.4 ITS Services
ITS User Services describe what functions ITS perform from a user's perspective. Service packages bundle various elements. They are considered to be the building blocks of ITS, and a specific project can include multiple Services. For LYNX, the following 17 ITS Services are applicable in the architecture:

- Emergency Response
- Roadway Service Patrols
- Transit Vehicle Tracking

- Transit Fixed-Route Operations
- Dynamic Transit Operations
- Transit Fare Collection Equipment
- Transit Security
- Transit Fleet Management
- Transit Passenger Counting
- Transit Traveler Information
- Transit Signal Priority
- Multi-modal Coordination
- Transit Connection Protection
- Personalized Traveler Information
- Infrastructure-Provided Trip Planning and Route Guidance
- In-Vehicle Signage
- Traffic Incident Management System

2.7.5 ITS Projects

Specific ITS projects are identified in the architecture, involving application of different elements and bundling of service packages where applicable. Projects also identify specific information flows and functional requirements. Five projects for LYNX are identified:

- AV Concept
- Fare Integration
- Trip Planning
- TSP CAV
- Website Integration

2.7.6 Information Flows

Information flows reflect information that is exchanged between physical objects (subsystems and terminators) within the national and regional architecture. They are the primary tool used to define the ITS architecture interfaces between subsystems and terminators. About 150 information flows are identified related to the LYNX interface with the architecture.

2.7.7 Standards

Standards are important components of the information flows within the regional architecture. They facilitate application of interoperable systems without impeding information as technology advances and new approaches are identified. Twenty applicable standards have been identified, including the American Public Transportation Association (APTA), American Society of Testing Materials (ASTM), Institute of Transportation Engineers (ITE), National Transportation Communication Information Protocol (NTCIP), and Society of Automotive Engineers (SAE).

2.7.8 Agreements

The various agreements among the different stakeholder agencies and organizations within the regional architecture in implementing ITS projects is identified. For LYNX, the current applicable agreement is for the Greater Orlando Transit Signal Priority Project.

2.7.9 Areas of Update for LYNX in the Regional Architecture

Based on the list of projects and programs identified for LYNX in this ITS Strategic Plan Update, the following should be considered for integration into the District 5 Regional ITS Architecture.

- Make Data Available Through Standards
- New Cloud-based Call Center Phone System
- Continue Participation in Regional TSP Program
- Enable In-Vehicle Credit Card Payment
- Improve Fare Media System for Demand-Response Service
- Create Systemwide Performance Monitoring and Tracking System
- Create an Integrated LYNX and SunRail Payment System
- Implement Real-Time Advertising on Buses
- Implement Connected Vehicle Technology on Buses

As a follow up to this plan update, it is recommended that LYNX pursue formal updates to the architecture for the above projects, using the form identified in Figure 1.

2.8 Summary

Intelligent Transportation Systems, or ITS, are digital technologies that support transit operations. In the coming years and decades, LYNX is interested in pursuing specific ITS projects that support its core needs and priorities as an agency. Progress towards achieving these projects will be monitored throughout the agency and re-assessed in a further update of the ITS Strategic Plan in five years.

Additional background information that guided the development of the ITS Strategic Plan recommendations is provided in the appendices of this report. A more detailed supplemental needs assessment and technology overview document and a summary of survey results, interview summaries, and department-specific organization charts has also been prepared separately.

Appendices

A. Past ITS Strategic Plans

Overview

LYNX is an innovative leader in the transportation community. The 2003 LYNX ITS Strategic Plan was the first document developed in the effort to identify the ITS applications and strategies to help address the agency's needs. This plan identified a series of recommendations in a phased LYNX ITS Work Program divided into three sequential phases.

The 2011 and 2016 LYNX ITS Strategic Plans were developed as updates to the 2003 LYNX ITS Strategic Plan. These plans focused on ways that LYNX could continue innovating and included an assessment of LYNX technology, an evaluation of progress against previous Strategic Plans, a review of emerging technology trends, and identification of short-, mid-, and long-term needs.

2003 ITS Strategic Plan

The 2003 LYNX ITS Strategic Plan identified the ITS applications and strategies available to help address the agency's needs. The plan also presented a recommended phased program of ITS projects, summarized LYNX's position relative to conformance with the Federal Transit Administration's ITS Architecture Policy, and discussed funding strategies.

The following needs were identified in the 2003 LYNX ITS Strategic Plan:

- Travel Times – minimize times and make travel times as reliable as possible.
- Traveler Information – provide more information to customers at various points in their trip, make the information accurate and timely, and provide the information in an efficient, cost effective manner.
- Fare Payment – provide the ability to implement more sophisticated fare payment strategies that will allow for participation in regional integrated payment systems, reduce fare-handling costs, and provide additional convenience to riders.
- Passenger Safety – improve the ability to quickly and effectively respond to medical, security and other incidents on board vehicles and at transit facilities.
- Transit Services – enable cost-effective flexible services such as route deviation; improve the ability to make same day changes in demand-responsive service, such as adding trips to fill cancellations; and make it easier for riders to transfer, both between LYNX services and to and from other transportation systems.
- Vehicle Maintenance – reduce breakdowns, downtime, and cost of repairs through proactive and well-managed maintenance.
- Planning, Analysis and Reporting – facilitate more effective and efficient operations planning, reporting, data archiving, and planning coordination with other agencies.

Based on the examination of LYNX needs, a recommended phased LYNX ITS Work Program was developed. The program was divided into three sequential phases; within each phase, projects were identified in two categories (primary focus and secondary focus).

The Near-Term deployment phase focused on implementation of the CAD/AVL system, as a first step in the phased process of providing trip planning functionality; continuation of the ORANGES

regional electronic fare payment demonstration project; and implementation of basic phone system upgrades needed to accommodate overall LYNX communications.

The Mid-Term deployment phase focused on introducing real-time traveler information through a variety of media, derived by the CAD/AVL system implemented in the Near-Term. The Long-Term deployment phase focused on ITS strategies that were not considered high priorities or those that rely upon systems to be deployed in the Near-Term or Mid-Term.

The Regional ITS Architecture was reviewed to determine whether LYNX projects were included, how accurately they were portrayed, and whether the architecture included ITS applications that were not envisioned by LYNX at that moment. Overall, the architecture was found to be reasonably accurate. A recommendation in the 2003 LYNX ITS Strategic Plan was that while LYNX focused on its Near-Term ITS Projects, ITS system architecture material should also be developed in the form of updates to be provided to FDOT for the statewide architecture.

The 2003 LYNX ITS Strategic Plan recommended funding various ITS projects in logical and constructive phases. Multiple funding sources were reviewed but most of them were sources of funding for core transit purposes (operations, maintenance, and capital costs). LYNX was found to be in good standing with respect to demonstrated ability to acquire and successfully manage federal dollars. Based on a review of the LYNX capital program, LYNX could reasonably be expected to acquire about $2 million per year for their ITS program. The plan strongly recommended continuing efforts to secure a dedicated funding source or gain long-term commitments of local funding levels.

2011 LYNX ITS Strategic Plan

The 2011 LYNX ITS Strategic Plan focused on ways that LYNX could continue innovating to meet community needs. The 2011 ITS Strategic Plan update included an assessment of LYNX technology, evaluated progress against the 2003 LYNX ITS Strategic Plan, reviewed technology trends, and identified short-, mid-, and long-term needs.

Table 3 shows the 2011 Short-Term, Mid-Term, and Long-Term LYNX ITS Work Programs proposed in 2011.

Table 3: 2011 LYNX ITS Work Program

Project	Description
Short-Term (2011-2015)	
System Upgrades	Great Plains Accounting
	EAM Inventory Management
	CAD implementation and integration with AVL
	On-board video security and high speed wireless gateways for downloading video
	Map out internal process flows to identify areas for potential improvements
	Downtown LYMMO area stations to provide travelers information
	Video display in the LYNX Main Station
	Work with Orange County to ensure that all radio communications are compliant with the FCC narrowband requirement
Organizational Change	Create ITS Oversight committee
	Create a professional Project Management team
	Create a multi-channel outreach program that focuses on social media and customer experience
New Capability	Begin working with FDOT to define common systems and processes for the new commuter rail system
	Implement payment card and mobile payment and integration with Ticket Vending Machines. Implement mobile applications.
	Develop ability to use Near Field and Far Field communications with passive Radio Frequency Identification Tags
	Develop a Tri-County Traffic Management System that will give LYNX and public responder vehicles priority at all traffic signals
	Have systems in place on the buses and at stations for cashless payment
	Fact based route and schedule optimization
	Develop a cross platform mobile application that will integrate bus a commuter rail information
	Work with other regional transit systems to design and specify onboard vehicle and communications subsystems that will comprise the bus and rail car of the future
	LYNX will need to start developing into a multimodal transit authority
Mid-Term (2016-2021)	
New Bus Fleet	Replace bus fleet - fully implement the "connected bus" concept through standardized interfaces and equipment
Integration of Next Generation Systems	Dedicated Short Range Communications applications to improve passenger and vehicle safety
	Integrated database of Automated Vehicle Location, Computer Aided Dispatch to determine distance base fares
	Driver safety and control applications
	Video security systems that record both internal and external activities
	Environmental systems including sensors that measure weather conditions along the bus route
	Far Field communications
	Secure payment systems
	Super Wi-Fi
Multimodal Integration	By 2016, LYNX will need to be prepared to take over the entire operations of the commuter rail system
	Create a common set of management guidelines that will allow LYNX and the commuter rail to work as a single enterprise
Long-Term (2021-2031)	
Expanded Multi-Modal Integration	The Orange Blossom Express
	The Convention Center to Orlando International Airport - east/west passenger rail line
	The Orlando to Miami passenger rail
Super-Regional Integration	Creation of a super-regional traffic management and transit planning coordination
Self-Piloted Vehicles	Bus fleet replacement or modernization
	Self-piloted vehicles for fixed routes with redundant sensors and
	infrastructure to support remote monitoring and management

2016 ITS Strategic Plan Update

The 2016 ITS Strategic Plan had a vision statement focused on application of ITS to provide enhanced services and communication to transit riders, increase the efficiency of vehicle operations and maintenance, and streamline internal organizational practices, in particular workflow processes and paperless documentation. Further application of ITS was expected to provide greater connectivity among bus, paratransit, SunRail, and bike share services, while at the same time providing for safer and more secure operations and facilities for transit riders and LYNX personnel. Seven goals and 24 objectives are associated with this vision statement.

The plan identified a set of 29 projects and strategies to expand ITS application within LYNX operations over 20 years. These projects and strategies were divided into the short-term (0-5 years), mid-term (6-10 years), and long-term (11-20 years). Given that federal funding sources and levels are generally only authorized for limited periods of approximately five years, only the short-term projects and strategies had estimated costs (in existing dollars) and potential funding sources. A start year was identified for each short-term project, but actual start dates and staging of most of the projects were expected to extend over multiple years, based on the extent of the application and available funding. Short-term projects focused on applications to improve internal LYNX communications and procedures, conversion of the overall AVL to Clever Devices technology, expansion of TSP and automatic passenger counters (APCs), development of mobile applications, and institution of initial aspects of "connected" vehicle technology. Mid- and long-term actions focused more on further application of connected vehicles and enhanced communication systems, with a major need for ITS integration if SunRail were to be integrated into LYNX operations in the mid-term.

While some projects proposed in 2016 have been implemented, many other identified projects have not yet been implemented. This is to a large extent because of limited funding being available, leadership change at the agency, and due to technology evolving so quickly that a desire to wait until the latest technology became available superseded immediate investment. Another challenge against implementing ITS applications was a lack of a full understanding of all of the capabilities of existing software and hardware in-house. There are often multiple layers of required coordination to conduct basic administrative functions such as employment timesheets and payroll, training, and vendor solicitation and payment, so even when a solution does exist, it could be streamlined and enhanced by ITS and other technology solutions.

During discussions held for the 2016 update, it was found that there was consensus that LYNX has been a cutting edge agency in applying ITS, and was recognized as a transit agency willing to conduct demonstration projects to test the latest in ITS technology. In order to inform LYNX on how to keep this status in the future, the 2022 ITS Strategic Plan update will also provide guidance on emerging trends in ITS and transit that LYNX should consider as it moves towards implementing the plan. These topics are explored in Appendix B of this document. These trends may also be included throughout this updated document as recommendations for each department's use of ITS technologies to meet their needs.

2016 Project Status

A list of potential ITS projects to be pursued through 2036 was presented in the 2016 ITS Strategic Plan Update. A number of the projects that were presented have already been implemented, others are ongoing, and some have not yet been started. Status updates for those projects

identified through 2021, organized by year, are provided in this section. These updates were confirmed through staff interviews.

Table 4: 2016 ITS Strategic Plan Project Statuses

Project	Lead Department	Status	Comments
2017			
Hire ITS Coordinator	Planning	On hold	Position was put on hold pending updates to internal structure. More support is still needed for ITS coordination, but it may or may not be in the form of this specific position
Internal process flow mapping	IT	Ongoing	This is still being worked on by individual departments, and IT is brought in to help whatever process flows need to be automated
Improved data flow between systems	Planning/IT	Ongoing	Processes and data needs continue to evolve
Automate vendor/ solicitation process	Procurement	Complete	An automated solicitation process has been setup, and is publicly available and completely paperless
Automate process for employee management (personnel, timesheets, payroll, and training)	HR	Incomplete	The current system cannot support it. A newly procured system may be able to meet this need
Develop unified real-time travel mobile application	Planning	Canceled	LYNX is moving to standard data feeds to enable third-party applications. Direction is to focus on transportation, not provision of apps if available by third-parties
Create system wide performance monitoring and tracking system	Planning	Incomplete	Have developed parameters for system wide performance, but haven't integrated it into a dashboard
Add cameras at LYNX Operations/ Maintenance facilities	Safety	Complete	Cameras are located on bus platforms, throughout buildings, at strategic locations, and at the maintenance shop exterior
Continued participation in Regional TSP program	Planning	Ongoing	All LYNX buses are equipped with Opticom TSP equipment. Florida Department of Transportation (FDOT) and local jurisdictions implement and control the intersections
Integrated bus / SunRail payment system	Finance	Incomplete	SunRail was in the process of upgrading their payment system, which needs to be completed before integration can occur.
2018			
Implement mobile payment system	Finance	Complete	Next step is to enable in-vehicle credit card payments, which is being actively investigated

Project	Lead Department	Status	Comments
Provide real-time monitoring of on-bus operation	Risk Management/ Safety	Incomplete	Inquired with the vendor, and found that some buses have the capability for live look in from a short distance of the bus (a few hundred feet). Haven't moved forward with extending those capabilities
Implement IVR system at call center	Communications	Incomplete	
Initiate Collision Avoidance System on select buses	Transportation	Incomplete	
2019			
Complete conversion to Clever Device CAD	Transportation	Complete	Change of direction with decision to convert fleet to a full Trapeze CAD fleet
Implement automatic bus assignment system	Transportation	Canceled	Change of direction to sequential pullout, so automated bus assignments not needed
Implement system for tracking fixed assets	Finance	Ongoing	Idea would be to track the state of good repair by adding inventory bar codes and tracking them through a software system
2020			
Acquire automated maintenance parts retrieval system	Finance	Incomplete	Material control is looking to bar code all of their assets to allow Maintenance the ability to prepare work orders and generate a parts list through an automated process
Implement automated maintenance health checks on buses in real-time	Maintenance	Incomplete	It will likely be implemented in 2022, though additional vendor support will be needed
Real-time advertising on buses	Communications	Incomplete	Still considered to be a potential revenue source, but has not been implemented due to high upfront costs
2021			
Real-time advertising at major ridership stops	Communications	Incomplete	RFP 18-R20 released June 4, 2018. Two vendors responded. Bids rejected as non-responsive as of September 18, 2018
Complete retrofit of entire fleet to include APCs	Transportation	Complete	
Electric Vehicle demonstration project	Transportation	Ongoing	Eight buses in revenue service on LYMMO as of January 2021. Charging station with eight dispensers installed as of April 2021. Complete transition of LYMMO fleet to battery electric by summer 2022

B. Existing and Prospective Technology Overview

Overview

ITS technologies cover a wide range of applications and options for transit agencies, some of which LYNX has already adopted, others that would benefit LYNX to adopt in the coming years, and a few which may not be applicable to the specific use cases and types of service that LYNX provides. A synopsis of ITS opportunities currently available is provided in this section; how these technologies would meet the needs of various LYNX departments is provided in the subsequent department reviews. This synopsis includes existing technologies LYNX is already utilizing, as well as emerging trends the agency should be aware of as it makes decisions on whether and when to apply these technologies.

How public transit is provided by agencies and used by passengers is rapidly changing as technology provides new ways to plan, pay for, and manage trips. Many of the systems that are applicable to transit are benefiting from significant innovation in other sectors that also utilize heavy-duty and light-duty vehicles. These new technology options and tools can enhance the customer experience, grow ridership, and provide data and analytics to help create more effective, responsive, and efficient mobility options.

Many of the systems outlined in this section are available commercially off the shelf, and can be purchased through traditional procurement strategies that LYNX is familiar with. Some are more cutting edge, and may require significant vendor support. LYNX is interested in seeking this support as part of a contract when needed, rather than requiring this expertise in house while a technology is still under development. This support should include provisions to require system integration in vendor agreements so that systems implemented across the agency are interoperable and non-proprietary.

Voice and Data Communications

Voice and data communications enable transit agencies to share information through wired, wireless, radio, internet, or other means. This supports the exchange of critical information between operators, dispatchers, emergency responders, and supervisory personnel. It can also support WiFi access for passengers. Voice and data communications have been used by transit agencies for many years, supported by underlying communications systems that have become increasingly more sophisticated, adding in additional capabilities over time.

Voice and data communications are heavily dependent on the available infrastructure and devices that are used. This communications infrastructure is also critical to the planned integration and implementation of transit ITS technology. Examples include cellular-based communication, simple hand-held radios, and new ITS systems that have significant capabilities to transfer video, audio, location, and number of passengers on a vehicle in real time or near real time with the use of a bus's AVL system. Current 4G technology is adequate for existing data and voice communications, and future systems will be faster with the implementation of 5G service. As 5G becomes more prominent, route planning technology, especially for buses, can be greatly enhanced. A reduction in wait times and real-time updates, for example, will make transit systems more efficient and easier for travelers to navigate.

Alignment of voice and radio communications strategies will provide potential operational cost savings through adherence to schedules and real-time information sharing. Safety and emergency situations can be addressed more easily and with a more focused approach using

cellular-based systems. The type of interfaces and information available to bus drivers today is shown in Figure 2. In addition, radio systems are likely to remain in use by many agencies as a backup and for the ability to communicate with vehicles not yet equipped with new systems.
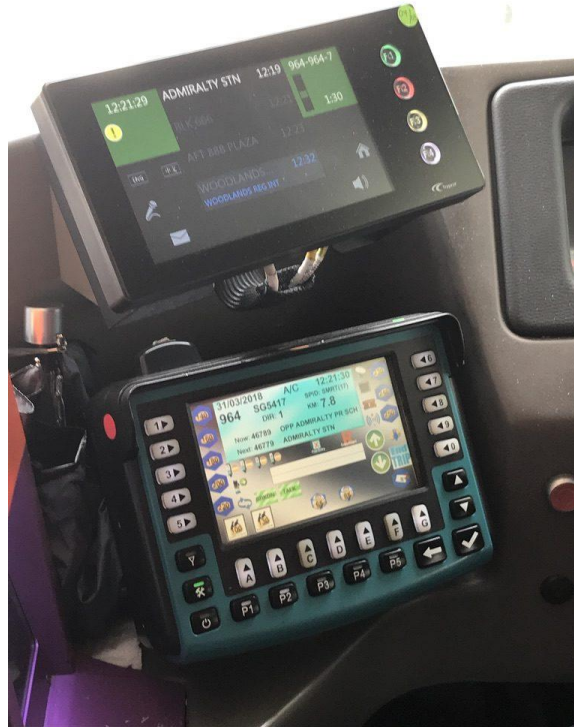

Figure 2: Example Data Interfaces for Bus Operators

Source: https://www.kiat.sg/2018/04/01/the-dashboard-for-bus-drivers/

Mobile Applications

Transit mobile applications, shown in Figure 3, can improve, simplify, and streamline the customer experience by integrating trip planning, fare payment, wayfinding, and trip guidance. Based on discussions with LYNX staff, the organization is not interested in deploying their own mobile application at this time, beyond supporting existing applications, and would instead like to focus on providing their data using adopted standards and supporting external transit mobile applications with larger user bases and strong underlying support systems. This meets passengers where they are in mobile applications they are already using, rather than requiring passengers to identify and use LYNX-specific mobile applications. Emerging mobile applications are adding specificity – where along a platform to board, crowd-sourced data on things like level of crowding, and integration across modes, including recommendations on how to leverage both transit and bike share systems to optimize a trip.
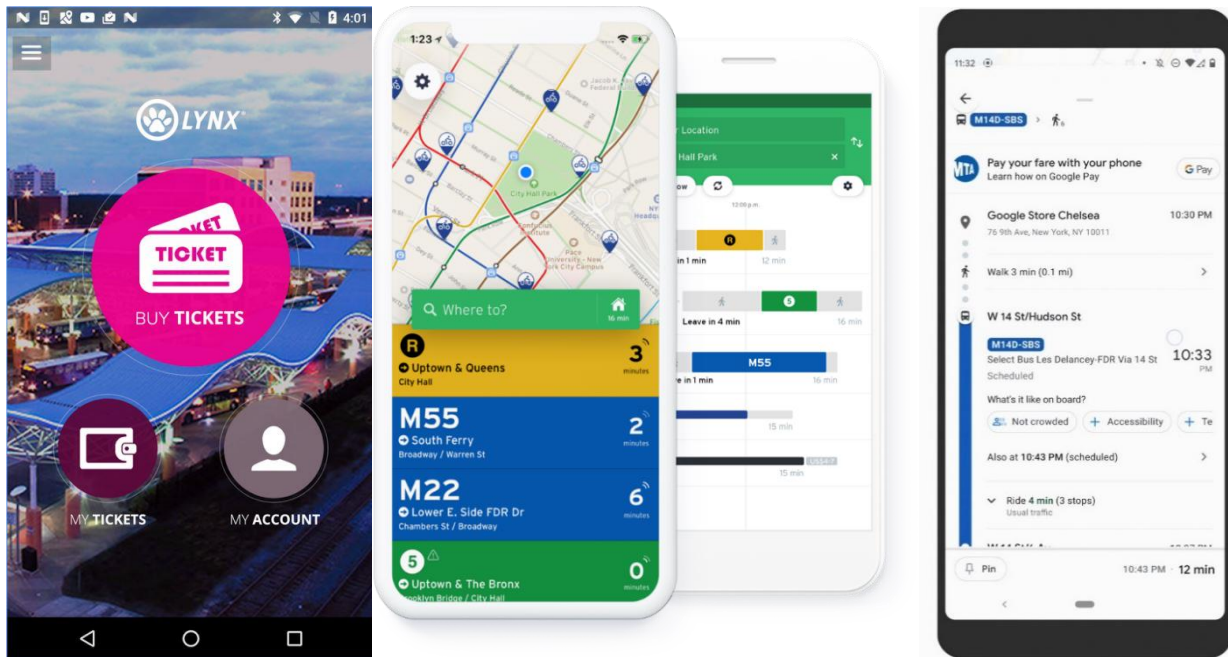
Figure 3: Example Transit Mobile Applications

Sources: LYNX, Transit App, and Google Maps

Real-Time Passenger Information

Real-time bus information systems provide accurate information across routes and trips to improve the customer experience and facilitate mobility through enhanced trip planning and trip guidance. The benefits of accurate real-time passenger information is that it can result in fewer missed rides, fewer complaints, increased ridership, and enhanced regional connectivity for transit users. LYNX provides this information to passengers through a number of different platforms, one of which is shown in Figure 4, and is consistently exploring what additional information or context would be valuable to provide, such as service alerts, emergency information, or partnerships with local businesses.

Many new CAD/AVL systems are based on the General Transit File Specification Real-Time (GTFS-RT) format so that real-time information can be used by a variety of applications. LYNX provides GTFS-RT for third-party use, so that this information can be displayed on multiple mobile applications that fit varying passenger needs, as well as electronic passenger information display boards at strategic locations. These display boards can also show advertising, which can be a potential revenue source for the agency. Automated voice annunciators can also be used to provide audible announcements of the same information.

Ongoing work is being conducted to develop similar standards for on-demand transit systems, a specification currently known as General On-Demand Feed Specification (GOFS).[1] A working group has been convened to standardize the representation of on-demand services and to set guidelines to manage rider-facing transactional data for a variety of different use cases. LYNX is

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[1] This effort is being led by a Canadian non-profit organization called MobilityData. More information can be found at the following link: https://mobilitydata.org/mobilitydata-is-accelerating-the-standardization-of-on-demand-transportation-with-the-gofs-project/.

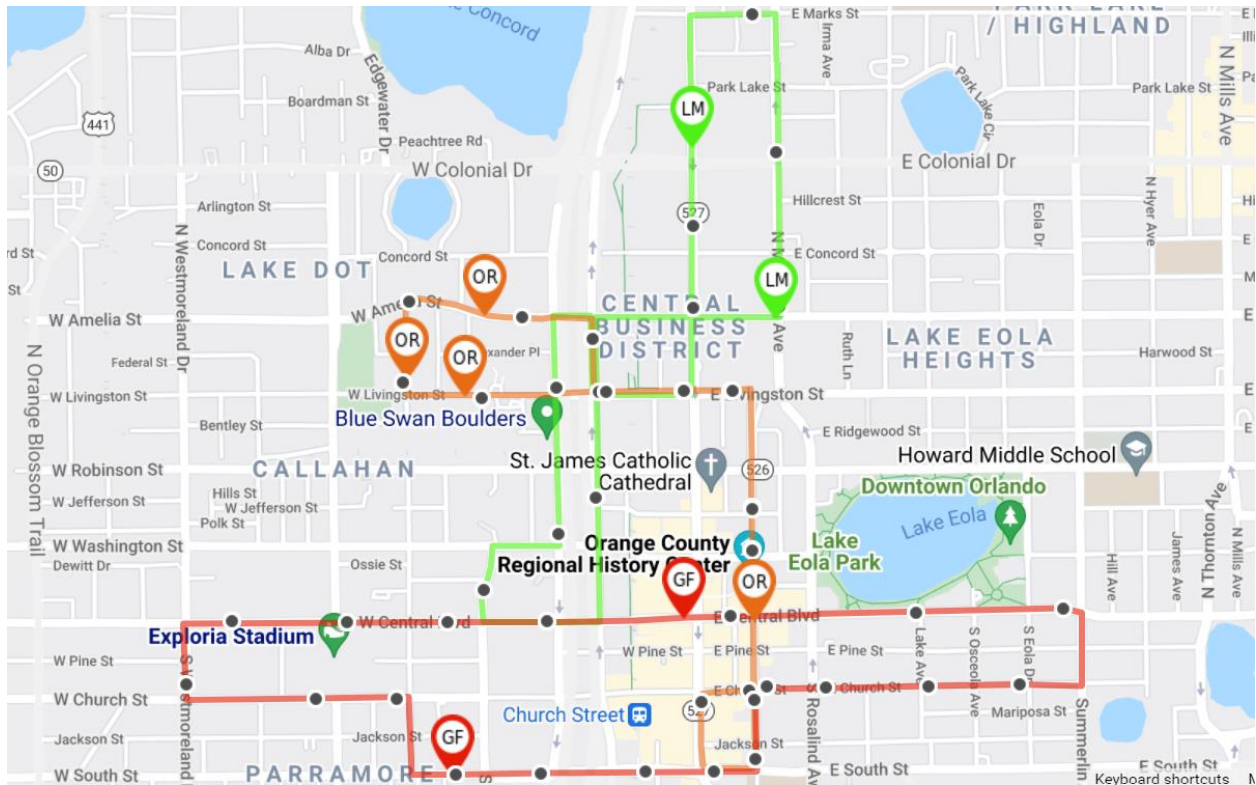monitoring the progress of this initiative and plans to provide data within these standards once they are developed.

Figure 4: Real-Time Locations of LYMMO Orange, Lime, and Grapefruit Line Buses

Source: https://golynx.doublemap.com/map/

Transit Signal Priority

Traffic Signal Priority (TSP) reduces the dwell time of transit vehicles at traffic signals by holding green lights longer or shortening red lights when a transit vehicle that meets certain conditions (schedule adherence, ridership, etc.) is approaching, as demonstrated in Figure 5. TSP systems are becoming more cost-effective as their adoption increases and the technology options improve. They are particularly useful when supporting bus rapid transit (BRT) services and when they are deployed in conjunction with other operational solutions to reduce trip time and improve system performance. Connected vehicle technologies can be used to support a TSP system, as can cloud-based architecture solutions.

LYNX has participated in a regional TSP deployment led by FDOT, by equipping all its buses with TSP equipment. This deployment could be expanded to additional routes and intersections, allowing for better utilization to enhance service reliability. This would likely require some additional funding, as well as regional coordination on strategies for implementation.
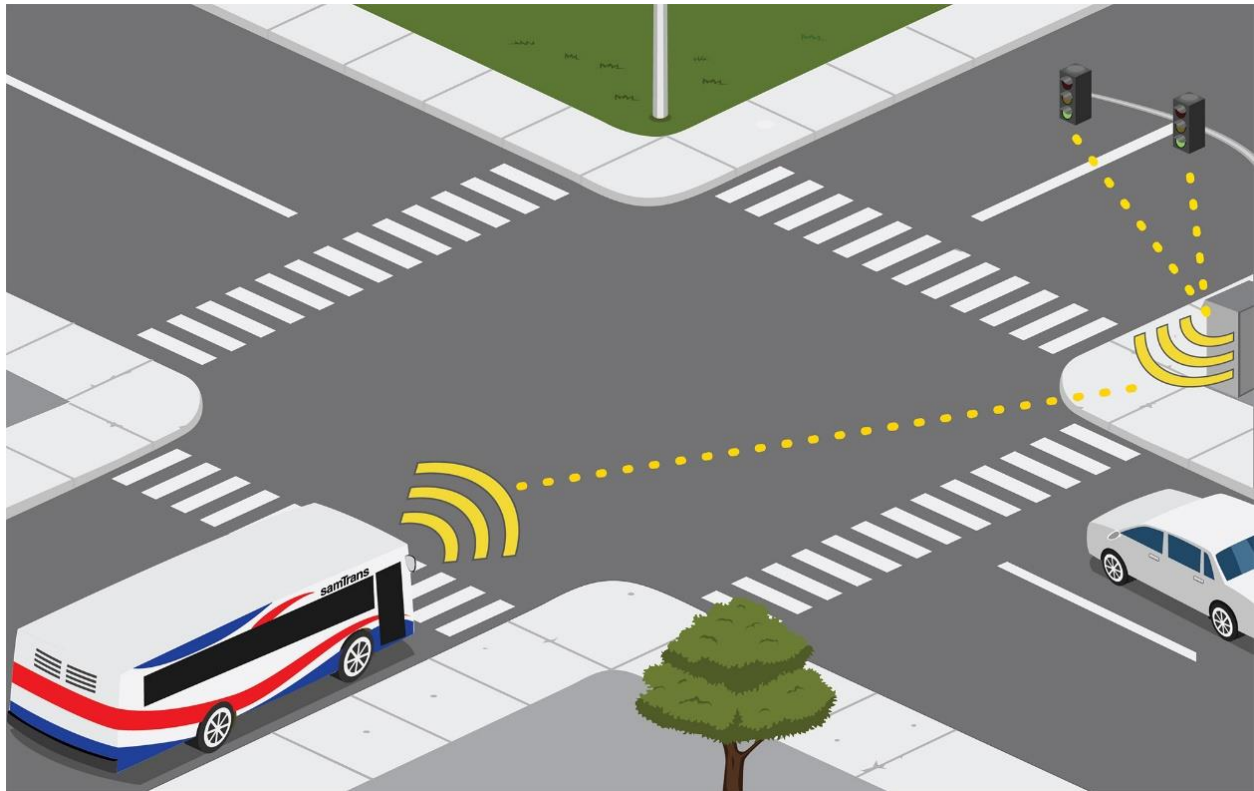
Figure 5: Active Transit Signal Priority

Source: SamTrans

Security Systems

Security systems for transit can provide both real-time monitoring and after-the-fact litigation support. There are many existing solutions, including CCTV security cameras on transit vehicles and at some stop locations. They are becoming increasingly more sophisticated by enabling real-time viewing from a remote location and enhanced abilities to pull specific video based on time, location, and other conditions. Emergency call boxes that include a camera that is activated whenever the intercom button is pushed as well as mobile applications that allow users to discreetly communicate and report problems via text can help prevent and respond to criminal or suspicious activity. Examples of what is shown at the security monitoring facility are provided in Figure 6.

Figure 6: Example Real-Time Security Systems for Transit

Source: SEON

Maintenance Systems

There are a number of ITS technologies that can support maintenance on specific tasks such as parts retrieval and vehicle maintenance health checks. Predictive maintenance systems can be used to determine the condition of in-service equipment in order to estimate when maintenance should be performed. Radio Frequency Identification (RFID) tags can use electromagnetic fields to automatically identify and track tags attached to different assets. Automated parts retrieval is a newer application that can take this information and automatically deliver the correct parts to where they need to be. These and other solutions can help an agency maintain and monitor (see Figure 7) its assets to a state of good repair, so the system can reliably operate at a full level of performance.
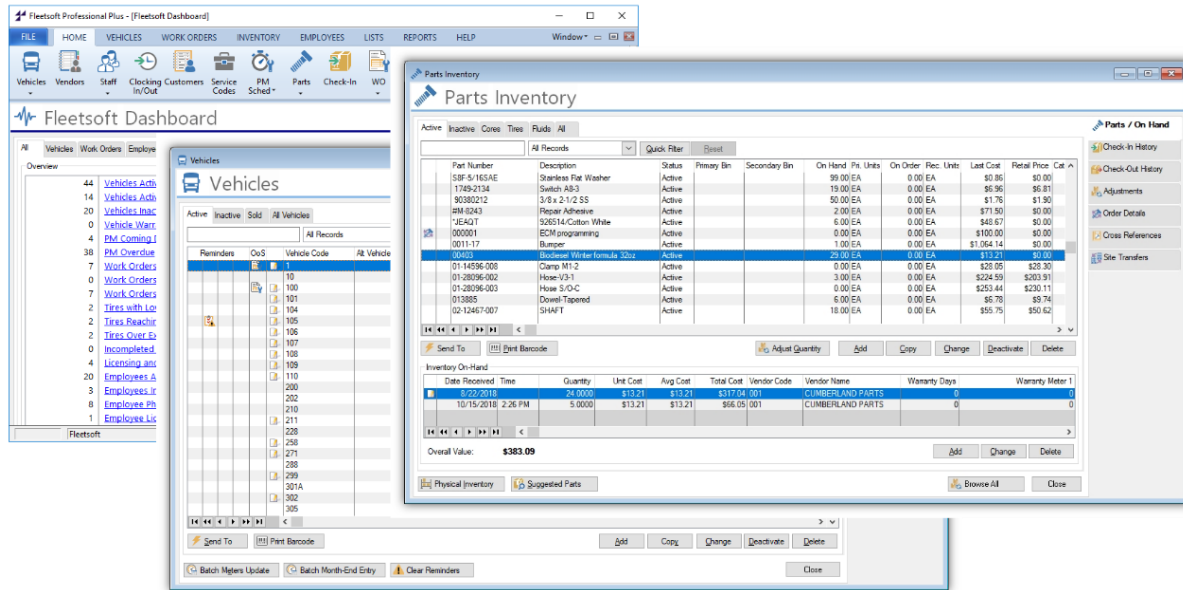
Figure 7: Example Fleet Management Maintenance Solution

Source: https://fleet-maintenance.com/

Electric Vehicles

Zero emission vehicles such as battery electric buses that operate strictly on electricity-powered batteries and not gasoline or overhead wires are currently experiencing growing interest for both public and private fleets. An example at LYNX is shown in Figure 8.

LYNX has already started adding some electric buses to its fleet (on the downtown Orlando LYMMO system), and is potentially interested in adding more in the coming years. Challenges related to charging infrastructure and ongoing operational costs relative to other propulsion systems (not just capital costs) continue to be worked through and resolved. Reliable access to secure, sustainable, and cost-efficient energy generation and distribution systems is key to the widespread zero emission transition for transportation systems like LYNX.

Figure 8: Inside and Outside of a LYNX Electric Bus

Source: LYNX

A key ITS technology that will need to be leveraged to support electric vehicles is telematics. Current bus propulsion systems are sufficient for the daily amount of service LYNX provides, and refueling is a quick process that can be accommodated at the garage when the bus returns. Electric vehicle range is sensitive to how the bus is driven, so this behavior could be monitored in real-time on electric vehicles, with a system that provides guidance to drivers on how to operate most efficiently and the corresponding range they can expect to receive. Battery recharging could also be supported by telematics to extend the life of batteries and maximize even charging across the fleet, in the event there are more electric vehicles that need charging than chargers available.

LYNX currently uses cloud-based Viriciti software to monitor its buses. This also allows monitoring in real-time of the battery status of in-service buses to ensure a bus doesn't operate beyond on-board battery capacity and be unable to return to the depot. LYNX completed a demonstration project in November and December 2021 of an express service using battery electric coach buses and found this monitoring to be necessary as cold days increased battery drain through the use on onboard heaters, reducing vehicle range.

Bus Technology/Connected and Automated Vehicles

Computer Aided Dispatch/Automatic Vehicle Location (CAD/AVL) uses computers and Global Positioning Systems (GPS) to dispatch and track a fleet of transit vehicles. CAD/AVL systems usually result in added costs of operating and maintaining additional computer equipment, but agencies benefit from improvements to customer service through real-time information dissemination and analysis. LYNX has CAD/AVL systems installed throughout its fleet.

In many ways, CAD/AVL systems are the backbone of ITS functionality. The hardware and software monitors the data flow, including vehicle real-time locations, providing schedule adherence tracking and generating useful reports. Goals for a CAD/AVL system can include improving on-time performance by disseminating continuous, real-time information to operators, improving dispatch reliability and efficiency, improve scheduling and planning by providing more accurate data and reducing the schedule preparation time and staffing, improving scheduling and planning, and improving data management and reporting by automating data collection and improving the accuracy and accessibility of data.

Beyond this bus technology, collision safety systems are helping to make transit systems safer and more effective, reducing delays and improving service. Collision avoidance systems are becoming more sophisticated with expanding coverage and greater speed and functionality and providing risk management and equipment repair savings. Collision avoidance systems generally use radar, LiDAR, or some other detection method to prevent or reduce the severity of collisions. An example of using of these sensors to prevent or reduce the severity of collisions is pedestrian warning systems, which alert pedestrians of the presence of a vehicle moving slowly in either drive or reverse using an audible warning player from a speaker mounted on the vehicle.

Collision avoidance systems have been deployed at transit agencies throughout the country, with deployments still generally in the pilot phase. Many deployments have been faced with operator resistance, triggered by excessive alerts and false alarms during initial calibration.[2] However, many deployments have also documented significant safety improvements due to the installation of this technology. The most readily available solution is a retrofit kit, with the interface shown in Figure 9, that can be installed on an existing vehicle for approximately $5,000-$10,000 per vehicle. The lifetime of the equipment is approximately 5 to 10 years, so while more advanced technology is likely to eventually replace collision avoidance systems (as will be discussed in the next paragraph), this is unlikely to occur during the lifetime of any systems that are deployed today.

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[2] https://www.trb.org/Main/Blurbs/180260.aspx

Figure 9: Examples of Collision Avoidance System Interfaces for Bus Operators

Source: Mobileye

Building on collision safety systems, connected and automated vehicle (CAV) technologies allow vehicles to detect their surroundings and communicate with other objects on the roadway. Connected vehicle (CV) technologies enable various types of vehicles, roadway infrastructure, mobile devices, and other objects to communicate quickly to share vital information. CV technologies enable vehicles to communicate with infrastructure (vehicle-to-infrastructure, or V2I), between vehicles (vehicle-to-vehicle, or V2V), and with other objects in the roadway (vehicle-to-everything, or V2X). Automated vehicle (AV) technologies enable vehicles to detect their surroundings using a variety of on-board sensors, including radar, LiDAR, and cameras. By merging these information sources, as well as others such as global positioning system (GPS) data, an advanced control system on a vehicle is able to interpret the data to detect obstacles, identify optimal navigation paths, and interpret traffic control devices such as signals, signs, and pavement markings.

CAV technologies for transit vehicles are advancing rapidly, and some limited applications are commercially available today. More sophisticated capabilities are expected to be introduced incrementally in the coming years and decades. Even today, capabilities can begin to be implemented within certain conditions, such as along a fixed BRT route or within an automated bus yard. LYNX has already started exploring the concepts, constraints, and framework involved with adding CAVs to its service offerings through the LYNX AV Study completed in 2021. This study resulted in a Concept of Operations for the deployment of AVs on the LYMMO Orange Line or elsewhere throughout LYNX's service area. Actual deployment of the technology will be subject to funding availability, either through vendor support or external grant opportunities.

Other bus and infrastructure technology amenities that can improve the passenger experience and enable enhanced services like high-capacity BRT corridors include enhanced station and streetscape design and amenities, transit integration with other modes such as bike lanes and pedestrian facilities, and infrastructure improvements that support the efficiency of transit operations. A suite of technology-based solutions, such as TSP, pedestrian detection sensors and alerts, and real-time information screens, alongside non-technology-based solutions, such as dedicated bus lanes, curb extensions, and benches and shelters, can work alongside each other to facilitate a Complete Street approach that prioritizes transit operations and passenger and pedestrian safety.

Fare Collection

New fareboxes and mobile ticketing applications can offer new functionalities to enhance customer experience. The American Public Transportation Association (APTA) maintains a list of standards for technology for transit systems at https://www.apta.com/research-technical-resources/standards/technology/. The majority of these standards are related to fare media.

LYNX deployed new Genfare FastFare electronic fare boxes in 2020, combining traditional fare media with emerging technology options. Automated Fare Collection (AFC) systems like this one enable transit agencies to collect, process and manage revenue collection activities.

Mobile ticketing can also be a cost-effective technology improvement which can accommodate fare capping and other discount programs. While relatively new to the transit marketplace, this technology is proving to be an important factor in increasing rider adoption and improving efficiency in transit operations. It is often being deployed in conjunction with other contactless payment solutions, such as tap-to-pay of reusable smartcards and account-based ticketing. LYNX has the PawPass mobile ticket system, shown in Figure 10.

Figure 10: LYNX PawPass Ticket System

Source: LYNX

LYNX is also interested in considering other revenue streams beyond fare collection, such as location-based advertising. Partnerships with private platform providers can enable this model, allowing LYNX to receive a steady stream of revenue as well as some use of the platform for agency-specific advertising.

Internal Management Systems

Internal management systems can help LYNX reduce trip times and increase on-time performance while improving safety and operating efficiency, ultimately benefiting the customer experience. This includes operator control units, which function as an interactive communication platform for the bus and its equipment. More broadly, back office systems are necessary to support the many IT and other technical tasks an agency like LYNX is responsible for. Emerging web-based applications enable an agency to share information and updates across departments rather than within separated, siloed applications. The example shown in Figure 11 demonstrates how these systems could be used to manage a bus yard, which could have a variety of applications, including enabling this bus yard to allow for automated operation of some vehicles within its premises.

A proper, well-designed project management approach is key to planning and implementing projects successfully at an agency. Project management and other computer software can greatly enhance this process and benefit both individual departments at an agency as well as communication and collaboration between departments.
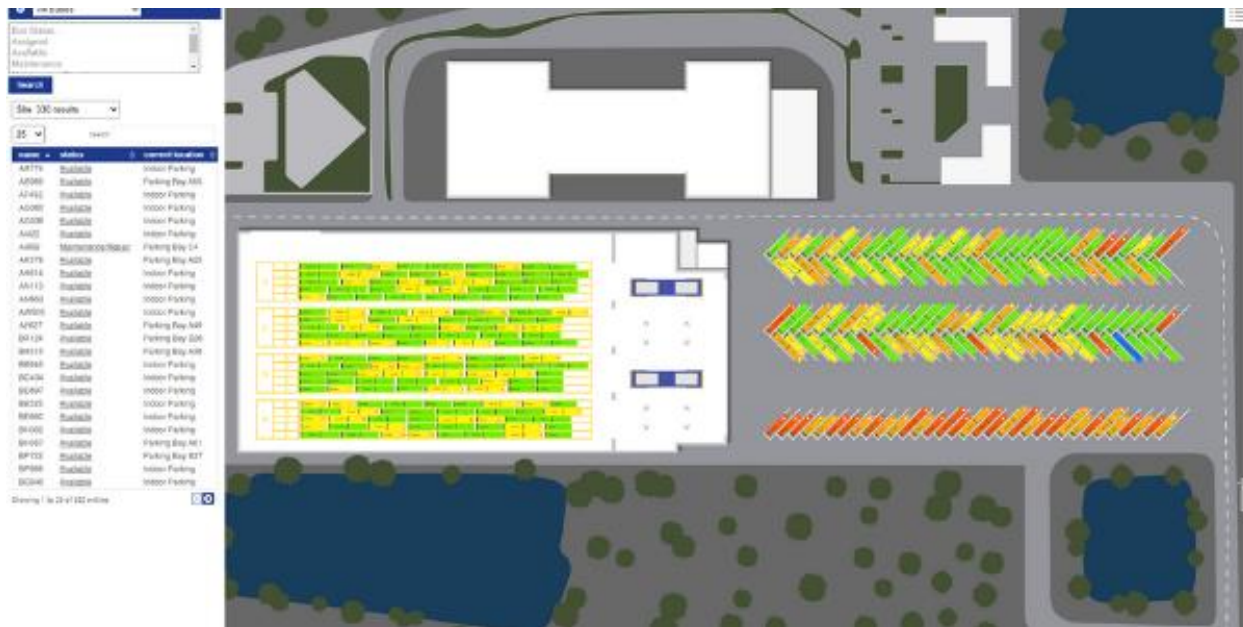

Figure 11: Example Management System for Bus Yard Automation

Source: https://ubisense.com/transit-management/

C. Needs Assessment

Agency Overview

LYNX was founded in May 1972 as the Orange Seminole Osceola Transportation Authority (OSOTA). OSOTA was renamed Tri-County Transit in 1984 and started doing business as LYNX in 1992. The official name was changed to the Central Florida Regional Transportation Authority in March 1994. LYNX serves an area of approximately 2,500 square miles with a resident population of more than 1.8 million people in the tri-county region of Orange, Seminole and Osceola counties in Florida.

LYNX does not currently have a specific ITS department. However, staff with expertise and experience related to ITS are distributed across the agency. There is staff in the Innovation and Sustainability group that is well-versed in ITS and other emerging technologies, including identification of a Chief Innovation Officer position. There are other staff that provide ITS-related technical assistance related to specialized areas, such as CAD/AVL in the Transportation and Mobility Services Departments, and mobile applications in the Customer Service Department. Coordination between these staff members across the agency has been vital to the success of ITS at LYNX to date, and is expected to continue to contribute to its success in the coming years. The latest overall organization chart for the agency (as of March 21, 2022) is shown in Figure 12.
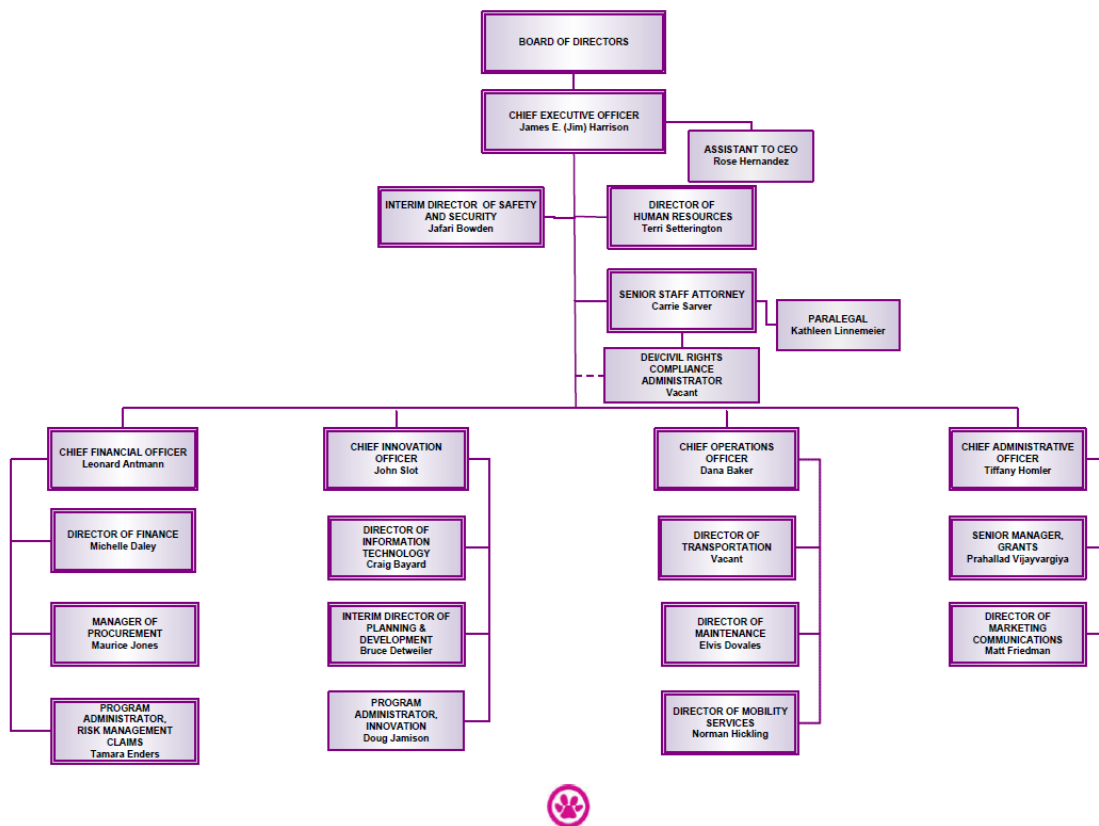
Figure 12: LYNX Organizational Chart (As of March 21, 2022)

This section presents an assessment of the current conditions for departments at LYNX that interface with ITS technology. Based on survey results, department interviews, and other resources, management and service gaps are identified and the role of ITS technology to fill these gaps and meet future needs is established.

The survey was sent out to and interviews were conducted with all LYNX departments to ask a series of common questions in three major categories:

1) Existing Conditions

2) Gaps in Management/Service and Future Focus

3) Role of ITS Technology to Fill Gaps and Meet Future Needs

There were added questions for Innovation and Sustainability and IT staff due to the more technical nature of their expertise in the subject. The needs gathered during this stakeholder engagement process were used to inform the insights presented in this section.

Department Assessments

Innovation and Sustainability

Existing Conditions

The Innovation, Sustainability, Planning and Development, and IT Department enables forward-thinking projects and initiatives to be championed at the agency. The Innovation and Sustainability group needs to ensure that LYNX has the base systems to support any agency changes, including the stability of existing systems. Top priorities include standardization of data, deployment of contactless payment options, and electrification of services.

LYNX has been using ITS and Geographic Information System (GIS)-based technologies for several years with support of the Innovation and Sustainability Department. Some examples include Transit Signal Priority (TSP), automatic passenger counters (APC), computer-aided dispatch (CAD) and automatic vehicle location (AVL), location-based software applications and tools to perform scenario planning, and scheduling to support the LYNX transit system operation.

Gaps in Management/Service and Future Focus

Survey Results

Key survey feedback included that while the 2016 ITS Strategic Plan gave direction and met the direction of the agency in 2016, one area that it did not meet was the understanding that this is an agency-wide plan that requires agency-wide effort. Since that time, LYNX has also provided input to the updates to the Florida ITS Architecture, including participation in FDOT reviews and workshops, which have been integrated into the ITS Strategic Plan effort. Including major initiatives that funding partners are currently pursuing in this strategic planning effort also provides context on future direction at LYNX.

There is a substantial amount of ITS data available to LYNX, but staff do not always fully understand how to view and analyze the data. Taking an outside look at what data is available and how it could be used would also be helpful to the ITS strategic planning effort, as well as to ITS initiatives at LYNX more generally. The focus should be on how data can be used by LYNX rather than what would be done if more data were available.

LYNX pursues grant funding for ITS projects, but can be challenged by meeting local match requirements. LYNX does not have a dedicated revenue source, so budgeting long-term is harder. Some key enabling systems currently supported by LYNX include: Computer Aided Dispatch/Automatic Vehicle Location, Automated Passenger Counters (on 100% of vehicles), fareboxes and electronic payment, real-time information (mobile app, GTFS, GTFS-RT), GIS, and Workplace (Purchase Requisitions, Purchase Orders, materials received, invoice tracking against POs).

Interview Summary

During the interview, staff reiterated that LYNX's focus is to provide the best transit services they can. The agency's core values are safety, reliability, and fiscal responsibility. On the ITS data side, the goal is to make data available, but not to focus on making apps in house to distribute that data. Adopting the functionality that's in the marketplace will allow solutions to be available faster and better, and LYNX's role is primarily to provide data within standards to support this.

As mentioned previously, LYNX does not have a dedicated ITS department, and staff with expertise and experience related to ITS are distributed across the agency. LYNX is currently interested in continuing with this distributed organizational approach.

Given the timing of this ITS plan update, and anticipated infrastructure funding likely coming soon, this plan should include agreement on recommendations as shovel-ready projects so that funding can be secured to support them.

The interview also discussed what ITS systems are currently being applied by Innovation and Sustainability staff, what needs these existing systems are not fully meeting, and whether there is an adequate framework of ITS data to meet the business needs of the agency.

Gap Analysis

At a high level, LYNX supports the movement of large numbers of people with common travel patterns. There are technology solutions that could be used to support this, but there is also a limit to what can be done internally. A core direction at LYNX is that data is to be made available through standards, and not through Application Programming Interfaces (APIs) unless it cannot be avoided. LYNX does not want to be a custom software development agency that leverages individualized mobile applications, agency specific fare payment, micro transit, or other more personalized services, but rather an agency that makes data exchange available through standards to allow interface with third-parties that provide these services.

For example, LYNX has GTFS and, as of recently, GTFS-Real Time data deployed. Any emerging trends on similar data feeds or connections for on-demand public transit (NeighborLink), paratransit (Access LYNX), or fare payment (contactless EMV) that allow LYNX services to be "discoverable" and connectable in a secure manner for third-party providers would be of interest. An example would be allowing a third-party to connect to LYNX and purchase a digital pass as a virtual reseller, providing LYNX with payment and the ability to recognize and validate the unique pass, and the third-party to bundle the digital pass outside of LYNX with other services such as scooter or bike share. There is currently a substantial amount of ITS data available to LYNX, but staff do not always fully understand how to view and analyze the data.

Innovation and Sustainability staff needs to ensure that LYNX has the base systems to support any agency changes, including the stability of existing systems. When the telecommunication systems ended 2G/Code-Division Multiple Access (CDMA) coverage in December 2020, LYNX

had to update systems that relied on that network, including fixed route and paratransit CAD. There is a need to ensure that the agency does not foresee expiration of any base technology or systems that are used to operate systems, as well as a need to prepare for any transitions required to support initiatives. LYNX also needs to prepare for emerging base technologies, such as Connected and Automated Vehicles, to be able to participate in and gain value from these technologies.

On the sustainability side, the 2021 LYNX TDP annual update identified developing a sustainability strategy as an upcoming initiative. This will be supported by establishing sustainability performance measures that include standards.

Lastly, there is also a need to better understand regional relationships and initiatives and how LYNX should interface with them. As an agency, LYNX aligns with its funding partners and their plans, and won't be reinventing anything that's already been developed by funding partners. Therefore, recommendations in the Strategic Plan should also consider the documented needs of LYNX's strategic partners.

Role of ITS Technology to Fill Gaps and Meet Future Needs

In the interviews for the 2016 ITS Strategic Plan Update, LYNX staff at the time felt that fewer, more consolidated applications would be easier from a software development and maintenance and customer understanding perspective. This desire continues today, including a focus on supporting outside partners rather than needing to create all applications in house.

Simulation tools such as Remix that the Planning and Development Department has already started using may be able to provide the same value of some existing systems at lower cost. There are also new mapping formats that should be considered in any new real-time information application. A large portion of LYNX's customer base are already experienced with using mobile technologies and social media to share and receive information, and would likely be receptive to more information being provided through these platforms.

In recent years, LYNX staff have come to realize that technology solutions are not always the right fit for every problem, and that the more "innovative" and better solution may at times be more traditional. For example, there was a recent comment that an electronic display in the lobby that shows all routes and the bay to which they are assigned would be useful. However, a poster created by Marketing and Communications could meet this same need more quickly, at a far lower cost, is less likely to break down, and does not incur software licensing.

In summary, the following needs of the Innovation, Sustainability, Planning and Development, and IT Department could be addressed by ITS solutions (additional needs of IT are discussed in the following section):

- Making data available through standards to support externally-developed applications
- Establishing the base systems needed to support any agency technology needs
- Supporting the needs of other departments at LYNX and agencies throughout the region

Information Technology

Existing Conditions

The Information Technology (IT) Group is now included within the Innovation, Sustainability, Planning and Development, and IT Department, and is responsible for the management of a variety of systems and subsystems currently installed at LYNX. Key responsibilities of the IT

Group include management of the voice and data networks and communication, application/system administration and management, information security, management of emails and Groupware, management of the HelpDesk, staff training, IT-required support of project applications, application development, and technology contract management.

IT systems are not the same as ITS – ITS systems are generally used to support transit operations, while IT systems are generally used to support administrative functions. However, these two types of systems often interface with each other, and highly functional and reliable IT systems are essential to the smooth operations of ITS, and a transit agency more generally.

Software is budgeted by IT at the request of the departments, but the budget for IT-related hardware and software will be under IT. IT is included in project development for all departments, and may need to help support additional ITS systems that support these departments' needs.

The IT Group helps to support the LYNX ITS program with support in technical infrastructure and in human capital. The IT Group maintains a solid infrastructure (network connectivity, wireless communications, etc.) to support the current LYNX needs. Additional infrastructure requirements, such as more bandwidth, secure mobile circuits, and advanced radio communications capabilities that are part of the ITS Strategic Plan will be addressed on an as needed basis. Project development and scoping needs to include the IT Group to provide recommendations and input on requirements including whether a project should use on premises or hosted IT resources.

The IT Group does have human resource constraints that could be affected by some of the proposed projects. LYNX enjoys a relatively stable technical environment which is well managed by existing human resources. Addition of new technologies and systems may require additional time and effort from these resources. Implementation of projects should also include input from the IT Group on if on-going internal resources will be required to support the project, or if external contract or consultant resources are required to augment staff during the project deployment. It is important that LYNX project the cost of additional resources – contractors, consultants, part time or full-time resources – as part of ongoing maintenance costs during the initial project planning phases, and prior to requesting funding for the project.

Gaps in Management/Service and Future Focus
Survey Results

Survey responses confirmed that IT is responsible for maintaining data infrastructure, the core network, connectivity, system patching, security, application development, and the phone system. IT uses a change management process and a help desk to manage projects and systems. IT supports end users by developing user guides, help documentation, training, ad-hoc help-desk, and/or on-site support.

In the coming years, the IT Group plans to support the agency in enterprise applications, mission related applications, back office, ITS, and State of Good Repair. Meeting these needs will require enhanced staffing and skill re-investment of existing staff, with a continual focus on cross training staff and roles within the department.

As the agency identifies more opportunities and priorities for customer facing apps, mobile ability is essential.

Interview Summary

People often lump IT under ITS, but IT is not ITS. IT supports the computer data network systems and applications, but IT is not the manager of these applications. IT's role is not to determine what the best GIS software to use is, but to support whatever software or system that is chosen to make sure it is operational and safe. There is no department nor a piece of software at LYNX that IT does not help support, but they are not the owners unless it's an IT software. ITS systems that are currently being applied in the IT Group include Helpdesk, network monitoring, patching, imaging, and MFA (multi-factor authentication).

In a world of COVID and of cloud-based services, there are now better options available for many traditional solutions LYNX has used for decades. But other changes are also required, for example, having transitioned from a permanently housed in-person call center to a remote one requires different technologies to work most effectively.

For change management, IT uses an industry standard helpdesk system which has change management functions. The IT Group is continually evaluating software that might replace current software deployed at LYNX to provide better, more effective solutions.

The direction of LYNX and upper management has been to keep things in house, and store and secure data internally. There has also been a push to start looking at cloud-based solutions. A big hurdle for the agency that has not been addressed by the Federal Transit Administration (FTA) or others, is that an agency like LYNX generally has easier access to and ability to plan for funding for capital expenses than ongoing operating expenses. Traditionally, keeping systems in-house is a capital expenditure, but transitioning out to the cloud will make this an operating expenditure, which will drive up the operating budget.

IT is in the process of making room for more servers to address security concerns. There is also a need to protect the power system by upgrading the UPS's, as there is likely to be more strain on the electrical system in the coming years. Cybersecurity has become even more important with many LYNX employees working remotely. To help meet this need, the LYNX IT Group added the Cybersecurity Analyst position in February 2020. Going forward, consideration of cybersecurity and involvement of the Cybersecurity Analyst will be necessary in the development of all ITS systems and projects. In addition, LYNX will be needing an Endpoint Detection and Response (EDR) system to monitor and respond to mitigate cybersecurity threats, which will be going into next year's budget proposal, which starts October 2023.

Gap Analysis

Some of the upcoming fiscal year IT Group projects, include the following:

- Upgrading the software and storage backup system
- Upgrading/replacing the in-house telephone system
- Replacing the current call center telephone call in system
- Replacing computer rack in the LCS computer room
- Upgrading UPS system

Computer hardware has not been changing a lot in recent years. However, software companies are moving away from perpetual licensing to yearly based or monthly based fees. This makes software no longer a capital cost, but rather an operating cost. In addition, cybersecurity may require more funding for newer cybersecurity tools, also on an operating cost basis.

Role of ITS Technology to Fill Gaps and Meet Future Needs

ITS technologies can help IT continue to support legacy applications. Currently, IT generates and exports the GTFS data. IT also posts the GTFS-RT data on the server. This process could be updated.

As the agency identifies opportunities and priorities for customer facing apps, the ability to function on mobile devices is essential. The remaining planned improvements are part of IT service and skill re-investment, and include the continual focus on cross training staff and roles within IT to reduce on-going costs and additional permanent staffing needs.

The IT Group has made significant progress and investment in improving the network stability and performance and thereby allowing them to move into a proactive role with the ability to plan for future enhancements and get ahead of the traditional break/fix role that has traditionally been a challenge for the group.

In summary, the following needs of the Information Technology Group could be addressed by ITS solutions:

- EDR system

Transportation

Existing Conditions

LYNX provides an array of transportation services in the form of fixed route bus services, door-to-door paratransit services (Access LYNX), on-demand public shuttles (NeighborLink), carpool/vanpool services, flex-route services, limited-stop bus route services, rapid bus circulators, and community shuttle service to special events. The Transportation Department supports fixed route services, with most operations and maintenance performed in-house. (Door-to-door paratransit services and on-demand public shuttles are operated under Mobility Services while carpool/vanpool services are operated by an outside contractor.) While the Maintenance Department technically "owns" the vehicles (orders and maintains), the Transportation Department operates the vehicles.

Gaps in Management/Service and Future Focus

Interview Summary

LYNX staff verified the software that is used for bus locations and stop estimated time of arrivals (ETA's) as well as real-time passenger information, summarized in Figure 13. This diagram, and the other workflow diagrams provided throughout this document, are intended to summarize workflow and internal communications throughout the agency, rather than to provide a full inventory of all data elements and ITS architecture that the agency supports.
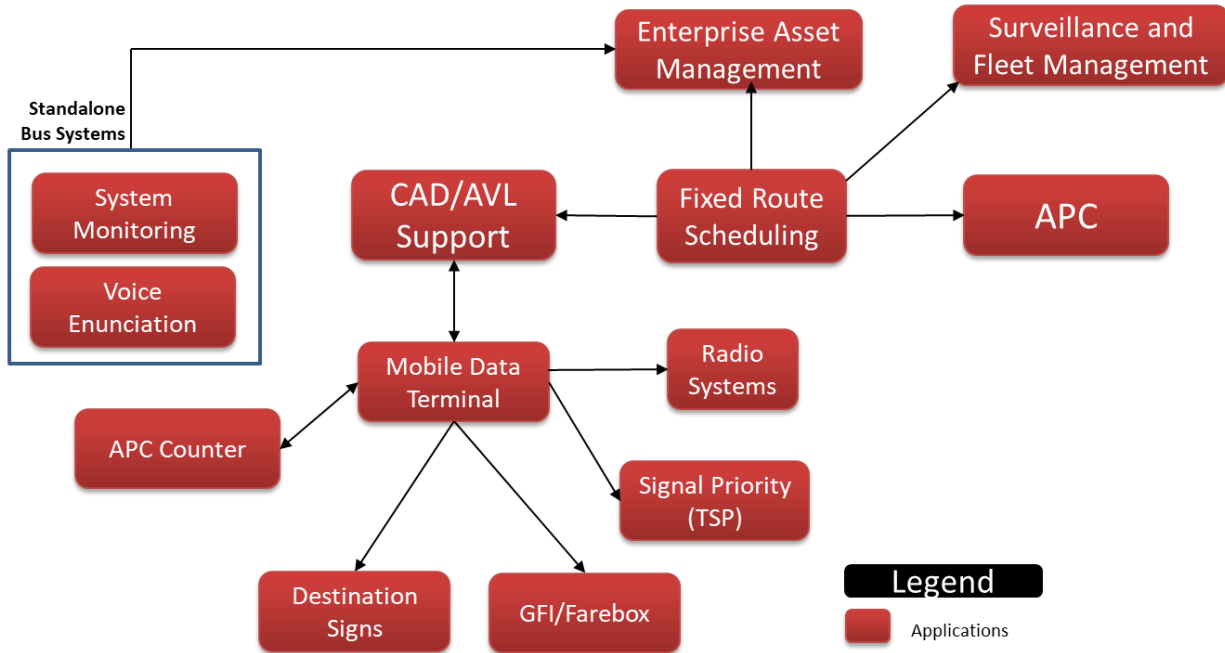
Figure 13: Existing Workflows for Transportation

The Transportation Department relies on strong relationships with all other departments at LYNX to support their everyday functions. Over the next five years, the department is looking to upgrade frequently used databases, expand the vehicle inventory, and perform strategic hiring activities to accommodate an anticipated increase in workflow.

Gap Analysis

While identified as a gap in 2016, Automatic Passenger Counters (APC) have now been installed on all vehicles in LYNX's fleet. Any additional information that could be collected and/or managed automatically would be useful, such as employee availability/scheduling or passenger transfer behavior.

The TDSP stated the need for service improvements; ranging from additional operator training to improved communications between dispatcher and operator to technological improvements (mobile applications) that improve trip information dissemination to the client. They would also like regional coordination of trips. Additional technology suggestions included in the 2018 to 2023 TDSP, some of which have since been implemented, included:

- Software to Track Bus Pass Usage
- Mobile Fare Payment
- One-Call, One-Click Transportation Resource Directory Website
- Mobile Trip Application
- Automatic Vehicle Location (AVL) to enable Bus Estimated Time of Arrivals (ETA), which has been fully implemented since the TDSP was published
- Interactive Voice Recognition (IVR)
- Automated call responses for booking reservations and for common information requests

Creating an inventory of the software and technology currently available at LYNX, including system capabilities, will allow other departments to identify the information and tools available that can be used to improve their department's efficiency.

Role of ITS Technology to Fill Gaps and Meet Future Needs

Further application of ITS will provide greater connectivity among bus, paratransit, SunRail and bike share services, at the same time providing for safer and more secure operations and facilities for transit riders and LYNX personnel. This could help LYNX minimize travel times and make service as reliable as possible, while also providing more information to customers at various points in their trip, making the information accurate and timely, and providing the information in an efficient, cost effective manner.

Collision avoidance technology and, eventually, automated vehicles could change much of how operations are conducted at LYNX. Next-generation vehicles could also have better seating arrangement, enhanced information sharing, advertising, and entertainment capabilities, and propulsion systems (i.e., electric buses).

In summary, the following needs of the Transportation Department could be addressed by ITS solutions:

- Enhanced methods for calculating estimated times of arrival (ETA's) and improving the routing, scheduling, and dispatching systems
- Implementing new technology to help with point-to-point directions for fixed route passengers
- Upgrading databases to enable seamless use throughout the agency

Mobility Services

Existing Conditions

Mobility Services supports all on-demand services provided by LYNX, including NeighborLink and paratransit. Operations and maintenance are contracted out, with monitoring by department supervisors as well as the Compliance team.

Customer Service is responsible for call center operations, customer relations, management of lost and found items, and terminal pass sales. This group has been integrated into the Mobility Services Department, whereas back in 2016 it was part of the Marketing and Communications Department. Marketing and Communications is discussed separately in the following section.

Gaps in Management/Service and Future Focus

Survey Results

According to survey responses, top priorities of the Mobility Services Department over the next five years include procurement of a new call center phone system and transportation contractor. Department needs with potential ITS solutions include improving the routing, scheduling, and dispatching systems, implementing new technology to help with point-to-point directions for fixed route passengers, and improving the fare media system for demand response service.

A data need that was identified was the ability to create interfaces that are specific to the needs of this department, making it easier and simpler to find information they use frequently. Mobility Services collaborates with many other departments, and understands that other departments cover many of their core needs (such as IT covering technical infrastructure needs).

Interview Summary

LYNX staff verified the software that is used for paratransit scheduling, NeighborLink scheduling, and the phone system, summarized in Figure 14.
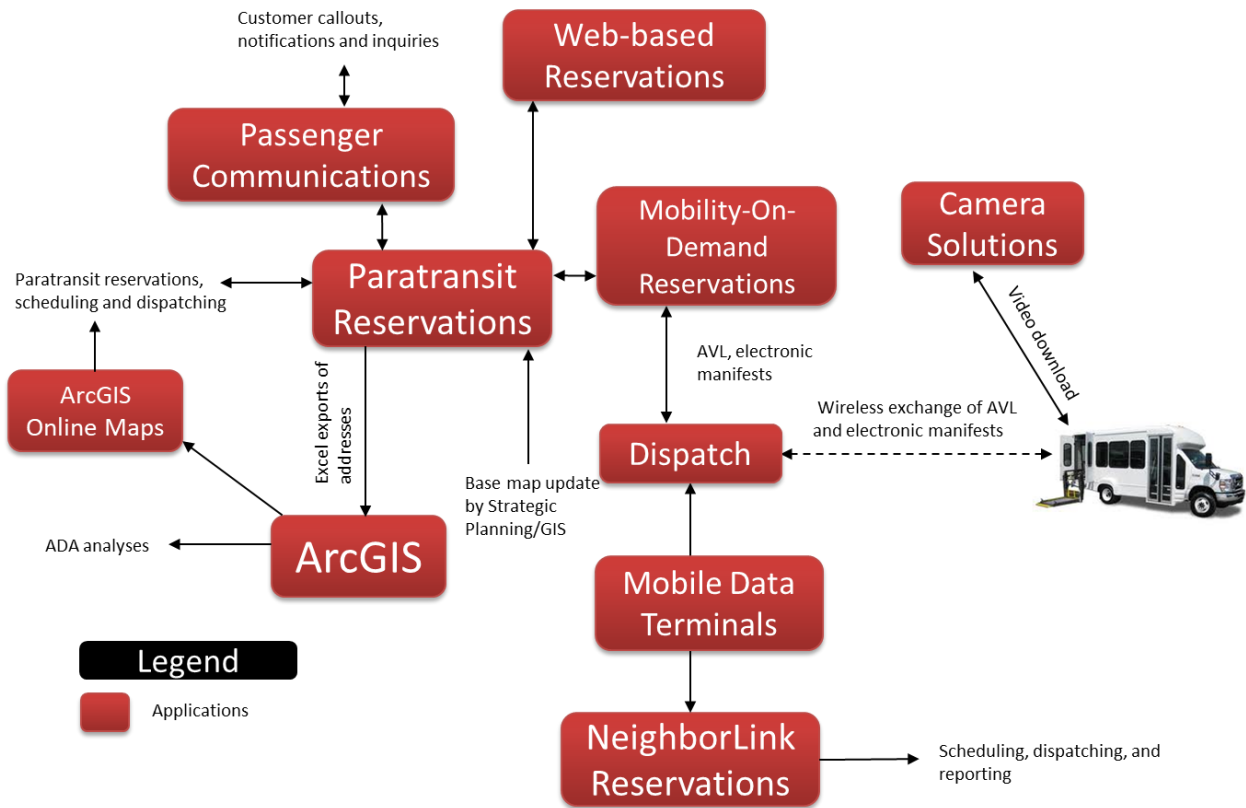

Figure 14: Existing Workflows for Mobility Services

Gap Analysis

Ways to enable cost-effective flexible services could include route deviation for fixed routes; improvements in the ability to make same day changes in demand-responsive service, such as adding trips to fill cancellations; and making it easier for riders to transfer, both between LYNX services and to and from other transportation systems.

On the customer service side, there is a desire for more ways to regularly seek rider input about the quality of service and evaluate current methods of information sharing. During the COVID pandemic, the call center moved to remote operation, which required remote access to all software and impacts training of new employees who will work remote.

Role of ITS Technology to Fill Gaps and Meet Future Needs

The Mobility Services Department has recently implemented initiatives to improve the customer experience, including a new 24/7 online reservation system for paratransit trips and assigning trips to taxis when appropriate. During the past year the call center moved remote, so remote access to all software became an immediate need. This has also impacted how new employees who will work remote are trained.

In summary, the following needs of the Mobility Services Department, including Customer Service, could be addressed by ITS solutions:

- Procurement of a new call center phone system
- Procurement of a new software used for NeighborLink, possibly with a solution that incorporates both paratransit and NeighborLink
- Automated call attendants to help with reservations and responses to common information requests
- Improving the fare media system for demand response service

Marketing and Communications

Existing Conditions

The Marketing and Communications Department creates marketing campaigns and analyzes passenger trends. This department is responsible for communications outreach to passengers and to the community, staff outreach events, and monitoring and managing social media feeds (Facebook, YouTube, Twitter). They also manage and update the website with the help of third-party hosting, oversee advertising on buses, digital signs at LYNX Central Station and other locations, and manage information content on digital signs at LYNX Central Station. The Marketing and Communications Department uses data provided by the Planning and Development Department to edit and print schedule books. They are also responsible for the carpool and vanpool programs.

Gaps in Management/Service and Future Focus

Interview Summary

The discussion with Marketing and Communications covered a wide range of topics. The primary topic was how they get information out to customers. The process is not automated, though in recent years there have been higher traffic volumes on the website and fewer direct calls. Some major systems have social pages just to broadcast information on delays, which is managed by the customer service team. LYNX is not currently populating service alerts for GTFS.

The top priority for Marketing and Communications in the next five years is to bring back something like Transit TV, which would allow the agency to provide important messages to a captive audience. Regional integration of information, which was planned to occur in the past five years, has not happened yet but is still a priority. There is some information sharing with SunRail, and in general Marketing and Communications does not have any major issues sharing data with partners.

Figure 15 shows systems supported by and supporting the Marketing and Communications Department.
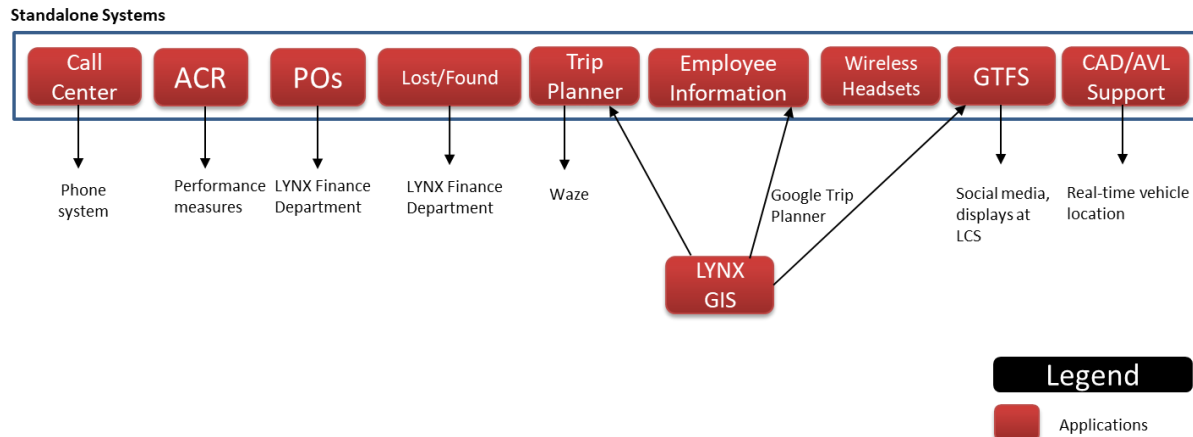
Figure 15: Existing Workflows for Marketing and Communications

WiFi has been available on buses and facilities since 2017, and it is managed by IT (Wi-Fi is not available on NeighborLink and Access LYNX vehicles, just fixed route buses). It is not getting the usage that was expected when it was deployed.

Gap Analysis

Specific needs related to the Marketing and Communications Department identified in other resources included:

- Automated alerts to communicate route delays (dispatch to customer service), which will help representatives to assist customers.
- Automated alerts to passengers to directly communicate the same information, potentially through the GTFS-RT feed.
- User friendly kiosks at LYNX Central Station and outlying transit centers for trip planning and general information, with a printer.
- TV monitors at every bus bay at these facilities and some stops to push out information and potentially sell advertising based on location.
  - o This already exists at every bay at LYNX Central Station.
- Allow customers to call the call center and get bus information without having to speak to a representative.

Role of ITS Technology to Fill Gaps and Meet Future Needs

LYNX currently has a real-time information app and a mobile pass app and provides GTFS-RT to make other apps able to provide real-time information. LYNX needs to continue to have a plan to support this new technology, including training current and new staff, sustaining funding for capital and operating expenses, and interfacing with third-party providers.

New fareboxes and the mobile ticketing application can also offer new functionality to enhance customer experience, as well as create more revenue for LYNX. Genfare Fast Fare fareboxes were installed in July 2020, though not all capabilities have been activated (such as electronic payments).

In summary, the following needs of the Marketing and Communications Department could be addressed by ITS solutions:

- Adding kiosks, TVs, and other enhancements at strategic locations and using them to broadcast information and potentially as an advertising revenue source
- Regional integration for fare payment, transfer coordination, and other ways to enable a seamless mobility connection

Vehicle and Facilities Maintenance

Existing Conditions

The LYNX maintenance functions are broken out into two departments – Vehicle Maintenance and Facility Maintenance. Vehicle Maintenance is committed to the safe and efficient operation of the fleet of buses. The Vehicle Maintenance Department operates at two facilities, with paratransit vehicle maintenance performed by contractor MV Transit at a third facility, each of which are maintained by the Facilities Maintenance Division. The Facilities Maintenance Department is also responsible for all other infrastructure owned by LYNX.

The Vehicle Maintenance Department performs scheduled and unscheduled vehicle maintenance, and software/firmware updates for on-board systems/subsystems on the revenue and non-revenue fleet of buses and other vehicles, as well as for facilities. The Facilities Maintenance Department performs scheduled and unscheduled maintenance at LYNX facilities, Superstops, and bus stops within the service area. Maintenance as a whole is also responsible for the maintenance and configuration/reconfiguration of systems and subsystems that are installed in LYNX vehicles and facilities. Items that need to be maintained include electronic systems, such as Digital Surveillance, Automatic Passenger Counters, Destination Signs, Fareboxes, and Digital Talking Buses.

Gaps in Management/Service and Future Focus

Survey Results

Responses from both the Vehicle Maintenance and Facilities Maintenance teams both stated the need for improvements to work orders and maintenance work distribution, which could be a more formalized program supported by a software system.

Both departments have some informal training opportunities, but do not have a formalized training program. Technical infrastructure in place to support the department includes Trapeze EAM CMMS, Workplace, dynamic budgets, time stamp, Computer Aided Dispatch for monitoring and locating vehicles, Standard Operating Procedures (SOPs), and policies.

Interview Summary

The top goal of the two maintenance departments as it relates to ITS technology is to streamline and automate as many systems as possible. There is a particular interest in the ability to order parts through an automated system, as well as to manage work orders (including those for contractors). Some processes that are currently on paper should be moved to an electronic format that populates follow up tasks as needed to ensure everything is streamlined and adequately addressed.

Figure 16 shows, at a high-level, the standalone systems that are currently used by the two maintenance departments. This graphic may need to be updated to provide greater detail on the services that the departments utilize.
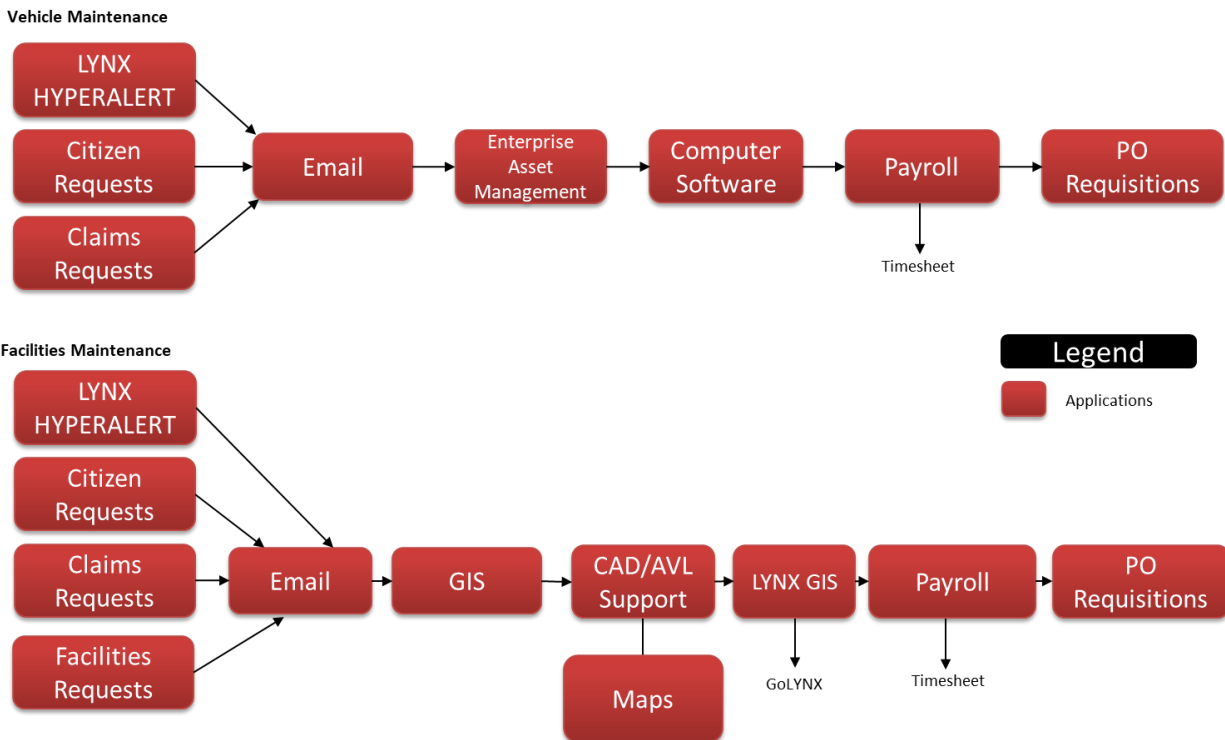
Figure 16: Existing Workflows for Maintenance

There are also about 30 Standard Operating Procedures that support the processes used by the maintenance departments. They have been gathered and stored, though they could be organized and distributed better. Integrating software both within the maintenance departments and across departments throughout the agency would help streamline information sharing and internal consistency.

Gap Analysis

LYNX will be proceeding with a refined site evaluation study for a new site and operation to replace the Osceola Satellite Facility. This new site will need to be designed to service a portion of the fleet that could include electric vehicles (as it is easier to install charging infrastructure in a new facility) and longer, articulated buses. Any other infrastructure needs for emerging technologies will need to be included in plans for this new facility.

LYNX is committed to operating in an environmentally responsible manner in all business areas. Since fleet operations is an area with a high environmental impact, LYNX has been particularly proactive in seeking out environmentally responsible and/or renewable alternatives and solutions. The transition of fuel types for the fleet have added electric vehicles, which will require charging and monitoring. LYNX needs to ensure each vehicle is "fueled" on time for pullout without exceeding electricity supply while minimizing demand charges. The fleet also needs to be monitored as operator performance greatly effects battery usage. Operator driving patterns need to be identified for training to maximize the miles per charge (range and efficiency). Charge rates also need to be monitored to ensure battery degradation over time is understood, as it affects range.

Fleet and components standardization mandates that the same components are specified for all new bus purchases including the placement of components. Benefits of this program include reduced parts inventory, reduced training required for technicians with new vehicles, and lower maintenance costs. The following electronic components and systems are reviewed as part of all new bus procurements whenever possible:

- Voice annunciation
- Destination sign
- Surveillance systems
- Farebox
- Automatic Vehicle Location (AVL)
- Computer Aided Dispatch (CAD)
- Automatic Passenger Counters (APC)

For maintenance systems, an automated parts ordering and retrieval system associated with an enhanced fixed assets inventory system would facilitate both vehicle and facilities maintenance functions at LYNX.

Role of ITS Technology to Fill Gaps and Meet Future Needs

LYNX has installed technology on vehicles to provide efficiency in operations and to improve service delivery and information for passengers. All LYNX-operated revenue service vehicles are monitored by Computer Aided Dispatch (CAD) systems with Automatic Vehicle Location (AVL) and have Mobile Data Terminals (MDT) on-board.

Vehicle Maintenance could be further supported by ITS technology to reduce breakdowns, down time, and cost of repairs through proactive and well-managed maintenance. Facility Maintenance could be supported by adding additional cameras at strategic locations and/or providing access to maintenance of existing camera feeds they do not currently have access to. The Facilities Maintenance Department could also be supported by automated equipment health checks with exception reporting (air-conditioning, electric bus charging station, bus wash, fueling, etc.). Both could be supported by automated maintenance health checks in real-time and/or implementing an automated system to order parts.

LYNX has expressed an interest in the adoption of crowdsourcing options to engage customers and provide an additional mechanism for collecting critical information such as wayside infrastructure (e.g., bus stop signs, bus shelters, and trash receptacles), safety concerns, and overall ridership concerns. The use of crowdsourcing can provide LYNX with cost-effective information and data gathering options that can at the same time enhance customer involvement with the agency.

In summary, the following needs of the Vehicle and Facilities Maintenance Departments could be addressed by ITS solutions:

- Automated parts ordering and tracking of work orders for both vehicles and facilities
- Automated equipment health checks and preventive maintenance scheduling for vehicles
- Crowdsourcing for vehicle and facility maintenance needs

Planning and Development

Existing Conditions

The LYNX Planning and Development Department consists of Service Planning and Strategic Planning. Service Planning is responsible for short-range planning. Specific tasks include making route changes, writing schedules, determining bus stop locations, and preparing operator bids. Strategic Planning is in charge of long-range plan development, and also includes GIS. Strategic Planning facilitates LYNX's connections with the planning divisions in the jurisdictions within and outside LYNX's service area. This department also facilitates coordination with the planning processes conducted by MetroPlan Orlando and FDOT District 5.

Gaps in Management/Service and Future Focus

Survey Results

Survey responses indicated that the department hopes to hire a data analyst as well as have all other vacant positions in the department filled. The data analyst will improve data collection and reporting by being exclusively dedicated to collecting the different types of data the department needs and reporting it in both functional and attractive looking spreadsheets. This is similar to how they currently have someone in the department that is responsible for each project or system. For example, the APC system is monitored by one staff member who is responsible for reaching out to the vendor when issues arise or upgrades are needed.

Planning and Development also intends to conduct a new system-wide passenger survey. This data will also need to be analyzed. A type of data that was mentioned frequently in the responses as something that could be streamlined and improved was National Transit Database (NTD) data.

Planning and Development interacts with every department in the agency. Whether it's coordinating with staff to get input on plans, or supporting the development of their respective plans/processes. Training, via webinars and conferences, is a key part of the role of planners; they have to be constantly learning about what's upcoming in the industry to be able to plan effectively.

Interview Summary

Planning and Development reiterated that there is little desire at the agency to develop new software tools in-house, beyond continuing support for tools that already exist. Instead, the focus is on enabling third party apps, which underscores the need to have the human and technical capacity to make sure data provided is as accurate as it can be and that it is managed well. There is still the opportunity to have an in-house system interpret that data and not just rely on third party apps to take in data and interpret it, for both data integrity and housekeeping purposes.

Planning and Development has numerous Standard Operating Procedures that they have put together over the past few years. Many refer to the applications utilized by the Planning and Development Department, shown in Figure 17.
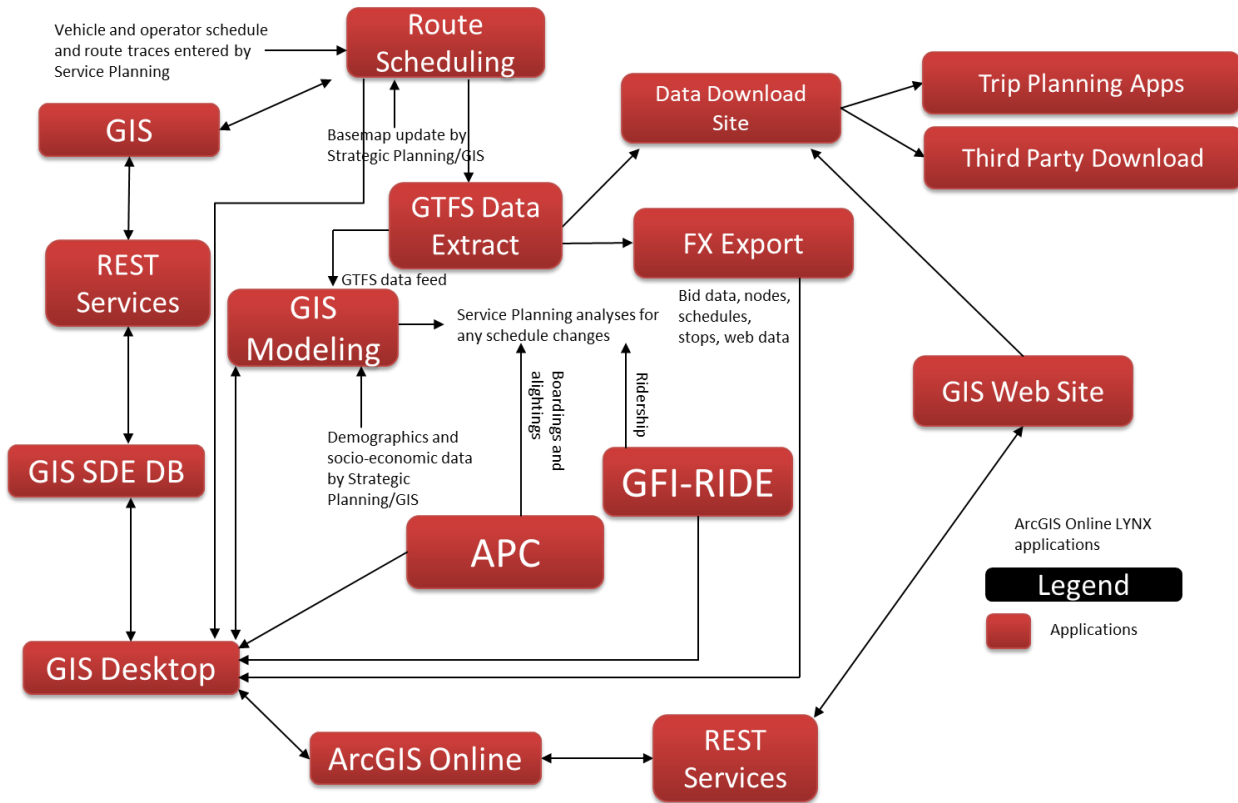
Figure 17: Existing Workflows for Planning and Development

The Planning and Development Department does not currently have a holistic tracking system to monitor systemwide trends and characteristics. Performance monitoring does happen through a variety of siloed static reports and key performance indicators, but linking these to a dashboard continues to be a need of the department.

The TSP system does not provide feedback to LYNX in real-time (intersection TSP requests are reported to FDOT). Planning looks for broader trends, like whether they are seeing a lesser need to add buses to the routes to maintain headways. The TSP initiative in the LYNX service area has been to date managed by FDOT, though there is some desire going forward to have a LYNX-managed system on roads where new premium transit services such as bus rapid transit (BRT) have been identified for application.

Looking forward, there is some interest in connected and automated vehicles, but it is likely many years in the future until this will occur. In the meantime, any investments that are made in dedicated lanes or BRT should be done with the intent of it eventually becoming an autonomous running way. This will allow the transition to occur gradually and not preclude any future opportunities in LYNX's service area.

Gap Analysis

There is a desire at the agency to support the evolution of existing systems toward open systems (not proprietary) to support flexibility in solutions and system integration. Policies need to be created to require new systems to support integration.

Interfaces with other agencies, including SunRail and FDOT on shared projects and interoperable systems will continue to be important.

There is also a need for more ITS emphasis in planning, including programmers, staff to support input to maintain systems, more emphasis on keeping data up-to-date and accurate, and policies to ensure that data is being input into systems.

NTD reporting currently relies on requesting data from departments. There isn't a repository or a standard form to get this information on a monthly basis. Planning and Development receives the data from departments and has to review it and report it to the NTD system. It's a stressful process, because it relies on people reporting it accurately and on-time. A lot of effort goes into gathering the data.

Information and data sharing with other agencies is not a seamless connection, but rather just the sending and receiving of static reports.

Role of ITS Technology to Fill Gaps and Meet Future Needs

ITS systems can facilitate more effective and efficient operations planning, reporting, data archival, and planning coordination with other agencies. Specific initiatives could be to develop a capital funding system and improve any reporting system to better monitor progress towards performance measures.

Planning and Development can also consider adding more functionalities to the TSP system and other projects that have been implemented since 2016, such as the APC devices that have now been installed on every fixed-route bus. By exploring how this data could be better utilized and analyzed, Planning and Development can enhance operations and make recommendations that are based on analysis of real-world data and a more informed understanding of continued data needs.

In summary, the following needs of the Planning and Development Department could be addressed by ITS solutions:

- Create a system wide performance monitoring and tracking system, with real-time performance monitoring and creation of a dashboard for key performance indicators, enabled by systems across the agency that can talk to each other
- Streamlining and improving NTD reporting and information sharing with other local agencies
- Exploring more applications of and locations for the TSP system

Engineering and Amenities

Existing Conditions

Engineering and Amenities are responsible for designing and building the core physical infrastructure required to support LYNX service. This includes the identification of sites for amenities such as shelters and transfer centers, as well as their design and construction. Considerations need to be in the design to support future ITS systems including conduit, power, space, mounting locations, and data connections. This team (currently only two staff) is located within the Finance Department.

Gaps in Management/Service and Future Focus

Survey Results

Survey responses stated that the Engineering and Amenities team is working on updating and adopting Standard Operating Procedures and leading various capital projects. They would benefit from project management software and agency-defined performance and service delivery monitoring and feedback.

Engineering and Amenities works with departments across the agency, but not all departments understand what their role is, so there may be a need to start a separate Project Management Office.

Interview Summary

Many topics were discussed in the interview, most notably the use of engineering Standard Operating Procedures (SOPs) and the need for project management software. The engineering SOPs have been complete for some time, but are waiting for review and integration with the SOPs of other departments.

Engineering and Amenities is currently acting as a de facto project management office, bridging all other departments to help them procure and manage engineering firms for support. To manage this, they use a lot of Excel sheets, as they don't have dedicated PM software (they have access to Microsoft Project but it's not installed on every computer). Engineering would like to have a tool that provides a vision of all the projects that are happening at any given time and all those that are planned.

This tool would need integration with many other programs at LYNX to make sure they have information from the appropriate departments and so everyone can see what's going on for each project. There is concern about having a system or software that is cloud-based rather than something that's installed and housed on the computer. Cost is also a consideration.

Gap Analysis

LYNX continues to move forward with the planning and construction of new facilities to support and improve transit service. Planning for future facilities has included coordination with local partners and innovative design concepts. ITS applications should be included in these concepts whenever they make sense, which has not always been the case in the past.

LYNX does not have agency-defined performance and service delivery metrics, which limits the ability to measure trends over time and determine whether the department is operating efficiently.

Role of ITS Technology to Fill Gaps and Meet Future Needs

The needs that Engineering and Amenities would implement will be defined by the needs of other departments, and should be supported by systems engineering processes whenever possible. Systems engineering training would be a beneficial program to provide guidance on how to approach and understand project components, especially for ITS projects.

Adoption of Standard Operating Procedures will help guarantee that whatever policies are agreed upon, have accountability and traceability to being implemented and followed.

A specific ITS application that could support this department is a project management software.

In summary, the following needs of the Engineering and Amenities team could be addressed by ITS solutions:

- Project management software
- Systems engineering training
- Adoption of Standard Operating Procedures

Safety and Security

Existing Conditions

The Safety and Security Department is primarily responsible for security and safety compliance. The Safety and Security Department works with each department to ensure safety, emergency management, and security are core to their decision making. This includes overseeing drug and alcohol compliance, emergency management, new security technology, physical security presence, and transportation safety.

Gaps in Management/Service and Future Focus

Survey Results

Members of the Safety and Security team stressed the need for implementation of a safety management system and more training programs in their survey responses. Another identified priority was examining creative ways to improve safety from a technological perspective. Technology replacement and upgrades were also identified as specific needs.

Digital forms to be shared during an emergency activation would be useful for the department. The department is well-versed in the systems it is using, but open to trying new systems. Performance meetings and training plans are used to ensure staff member skills are developed appropriately to current and emerging technical and business needs.

Cameras have been installed on all buses. However, video is stored locally on the bus and can only be downloaded on demand once the vehicle is back at the maintenance facility. Live access is not available, with the exception of encrypted line-of-sight Wi-Fi access.

Interview Summary

The interviews discussed many needs of the department, including the implementation of a new safety management system. This is something that will be mandated by FTA, so it's not only required but will also enable an agency-wide safety program that explains to each department what their roles are related to safety.

Recently, a new solution for communication with passengers on safety issues was procured, the SeeSay app. Customers have the ability to text and read responses. However, this app tends to only be downloaded by passengers when they have had an issue, resulting in few downloads. An alternative for emergency alerts for passengers could be to push them through GTFS-RT, which would go to all mobile apps connected to the feed. The Safety and Security Department is also in the process of including a Safety and Security section on the LYNX website to better inform people how to safeguard themselves while using the system. On board vehicles, the talking bus feature runs a general loop with different messages for the riding public. This feature is geo-cued, and provides bus stop arrival information as well as safety tips.

Safety and Security feels that they are currently getting all the data they need from the system and from partners. They collaborate within the agency and share ideas as issues arise. If there's an incident that's associated with a roadway design constraint or inappropriate construction signage, or they see a spike in a particular type of accident that is taking place, they will share

these findings with the LYNX Planning and Development Department. This department will in turn reach out to the cities LYNX serves to find a suitable remedy.

The systems the Safety and Security Department currently utilizes are summarized in Figure 18.
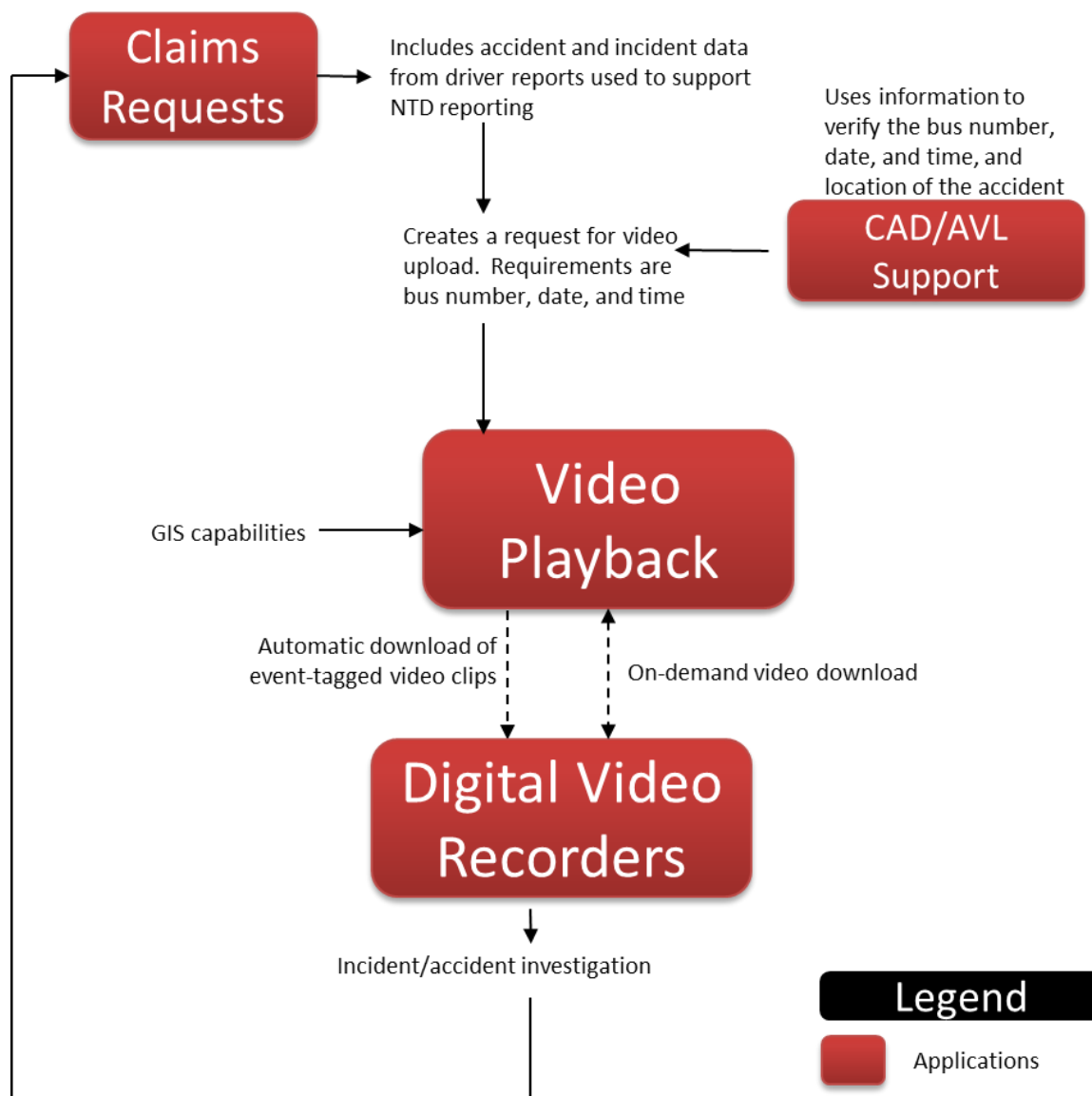
Figure 18: Existing Workflows for Safety & Security

The process for assessing an incident depends on the severity of the incident. If an incident or accident takes place in the field, the operator will fill out an incident report. Automated accident reports (long and short forms) are available on tablets and smart phones. These have error checking, can be filled in in either English or Spanish, and automatically sync to the Risk Department for future follow up.

Safety and Security will use the date, time, and bus number to download the footage once the bus has returned to the facility. Once video has been downloaded, it's moved from the video vendor's system to the network database. Videos are housed there for a safety officer to review

and make a determination if the incident/accident was preventable or non-preventable by the bus operators. Footage from the video is also used for corrective actions and refresher training. Safety and Security will provide the video to Law Enforcement upon request. The Risk Management department will provide the video to an attorney upon subpoena.

Safety and Security have been considering methods to communicate with all staff in the event of an emergency or the need to communicate other immediate information. Not everyone has email access, so this would need to be a mobile or other type of system that builds on the previous Lime Alert system. ITS technology could be used to provide enhanced information related to emergency communication.

Gap Analysis

All vehicles in the Access LYNX system and all fixed route buses are required to have working two-way radios. Two-way communications availability is confirmed through safety inspections and monitoring. However, there could be other ways to facilitate communication in real-time by leveraging other emerging technologies.

The most common types of safety incidents currently experienced at LYNX are street-side mirror strikes and street-side and curbside sideswipes. These generally involve another vehicle striking the bus, so collision avoidance systems and other solutions may not help resolve these situations.

Role of ITS Technology to Fill Gaps and Meet Future Needs

On the passenger safety side, ITS technology could be used to improve the ability to quickly and effectively respond to medical, security, and other incidents on board vehicles and at transit facilities.

With the advent of Connected and Automated Vehicles, the addition of safety protocols for these vehicles can offer several benefits to LYNX and should be reviewed as the technology advances and becomes available at the fleet level. Advancements in connected vehicle technologies can be used to successfully integrate different transit systems, such as connecting LYNX's bus fleet with the SunRail commuter rail. Low levels of automation, such as collision avoidance systems could support operators in operating more safely by increasing their situational awareness.

Collision avoidance systems have been considered by the Safety and Security Department as a potential need in the past, but there are a few concerns. One issue is the time that it takes for the system to discover a hazard on the road and alert the operator and for the operator to then take evasive action. Systems have improved at making these detections, but timing is still an issue. The other concern relates to operators becoming accustomed to getting an alert.

In the longer term, driverless vehicles may need to have a staff presence onboard to assist with customer needs and resolve security incidents.

On the data side, most sensitive information is shared by email or hard copy. Communication with financial institutions is over secured lines and using tokens. LYNX has integrated chip technology with all readers.

In summary, the following needs of the Safety and Security Department could be addressed by ITS solutions:

- Implementation of a safety management system (SMS) and more training programs associated with that system

- Method for communicating urgent information to all staff at the agency, as well as to passengers

Procurement, Finance, and Material Control

Existing Conditions

The Procurement Department is responsible for solicitation processes. Specific tasks include assistance with developing specifications and scopes for contracts and coordination with vendors. Procurement is housed in the Finance Department, and also works closely with Risk Management and Legal.

The Finance Department is responsible for providing timely, relevant and accurate financial information to senior management and LYNX's funding partners. The Finance Department's major areas of responsibilities include financial reporting, revenue collection, budgeting, grants accounting, fixed asset accounting, accounts payable, accounts receivable, payroll, property management, and materials management. LYNX does not have a dedicated funding source, so funds are allocated by budget and/or grants received. Finance interfaces with all departments to process invoices and payroll. They also communicate externally to report budget information to funding partners and respond to external audits.

The Finance Department includes Material Control, so this section also considers the handling of assets and inventory. Engineering and Amenities is also organized under Finance and was explored in a previous section.

Gaps in Management/Service and Future Focus

Interview Summary

The Finance Department's biggest need is updated software solutions. The department is currently very paper-driven, and this would improve the accuracy and availability of information. The systems and applications the Finance Department currently utilizes are shown in Figure 19.
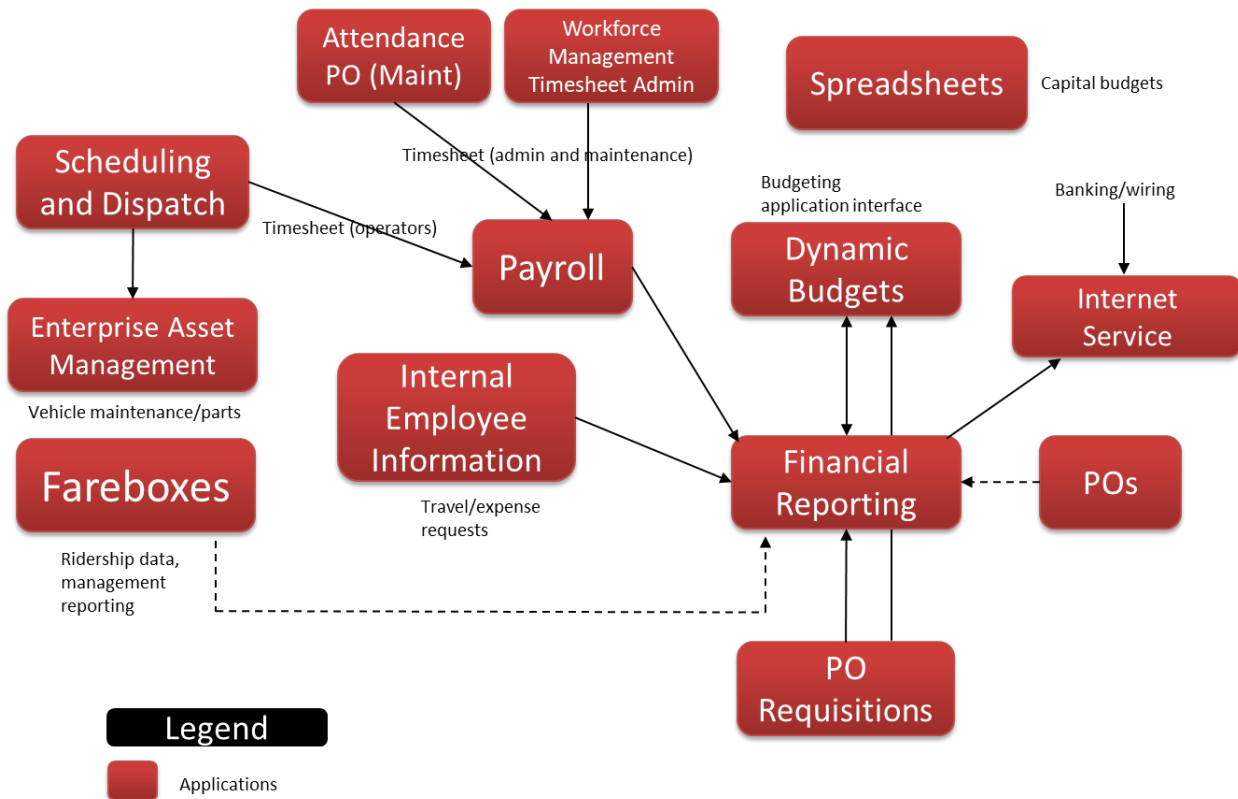
Figure 19: Existing Workflows for Finance

Other needs relate to reporting ridership data more efficiently, which can be enabled through the use of new fareboxes that have better reporting as well as newer APC devices that provide a secondary data source. These fareboxes also have enhanced abilities for fare integration and open payments, which may be utilized in the future. An example would be a guaranteed minimum fare, which many agencies are currently exploring. Cash collection of fares has decreased in recent years, and with Genfare there is expected to be a further decrease in cash collection (though there will likely always be a need to include cash as an option).

The Procurement Department uses Microsoft Access and Excel spreadsheets to track RFQ's and active contracts, but is interested in pursuing a more software-based solution. This would be a contract management software that also helps with Disadvantaged Business Enterprise (DBE) compliance and proactively flags contract expiration dates.

Material Control's primary need is for a barcoding system for fixed asset tracking that will provide the ability to get clear and accurate data on assets.

Gap Analysis

LYNX does not have a dedicated revenue source, so budgeting long-term is harder. LYNX pursues grant funding for ITS projects, but can be challenged by meeting local match requirements.

There are currently procurement and financial systems that cross multiple departments to meet the needs of each, while having the information in one place rather than needing to rekey it. These systems can become disorganized.

The ability to accurately gather ridership data in an efficient manner would help the entire agency, including Finance. Ridership is reported to funding partners and to make decisions related to operations.

Finance has been using the same payroll system for 20 years, and it is a bit antiquated. It would be nice to get more and better information from the system, in the right format and the right level of detail. LYNX has extensive files on Accounts Payable records in hard copy, but they should be electronic. There are also electronic time sheets, but no automation to move them through the system. Electronic processing of invoices with automated tracking capabilities would also be useful. Finance recently converted to chip readers on card readers and moved from manual checks to pay cards, so some of these gaps are beginning to be addressed.

Procurement does not always have the full skill set to write a requirements document for a procurement, and need a technical writer as a resource on staff to support departments.

For Material Control, a system for tracking fixed assets, especially in the field, would make it easier to perform the inventory process. An example could be RFID tags. Funds are in the LYNX capital budget, but the implementation needs more staff.

Many ITS and other emerging technology systems have some level of continuing system or data recurring costs on a monthly or yearly basis. Review of contract language will be critical to identify and plan for these recurring operating costs, as they can be costly and must be planned for beyond the initial capital cost.

Competitive procurements are based upon approved procurement guidelines, including a minimum number of responses for a procurement to be moved forward. There may be challenges receiving a sufficient number of proposals for some emerging technologies. Sole source procurements or other alternatives may also need to be an option in these cases.

Role of ITS Technology to Fill Gaps and Meet Future Needs
Better technology would free up some staff time and reduce the need for more staffing, particularly related to spending time analyzing data and making decisions based on manual input of data.

For fare payment, ITS technology would provide the ability to implement more sophisticated fare payment strategies that will allow for participation in regional integrated payment systems, reduce fare-handling costs, and provide additional convenience to riders. This would likely be supported by a virtual fare reseller via third party integration and open payments.

Implementation of an effective procurement management system and an automated solicitation process would also be useful to improve the process for vendors and contracts. LYNX should start by revisiting existing templates to improve the process. The ability to effectively develop specifications to provide accurate information to vendors based on data that is already in the system would also be useful to Procurement.

In summary, the following needs of the Procurement and Finance (including Material Control) Departments could be addressed by ITS solutions:

- Contract management software
- Procurement software
- Fixed asset tracking system

- Paperless document management to improve workflows for approvals and requisitions, especially with remote work

Grants

Existing Conditions

The Grants Department leads the programming and management of grants for LYNX projects, including local, state, and federal grants. This includes applying for grants and managing the grants that are awarded.

Gaps in Management/Service and Future Focus

Interview Summary

Improving the grant reconciliation system with financial data continues to be a need of the department. Grant financial data is dependent on the Finance Department, which still uses the Great Plains system. Reconciliation may be improved when a new financial system is implemented or if a module becomes available that could do the reconciliation process automatically. The current system does not have a separate grant process. The manual process currently involves taking the reports from Great Plains and developing Excel worksheets to take individual grants and see their expenses and obligations. Grants will then follow up with project managers based on this reconciliation to see if the project is still ongoing and how long it will take to complete. This provides information on the balance left and the PO. If these reports were automatically developed, they could be sent directly to the project manager for verification and then the process would be complete.

In 2016, Grants had also just begun using a new system deployed by FTA (TrAMS), as part of a new reporting process to the FTA. This and other systems used by the Grants Department are shown in Figure 20.
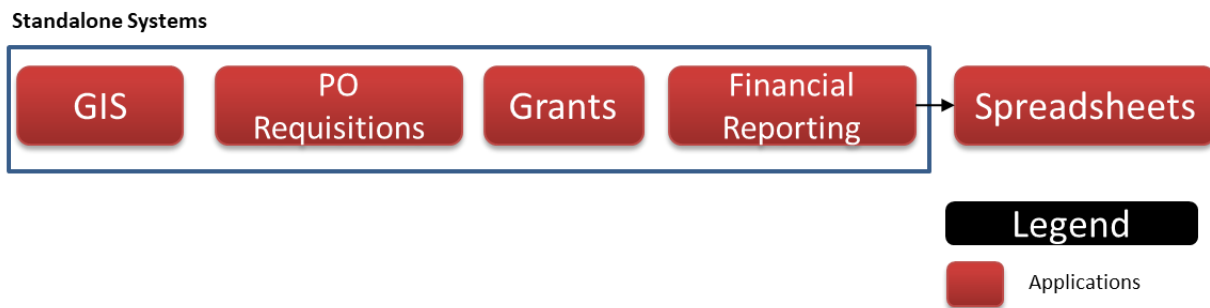
Figure 20: Existing Workflows for Grants

Currently, the Grants Department reports to FTA on a quarterly basis for each project and monthly for fleet reports. If LYNX had a project management system where each project manager could update their progress on each project, this process would be much easier. Projects could then be updated on a monthly basis by each project manager, so the information would be readily available to the Grants Department when reporting time comes. The current process is to send out emails every quarter, which is quite a labor-intensive process that can involve some back and forth. This would also help from the PM side. For example, when a project is closed out in October, it can be hard for PMs to remember the details come reporting time in January.

While NTD reporting is conducted by the Finance and Planning and Development Departments, Grants is the user of the data, and they receive the information as a hard copy. A centralized NTD reporting or saving system would therefore benefit Grants as well.

Gap Analysis

From other resources, an identified need is to improve the grant reconciliation system with financial data. This will improve the reporting process and avoid dual reconciliation. Grants is also an example of a department that will benefit from the development of this strategic plan by obtaining a better understanding of the ITS needs that can be matched to grant opportunities as they are released during the five-year planning horizon of the document.

Many federal grants require a local match. If LYNX can find a local partner to commit to a match, LYNX will complete an application, but if not, they may have to pass on a funding opportunity.

Role of ITS Technology to Fill Gaps and Meet Future Needs

Many of the needs of the Grants Department depend on the needs of other departments. In addition, ITS systems are eligible for some specific grant opportunities, including the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) grants, that this department should continue to monitor for future opportunities.

In summary, the following needs of the Grants Department could be addressed by ITS solutions:

- Continue to improve the grant reconciliation system with financial data
- Streamline grant reporting through an automatic process

Legal and Compliance

Existing Conditions

The Legal group is responsible for ensuring that LYNX complies with all applicable laws and regulations for all of the business it conducts. LYNX has added the in-house legal team since 2016 under the Chief Executive Officer (CEO). They continue to be supported by outside counsel as well.

The Compliance group also reports to the CEO and works to ensure that LYNX complies with the many regulations on public transit, particularly when it comes to procurement and accessibility. This includes Title VI analyses, which rely on GIS support, as well as Limited English Proficiency analysis.

Gaps in Management/Service and Future Focus

Interview Summary

Most of Legal's needs as they relate to ITS technology are being met. One outstanding need is for a software that could help with Disadvantaged Business Enterprise (DBE) compliance. For example, a database software for tracking and filing compliance would ensure LYNX and the companies it does business with are meeting their requirements. Depending on the type of service being provided, there will be paperwork that a contractor has to submit to prove that a DBE enterprise is working on a project. LYNX has to categorize and report on this annually, which is what this database would support.

Legal would also like more guidance on policies. This guidance can generally be obtained from the FTA, by either looking online or reaching out, but a more centralized method of obtaining guidance would be helpful.

The last topic discussed was data sharing. Data sharing is not always covered by Sunshine laws or state statutes, so LYNX does sometimes have to add specific language to contracts with vendors to ensure that data is secure and handled properly. IT manages the security requirements, but Legal participates when there is a legal component involved.

Gap Analysis

In general, in the 2016 ITS plan interviews, staff felt a critical need to reduce the amount of paper processing within the organization, and to develop more streamlined communication channels between departments, as well as a common data base. Doing so will need to meet any existing and new legal requirements. Contract review is currently done electronically, but routing is still a hard paper process. PO's and approvals are also still using paper. To go paperless, LYNX must put that in their policies, and they would need to get buy-in from all departments that are involved in the process.

Role of ITS Technology to Fill Gaps and Meet Future Needs

Legal is more likely a supporter of any deployments than a customer of ITS technology. However, Legal and Compliance will need to be involved to ensure any new systems continue to meet legal requirements. An example is the certification and eligibility process for customers for ADA paratransit eligibility based on the relevant Federal Administrative Code. Even more innovative systems, such as connected and automated vehicles, need to meet ADA requirements, as well as Federal Motor Vehicle Safety Standards and other regulations.

Authorization is obtained from executive staff when exchanging data within LYNX and outside agencies. All external data sharing needs to be reviewed with the Legal Department.

In summary, the following needs of the Legal and Compliance Departments could be addressed by ITS solutions:

- DBE compliance database software

Risk Management

Existing Conditions

The Risk Management Department is primarily responsible for claims management and risk assessments. The department works with the TrackIt software team for updates to the system.

Gaps in Management/Service and Future Focus

Survey Results

Survey responses indicated that processes that could be improved include video viewing (having one central location for all to view videos and updated equipment to view, including in real time on vehicles and at transfer locations) and timely claim reporting and investigation. The later process could be supported by timely reporting from employees. A better Risk Management Information System (RMIS) system is also needed. The department also works with the TrackIt software team for updates to the system.

Interview Summary

Risk Management's primary software system used is TrackIt. This system does not have a dashboard or good analytics, nor does it have real time reporting. It is not really an RMIS system, nor is it one of the leaders in the field. Moving to a better system is on the department's five-year wish list.

Another five-year desire is to move the handling of claims in-house. There could result in substantial cost savings, an increase in follow up of insurance claims, and better documentation of claims if this were done in house.

Risk Management is currently receiving most of the data they need, other than access to real-time video feeds. Without video feeds, they often need to rely on handwritten reports from operators or supervisors.

Gap Analysis

Federal regulations require providing the longitude and latitude for the location of any given incident. LYNX's emergency notification system might have the capability to provide accurate geolocation information for incidents. The bus AVL system might also have this capability. However, there are no training or support opportunities available that could allow using the capabilities of the existing technology in place to the fullest.

There is a need to hire more supervisors, training personnel and clerk assistance for the Risk Management Department.

Protection of data, including for any ITS systems, is very important. Data sharing with outside entities and access to external data sources needs to consider this.

Role of ITS Technology to Fill Gaps and Meet Future Needs

Risk Management currently uses SEON to download video from on-bus security cameras using a wireless connection. The video can only be downloaded when the transit vehicle is in the yard; the system allows downloading video from 10 vehicles at a time. The SEON system may still need to be updated to improve the following:

- Video download requests are sometimes not processed, and the SEON system does not provide messages or alerts identifying the reason for the unprocessed requests.
- The Osceola maintenance facility currently handles about 1/3 of the LYNX fleet. There is no wireless connection at this facility; therefore, videos from the vehicles stored in the Osceola facility cannot be downloaded using SEON.

ITS technology could also enhance the ability to communicate with bus operators in case of an incident.

In summary, the following needs of the Risk Management Department could be addressed by ITS solutions:

- An enhanced RMIS system
- Bring handling of claims in house

Training

Existing Conditions

The Training Department supervises and directs the functions and activities associated with organizational development and training. The department is responsible for managing the development, administration, and evaluation of training policies, programs, methods, materials, and techniques throughout the agency. This includes new bus operator training, bus operator refresher training (every two years), new supervisor training, supervisor refresher training, accident prevention training, and Commercial Driver License (CDL) training. Vehicle maintenance training is handled by the Vehicle Maintenance Department.

Gaps in Management/Service and Future Focus

Survey Results

The department's top priority over the next five years is to move to a computerized employee file storage system, as well as a paperless training file. They also plan to improve the bus simulator software and hardware as well as improve the employee training tracker.

To support training needs, they exchange data with other departments, including the use of Trapeze to enter new bus operator information with Transportation, data entry to TrackIt and video from accidents for re-training operators with Safety, and lists of newly hired bus operators and transportation supervisors for training with HR.

Interview Summary

Training interacts with many different systems and databases, but they don't all talk to each other. Training uses a set of standalone systems, as identified in Figure 21.
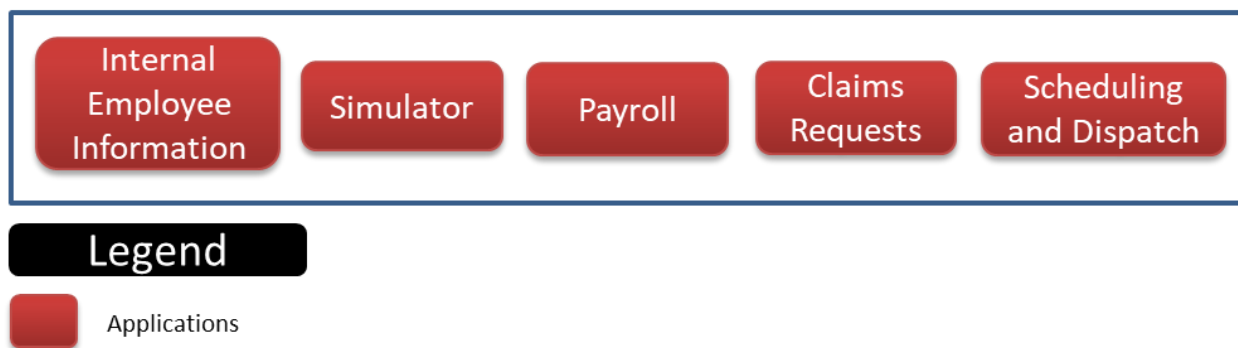

Figure 21: Existing Workflows for Training

The bus simulator is a standalone system that does not connect with anything. The software is over five years old, and there are plans to update that software to create better scenarios for accident prevention. That is now in the capital budget for 2022.

The main communication between Training and HR is for new hire set up, training, and orientation. Training then implements their plan for developmental training throughout the course of employment. LYNX does not currently do employee reviews, and would like to develop a plan for performance reviews, with a performance management system that ideally links to training and payroll modules.

While other departments may benefit from real-time video feeds, after-the-fact pulling of video footage is sufficient for Training's needs. Right now, the Safety and Security Department would have to convert the video for Training. The purpose of viewing the video is to review it with the operator, so they can see what their actions were. There is not currently automated identification of aggressive driving (excessive acceleration and sudden stopping) or other behavior that could identify specific operators for re-training. However, this is likely to grow in importance with electric vehicles, as the manner in which the bus is driven more directly affects battery range.

A computerized employee file storage system or paperless training file is a major need of the department. Right now, Training has to track all training manually. Moving forward, the plan is to make sure to create a mechanism to store that information to avoid any issues with obtaining the

information they need when they need it. Moving to an e-learning system is the next priority. There is a lot of training that needs to happen, but they don't always have the space and rooms available. E-learning can help support the agency's need of educating operators more frequently and in a timelier manner.

Gap Analysis

One issue is that training is typically given at staff hiring, and then there is not a program for refresher training for all positions. Systems deployed for a long time have resulted in staff training new staff, so lack of knowledge, short cuts, and bad habits may be passed down. This also has resulted in localized "gurus" who may be an "expert" in a system even though it doesn't match their job classification.

As a specific department example, based on the analysis of the internal audits of the Maintenance Programs, training is tailored for all technicians on any deficient area(s). The training program covers all subsystems in the revenue vehicles and training begins the first day as a new hire. The training sections cover maintenance bulletins and alerts. In addition, technician training is scheduled on a yearly basis based on technicians' needs, fleet analysis and audit reports analysis. All technicians are required to attend training when selected. Training is completed on site in the dedicated training bay. The training sessions not only administer training but also formulate and create training documents.

Role of ITS Technology to Fill Gaps and Meet Future Needs

Training for new employees and refresher training on ITS technology would be useful. This should include training for administrative staff, which may need to include travel to national conferences to stay aware of emerging technologies. A dedicated group that can provide training and support for the existing and future ITS systems would greatly enhance ITS deployment at LYNX.

ITS technology could also be used to support existing training needs. For example, automated identification of aggressive driving could identify specific areas for retraining operators.

In summary, the following needs of the Training Department could be addressed by ITS solutions:

- Computerized employee file storage system or paperless training file

Human Resources

Existing Conditions

The Human Resources (HR) Department supervises and directs the functions and activities associated with organizational development. The department integrates and ties the goals of training to the strategic needs, core competencies, and performance expectations of the organization. Functions include supporting recruitment, employee relations, compensation, benefits, and wellness.

Every department creates an Operating and Capital budget annually. Labor is handled by HR, so other than identification of needed positions, departments do not budget labor time.

Gaps in Management/Service and Future Focus

Survey Results

This department plans to prioritize resources to obtain a document management system and offer computer-based skill training. They also want to have a more attractive and interactive website for recruiting purposes. This would include walking potential employees through the CDL licensing

process. Having the information online rather than having to call and make contact with somebody to answer questions could facilitate the recruitment process.

For project management, the majority of projects are handled within the department. They do not have a system that manages projects. Spreadsheets are created to track progress. Spreadsheets are also used to provide manpower number data, employee relations data, and compensation data and benefits. The department also operates an HRIS system.

Interview Summary

Currently, HR document management is all paper in a filing room that has to be pulled and refiled when information is needed. An enhanced document management system would be paperless, and house and manage all HR documents, applications, employee change forms, Family Medical Leave Act (FMLA) paperwork, and more. The standalone systems supported by HR are shown in Figure 22.

Standalone Systems

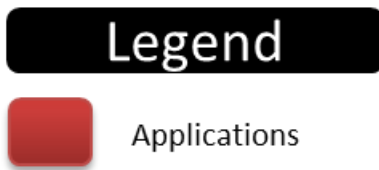| Scheduling and Dispatch	Internal Employee Information	Payroll
	Open position requisitions	Payroll, benefits, recruiting

Legend

🟥 Applications

Figure 22: Existing Workflows for HR

There are a number of issues with the Ceridian system, that may be due to it not being set up properly when it was first implemented. Support has also not been up to expectations. Trapeze works better, but output data is not always in a great format. Systems also do not talk to each other. For new bus operators, for example, the process is to enter all new bus operators in Trapeze first, then HR can put it in their database, then Training has to manually put all that information in TrackIt. There is not one place where they can key information in that exports it everywhere else. The spreadsheets that HR currently manages are all independent and do not interact with each other.

Gap Analysis

The HR Department needs to address compensation equity, employee retention, and creating job descriptions with a training plan attached.

Role of ITS Technology to Fill Gaps and Meet Future Needs

Electronic personnel management (discipline, medical, personnel actions, training) could be automated. The ability to track demographic information for new hires and existing employees will also allow assigning personnel to the nearest maintenance facility, reducing their commute time.

In summary, the following needs of the Human Resources Department could be addressed by ITS solutions:

- Automate process for employee management
- Document management system

Government Affairs

Existing Conditions

The Government Affairs Department is responsible for coordinating LYNX activities with federal, state, and local governments, including processing of grant applications, development of intergovernmental agreements with assistance from Legal, and presenting LYNX positions with respect to new legislation that impacts LYNX operations. In conjunction with the Executive Department, the Government Affairs Department is also responsible for communications with funding partners.

Gaps in Management/Service and Future Focus

Interview Summary

The interview with Government Affairs discussed the status of regional integration of fares and services with SunRail, which has not happened yet, though information sharing on real-time vehicle locations does occur. While Government Affairs did not report any legal constraints involved with sharing information with other government partners, they did voice a need to automate the process of collecting information that needs to be reported from across the agency and of creating these reports, as the process is currently highly manual.

Gap Analysis

Due to lack of dedicated funding, LYNX has a one-year funding cycle and budgeting process that depends highly on its partners. Enhanced coordination with SunRail and other regional partners continues to be a priority.

Automatic reporting would greatly enhance the reporting that LYNX is responsible for providing to its partners. Board reporting is currently conducted through an antiquated, inefficient system, and more automation and communication between different systems at the agency would greatly enhance this process.

Role of ITS Technology to Fill Gaps and Meet Future Needs

ITS technologies could create opportunities for funding partners to engage with LYNX. LYNX could work with funding partners to get access to their training resources, rather than just funding. LYNX could also use fiber optic cable that may be dormant in the local jurisdiction infrastructure as part of a high-speed metro Wi-Fi network. This would require coordination with other local agencies.

Projects that will be included in the ITS Strategic Plan Update will have to be presented to elected officials and partners. The projects will have to include a timeline to completion and estimated cost. Funding is an issue when it comes to implementing new projects. It takes leadership and a consistent source of funding to be able to implement projects.

In summary, the following needs of the Government Affairs Department could be addressed by ITS solutions:

- Integration with SunRail and other regional partners for integration of services, to become more competitive for funding opportunities, and/or to enhance training
- Automatic reporting system

Summary

Needs identified across the departments have been compared to best practices and discussed during the interviews with LYNX staff. These needs are in line with the principles, presented below, that will form the basis for the goals, objectives, and recommendations of the ITS Strategic Plan:

- LYNX's core mission is focused on providing transit services
  - o Innovation that can support this core mission will be explored as needed, but it will not be pursued for the sole purpose of fostering innovation.
  - o LYNX is not a custom application shop and prefers to procure externally-developed applications or provide data for third party use when doing so is feasible and complimentary to what LYNX can provide.

- LYNX provides the services requested by regional funding partners in support of their programs.

- A needs and systems analysis for any proposed technology solution must clearly and convincingly show a valid operational need exists, with a feasible approach to fill that need at an affordable cost and acceptable level of risk.
  - o Solutions need to solve an existing problem at the lowest level of technology to solve the issue.

- Any data used or provided by LYNX must meet applicable industry standards, so that it can be used to support third-party applications that customers are already using to meet their needs.

- Risk is minimized to the extent possible by integrating the safety and security of projects as a top priority, including cybersecurity.

In summary, Table 5 summarizes the needs of LYNX that could be addressed by ITS solutions and will be explored as recommendations in the ITS Strategic Plan:

Table 5: Department Needs that could be Addressed by ITS Solutions

Department or Group	Need
Innovation and Sustainability	Making data available through industry adopted standards to support externally developed applications
	Establishing the base systems needed to support any agency technology needs
	Supporting the needs of other departments at LYNX and agencies throughout the region
Information Technology	EDR system
Transportation	Enhanced methods for calculating estimated times of arrival (ETA's) and improving the routing, scheduling, and dispatching systems

Department or Group	Need
	Implementing new technology to help with point-to-point directions for fixed route passengers
	Upgrading databases to enable seamless use throughout the agency
Mobility Services	Procurement of a new call center phone system
	Procurement of a new software used for NeighborLink, possibly with a solution that incorporates both paratransit and NeighborLink
	Automated call attendants to help with reservations and responses to common information requests
	Improving the fare media system for demand response service
Marketing and Communications	Adding kiosks, TVs, and other enhancements at strategic locations and using them to broadcast information and potentially as an advertising revenue source
	Regional integration for fare payment, transfer coordination, and other ways to enable a seamless mobility connection
Vehicle and Facilities Maintenance	Automated parts ordering and tracking of work orders for both vehicles and facilities
	Automated equipment health checks and preventive maintenance scheduling for vehicles
	Crowdsourcing for vehicle and facility maintenance needs
Planning and Development	Create a system wide performance monitoring and tracking system, with real-time performance monitoring and creation of a dashboard for key performance indicators, enabled by systems across the agency that can talk to each other
	Streamlining and improving NTD reporting and information sharing with other local agencies
	Exploring more applications of and locations for the TSP system
Engineering and Amenities	Project management software
	Systems engineering training
	Adoption of Standard Operating Procedures
Safety and Security	Implementation of a safety management system (SMS) and more training programs associated with that system
	Method for communicating urgent information to all staff at the agency, as well as to passengers
Procurement, Finance, and Material Control	Contract management software
	Procurement software
	Fixed asset tracking system
	Paperless document management to improve workflows for approvals and requisitions, especially with remote work
Grants	Continue to improve the grant reconciliation system with financial data
	Streamline grant reporting through an automatic process
Legal and Compliance	DBE compliance database software
Risk Management	An enhanced RMIS system
	Bring handling of claims in house
Training	Computerized employee file storage system or paperless training file

Department or Group	Need
Human Resources	Automate process for employee management
	Document management system
Government Affairs	Integration with SunRail and other regional partners for integration of services, to become more competitive for funding opportunities, and/or to enhance training
	Automatic reporting system

ITS/GIS Interface

The LYNX GIS functions are part of the Strategic Planning Division. Although the GIS team's daily interactions are within the Planning and Development Department, they work on a regular basis with IT, Customer Service, Access LYNX, Marketing, and Operations.

Additional detail on the use and potential of GIS at LYNX is provided in the 2022 GIS Strategic Plan Update, developed concurrently with this 2022 ITS Strategic Plan Update.

Existing ITS Projects and Software

LYNX departments and divisions use several technologies for their daily needs. The existing system and software applications and the departments they support are described in Table 6.

Table 6: Existing System-Software Applications at LYNX

System/Software	Description	Department Use
APC Counters	Automatic passenger counting	Transportation
ArcGIS Desktop	ArcGIS for Desktop (ArcMap and ArcGIS Pro) is available in three license levels: Basic, Standard, and Advanced. ArcGIS for Desktop includes an ArcGIS Online subscription at no additional cost	Planning, Mobility Services
ArcGIS Online	Complete, cloud-based mapping platform. It's possible only with ArcGIS Online, a scalable and secure software-as-a-service hosted by Esri	Planning, outside users
CMS Supervisor – AVAYA	Tracks calls into the caller center. Provides statistics on queues and individuals	Customer Service, Marketing and Communications
Dayforce	Timesheets, payroll	HR, Maintenance, Finance, Training
Destination Signs	Vehicle/ride information for passengers	Transportation
DoubleMap – FlexRide	Real-time reservations of NeighborLink services	Mobility Services
DriveCam	Video download	Mobility Services
FA Suite	Vehicle maintenance/parts	Transportation, Finance
GFI/Farebox	Ridership from farebox fares	Transportation, Planning, Finance
Google Maps, Bing Maps, Transit App, other trip planning apps	Static bus schedules and real-time arrival information	Marketing and Communications, IT, Planning

System/Software	Description	Department Use
GovAQ	Track complaints, compliments, and suggestions; interface with LYNX Performance Measures, calculating the average number of days to close cases for NTD reporting	Marketing and Communications
Great Plains	Financial reporting	Finance, Grants
inLYNX	Internal platform for employee facing information, applications, and forms.	Marketing and Communications, Planning, Training, HR
Intertel System	Customer callouts, notifications, and inquiries	Mobility Services
Mobile Data Terminals	Onboard real-time information for operators	Transportation
PASS and PASS-WEB	Paratransit reservations, scheduling, and dispatching, including web-based reservations	Mobility Services
SEON	On-demand video download, automatic download of event-tagged video clips	Transportation, Safety & Security
Simulator	Training simulations for new employees and for retraining	Training
TBEST (Transit Boarding Estimation and Simulation Tool)	Multi-faceted GIS-based modeling, planning and analysis tool Integrates socio-economic, land use, and transit network data into a unique platform for scenario-based transit ridership estimation and analysis	Planning
TrackIt	Claims request for NTD reporting, maintenance tracking	Maintenance, Safety & Security, Training
Trapeze – EAM	Enterprise asset management	Maintenance
Trapeze – FX	Route scheduling	Transportation, Planning, Finance
Trapeze – OPS	Work assignments (from schedule) for bus operators Tracks bus replacements	Transportation, Planning, Customer Service, Finance, Training
Trapeze – Streets	Work assignments matched to buses in field Tracks buses and identifies operators	Transportation, Planning, Customer Service, Maintenance
UTA – APC Ridecheck Plus	Ridership from automatic passenger counters (Trapeze CAD buses)	Transportation, Planning
VUEWorks	Web-enabled Integrated GIS, Enterprise Asset Management system designed to track the condition, minimize failure risk, and optimize expenditures and service delivery of their physical assets	Planning, Maintenance, Grants
WorkPlace	PO requisitions	Maintenance, Finance, Grants

Current ITS Projects

LYNX has multiple ITS projects underway. Table 7 provides details about the timeframe to completion and the issues that are to be resolved for successful implementation. This table does not include ITS projects that have already been fully implemented.

Table 7: Current ITS Projects at LYNX

Project	Description	Percent Complete	Timeframe to Complete Implementation	Project Issues
Transit Signal Priority	Working with FDOT. Opticom Multi-mode 2101 low priority emitters with GPS on bus, integrated to Trapeze CAD systems	100% of original locations, could expand to more locations	Currently in the planning stages	FDOT installed hardware without software causing issues at intersections, LYNX buses had to be disabled until fixed
GTFS, GTFS-RT, GOFS	GTFS and GTFS-RT provide static and real-time arrival information for fixed route services. Ongoing work is being conducted to develop similar standards for on-demand transit systems, a specification currently known as General On-Demand Feed Specification (GOFS)	100% – GTFS and GTFS-RT 10% – GOFS	Currently monitoring what the specifications for GOFS will be and whether existing specifications for GTFS and GTFS-RT will be updated	Service alerts are not currently being populated for GTFS
Cloud-Based Universal Communications as a Service	The implementation of an Internet cloud-based Contact Center service will augment customer communication with LYNX Mobility Service Representatives by using different methods of communication including voice calls, SMS messaging, and web-based chat	20%	Currently out to bid	