MOTION NO. M2012-45
Phase 1 of the ST2 Research and Technology Program

MEETING:	DATE:	TYPE OF ACTION:	STAFF CONTACT:	PHONE:
Operations and Administration Committee	7/5/12	Recommendation to Board	Brian McCartan, Executive Director of Finance and IT	206-398-5100
Executive Committee	7/5/12	Recommendation to Board	Michel Danon, Chief Information Officer	206-398-5170
Board	7/26/12	Final Action	**De Meyers, Research and Technology Program Manager**	206-398-5199

PROPOSED ACTION

Approves Phase 1 of the ST2 Research and Technology Program to implement improved transit customer rider technologies.

KEY FEATURES

- During the Board budget process for the Adopted 2012 Budget, staff committed to return to the Board in 2012 to identify the initial phase of the ST2 Research and Technology (R&T) Program. Staff has developed the 2012-2015 Research and Technology Strategic Plan that outlines Phase 1 of the R&T Program.
- Phase 1 of the R&T Program implements technologies that support Sound Transit's goal of increasing ridership by implementing improved transit rider technologies, including station information, rider alerts, trip planning, real time train and bus data, parking information, and research on fare collection and parking payment.
- Phase 1 will be implemented from 2012 through 2015 at a cost of $9,000,000. Funding for Phase 1 is included in the lifetime budget and the Adopted 2012 Budget includes sufficient funding for work contemplated in 2012.
- Phase 1 also includes funds for program management and planning future phases of the R&T Program.
- Staff will return to the Board or its committees to approve contracts implementing Phase 1 of the R&T Program as required under Board Resolution 78-2.

PROJECT DESCRIPTION & BACKGROUND

The ST2 R&T Program builds on the Sound Move R&T Program and "Sound Transit Technology Plan" established by the Board in 2002 through Motion No. M2002-101.

The Sound Move R&T Plan achieved many of its original goals and contributed to improved customer communication, security and operational efficiency. The program accomplishments included:

- Contributions to development of the ORCA program
- Development of the agreement with University of Washington's TRAC Program for transit research and traveler information
- Completion of Board requested studies for Alternative Transit Technology
- Partnership with King County for Smart Bus Demonstration Project
- Completion of the Paratransit Technology Plan with regional partner agencies

- Creation of the regional GIS based Route Map with King County Metro
- Funding and program development and implementation for Closed Circuit TV and security technology at specific Sound Transit facilities
- Implementation of variable message signs and public announcement capabilities at Sounder Stations and on Sounder trains
- Funding for the On Board Systems and Radio Replacement Projects for the ST Express bus fleet operated by Pierce Transit and King County Metro
- Funding and development of a project agreement with Pierce Transit/City of Tacoma for the development of Transit Signal Priority in Downtown Tacoma
- Development of a project agreement with the City of Redmond and King County Metro for ST Express funding participation in the Redmond Intelligent Transportation Systems Project
- Implementation of Automatic Passenger Counting technology on ST Express and Sounder

ST2 Research and Technology Program

The ST2 R&T Program supports the goals established by the Board in 2002 to improve service in the areas of customer service, safety and security, operating efficiencies, speed and reliability, accessibility, and interoperability between transit agencies.

The original ST2 Program contained $50.5 million (2010$) in funds for the ST2 R&T Program. In 2010, in response to the economic recession, these funds were reduced to $19.6 million (2010$) in the Adopted 2011 Budget, or $24.9 million in year of expenditure dollars.

The Adopted 2012 Budget includes $2.6 million to begin work on defining the ST2 R&T Program and funding active technology projects. 2012 accomplishments include:

- A redesigned website and regional trip planner
- A mobile website that provides riders with schedule information and trip planning capabilities
- Initiating an upgrade to Sounder Wi-Fi to provide more bandwidth for customers
- Researching potential data feeds from the transit operators to support real time information
- Deploying Automated Passenger Counters (APC) on Sounder and ST Express

Phase 1 of the ST2 Research and Technology Program

Phase 1 of the R&T Program is based on initiatives that support ridership growth, providing improved information to transit riders and improving the transit customer experience through technology. The strategic plan identifies four key areas of investment:

- Improved real time bus and train information
- Improved station information and signage
- Improved transit rider tools
- Research and planning for new parking and fare collection systems

The Phase 1 budget also includes funds for program management and funds for planning for future phases for the R&T Program. The attached 2012-2015 Strategic Plan defines these technology investments in detail.

FISCAL INFORMATION

This action is within the Adopted 2012 Budget and Board-endorsed 2012 Transit Improvement Plan (TIP).

Costs for Phase 1 of the ST2 R&T Program will be charged against the $24.856 million ST2 R&T Program in the 2012 TIP (page 167). The proposed 2013 budget and TIP would include updated annual cash flow estimates for the program. The Board would review the R&T Program each year in its adoption of an annual budget.

There is no action outside of the Board-adopted budget; there are no contingency funds required, no subarea impacts, or funding required from other parties other than what is already assumed in the financial plan.

Research and Technology	2012 TIP	Life To Date Actuals	This Action	Actuals Plus Action	Uncommitted / (Shortfall)
Systemwide ($000)	24,856	1,926	9,000	10,926	13,930
Total Current Budget	**24,856**	**1,926**	**9,000**	**10,926**	**13,930**

Total Cost of Ownership

The Phase 1 R&T investments were evaluated based on 5-year total costs of ownership. While the budget to design and build these technologies is $9.0 million, there are additional on-going maintenance and staff costs to sustain these investments. The total 5-year total cost of ownership is estimated to be $10.6 million. This includes the costs for an estimated two full-time employees that would be required to maintain these systems on an on-going basis.

PRIOR BOARD/COMMITTEE ACTIONS

Motion No. M2002-101: Adopted the Sound Transit Technology Plan for funding the development and implementation of advanced transit technologies and authorizing the Executive Director to take necessary steps to implement the Plan.

TIME CONSTRAINTS

A one month delay would not create a significant impact to the program schedule.

PUBLIC INVOLVEMENT

Not applicable to this action.

LEGAL REVIEW

JW 6/29/12

SOUNDTRANSIT

MOTION NO. M2012-45

A motion of the Board of the Central Puget Sound Regional Transit Authority approving Phase 1 of the ST2 Research and Technology Program to implement improved transit customer rider technologies.

BACKGROUND:

During the Board budget process for the Adopted 2012 Budget, staff committed to return to the Board in 2012 to identify the initial phase of the ST2 Research and Technology (R&T) Program. The ST2 R&T Program builds on the Sound Move R&T Program and "Sound Transit Technology Plan" established by the Board in 2002 through Motion No. M2002-101. The ST2 R&T Program supports the goals established by the Board in 2002 to improve service in the areas of customer service, safety and security, operating efficiencies, speed and reliability, accessibility, and interoperability between transit agencies.

Phase 1 of the R&T Program is based on initiatives that support ridership growth, providing improved information to transit riders and improving the transit customer experience through technology. The strategic plan identifies four key areas of investment:

- Improved real time bus and train information
- Improved station information and signage
- Improved transit rider tools
- Research and planning for new parking and fare collection systems

Phase 1 of the R&T Program implements technologies that support Sound Transit's goal of increasing ridership by implementing improved transit rider technologies, including station information, rider alerts, trip planning, real time train and bus data, parking information, and research on fare collection and parking payment.

Phase 1 will be implemented from 2012 through 2015 at a cost of $9,000,000. Funding for Phase 1 is included in the lifetime budget and the Adopted 2012 Budget includes sufficient funding for work contemplated in 2012. Phase 1 also includes funds for program management and planning future phases of the R&T Program. Staff will return to the Board or its committees to approve contracts implementing Phase 1 of the R&T Program as required under Board Resolution 78-2.

MOTION:

It is hereby moved by the Board of the Central Puget Sound Regional Transit Authority that Phase 1 of the ST2 Research and Technology Program is approved to deploy improved transit rider technologies, including station information, rider alerts, trip planning, real time train and bus data, parking information, and research on fare collection and parking payment as detailed in the 2012-2015 Research and Technology Strategic Plan.

APPROVED by the Board of the Central Puget Sound Regional Transit Authority at a regular meeting thereof held on July 26, 2012.

Pat McCarthy
Board Chair

ATTEST:

Marcia Walker
Board Administrator

Transit Rider Technology Strategic Plan 2012-2015

Draft V9

June 29, 2012

Table of Contents

Executive Summary

The *Sound Move* plan approved by voters in 1996 established a $37 million Research and Technology (R&T) Program to "evaluate innovative ways to provide transit service, reduce dependency on single occupancy vehicles, improve public transportation's cost effectiveness, and better respond to customer needs." Through 2009, the R&T Program achieved important objectives to enhance transit services in the Central Puget Sound, including implementing and/or improving CCTV systems, the ORCA smart card, Sounder Wi-Fi, automatic passenger counters, bus communication system, and Sound Transit customer web site.

The voter-approved ST2 program included a $50.5 million (2010$) R&T fund to continue funding and development of transit technologies. In response to the loss of revenue from the 2008-2009 recession, the Board reduced the R&T program to $24.9 m (2010$). This plan outlines the work plan for the ST2 R&T program, which would be programmed as follows:

Phase	Budget (YOE)	Goal
Life-to-date Expenditures	$1.926 M	Completion, upgrade of Sound Move related projects, primarily regional trip planner
Phase 1: 2012-2015	$9.000 M	Deploy the best of proven, cost effective transit rider technologies
Future Phases: 2016-2023	$13.930 M	To be determined To reflect Board priorities and technology opportunities, requirements and budget availability

With the rollout of Link light rail in the summer of 2009, Sound Transit implemented the last of it three major regional transit systems: Link light rail (Central & Tacoma), Sounder commuter rail, and Sound Transit Express bus service. Although construction and expansion continue, Sound Transit's responsibilities for operations have increased and with that, the need to focus on increasing ridership among potential transit riders and to create tools to make the transit system more accessible and easier to use by both current and potential riders.

Transit Rider Technologies provide a potentially powerful set of tools that build on customer-centric, technologically savvy, and forward-looking strategies to attract new riders and increase ridership among existing customers. Phase 1 of the ST2 R&T program focuses on the deployment of proven technologies to improve our customers' experience, learn more about our customers to enhance future transit planning and study, and potentially deploy additional improvements.

This document provides information on the *Sound Move* and ST2 Research and Technology programs. It reviews the Sound Move R&T program and provides planned scope for the ST2 R&T program for the 2011-2023 timeframe. Four major Transit Rider Technology project groups are included in Phase 1.

Phase 1 Transit Rider Technology Projects

Project Group 1: Data and Real Time Solution

- Data Repository
- Data Integrity
- Real Time Sounder and Link Info
- Developer Portal

Project Group 2: Transit Rider Tools

- Real Time Integrated in Maps
- OneBusAway Capabilities
- Improved Rider Alerts
- Improved Trip Planner

Project Group 3: Evolution of Parking and Fare Collections

- Research and Project Management oversight for:
    - Parking Payment/ORCA Validation Study
    - Open Payment Pilot Evaluation
    - Online Ticketing Evaluation
    - Bike Locker Payment
    - ORCA Website and Application Changes
    - ORCA Mobile Site

Project Group 4: Transit Rider Station Information

- Parking signage/information study
- Station signage
- Station signage control system
- TVM interface redesign

Plan Development

This strategic plan was developed by Sound Transits staff in conjunction with CH2M HILL and Winnick & Associates.

Background

Sound Transit Research & Technology Program

The Sound Transit Research & Technology program has been funded by two voter initiatives: *Sound Move* in 1996 and ST2 in 2008.

Sound Move Research & Technology Program

The 1996 *Sound Move* program contained $37 million for a Research and Technology Program to "evaluate innovative ways to provide transit service, reduce dependency on single occupancy vehicles, improve public transportation's cost effectiveness, and better respond to customer needs." In 2002, the Sound Transit Board approved the "Sound Transit Technology Plan" (Motion No. 2002-101), which established the goals, objectives and funding limits for a set of advanced technology-based initiatives. The purpose of these initiatives was to provide research, funding and funds for implementation of new systems to support bus rapid transit-type technologies, improve visual and en route passenger information systems, and increase security technologies among Sound Transit facilities and services.

Under the 2002 Technology Plan, 93% of the funds were earmarked for initiatives focused on improving Sound Transit customer service, safety, security and operations. The remaining 7% were set aside for the Regional Transit Technology Initiative to identify an array of transit technology enhancements that require regional coordination and support.

In addition, the *Sound Move* plan contained a $57 million (YOE$) Fare Integration Program for the development of a single-ticket fare system and integrated fare policy for the Puget Sound region. These funds were invested in the development and implementation of the Puget Pass and ORCA systems.

Framework for Sound Move R&T Program

In adopting the 2002 Technology Plan, the Board established the following R&T program goals:

- Customer Service & Satisfaction
- Safety & Security
- Efficiency
- Fuel
- Speed & Reliability
- Accessibility
- Interoperability

The *Sound Move* R&T initiatives were organized within these goal areas.

Accomplishments of Sound Move R&T Program

The Sound Move R&T Plan achieved many of its original goals and contributed to improved customer communication, security and operational efficiency. The program accomplishments included:

- Contributions to development of ORCA (Smart Card) program

- Development of the agreement with University of Washington's TRAC Program for transit research and traveler information
- Completion of Board requested studies for Alternative Transit Technology
- Funds for the King County Water Taxi
- Partnership with King County for Smart Bus Demonstration Project
- Completion of the Paratransit Technology Plan with regional partner agencies
- Creation of the regional GIS based Route Map with King County Metro
- Implementation of Closed Circuit TV (CCTV) at Sound Transit facilities
- Implementation of variable message signs (VMS) and public announcement capabilities at Sounder Stations and on Sounder trains
- Funds and program development and implementation for CCTV and security technology at specific transit centers
- Funds for the On Board Systems and Radio Replacement Projects for the Sound Transit bus fleet operated by Pierce Transit and King County Metro
- Funds and development of a project agreement with Pierce Transit/City of Tacoma for the development of Transit Signal Priority in Downtown Tacoma
- Development of a project agreement with the City of Redmond and King County Metro for Regional Express funding participation in the Redmond ITS project
- Implementation of Automatic Passenger Counting (APC) technology on Regional Express bus fleet and Sounder
- Funds for and implementation of customer Wi-Fi on Sounder and some buses in the Regional Express fleet.

Lessons Learned from the Sound Move R&T Program

The set-aside of dedicated funds for technology investments, separate from the capital and operating budgets, allowed the development of discrete programs focused on implementation technologies to improve public transit for all providers throughout the Sound Transit region. These initiatives benefitted the entire region.

The original vision of the program was that some funds would be used for technology research, but as the program evolved the Board elected to spend funds on deployment of existing, proven technologies. This shift of emphasis was valuable as it allowed a higher return with lower risk than pursuing unproven, new technologies. The 2012 R&T Plan continues this strategic focus on proven technologies.

In addition, the *Sound Move* R&T projects that had the fastest delivery were those that were wholly within Sound Transit's funding and project management control. While the R&T investments need to be coordinated with our regional partners to provide a seamless customer experience, the higher the management control over the projects the more likely the project will be completed within original scope, schedule and budget.

Business Case & Framework

ST2 Research & Technology Program

The original ST2 program contained $50.5 million (2010$) in funds for the ST2 Research and Technology program. In 2010, in response to the severe economic recession, these funds were reduced to $19.6 million (2010$) or $24.9 million (YOE$) in the Adopted 2011 Budget.

ST2 Framework

The ST2 R&T program will be managed with the existing seven program goals approved by the Board:

- Customer Service & Satisfaction
- Safety & Security
- Efficiency
- Fuel
- Speed & Reliability
- Accessibility
- Interoperability

ST2 Work Plan and Schedule

There are many distribution channels for providing transit information to customers. The internet and a variety of mobile devices have become prominent resources for information dissemination. Coupling these with the large volume of customer information now available from implemented transit systems, such as the ORCA fare system, provides an excellent opportunity to apply existing technology to learn more about our riders to provide better and more timely information to our customers. Sound Transit has implemented a number of technology initiatives in this area, however there are additional technology investments that the agency can implement that have already been proven in public transit.

Sound Transit has completed the majority of its *Sound Move* investments. The transit services that are in place for the public, particularly the Link light rail system, are still relatively new. Consistent with the Board's 2011 strategic priorities, the initial phase of the ST2 R&T Program will focus on increasing ridership and usage of these new services to help Sound Transit reach "mature" ridership levels. This work will be conducted under "Customer Service & Satisfaction," one of the seven R&T Program goals that were established by the Board in 2001.

The ST2 R&T program will be divided into phases, with the first phase comprising 2012 to 2015 and future phases running from 2015 through 2023. This phased approach allows the R&T investment to be made over the full ST2 program period and enables the program to change as transit technology evolves and as the agency's business requirements change, leaving resources to meet agency needs in each phase of the ST2 program. In light of the ST2 projected revenues that were lost as a result of the 2007-2008 recession, this approach will also allow the future phases to be held in reserve in the event they need to be reduced to meet additional revenue shortfalls.

The Case for Transit Rider Technologies

Transit Rider Technologies (TRTs) provide Sound Transit with a potentially powerful set of tools that build on customer-centric, technologically savvy, and forward-looking strategies to attract new riders and increase ridership among existing customers. Phase 1 of the ST2 R&T program focuses on the deployment of proven technologies to improve our customers' experience, learn more about our customers to enhance future transit planning and study, and potentially deploy additional improvements.

With the rollout of Link Light Rail in the summer of 2009, Sound Transit reached a significant milestone in a long effort to plan, build, and implement three major regional transit systems: Link light rail (Central & Tacoma), Sounder commuter rail, and Sound Transit Express bus service. With that achievement, the agency now has multiple roles with responsibilities for planning, construction and operations. With increased responsibilities for operations comes a need to become more customer-focused.

During the last five years, the Puget Sound region experienced very high unemployment as a result of the Great Recession of 2007-2008, which caused initial ridership declines and reduced revenues for the agency. Although ridership is improving again, Sound Transit faces a pressing need to update its brand and capabilities to reflect the new identity as a customer-centric transit operating agency. Additionally the agency is focused on increasing ridership among potential transit riders and creating tools to make the transit system more accessible and easier to use by both current and potential riders.

Faced with these challenges, Sound Transit has identified three major opportunity areas where TRTs can play a significant role in unlocking the value offered by each of the opportunities:

- **Untapped Markets and Mode Shift**. TRTs can help to convert new riders and encourage existing riders to ride more often by increasing rider confidence in both the information they receive and the service they use.
- **New Revenue Sources**. TRTs can provide paid marketing opportunities through variable message signs (VMS) and other channels.
- **Customer Service as a Marketing Tool**. TRTs can support Sound Transit's brand values simply by providing well designed technology systems that are responsive to customers' needs. In addition, communication channels such as the Trip Planner can increase public awareness of the various other TRT services that are offered, and in that way drive even more ridership.

Key Transit Rider Technology Needs, Opportunities, and Challenges

Just as a highway system would be dangerous, inefficient, and forbidding without proper signage, a transit system would be dangerous, inefficient, and forbidding without the proper TRTs to guide and inform riders as they plan and execute their trips. The overall vision for TRTs is to reduce stress for existing riders and eliminate barriers for riders and potential riders. This can be achieved by providing everyone with easy and direct ways to get personalized and location-aware information, where they need it and when they need it. With TRTs, Sound Transit has an opportunity to build public awareness,

reduce ridership hurdles, and build confidence for taking transit, thereby increasing ridership and revenue.

Sound Transit has developed a number of TRT aids to help the public in using the transit system, which have helped to improve operating efficiency by increasing ridership. Some of these TRT systems are more developed than others. For example, the Trip Planner is at a medium level of maturity, but the Link real-time location information system is in its infancy and the data have not been integrated with any other Sound Transit TRT systems.

CH2M HILL was engaged to provide outside expertise to evaluate and assess Sound Transit's needs and available current technologies. Existing systems and those in development were reviewed, both for Sound Transit and for its partner transit agencies, including King County Metro, Community Transit, Pierce Transit, and Everett Transit. In addition to identifying Sound Transit's needs, the CH2M HILL team identified benefits, costs and risks of various TRTs, with the objectives of improving the customer experience and increasing and maturing ridership.

The process included charrettes with Sound Transit staff and an interactive prioritization process with Sound Transit's leadership to assist in focusing and prioritizing the TRTs that were identified as having the greatest potential value for achieving the agency's objectives. Potential projects were also evaluated through the eyes of Sound Transit's rider personas: two "current" riders (Adam, who is techno savvy, and Fernanda, who is transit dependent) and two "potential" riders (Bob, an infrequent rider, and Akio, a tourist from New York City). (See Appendix C for additional information on personas.)

A primary strategy for the first phase of the ST2 R&T Program is to deploy the best suite of proven, cost effective transit rider technologies. Four major Project Groups have been identified for implementation during the first phase of the ST2 R&T Program. Future phase R&T projects will be determined a year before each phase begins, based on technology opportunities, Board priorities and budget availability.

In addition to the TRTs recommended by this process, strategic implementation strategies were identified: User Centered Design (UCD) and Project Management Oversight. This strategy is utilized by many of the projects and is discussed in the R&T Program Development section.

Work Plan

Transit Rider Technology Projects

A collection of 13 transit rider technology, organized into four groups, projects present near term opportunities for Sound Transit to pursue in the next three years.

Project Group 1: Data and Real Time Solution

- Data Repository
- Data Integrity
- Real Time Sounder and Link Info
- Developer Portal

Project Group 2: Transit Rider Tools

- Real Time Integrated in Maps
- OneBusAway Capabilities
- Improved Rider Alerts
- Improved Trip Planner

Project Group 3: Evolution of Parking and Fare Collections

- Research and Project Management oversight for:
    - Parking Payment/ORCA Validation Study
    - Open Payment Pilot Evaluation
    - Online Ticketing Evaluation
    - Bike Locker Payment
    - ORCA Website and Application Changes
    - ORCA Mobile Site

Project Group 4: Transit Rider Station Information

- Parking signage/information study
- Station signage
- Station signage control system
- TVM interface redesign

Each of the TRT groups and projects above is described in this strategic plan including descriptions of current systems, evaluations of needs, benefits and opportunities, and plans for development, deployment and ongoing maintenance.

Project Delivery Risks

The 2012-2015 R&T Strategic Plan details the initial scope, schedule and budget estimates for the 13 plan projects. However, these projects are in very early design and scope definition stage and these initial schedule and budget estimates will invariably change as scope for the projects is better defined, user-centered design input is incorporated, partner agency needs and capabilities are determined and the underlying technology itself evolves. Some of the 13 projects may be dropped from the plan or modified as more information is gained, while other new projects may be added, consistent with the

vision of the 2012-2015 Strategic Plan to deploy proven technology to improve rider/customer information.

Sound Transit employs a phase/gate system for project management, which will be applied to the R&T projects, under which baseline budgets and schedules are established, and reviewed and approved by the agency's Technology Governance Team (TGT) at the point when project scope is finalized. Sound Transit staff will report to the board on a regular basis as schedule, budget and scope information on the 13 projects evolve. In addition, the board will review and approve the R&T budget on an annual basis as a part of its review of the agency's annual budget and Transit Improvement Plan (TIP).

R&T Program Development

Timeline: 36 months
TCO for Program Development: $600,000
Features:

- Institutionalizing user-centered design (UCD)
- Reporting metrics
- Process improvements
- Definition of ongoing needs
- Implementation of best practices
- Phase 2 Strategic Planning

Implementation of the Transit Rider Technology systems presented in this Strategic Plan will be a complex undertaking over the course of three years. Each of the systems will have many touch points with other technology systems, Sound Transit departments, external partner agencies, and external consultants and other vendors. There will be many project management and communications issues to manage during the development, testing, and rollout phases of these projects. In addition, there will be significant integration and institutionalization challenges to address as each of these systems is brought online and solidly established under the umbrella of Sound Transit standard operations.

For each project, day-to-day project management will be performed by the R&T project management team. The level of effort required for these tasks is captured in the FTE column of the budget table. One limited-term project manager will manage each group of projects and will follow ST's IT PMO (Project Management Office) framework. The R&T Program manager will be responsible for leading the team, relationships with partner agencies, Agency communication regarding the program, strategic oversight and the following program development areas.

The R&T Program Development effort will address the following key tasks:

- **Institutionalizing user-centered design (UCD)** – The team will follow the UCD methodology to test deployed systems to ensure they are meeting users needs, and suggest improvements to

the design teams as required. User Centered Design is an evidence based design methodology that optimizes a product based on how users actually want (or need) to use a specific technology – in this case, Transit Rider Technologies. UCD employs a multistage process that begins with studies and predictions of how users will want to use a particular technology, then develops the technology, and then tests the technology in real-life situations to see whether the initial assumptions about user behavior are correct. In this way a virtuous cycle is established wherein the product is continuously improved over time, encouraging more and more usage. Typical UCD design tools include "Personas," which for TRT's describe a typical (fictional) person within a given rider market segment. A "Scenario" is then created for each Persona. A Scenario is a fictional story about the daily life of the Persona. Finally, "Use Cases" are developed which describe how each Persona would interact with the technology product. The Use Cases provide the link for communicating the UCD derived design directions to the software developers.

- **Reporting Metrics** – Systems that are deployed should be monitored by user metrics to continuously evaluate the health/usefulness of the system. Changes in metrics will allow Sound Transit to identify problems within a system and over the long term will create data that can be used to support best practices and lessons learned that can be applied to future projects.
- **Process Improvements** – Program Development oversight provides for continuous review and evaluation of project design, development and implementation by a third party that is knowledgeable of both the project and oversight activities. The Program Development team would engage agency and partner stakeholders in a meaningful exchange of information, provide accurate information regarding project documentation and progress, foster acceptance of new methods of work, and strive to manage expectations of people impacted by the project.
- **Definition of ongoing needs** – Anticipate project needs and risks as projects progress. Potential risks include budget, schedule, staffing, communications, and feasibility. Understanding and managing dependencies among the TRT initiatives as well as with other initiatives at Sound Transit or partner agencies will ensure needs and risks are managed.
- **Implementation of Best Practices** – The Program Development team will maintain open communication with Sound Transit management and executive staff, to ensure everyone knows, or has access to information about the status of all projects over time. This also includes open and on-going communication with technical leads and managers from other groups (Sound Transit and other agencies) that will integrate with, or in some way be impacted by the TRT programs. Address concerns as they arise. The Program Development team will enforce standards and protocols to establish and communicate standards for project management, including software project development best practices (e.g., UCD). Sound project management tools should be used to provide for project status visibility to all stakeholders and executive sponsors. The team will also institute best practices for testing procedures to ensure that all systems are tested and validated before release.
- **Phase 2 Strategic Planning** – A future Phase 2 is under consideration for 2015-2023 and will reflect Board priorities and technology opportunities, requirements and budget availability.

Project Group 1: Data and Real Time Solution

Estimated Timeline: 30 months
Projects:

- Data Repository
- Data Integrity
- Real Time Sounder and Link Info
- Developer Portal

Estimated Budget: $3.3 million (YOE$)

Data Repository and Data Integrity

The goal of this project is to identify improvements to the process of providing static and real time transit data from all agencies in the region to the public. Currently, there is no central location for storing real time data. This project will develop a regional repository holding each operators static data as well as a feed of real time data including stop locations, routes, schedules, timetables, rider alerts and real time location and status of all active revenue vehicles. The vision for this project is to provide easy and direct access to information needed, when needed, and delivered in personalized, location-aware, formats.

The approach is fully outlined in the Regional Data Repository Architecture. Data from partners' scheduling and real time systems will be brought together into a common format and data store. This project will leverage the existing ATIS replication system and also consolidate existing real time feeds from those partners that have them. A major benefit of the project is a single location repository for accurate and standardized static and real time data feeds of all agencies. This provides the foundation for further projects such as the developers' portal and the improved regional trip planner. A key component of this task is incorporating real time data into trip planners that give riders more and better information about their transit options. A regional data repository is important to consolidate static and real time data to improve accuracy and accessibility of data in the trip planner. To support the development of a regional real time data repository, details must be gathered from multiple agencies to define the interfaces and provide estimates for compiling real time information into one source.

Data integrity plays a critical role in establishing trust and adoption by establishing transparent controls to ensure quality, availability and issues management. Data quality controls ensure completeness, validity, consistency, timeliness and accuracy that make data appropriate for specific uses. Data availability controls ensure that upstream data sources are successfully captured, that downstream consumers are receiving their data as promised, and that the overall operation of services is maintained at the highest possible level. A centralized issues management process ensures that feedback and concerns are captured and promptly routed to the appropriate agency representative.

The Regional Data Repository will actively monitor the quality of data sources using a combination of periodic data profiling and validations against versioned snapshots. Availability of data services to

downstream users will be confirmed through a range of controls measuring characteristics such as uptime, latency and exceptions. Feedback and concerns will be captured and organized through issues management process based on best practices for triage, consolidation and assignment to specific groups or individuals as well as tracking resolution and alerting users.

This project will provide numerous benefits both to the agency and to customers. A data repository will open communications and access to data. For the agency this means reducing operational costs and human effort while also providing more control over projects that use data. Interaction with partner agencies will increase which will build relationships at all levels and increase transparency. Furthermore, data integrity with other agencies will benefit branding. Ultimately a data repository will benefit the agency by providing consistent data across multiple devices and channels which enables no or low cost solutions in the future for customer facing applications by third party developers.

The primary benefit of the data repository for customers is enhanced real time information that enables them to make choices with their time. This gives the riders confidence in information and empowers the riders with options to (apps, signage, website, mobile, variety of transit options). A developer portal will further enhance the rider experience by providing applications that take advantage of resources provided by the data repository.

The agency also benefits greatly from this project. It reduces staff effort and operational costs, provides consistent data across multiple channels and devices, give more control over projects that use data, builds relationships with partner agencies, allows for transparency, and provides no or low costs solutions for customer facing applications because developers will create and maintain the applications. Development of the Data Repository will require significant coordination and cooperation with partner agencies, and it will be essential to build consensus on both goals and tactics for the project. In short, everyone involved must understand the value of this project and its centrality to the success of the overall program. In addition, legal issues may arise if inter-local agreements are required to complete the project. All of these issues will be managed through R&T Program Development.

About Real Time Information

Real time systems are fundamental to developing a technology-savvy transit brand and essential for positioning Sound Transit for future advancements in rider technology. Ideally, real-time information should flow into trackside, on-vehicle, and in-station Variable Message Signage (VMS) and be coordinated among the various operating agencies. For example, Sound Transit messages might be inserted into the Tacoma Link VMS and the King County Metro VMS systems planned for the downtown core. Real-time information should also be integrated with the existing Sound Transit trip planner.

Up to date information about the transit system is important to riders because it can reduce the stress associated with system slowdowns and unplanned service changes. It is especially important for daily commuters and transit dependent riders whose schedules are closely tied to public transportation. Daily commuters should be able to confidently make last-minute changes to their schedules, and transit dependent riders need to be able to alert family members or employers to any significant, unplanned changes in their schedules. Up to date information could also tip the balance for some potential transit

riders who would feel more confident about making connections if they could check on the status of their bus or train prior to leaving work, or even while in transit.

Real time information for vehicles takes two essential forms:

- **Vehicle Location.** This information, usually drawn from transit agency AVL systems, simply indicates where vehicles are. If it is presented to riders, it is usually presented in map form, like the Tracker application at King County Metro.
- **Predictive Arrivals.** This requires an application with a predictive engine and it usually takes the form of "when will my bus/train be where I am?" or "what are the next five buses that will arrive at this stop?" An example of this is the One Bus Away application.

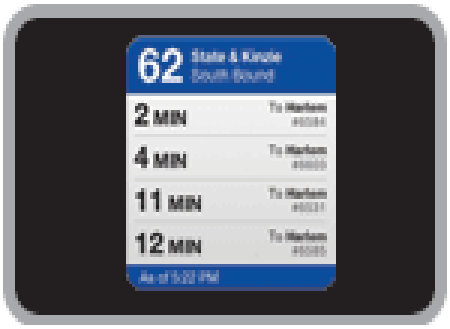
Currently, real-time information is sourced individually from each operating agency and is not shared among them. The agencies have installed various systems that provide real-time data on current vehicle locations and arrival predictions, including GE SCADA systems on Central Link and Tacoma Link, GE ISYS on Sounder, various platform annunciation systems (VMS), DILAX passenger counters, SIRI and GTFS real-time feeds, and INIT, Strategic Mapping and ACS/Orbital CAD/AVL systems. The CAD/AVL systems for buses are at different stages of development and deployment at each of the operating agencies.

Detailed information about the existing real time systems is presented in the summary of the needs analysis in Appendix B.

Availability of and access to real-time information is a necessary component of many of the TRT initiatives discussed here. Real-time systems will feed vehicle location data to the Rider Alerts system, VMS and other station-based information systems, including the Sound Transit Trip Planner, and assist riders in making last minute adjustments to their travel schedules.

Real Time Sounder and Link Info

For Link and Sounder, real time vehicle arrival predictions data are available but not currently in production. A prototype has been created to test access to and accuracy of this information. This system needs to be re-architected to bring it into a production configuration with proper security, and is being written in a more robust programming language.



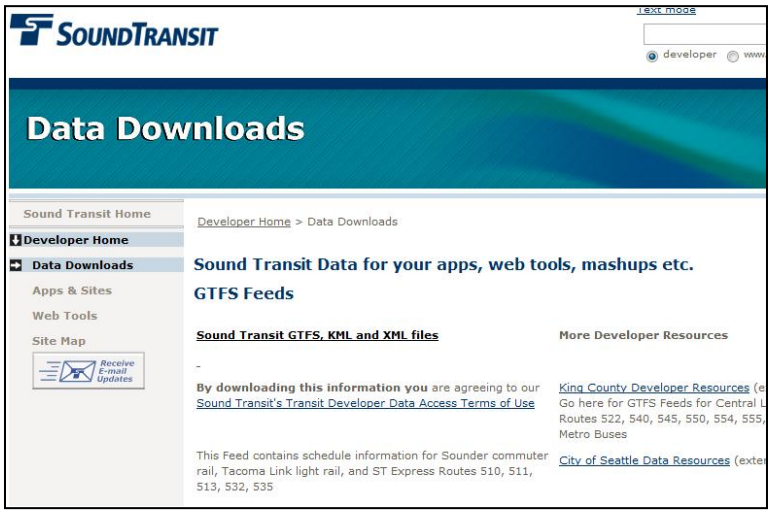
Sound Transit has a working prototype system that generates real time arrival predictions for the Link light rail SCADA system. The productionization of this new project would need to be built with redundancy, reliability, efficiency and secure architecture, adding real time Sounder data from the Sounder Digital Recorder GPS system, and bring the mobile and desktop websites with the data into production. This will include a predictive arrivals engine so that the mobile and desktop websites can include predictive arrivals. The data created by this system will also be able to feed the data repository.

The keys to the success of this project will be the accuracy of the predictive arrivals engine, successful replication of SCADA data and the user friendliness of the mobile and web interface. For this reason it is critical to engage the UCD process early.

Rail systems are inherently reliable when it comes to every day schedule adherence. Regular commuters rely on 'their' train to be there when they expect it. Therefore, when a train is not on schedule it is more important to have both up-to-date information and an accurate prediction for when it will arrive. Riders are coming to view this as base level information for a modern rail system and most peers have adopted some form of it.

Since the SCADA system is essential to train control and safety, it is always risky to pull data from it. By isolating SCADA behind two firewalls and working with a replica of the data, this approach will minimize the risk to an acceptable level. This project of securing the SCADA system and replicating the data between the SCADA firewall and Agency firewall is in progress.

Developer Portal



This project would provide GTFS and GTFS real time Application Programming Interfaces (API's) to provide a single region-wide portal for static and real time information from all of the operators. It will create a developers' portal website and mechanics to administer the developers' portal and maintain the app store. The project will provide a single region-wide portal for static and real time information from all of the transit operators to interested developers. Data will be provided in the General Transit Feed Specification (GTFS) standards-based format for static transit information such as route, stop and schedule data, and the GTFS real time standard for dynamic information, such as real time vehicle locations and rider alerts. Static data will be provided to third party developers through one feed that only needs to be accessed when there is a schedule change. Dynamic data will be provided through a second feed that is updated from the Regional Real Time Data Repository every thirty seconds.

Security will be designed into the developers' portal to give Sound Transit control of who has access to both static and real time data to give Sound Transit the ability to inhibit information if an application developed by a third party is poor quality or defamatory to Sound Transit or any of the partner agencies. This will provide tools to manage developers and to work with them should they not fully understand the data that are available through the portal.

The development of the portal assumes that Sound Transit will put in place the tools to manage the application and have resources available to support developers by answering basic questions on how to access and use the data provided.

The deployment of a developers' portal will provide a region-wide source for static and real time information. Key benefits of this approach include:

- Third party applications for mobile and website use of riders
- More data that is better integrated for riders
- Consistent data across third party and agency applications.

Agencies deploying developers' portals are perceived as the leaders in providing real time information to their customers. Portland's TriMet and more recently San Francisco's BART and Chicago's CTA are among the large city agencies that have deployed portals. These agencies have been highly successful at developing application stores that advertise a wide variety of applications developed by third party developers.

Making data available to third party developers and for the public's consumption requires great care to ensure that systems are operating accurately and providing high quality real time information. Partly for that reason, the regional planning group that was involved in the successful deployment of the Regional Trip Planner should be involved with the development of this project, along with staff from each agency who are responsible for the real time systems.

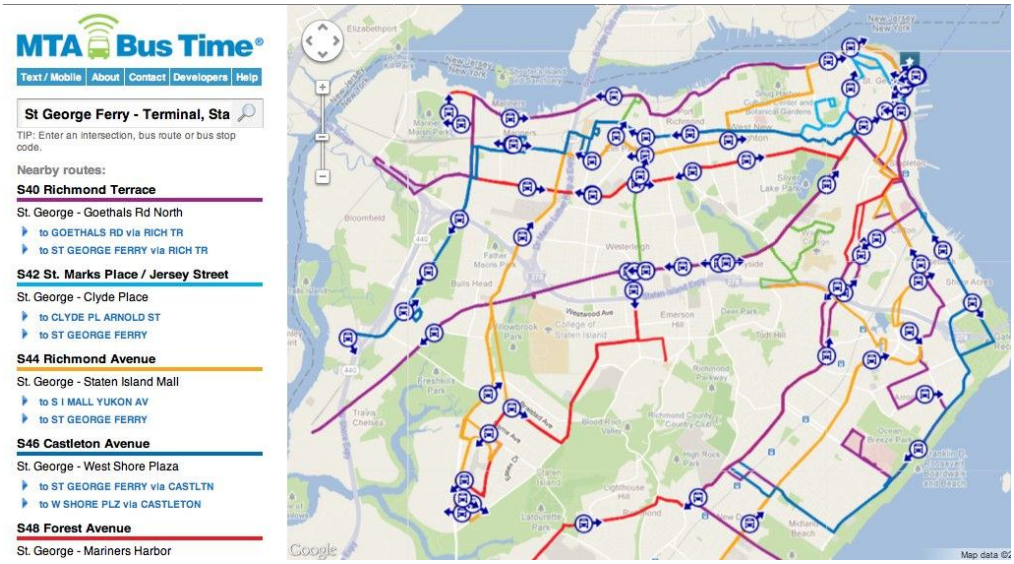
Project Group 2: Transit Rider Tools

Estimated Timeline: 36 months
Estimated Budget: $2,900,000
Projects:

- Real Time Integrated in Maps
- OneBusAway Capabilities
- Improved Rider Alerts
- Improved Trip Planner

Real Time Integrated In Maps

One of the primary forms of real time data is vehicle location, and the ability to see vehicle location on a map driven dynamically by the AVL system is very popular with riders and a common feature for modern transit agencies. King County Metro's Tracker application is an example of this technology and has been extremely popular with the riding public. Once the regional data repository is in place, it would be possible to map vehicle locations throughout the region.



This project would start with a pilot phase that would take the real time vehicle location data available in the regional data repository and put it against a map. For purposes of cost estimation, it is assumed that the mapping layer would be provided by Bing and that the regional Bing license would be renewed. Existing GIS information from the regional agencies would be leveraged independently from the map layer and therefore Bing could be swapped out for Google or another map layer at some future date.

As the regional data repository matures to include predictive arrivals, the map could include predictive arrivals by bus stop. Phase one of this project would be to display vehicle locations on the map and Phase two of this project would display the arrival information as well as the vehicle location. Data on the map is an example of a benefit for customers by providing a channel of information to save time by knowing when a vehicle is arriving.

The risks in this project lie primarily with the geocoding and the integration of GIS data from multiple sources. For example it is possible that the same bus stop will be coded in two (slightly) different locations by two agencies. To mitigate this risk, attention will need to be paid to quality control and to error correction processes.

The key success factor for this project will be acceptance by the public, which will hinge primarily on perceived accuracy and system up time. Three nines (99.9% up time or about 8 hours a year of down time) is a reasonable target that should be cost effective.

One Bus Away capability

One Bus Away has been a huge success for the rider community in the Puget Sound region. There are three essential functions served today by One Bus Away: 1) it has a predictive arrivals engine, which while somewhat crude, is widely used and certainly superior to vehicle location alone, 2) it is a mobile application, which is very popular, and 3) it also has APIs used by developers to build third party applications. Because these functions are valuable, Sound Transit, Pierce Transit and King County Metro have jointly funded the continuation of One Bus Away and an effort to document the existing functionality.

As Sound Transit looks to the future of TRT, the API functionality of One Bus Away will be largely replaced by the developers' portal project. However, it is critical to maintain the value of the other pieces: the route finder, stop finder, the predictive arrivals engine, and the mobile application. This project is to build those functions leveraging some of the One Bus Away code base, but also using a publically available engine. Project pricing is based on the use of Open Trip Planner, an open source engine and presentation layer.

Open Trip Planner is being used by a number of large transit agencies and it is common practice among transit agencies today to provide all three of these functions. Riders have come to expect route and station information, good predictive arrivals, and a mobile application. It is probably fair to say that improving these tools will add incentives for riders to use transit in the region. It is certainly true that allowing them to lapse will create disincentives to ridership.

The approach would be to use Open Trip Planner or something like it to build both a trip planner and a more accurate predictive arrivals system. Today One Bus Away uses a simple waterfall prediction method. If a bus is five minutes late at a time point, One Bus Away predicts that it will be five minutes late at all subsequent time points. A more sophisticated engine would take into account any padding in the schedule, traffic conditions, and historical ability to make up time.

The key risks on this project are relying too much on the One Bus Away technology, which is very dependent on a single developer and the performance risks inherent in developing a new engine. Mitigation of these risks and a key success factor will be a significant level of testing in the real world.

Improved Rider Alerts

This project would integrate existing channels for rider alerts (GovDelivery, the Sound Transit web site, Twitter, Facebook, VMS systems) through a single interface. It would be built on the existing systems and interface using APIs where available and 'screen scraping' where not. The system would be built using server side Java or an equivalent technology. UCD would be an important component since the primary technology is a new user interface.

The current system for generating rider alerts is quite fragmented and complex. A flow chart that illustrates the high level of complexity is presented in Appendix D, as part of a presentation to Sound Transit's Executive Leadership Team on the TRT planning process. To get an alert posted through all the available channels can take a person in the control center 15 minutes or more typing at four different computers and entering data into five or more systems. This leads to delays in getting critical messages out, inconsistency of messages across channels, and possible inaccuracies.

Real time rider alerts are most beneficial to frequent riders, including both daily commuters and transit dependents. Rider alerts should allow a rider to adjust their schedules once they have already left home or work, and are in transit. The alerts allow riders to efficiently adjust to changing transit conditions, and are especially important during disruptive weather events, traffic accidents that impact transit, mechanical problems with the transit system, or any other transit-disruptive event (e.g., by allowing riders to select alternate routes).

Rider alerts can include information on whether snow routes are in effect, elevators and escalators are out of service, or the Transit Tunnel is closed. For these rider alerts to be most effective, the information needs to flow to riders through the channels that they are already using, including texts, e-mails, and social media channels such as Facebook, Twitter, and others. It is also important that the same real time information be conveyed on emerging systems such as the data repository, mobile, web, signage, etc and to provide consistency of information across the channels.

The existing rider alert systems are heavily used in the Puget Sound Region. A "Riders' Alert Debrief" was conducted recently after a snow storm left 1'-2' of snow on the ground, from Olympia to Everett, followed by a moderate ice storm. The top customer complaint about Rider Alerts was that alerts via text and e-mail arrive too late to help. This issue should be addressed with any system improvements.

Incident handling on Central Link is currently a highly manual process, requiring agents to enter messages in as many as five systems. On Sound Transit Express bus service, the system is less robust and therefore less complex, but it relies quite heavily on driver announcements which are not always easily heard due to noise on the platform. On Sounder there are also few systems, and Sound Transit does not own or operate those systems.

Improved Trip Planner

The Regional Trip Planner is probably the most heavily used TRT at Sound Transit. It serves all of the transit riding public, and is most important for infrequent riders, visitors, and people without cars who use transit for both work and special events. It is particularly useful for infrequent riders, and can be an excellent tool for converting these potential riders. Expanding the regional Trip Planner and its capabilities could encourage mode change and mode flexibility, and identify Sound Transit as a prime source for trip planning. A major benefit to the agency is loyalty that is engendered by having a known source of ubiquitous and accurate information.

Given the importance of the Regional Trip Planner, this project will focus on improvements to this technology with benefits to riders being making the trip planner easier to use and expanding the system regionally. With the potential for the system to convert new riders, improvements to this system are advantageous. The following areas for additional development have been identified:

- **Trip Planner Backend Systems.** Although great improvements have been made to the existing trip planner, the backend of the system relies on a trip planner application called ATIS that includes agency schedules for Pierce, King and Snohomish counties. There can be some lag in data and some of the GIS data may not be specific enough (e.g., no multi-modal options, set walking distances).
- **Real Time Data Integration.** Bring real time data into the trip planner, showing actual bus and train locations, and adjusting trip computations accordingly. Also implement advanced cartography, perhaps using colors or other methods to show bus/train status.
- **Multiple-Destination Trip Planning.** Allow for multiple-destination, multi-modal trips, and also include information on parking and bicycle storage availability.
- **Multi-Modal Trip Planning.** Incorporate bicycle, parking and walking options into trip planning.
- **Integrate with 511.** 511 is a telephone number reserved for traveler information. Add the potential to expand trip planning by telephone using Interactive Voice Response (IVR). This could require normalizing bus stop numbers across agencies.
- **Hosting.** Considering the importance of the Trip Planner system, and the volume of daily trip planning traffic, Sound Transit should consider moving the system to an off-site hardened internet hosting facility that would provide continuity of service in case a disaster should affect Sound Transit's computing center.

Currently, trip planning data are aggregated by each agency and shared using Trapeze's ATIS format. Each agency's data are consolidated and shared among all operating agencies over King County Metro's Enterprise ATIS System. Each agency uses the data for their individual trip planners. Sound Transit publishes a web-based trip planner based on this consolidated data. Sound Transit also shares the data

externally using a Simple Object Access Protocol (SOAP) interface. All operators except Community Transit share their schedules using the General Transit Feed Specification (GTFS).

The multi-modal regional trip planning system would incorporate bicycle, walking and parking options into the trip planner and add more robust features for landmarks and other capabilities. This system would incorporate Open Trip Planner applications or a similar product to handle biking trails and walking options and also expand the capabilities to include parking options for customers who may wish to drive part of their commute and then transfer to transit.

The development of this system would leverage marketing studies Sound Transit is currently undertaking and use a UCD approach to up front design. Once the concepts are defined, the vendor community will be engaged to solicit ideas about the concepts and other potential new solutions to be considered. Once the vendor is chosen, the system will enter the final design and implementation phases.

There are only three or four multimodal trip planners in the United States today. Multi-modal trip planning is one of the Federal Transit Administration's key research areas for trip planning, as part of its Intermodal Corridor Management (ICM) and Connected Vehicle programs, which may lead to a source of funding to support this project.

All of the projects in this group meet the vision of the transit rider tools effort to provide easy and direct ways to get the information customer's need, when they need it and in personalized formats through a variety of channels.

Project Group 3: Transit Rider Station Information

Timeline: 36 months

Budget: $1,900,000

Projects:

- Parking information study
- Station Signage
- Station Signage Control System
- TVM Interface Design

Parking Signage/Information Study

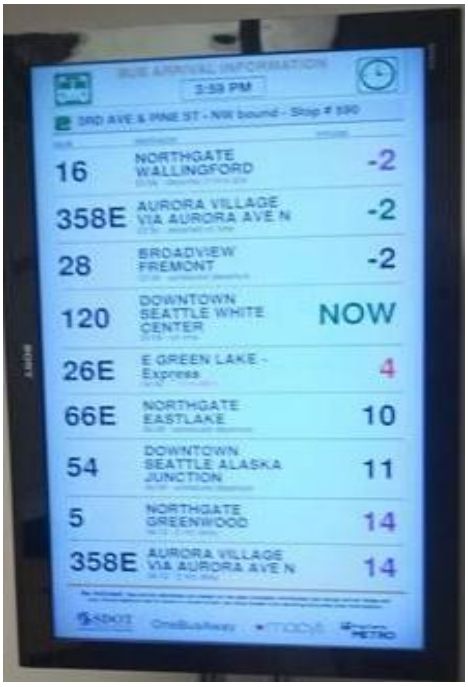
Parking is identified as a key concern for transit riders, especially commuters. This study will evaluate implementation of a parking management system as well as conduct research on parking cost elasticity that encourages turnover and charges higher rates at peak times. In addition, the study will review the technical aspects of implementation of the parking sensors and equipment.

A third party vendor could, in the future, provide street-level sensors, mobile apps, and parking analytics to manage parking. The parking management technology would be an integrated system that offers an overview of all the kinds of capabilities that can be implemented. The benefit for the agency is determination of the value of a parking management program including the revenue expected through a variable pricing demand-based model. The benefit for customers would be the ability to locate parking more quickly through accurate real time signage instead of multiple trips around the block cruising for parking. The project manager for project group 3 and 4 will work closely together to consider technologies for both parking information and parking payment.

Station Signage

Station communication systems are important to all riders, but they are especially important to new and inexperienced riders. They play an important role in decreasing stress and increasing the level of confidence for riders, allowing them to relax once they have determined that they are waiting in the right place and know how long they will need to wait. Station

communications can also play a major role in converting riders trying out the system to regular riders, because they know that they will have access to the information they need once they enter a station. Potential new riders should be made aware of the existence of these systems through advertising and other means. Station communication systems play an especially important role during service disruptions.



The pilot project for this station signage initiative will incorporate UCD principles to define signage location and content for three candidate stations along the Link alignment and one installation at UW Bothell. The approach for selecting these stations will be to choose three stations that are representative of different types of stations, whether by function (e.g., the Airport), configuration (e.g., multi-level stations, street level stations), or size. The key for the pilot project is to plan and deploy signage and content that adds value to the rider at each of these locations.

Smaller stations may be outfitted with two to four signs. For larger stations, such as those downtown and at the airport, up to ten signs are planned with sign content varied based on location to include next arrivals, way finding, and other pertinent information that the UCD process identifies as most beneficial to customers.

Station signage systems, when used in addition to variable message signs can also be used as advertising revenue generators. These systems can be implemented both inside stations and at nearby businesses such as coffee shops or other public areas, providing a new outlet for both rider information and business-related advertising.

Currently, Central and Tacoma Link have GE platform annunciation (PA and VMS) systems that provide audio and visual next train arrival messaging. There are also onboard audio and visual annunciations that are provided by a Meister annunciation system. This system relies on the operator to login to the unit and creates arrival and next stop information based on distance traveled. The Sounder station at Tacoma Link also has some VMS Signage. Sounder commuter rail vehicles are equipped with DR-600 systems that provide audio and visual next stop annunciation. Wayfinding in stations is provided with static signs. Changes to normal operations are posted with paper or laminated temporary signs to alert riders of changes to normal operation.

Station Signage Control System

This project will establish a central control software application that will maintain sign content and add alert messages (e.g. “elevators are out at Pioneer Square Station”). The signage control system facilitates management of information at each station and on each platform and level. The benefit to

riders of a centrally controlled system is immediate access to information on the platform or at the transit stop that can be updated in real time to alert customers of issues or changes in service.

This project will provide better information at the stations and can be used to increase the information for wayfinding and addressing problems along the alignment such as elevator outages or other issues that can affect riders. Deployment of this type of system would put Sound Transit within the group of leaders in the industry for digital information that include Denver's Regional Transportation District (RTD) and New York City MTA, who have had some recent large station signage projects. As part of the design and deployment process, Sound Transit would determine the location and staffing for the sign control capabilities. One possible location is the Link Control Center (LCC).

A UCD approach will be needed for this project, to prioritize information and signage placement within facilities. The project will also require significant coordination with facilities to manage how best to run power and communications cabling within stations. Careful coordination will be required to insure compatibility with multiple vendor systems.

Currently, Sound Transit's transit systems are installing three indoor signs and one rugged exterior sign at University of Washington, Bothell. These signs will display location specific information from OneBusAway.com using a browser. There are several electronic signs in the downtown area (example: Macy's Westlake) displaying this same information via a browser. The biggest risk for the current project is the limited, short-term support of OneBusAway.

TVM Interface Redesign

This project would identify potential methods to improve the rider's experience with the Ticket Vending Machines (TVMs). Understanding that dramatic changes to the display of the TVM may be impractical without costly changes to the system, Sound Transit should explore with a group of riders ideas to make the system more user friendly to new or casual riders, with the objective of removing potential barriers to ridership. The benefits of this project would be to make the TVMs easier to use for riders while reducing confusion, frustration, and the likelihood of purchasing invalid fares. Facilitating payment for transit always increases the likelihood of drawing new riders and of retaining and increasing transit usage for existing riders. In addition this would reduce the workload on customer service for fare refunds and eliminate customer frustration. It is fairly common in the industry to re-work TVM flows after a system has been in place for a few years.

TheTVMs that dispense tickets and add value to ORCA cards could be significantly improved. The demand level would support more machines, they could be easier to find, faster to use, and especially, easier to use. They should also include more real time information so that, for example, people cannot unknowingly purchase tickets for non-existent runs (e.g., after hours or for a Seahawks game when

there is no Sounder train). For the ADA community, TVMs could include "digital assistants" on machines, digital, visual, and/or audible beacons for finding, better signage for way finding, and applications to help find the equipment. There is also a need for proactive systems to reach out to, educate, and provide ways for elderly, disabled and other members of the riding public to easily purchase fare cards, such as portable TVMs and on-line tutorials or videos.

This project would take a clean slate approach to identify current system issues that make the system hard to navigate and identify the correct fare products that a rider would want to buy. A UCD approach should be used to brainstorm and elicit ideas that should be deployed, including "out of the box" ideas. The project would involve designing a new flow and implementing it using the Scheidt & Bachman and/or ERG/VIX toolset.

Project Group 4: New Parking and Fare Collection Systems

Timeline: 24 months
Project Budget: $350,000
Research and Project Management for Fare Potential Fare Projects:

- Parking Payment/ORCA Validation Pilot
- Open Payment Pilot
- Online Ticketing
- Bike Locker Payment
- ORCA Website and Application Changes
- ORCA Mobile Site

This group of projects is focused on research, project management and information sharing to determine feasibility and benefits of the implementation of fare projects. The goal for this group of projects is to enable discussion among fare administration, ORCA-initiated technology projects, and the IT group. The success of these fare projects hinges on the coordination among these groups.

Parking Payment/ORCA Validation Pilot

Developing the ability to charge parking fees or to validate parking users as transit customers is an important tool for managing limited parking resources. There are two components to this project:

- The ORCA system vendor (Vix) has been requested to propose options, pricing and schedule for provision of parking validation/payment functionality using the ORCA system. A complete proposal is expected by December 2012.
- The Research and Technology Program is proposing staffing and resources to extend the results of the June 2010 *Sound Transit Parking Pricing Study* into development of a pilot proposal (See parking information in "Improve Information at Stations" Group).

Open Payment Pilot

More and more agencies across the country are developing projects to accept credit and debit cards as direct fare payment. This enables riders, particularly infrequent riders, to entirely bypass the process of deciphering and purchasing fare media while still saving the cash handling costs and risks for the operators. The open payment project will explore a pilot open payments using contactless credit cards at the Link Airport and Westlake stations using VixErG. It is anticipated that this pilot project would include special Standalone Fare Transaction Processors (SFTPs) from VixErG that have been modified to accept contactless credit cards.

Online Ticketing

Sound Transit seeks ways to improve fare payment options, making it easier and quicker for riders to pay, while decreasing the cost of collecting that payment. At the same time, it is important that not to choose a technology such as cell phones which might exclude a significant portion of riders.

This project will research innovative ways to allow payment through cell phones that does not require smart phones. While it has not yet been adopted by any US transit agency it has been used successfully by numerous agencies including Stockholm Transit on whom this project design is based.

Bike Locker Payment

This project involves the use of ORCA as payment for bicycle lockers. The project would include exploring and researching industry best practices for utilizing smartcard payment systems for locker storage.

ORCA Website and Application Changes

This project will examine options for enabling the ORCA consortium to build a Content Management System and mobile application without the dependency and cost of utilizing a proprietary vendor like VIX-ERG. The goal would be more dynamic data accessibility. A benefit to the agency is avoiding costly proprietary vendor contracts.

ORCA Mobile Site

This project will evaluate a mobile autoload application which would allow automated and automatic loading of funds to an ORCA card. The ORCA system also needs a system to alert riders when there are system or equipment outages and when big changes (fares, fare policies) are coming. This system could perhaps use GovDelivery and could leverage the unified rider alerts project. In the future, ORCA readers could be upgraded to show card balances.

Future Phase Recommendations

Four future phase opportunities were identified as part of the TRT strategic planning process:

1. Analytics
    - Capture historic data from real time system
    - Build tools to integrate and report on ridership data across systems
2. Fare Information and Collection
    - Modify ticket vending machine interface to provide better rider information
    - Pilot open payment project on Link
    - Electronic ticketing
3. Social Media
    - Common publishing platform
    - Mapping of incoming posts
    - Crowd-sourcing delays and problems.
4. Interactive Voice Response (IVR) System for Customer Service
    - Region-wide IVR

These opportunities are tangential to the TRTs included in the Strategic Plan and merit further consideration, but are not recommended for implementation during Phase 1 of the Strategic Plan. A future Phase 2 is under consideration for 2016-2023 and will reflect Board priorities and technology opportunities, requirements and budget availability.

Projects Not Recommended At This Time

While developing the list of recommended initiatives, several possible projects were examined that not recommended at this time. In general in each of the areas, the projects not recommended represent the most aggressive approach and may not have the cost effectiveness of the projects chosen and developed above.

Some of the projects not recommended include:

- **Develop Mobile Apps on Multiple Platforms**. This would involve developing rider information applications on multiple mobile platforms, such as iOS (iPad and iPhone), Android, Windows Mobile, BlackBerry. It would be very costly, would require constant monitoring and updates, and the value can be better achieved through the developers' portal project.

- **Safety and Security Technologies.** These are technologies specifically focused on safety and security and include closed circuit television, fire and alarm systems and station communications. This was deemed to be outside the scope of the analysis of transit rider technologies.

- **Commercial Analytics Package.** This would be an off-the-shelf package that would sit on the real time data store to provide analytics capabilities. It would be very costly and would not necessarily fit Sound Transit's needs. Mapping data needs and developing reports against those needs is more cost effective.

- **Data Warehouse.** This goes beyond the data store of historical ridership data to a fully implemented data warehouse for Sound Transit that could include ridership, fare payment, vehicle location and maintenance, and other operational data. While this might be valuable for Sound Transit to pursue, it is a large and expensive project that is outside the scope of the analysis of transit rider technologies.

- **Parking Availability Retrofitted to Current Parking Lots/Structures.** This would retrofit existing Sound Transit parking lots and structures to provide real time availability feeds. It would be costly and would yield little added benefit since the primary problem today is too few available parking spaces rather than information about space availability.

- **Fully Automated Rider Alerts.** This would go beyond the rider alert project to create a central source for sending rider alerts through all channels and automatically trigger those alerts from system events. For example, when the Link Train Control System was set to turn trains short of the tunnel, an alert would be automatically generated. This would add a great deal of expense and complexity to the integrated rider alerts project. Additionally the human filter, in deciding which events should be alerted and how the alerts should be phrased, adds a great deal of value.

Each of these potential initiatives was examined against five evaluation criteria:

- Strategic Alignment: How closely does the project align to Sound Transit's strategic goals?
- Value to Riders: How much value does the project delivers to Sound Transit and regional riders?
- Cost Effectiveness: What is the ratio of value delivered to the cost and complexity of the project?
- Implementation Time: How long will it take to implement, especially in light of the three year time horizon of the first phase of the R&T Program?
- Peer Adoption: How much of this technology has been adopted by other transit agencies, bearing in mind that Sound Transit wants to be leading edge but not bleeding edge when it comes to new technologies?

The table below illustrates how the projects not recommended map to each of these criteria, further illustrating why these projects are not recommended for inclusion in the R&T Program.

Project	Strategic Alignment	Value to Riders	Cost Effectiveness	Implementation Time	Peer Adoption
Develop Mobile Apps on Multiple Platforms	High	High	Low	Long	Low
Safety and Security Technologies	High	High	Medium	Medium	Medium
Commercial Analytics Package	Medium	Medium	Medium	Long	Low
Data Warehouse	High	Medium	Medium	Long	Low
Parking Availability Retrofitted to current lots	Medium	Low	Low	Long	Low
Fully Automated Rider Alerts	High	Medium	Low	Long	Low

Appendix A – Interviews

Detailed interview notes available upon request

Summary of Interviews:

Interviewee	Title	Date	Time
Brian McCartan	Executive Director Finance & Information Technology Dept.	12/5/2011	3:30 PM
Michael Perry	Deputy Executive Director, Operations	12/6/2011	9:00 AM
Vida Covington	Director, Operations Business Support	12/6/2011	9:00 AM
Steve Corretti	Senior Business Systems Analyst	12/6/2011	10:00 AM
Phil Tapia	IT Consultant	12/6/2011	10:00 AM
Ted Clark	Programmer	12/6/2011	11:00 AM
Michel Danon	CIO	12/6/2011	1:00 PM
Jason Weiss	Deputy CIO	12/6/2011	1:00 PM
Ron Klein	Executive Director of Communications and External affairs	12/6/2011	2:00 PM
Mike Strong	IT GIS Analyst	12/6/2011	3:00 PM
Chris Jeffries	IT Senior Systems Engineer	12/6/2011	4:00 PM
Steven Bell	IT/DOT	12/7/2011	1:00 PM
Damon Berut	PM in Transit IT, Data & Customer Info	12/7/2011	1:00 PM
Wayne Watanabe	IT Manager	12/7/2011	1:00 PM
Steve Cripner	GIS Manager DOT IT	12/7/2011	1:00 PM
Christine Anderson	IT	12/7/2011	1:00 PM
Gail Torgerson	Sales and Customer Service Group	12/7/2011	1:00 PM
Tim Healy	Marketing & Communications	12/8/2011	9:00 AM
Julie Lavely	IT Client Service Desk Manager	12/8/2011	10:15 AM
Nick Marquardt	Transit Systems Manager	12/8/2011	11:00 AM
Gene Overly	Systems Engineering Manager, DECM	12/8/2011	1:00 PM
Jim Hammond	Manager, Customer Outreach	12/8/2011	2:00 PM

Marcus Clark	Customer Service Manager, Operations	12/8/2011	3:00 PM
Denene Dean	Sr. Customer Service Rep	12/8/2011	3:00 PM
Carolyn Urbanchock	Sr. Customer Service Rep	12/8/2011	3:00 PM
Doug Thomas	ERG/VIX General Manager, Americas	12/12/2011	3:00 PM
Cheryl Houston	Sound Transit	12/12/2011	3:00 PM
Paraic Reddington	On Phone- System Architect/Biz Analysts	12/12/2011	3:00 PM
Richard Mussel	On Phone – Engineering manager in Perth	12/12/2011	3:00 PM
Michael Miller	Manager Customer Facilities and Accessible Services	12/13/2011	11:00 AM
Terry White	King County	12/13/2011	2:00 PM
Gail Torgenson	King County	12/13/2011	2:00 PM
Dan Overgaard	KCM IT, Rider & Customer Information	12/13/2011	3:00 PM
Kathleen McMurray	Not gathered	12/13/2011	3:00 PM
Christine Anderson	Not Gathered	12/13/2011	3:00 PM
Joni Earl	CEO	12/14/2011	10:30 AM
Celia Kupersmith	Deputy CEO	12/14/2011	10:30 AM
Ric Ilgenfritz	Executive Director, Planning, Environment & Project Development (PEPD)	12/14/2011	11:15 AM
Vincent Choy	IT Systems Administrator	12/14/2011	1:00 PM
Curtis Small	Senior IT Systems Analyst	12/14/2011	1:00 PM
Phil Tapia	Contractor, Tapia Productions	12/14/2011	1:00 PM
Tana Wilson	Senior DBA, IT Applications	12/14/2011	1:00 PM
Cheryl Huston	Regional Program Administrator for ORCA	12/14/2011	3:00 PM
Garv Nayyar	Information Technology Manager	12/15/2011	9:00 AM

Appendix B – Needs Analysis/Findings

Document Purpose and Organization

Purpose

This document is an informal deliverable following the high level systems scan and interview processes and serves to gather an understanding of existing systems and needs. This document is a checkpoint in the process to add, correct, or modify information gathered and assumptions made on the information gathering process.

Organization

This document is organized into three sections:

1. Transit Rider Technology Existing Systems and Real-time Data Flows – Identification of current rider information and fare collection systems at a high level and data flows of key processes.
2. Transit Rider Systems Needs Assessment – Aggregated needs based on interview results are grouped and focused on individual needs areas.
3. Potential Projects Lists – Based on the aggregated needs and existing system, short and long term potential projects are formed using logical groups of functions that can be built by Sound Transit or procured commercially.

Transit Rider Technology Existing Systems, Real-time Data Flows

Transit Information Systems

There are multiple information systems that provide static and real time information at the operating agencies across the Sound Transit service region. These systems are managed independently by the operators and in many cases are aggregated region wide and shared between the operating agencies and Sound Transit.

Static Transit Information (Non-Real Time Operations Data)

Currently static schedule information is published using the General Transit Feed Specification (GTFS), which provides a standard format to share transit schedule and route data. Trip planning data is aggregated by each agency and shared using Trapeze's ATIS format. Data is consolidated and shared between all operating agencies using PERL, a high level general purpose programming language. This data is then shared with Sound Transit for their trip planner using a Simple Object Access Protocol (SOAP) interface.

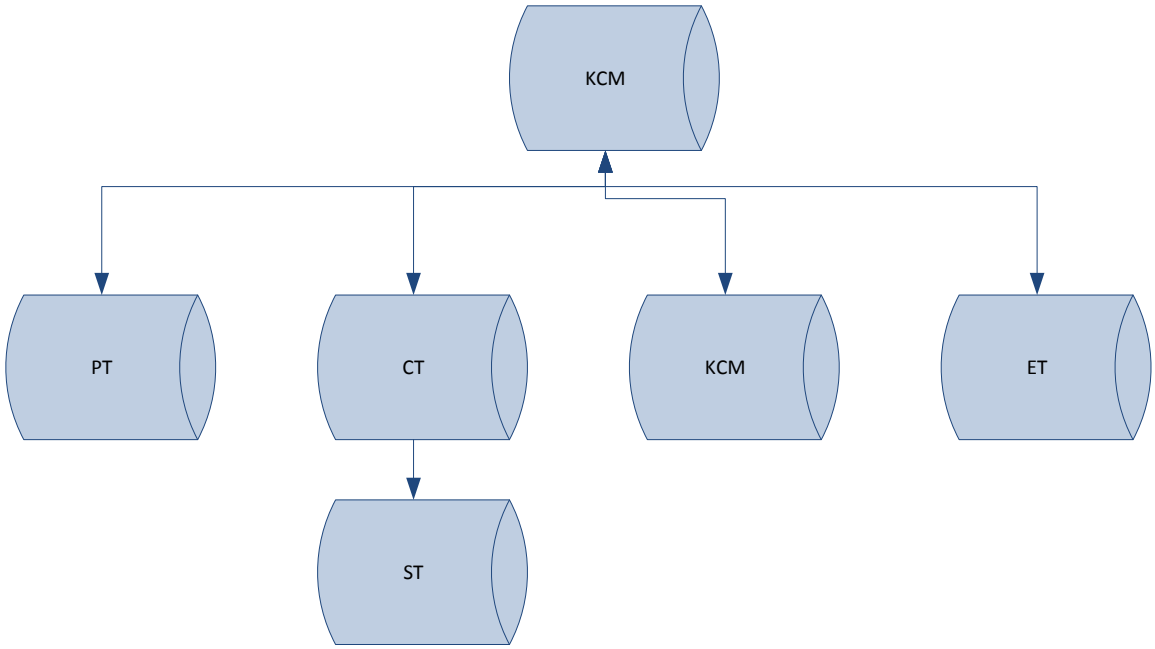


Figure 1: ATIS Data Instances are maintained by each operator and Sound Transit

Real Time Information Systems

Real time information is currently managed by each operating agency and is currently not shared. There are multiple systems installed today including:

Link Light Rail

Link Light Rail has a GE SCADA system which monitors real time vehicle location based on track circuits. Sound Transit's Operation Business Analyst has written an interface that allows the LCC to denote changes in track configuration, such asa tunnel shut down or single tracking, using an excel spreadsheet based applet and provides next train predictions based on anticipated travel times between each segment. He also has a suite of reports that summarize data gathered by SCADA and other systems identified below to generate operations statistics. The real time component of predictions is not currently in production and is only in use on the mobile device website which is not currently shared with the public.

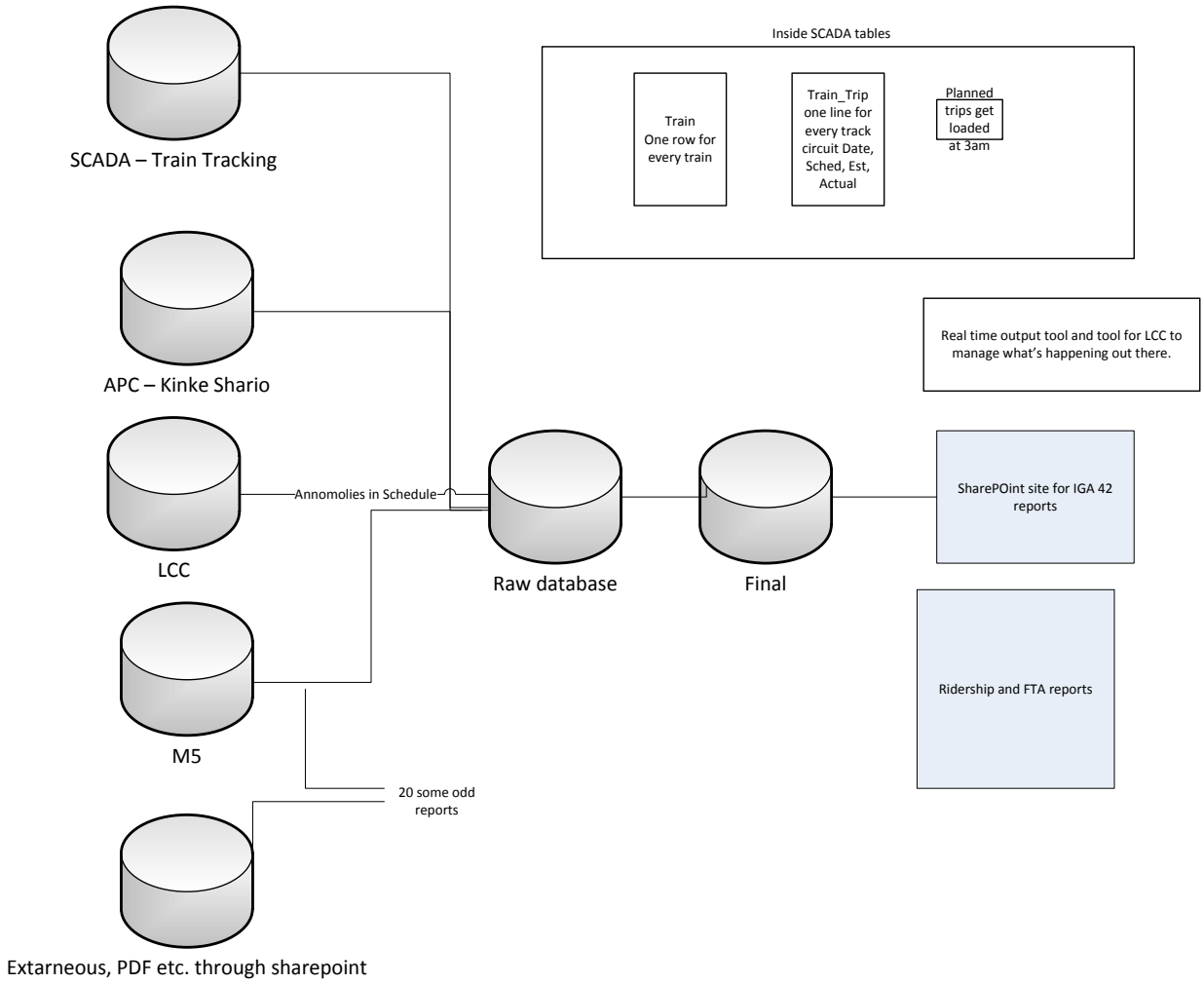


Figure 2: Sound Transit Reporting Systems installed to monitor Link Light Rail Performance

Link also has GE platform annunciation system that provides audio and visual next train arrival messaging. Some trains have DILAX passenger counting systems and provide ridership information that is used to support National Transit Database (NTD) reporting.

Tacoma Link

Tacoma Link has a GE SCADA system with station messaging system that provides audio and visual annunciation of next train arrival times. There are DILAX passenger counting systems on the vehicles that provide ridership information on the system. There is onboard audio and visual annunciations that are provided by a Meister annunciation system. This system relies on the operator to login to the unit and creates arrival and next stop information based on distance traveled.

Sounder Commuter Rail

Sounder commuter rail vehicles are equipped with a Digital Recorders DR-600 annunciation system that provides audio and visual annunciation for next stop annunciation. This system is also equipped with a 3G wireless card and is interfaced with a DILAX passenger counting system. Additionally, the cars are equipped with a passenger Wi-Fi system that provides onboard internet access and provides

communications via a 4G wireless card. This system also has a GPS receiver and transmits real time train location. Sound Transit's Operations Business analyst has created an interface to receive the data, but currently this system is not being used.

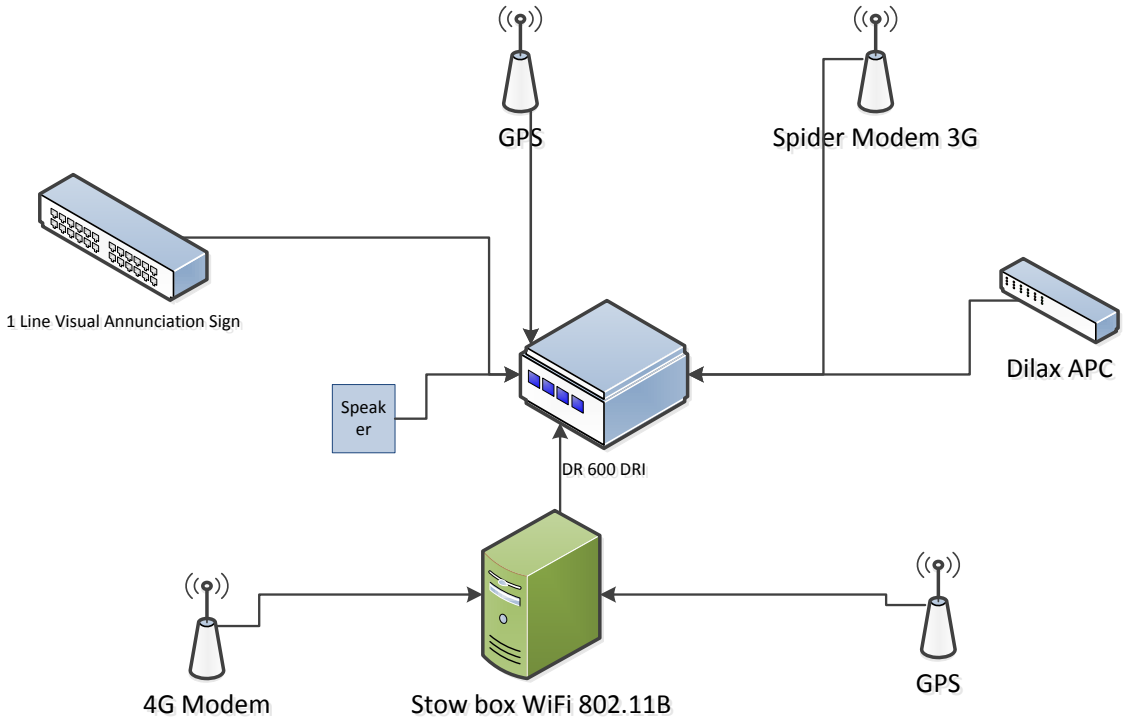


Figure 3: Sounder Real Time Information Systems

King County Transit

King County Transit currently has a signpost based bus location system that provides real time information based on the distance a transit vehicle has traveled past a signpost with the assumption that the vehicle is operating on its planned routing. They have developed a SIRI interface to provide real time information externally and also have a GTFS Realtime feed available. King County is in the process of replacing its signpost based system with an INIT GPS based real time system. This system also provides both SIRI and GTFS Realtime feeds. To support the development of a Regional Real Time Data Repository, additional details will need to be gathered to define the interfaces and provide engineering estimates for that project and any other projects that will require real time information.

Everett Transit

Everett Transit has a Strategic Mapping fleet management system that is currently being deployed. The Strategic Mapping products include basic Automatic Vehicle Location (AVL), Computer Aided Dispatch (CAD) and have the capabilities of providing next stop annunciation and real time traveler information.

To support the Regional Real Time Data Repository, additional details will need to be gathered to define the interfaces and provide engineering estimates for that project and any other projects that will require real time information.

Community Transit

Community Transit has an INIT CAD/AVL system that provides fleet management, next stop annunciation and has a SIRI interface to provide real time information.

To support the Regional Real Time Data Repository, additional details will need to be gathered to define the interfaces and provide engineering estimates for that project and any other projects that will require real time information.

Pierce Transit

Pierce Transit has an ACS/Orbital CAD/AVL system that has real time information components. Pierce Transit is also in the process of purchasing a module to support real time information to be applied to their ATIS trip planning system, which would inject real time status into the trip planning module to support trip planning taking into account real time conditions.

To support the Regional Real Time Data Repository, additional details will need to be gathered to define the interfaces and provide engineering estimates for that project and any other projects that will require real time information.

ORCA

ORCA data are currently structured only for financial management. Data iares aggregated through TVM's and SAFTP validators on platforms, onboard readers on buses. These data are uploaded in real time for platform mounted equipment and in batch form for transactions onboard bus. Handheld validators may also be used to validate that customers have paid the proper fare.

Data are aggregated within each agency and sent to the VIX managed clearing house to process card sales. Each agency has a reporting system that they can review point of sale (POS) transactions.

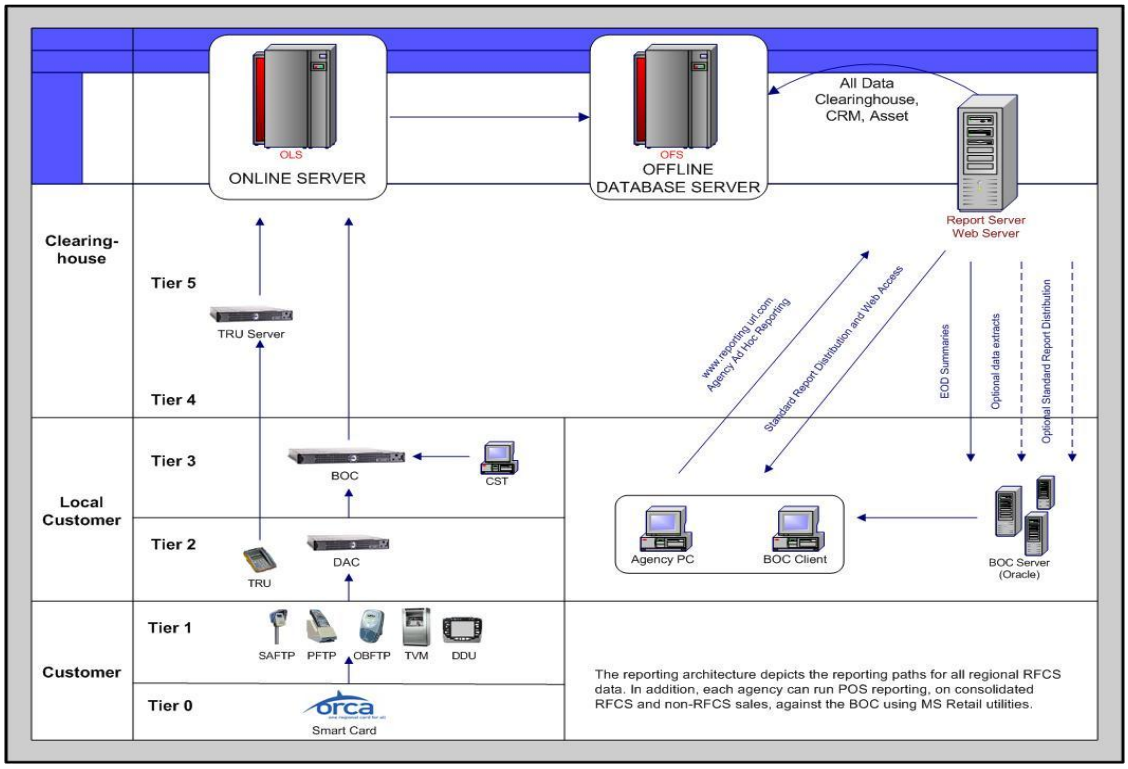


Figure 4: ORCA Data Flows

Rider Alerts Systems and Processes

Sound Transit and the operating agencies use a variety of systems to disseminate rider alerts. Variable Message Signs along the alignments, ATIS, Gov-Delivery and agency websites are the common areas shared by most agencies. In addition, Twitter, printed signs/posters and operator announcements convey rider information as appropriate.

The modes that rider alerts are disseminated vary depending on the type and severity of rider alert. The chart below provides an overall view of the wide variety and complexity of where and how rider alerts are generated. The diagram shows the staff and processes involved, but does not show the complexity of determining when and how information is and/or should be disseminated.

Currently, incident handling on Central Link is a highly manual process, requiring agents to enter messages in up to five systems. On Sound Transit Express, the system is less robust and therefore less complex, but it relies quite heavily on driver announcements. On Sounder there are also few systems but little opportunity for real time change of the systems.

In general the processes are complex, duplicative and manual. A goal of any future strategy and the architecture of a regional real time data repository would necessarily be the simplification and consolidation of both systems and processes. In developing both the strategy and the repository architecture, further information about current data storage and update processes will need to be gathered.

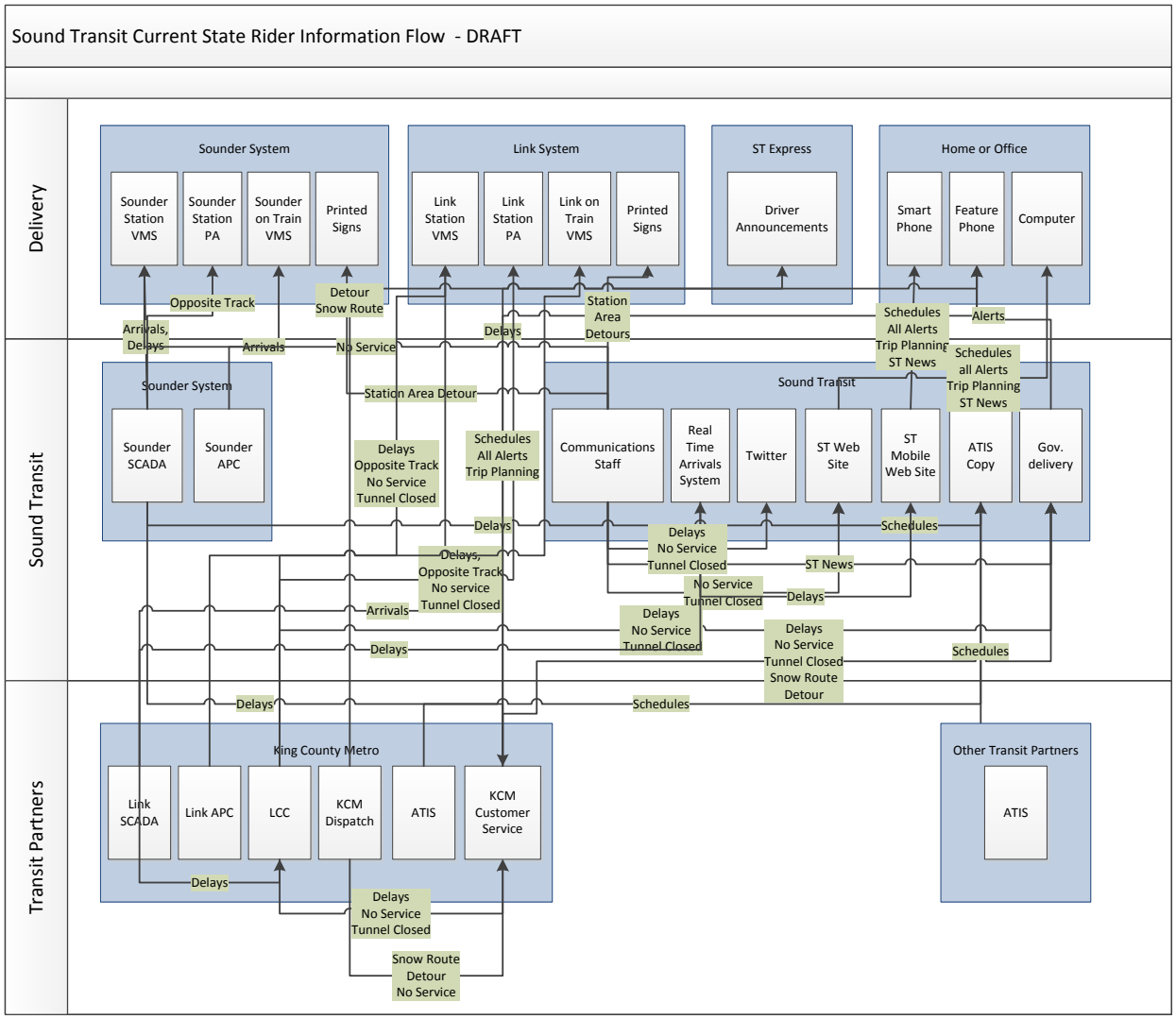


Figure 5 Rider Alert Systems/High Level Process Diagram

Transit Rider Technology Needs Assessment

The Transit Rider Technology Needs Assessment was developed through a series of interviews with key people from Sound Transit and King County Metro (see Appendix A). We interviewed both executive level and staff members in the FIT, CEA, DECM, OPPS, and PEPD Divisions. We also interviewed several people from other partner transit agencies, and personnel from VIX/ERG.

Each of the interviews were recorded in a separate MS Word document, and then reviewed by all members of our team. We then filtered through the interviews to discover the key needs for TRT as expressed by the interviewees. These "needs" were then compiled and organized by topic, and are presented below.

The first subsection is called "Global Design Requirements", and is relevant for any technology that might be implemented at Sound Transit.

Global Design Requirements for Transit Rider Technology

Multimodal and Cross Agency Solutions

A consistent theme throughout the interview process was that riders and potential riders want one system, or one set of systems, where they can get all of the transit information that they need. This is particularly true of commuters, who may ride with more than one transit agency, and on more than one mode of transport, on the way to and from work. (JE,RK)

It was also acknowledged that the goal of truly "agency agnostic" systems may be more of a long term goal rather than a short term possibility. Nevertheless, this ultimate goal of intermodal and cross agency transit functionality should be an important design parameter for any work undertaken in the future.

In addition to multimodal and cross-agency functionality, a number of other broad design goals emerged from the interviews, as follows:

User Experience

- When designing systems, focus on first time users and how they would interact with the system (JE, RK).
- Include graphics and maps with any system, and make it obvious how to get to that information (JE).
- Always look for ways that technology can improve a riders safety, as well as their perception of safety (JE, RK).
- Follow User Centered Design (UCD) or similar principles when designing IT projects, and get empirical feedback on usability (SB).
- All systems need to be intuitive, and where possible customized for location. In the case of a mobile app, for example, this would mean accessing the internal GPS unit on a smart phone or

tablet and then use the current location to deliver location specific information. In the case of VMS or traditional signage, this means having primarily information that is relevant to the location where the sign is viewed (JE, MD)

Mobile Devices

Technology solutions should be targeted over a range of devices, from simple feature phones to full GPS enabled phones. Solutions must exist for people who do not have access to high end devices (JE, MD).

Cost/Benefit

Want to maximize "bang for buck", and look at cost/benefit (BE) for implementing any particular technology solution or portfolio of solutions. Evaluate TCO (Total Cost of Ownership) when deciding on a technology mix.

System Architecture & Project Development

In addition to specific technology needs, the issues of system architecture needs and project development methodology needs also came up during the interview process. These are discussed more fully in a later section of this report. For now it's important to mention the following:

- All projects should be developed using an accepted design methodology, for example, the Agile method (DM)
- Select an overall system application architecture an data architecture prior to building new technology products. Two that have been mentioned include SOA (Service Oriented Architecture) for application communication, and the Kimball data warehouse design method for data architecture.

Trip Planning

Sound Transit recently launched a new website based trip planner (www.soundtransit.org), which has been a great stride forward for the agency. Additional new recommendations for the evolving trip planner capabilities include:

- The web site is the face of ST, and should continue to convey the appropriate marketing messages. For example, the message that ST is a service organization in addition to being a capital organization (RK, CH JH)
- A single trip planner (and 511 system) that integrates across agencies, and that allows for planning multimodal trips (JE, BM, MD, CH RI), and that also includes information on parking and bicycle storage availability ().
- A system that anticipates questions, and goes "above and beyond", for example, by suggesting next routes or allowing people to insert side trips (JE, RK,).
- Has stop numbers coordinated across agencies (MS,), or some kind of workaround, to help with multimodal trip planning.

- Google maps and trip planner sets the expectations for our systems (BM), system should work even if a person doesn't know the exact place names for their trip.
- Should support 3rd party app developers (MD)
- CMS and backend support need improvement or replacement (PT). Consider hosting offsite (GN)
- ORCA info should be integrated directly on ST website (CH)
- Think about color coding bus/train status, etc (green/yellow/red), use of tabs, etc (TH)
- For trip planner, KCM has not settled on a long term strategy (WW). Current system creates various versions of the same trip (DO). For long term, ST and KCM should coordinate.

Payment Systems

Ticket Vending Machines

TVM's Need to be more ubiquitous, easier to find, faster to use, and especially, easier to use. Could include "digital assistants" on machines, digital, visual, and/or audible beacons for finding, better signage for way finding, apps to help find the machines (SC, CH, CH, MP, MC, MM JH). The machines also need better language support and ADA access (Braille) (MP)

The machines should also include more real-time info so, for example, people are not able to purchase train tickets for non-existent run (as for a Seahawks game when there is no train) (SC). Other real-time information could be included as well.

Fare collections should allow for multiple ways of paying. NFC may be supported as it becomes available. Moving away from cash. (VIX:DT). Pay directly with credit card (RI) and/or purchase ticket or use with smart phones (NM). There should also be a way to pay for cards with cash, POS systems. Also, disposable cards (CH).

Need portable TVM's, or some way for seniors and others to easily purchase cards (CH, MP

While not directly related to transit rider technology, a number of interviewees also mentioned that the fare structure is too complicated (BM, MD), and that this impacts overall efficiency of the systems.

ORCA Readers

It's frequently not clear how to use the ORCA readers, or when they should be used. Anything that can clear this up will be useful.

ORCA cards might also be used for auto parking and bike parking (lockers) (MM, VIX:DT)

ORCA Website and Alerts

ORCA website needs to be more dynamic (MC), and better integrated with the main Sound Transit site.

Need alert system for ORCA users, perhaps using gov-delivery (MC,)

Real-time Information System

Essentially, riders and non-riders need better and more information, delivered in a way that is easy and convenient to consume. Accurate, region wide, for all modes. (JE, BM, RK, MD, WW, TW, RI

Alerts and "My SoundTransit"

We need to implement the concept of "My ST", allowing people to personalize the data streams they receive (NM, TW,). This means we need some kind of engine to find alerts relevant to any particular traveler. Perhaps integration with CRM will provide some of this (TW). In general, the tools should integrate with what people are already using (RI), meaning their existing mobile apps and internet usage patterns.

In addition, ST needs to proactively get information out to the right people (e.g, game day alerts), and we need to look at emerging research from EMS (TH). This research will describe the barriers to ridership that people are experiencing.

Real-time data, including rider alerts, train/bus arrival times, and next bus times, needs to be available for people on the channels they currently use (and that are emerging), including social media, email, text, mobile web (app), web, and phone (511) systems (RK, TW,). Systems should provide information automatically, without the need for a "real person" on routine requests (JE).

For collecting information about system status and other rider feedback, we should look at crowd sourcing (TH).

Systems should be sophisticated enough to show actual bus stop locations for trips that use different stop locations based on trip number or time-of-day, and which may vary depending on whether or not the bus is running late (JE, WW). If a bus is running late (typical during rush hour), these types of trips can cause major headaches for travelers. These headaches could be alleviated through the use of real time data integrated into mobile and web apps.

Need a system for communicating with ORCA card holders concerning issues with ORCA or related. Might relate to the CRM (TH)

Mobile apps should be 508/ADA (MM).

KCM supporting development of apps by third parties (WW), ST would also like to support this activity.

Parking is a key concern for transit riders, especially commuters. Think about "Integrated Corridor" concept. Technology systems should show parking availability, both along the roads, from ST websites, and from mobile apps (BM, MD, MD, MP, MM RI).

Info about parking should be integrated into all systems, e.g. TVM's, real-time mobile, etc.

Get creative with real-time. QR codes on seat backs to search for information relevant to riders on that particular bus or train, etc (TH). There may be other ways to get creative with real-time data, and we should look into it.

VMS (Variable Message Signs) and CAD/AVL (Vehicle Location)

Info needs to feed VMS, trackside, and on vehicles (TH), and perhaps allow station agents to update VMS (MM). Importantly, we need to get PA messages to deaf population (MM). Currently, there is no way for the deaf population to access important real-time information announced on the PA systems.

Perhaps VMS could be integrated with CMS (sending alerts to right people?) (MP).

Need good VMS at stations, along with same message over PA and mobile for emergency situations. VMS with better location/arrival times. Also, VMS needs faster updates. Lakewood offers opportunity for improvement (RK, MP, MC, MM).

KCM wants VMS downtown (WW, TW). This may be an opportunity for ST.

We need to insert ST messages into RapidRide VMS. Coordinate with ST on various feeds and formats (WW, DO).

A major component of the backend system for real time information is currently in prototype format. We need to evaluate and then either retool or replace the current system. If retooling, we need to rewrite the existing prototype real-time data systems using SQL Server, WCF, and .net (PT, TC). This includes a way to coordinate track info with LCC, possibly creating a GUI to replace Excel method (TC).

CAD/AVL for buses, agencies at different phases, good to integrate…good opportunity

Need to get info to people when incidents cause large delays (MP).

Need announcements on all buses, automated (coming) (MM).

IVR (Interactive Voice Recognition)

Many people mentioned the need for an up-to-date 511/IVR System for Sound Transit. As with other systems, the ultimate system would be integrated across all agencies. More specific needs include:

- Need 511 (RK, MD), which should include messaging for next arrivals.
- Need customer facing IVR, with better business hours. IVR will need good real-time info flows (MP, TW).
- Look at ways to coordinate with KCM IVR (WW, TW).
- Look at including trending items such as husky games (TW).
- All messaging should have coordinated info, text, phone, web, (TW).
- KCM would like to automate individual bus delay reporting, can't have human interaction on routine delays for individual buses (TW).
- KCM IVR, will be growing, adding modules over time. ST should coordinate with KCM.

Back Office, Internal Systems, System Architecture, and IT/PM

- Info flows, system architecture, system maintenance, security

Coordination and IT Project Management

Need to implement an IT best practices and continuous improvement methodology, perhaps using the CMM (http://en.wikipedia.org/wiki/Capability_Maturity_Model) maturity model for IT.

Also, need to get IT involved with all stages of project development, especially procurement phase (VC). This will help to insure that all procured systems fit within to the evolving ST IT architecture. In addition, need to have all systems under one team, as this will allow integrated systems to emerge (MD).

Also needed is a faster path to technology implementation, and better IT project management to insure projects are completed in timely fashion (JE). At KCM, a key problem is a backlog of customer information system development. They also need a way to prioritize projects on books (DO, (kbw, opportunity for coordination)

Need more integrated systems and standardization, systems and data.

CMS needs to be more user friendly (MC)

VIX is having a strategy workshop in January, would like people to attend (VIX:DT). VIX feels that they have been limited contractually on what they can do, and that the agencies should be strategic, rather than focusing on fixing small things (VIX:DT).

Also , the current VIX systems are using older software technology, systems need to be updated (VIX:DT)

Enterprise IT

IT Help Desk Ticket tracking system needs to be implemented/retooled. Need more monitoring on enterprise side (e.g., web site availability), and processes and procedures for dealing with issues. Management of patches, etc. (JL).

Application and Data Architecture

Any new systems should mesh with the evolving strategic vision of how to use data at ST (VC). There is currently an IT Strategic Plan in development, which should help with this activity. To the extent possible, systems should be standardized and simplified (GN).

In addition to system architecture, ST should also coordinate with the Customer Information System replacement project underway at KCM (WW).

Several people mentioned the need a middleware architecture at ST, perhaps using WCF to implement a restful API in a SOA environment. KCM is also looking at overall system architecture (PT, DO), and so

this offers a great opportunity for coordination. An advanced middleware architecture would provide a solid platform for all Sound Transit applications, for years to come.

IT network improvements may be another area to consider. It's the foundation of everything else (GN,

KC DOT looking at all data and systems infrastructure (WW). In particular, most older systems not integrated, need to be as they are replaced (WW).

SCADA

SCADA needs upgrading, making it modular in 3 components (MD, TC, MP, GO). Network may also need upgrade for this.

COMMS Communications issues from trains to data systems, may need more work. Also, question of Cell and/or WIFI in tunnels and on trains. Look at interoperability with radios at KCM and other counties (GO)

Business Process Engineering

Workflow of data entry very manual process, needs improvement, not enough templates (MP, MC)

Streamline process for creation of alerts and route adjustments that feed the IT systems. Delay with info flows biggest problem, especially for ADA (MM). VMS, PA, gov-delivery, messaging workflow needs work (MC, MP, MM, WW). More strategic thinking is needed here, for both emerging and immediate incidents. Processes for feeding gov-delivery are flawed. Revisit Operations workflow response and prioritization when dealing with incidents. For example, customer notifications need a higher priority (TH).

Use "drills" approach for training and scenario planning. Tap minds of folks who are good at orchestration, but remember to allow for human input especially in complex situations (TW)

Customer info strategy needs more definition. Clarify what is meant by real-time (alerts?, locations? Both?) (DO)

Analytics

Need to understand, "Why do people choose to not ride transit"?

Sound Transit must have its own performance metrics (MP), and the public is also asking for information about ridership and other metrics (MP). In addition, a better system is needed tracking customer complaints on ORCA & ORCA website (MC). And also, plans for the CRM (Customer Relationship Management) are in the works. This can be used to track customer feedback and complaints, amongst other things.

All of these issues, and especially performance metrics, can be addressed through the use of a data warehouse and business intelligence systems. Sound Transit has an existing data warehouse built in SQL Server using the Kimball design methodology.

Need to expand and build upon this existing Sound Transit Data Warehouse and Business Information database system, and especially add the analysis feature set (VC).

Outreach & Marketing

Need better coordination, and messaging about special activities and ways for people to save time. For example, giving info about 520 alternatives to driving to avoid paying the toll, or bus/train alternatives for special events (JE, RK, TH,)

Co-marketing of ORCA with events would be a great idea. Any technology systems that can support this would be good (MD).

Need to work with bloggers and other groups to get their input, especially with regard to technology ideas (JE).

For TOD (Transit Oriented Development), integrate payment systems and VMS with local merchants, keeps ST integrated with the local business environment (RI).

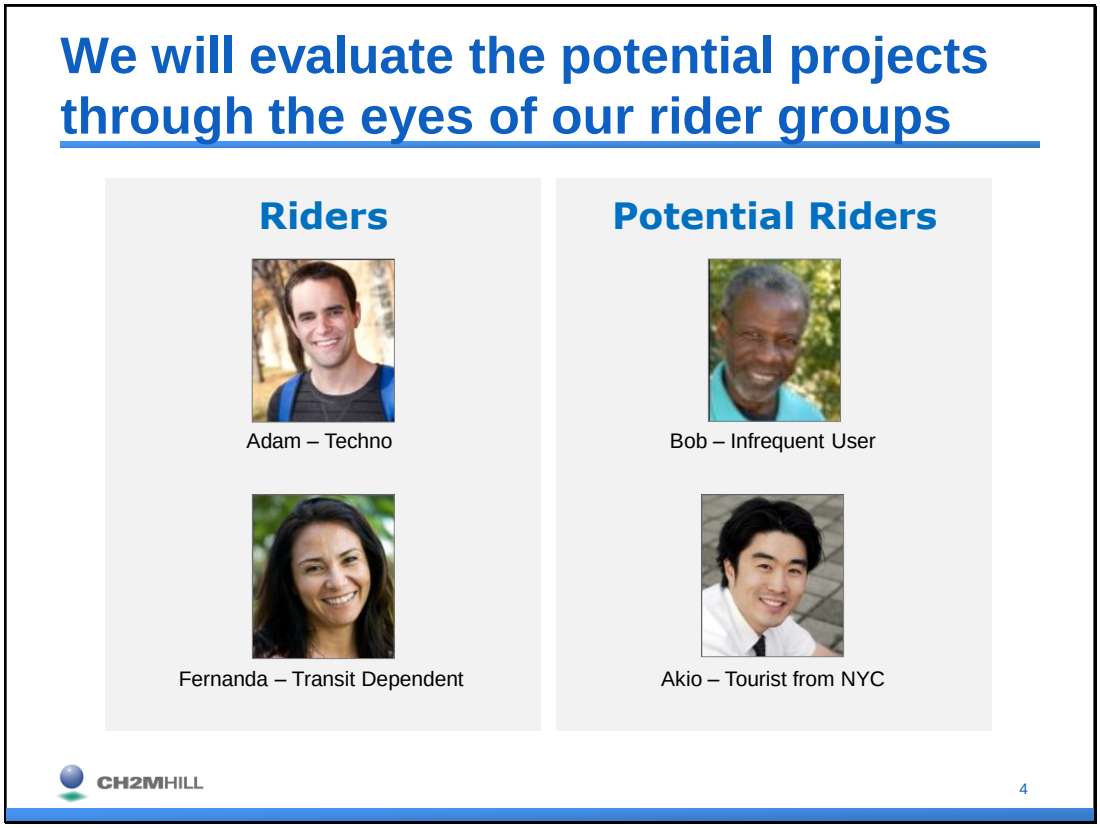
Need proactive systems for reaching out to elderly, disabled and other riding public. E.g., TVM teaching machine (JH). Connect social media and customer service, also www.rpin.org. This should all integrate with CRM (TH)

Potential Transit Rider Technology Projects

1. Near Term SCADA Real Time Info	Take the prototype Ted has built and architect a near term solution to provide real time information from Link SCADA and the Sounder DR-600 location feed
2. Region Wide Real Time Information	Based off of the Regional Data Repository develop real time mapping application with current bus locations and selection of display by route.
3. Developers portal and/or open source data mart for real time information	Developers portal and/or open source data mart including all operators planned schedules (GTFS data), GTFS Realtime, and or SIRI data streams for the entire region
4. Interactive Voice Response System (IVR) and or Text messaging capability for next stop information	Region wide IVR system that has all planned service and interface for real time information for next stop arrival, transit information, and links into each of the operators call centers (AKA a 511 System)
5. Parking Integration/Parking availability	Integration of parking monitoring systems with real time information to provide information on parking availability at Sound Transit Park & Rides. (May need to be integrated with facility planning)
6. Multimodal Trip Planning (bus, rail roadway)	Expanded trip planning system that integrates Sound Transit's trip planner along with road congestion, bike alternatives and other travel modes.
7. Integration of Incident notification tools and methods	Integration of rider alerts to provide a user interface that allows selection of notification delivery paths and provides a WYSIWYG user interface for message formatting.
8. Evaluate CMS and how to improve	From identified needs, evaluate current and other potential CMS solutions to develop a

customer experience	system that more easily is managed to promote better customer service
9. Evaluate how to move one bus away to the future	Determine whether One Bus Away should be "productionized" and an operations and management plan or determine if above potential projects make it obsolete.
10. Setup IT rigor with plan, policy, procedures to monitor and maintain customer facing applications	Per identified needs, develop IT policy and procedures for new and modified applications and standardize implementation processes from concept to production and maintenance.
11. Develop best practices for Social Media integration with Customer Service & Marketing	Develop a plan to support and promote social media for both customer service and marketing.
12. Advertizing related signage in stations with customer service information	Pilot signage for stations that provide planned schedule and real time information as well as customer service messaging and potentially advertizing (Sound Transit and/or external)
13. Build Datamart for ridership information	Behind the real time information data, build an archive of historical real time data that other systems such as APC and ORCA data could be integrated to provide a more robust integrated data environment.
14. Evaluate reporting tools and identify what else could be valuable to develop reports against	Evaluate commercially available reporting tools such as Trapeze Viewpoint, Ride Check Plus and others to determine if there are commercially available tools that could be used with current information being gathered e.g. on time performance, APC, etc.

Appendix C – Personas



Adam is a young professional, who works as an IT engineer for a bank downtown Seattle. Monday - Friday, Adam rides his bike to the transit station from his home in Redmond where he takes the bus into Seattle for work. Adam has a car, but chooses to use public transportation whenever possible. Adam's days are hectic and stressful and he looks forward to downtime during his commute. On his ride home he catches up with friends on his iPhone, which by the way, he is addicted to. He uses it ALL the time, managing his life while he is on the go.

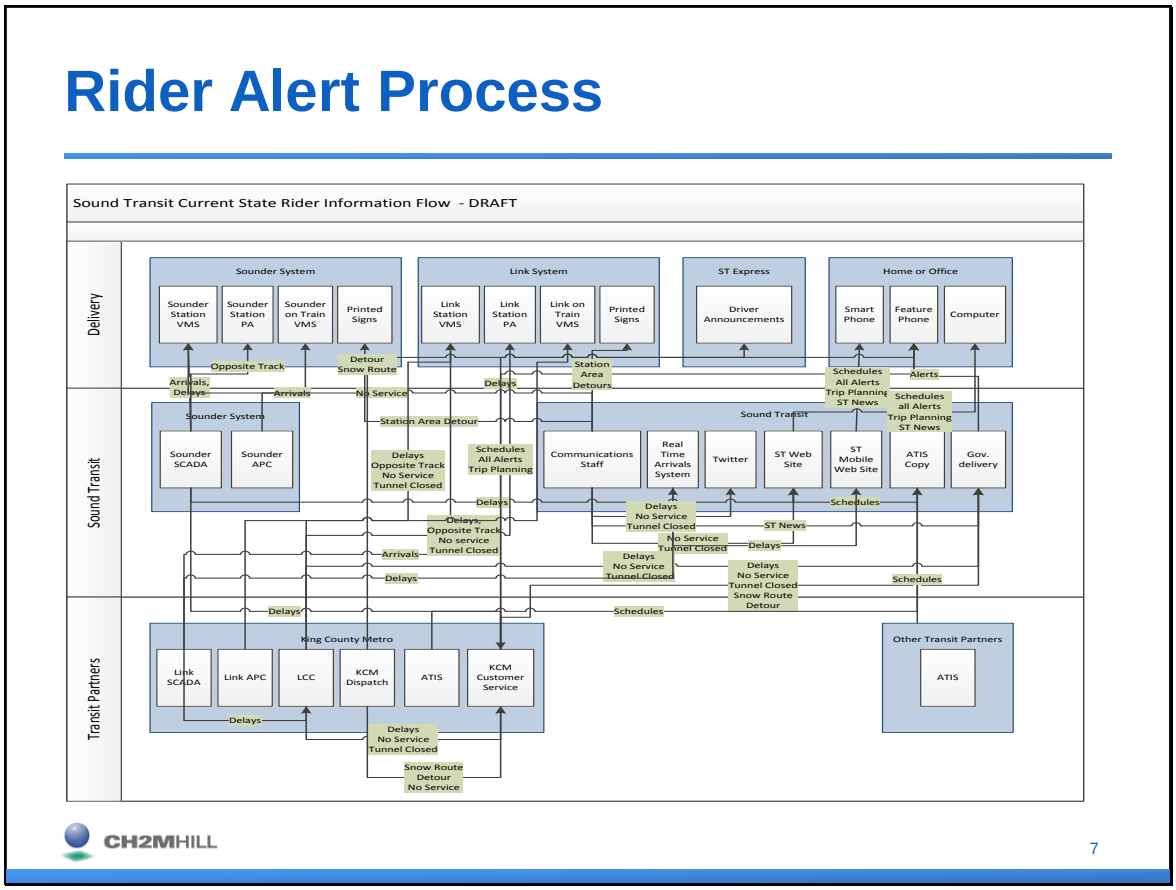
Fernanda lives with her husband and two children in Everett. She is an administrative assistant for an accounting firm in Seattle. She gets up early and takes the bus to the city to work every day. Fernanda needs to be home on time daily so Hector can go to work at his night job. While she is on the bus, she totally enjoys the 30 minutes during her commute where she has a minute to relax and be by herself. Once she gets home, the hectic part of her evening begins. Dinner, kids and chaos! They use the Orca card to pay for their fares.

Bob and Keisha live in Tacoma where Bob works as a chef at a Hotel and Keisha is a school teacher. Bob works a variety of shifts, so his schedule is different on a weekly basis. He drives his car to work, but is often tired in the evenings late at night while traveling home from a long day behind the stove. One of Bob's favorite things to do on the weekends to relax is go to a ball game. He and his buddies often make

a day out of it and travel into Seattle for weekend games. Bob considers using public transportation for his daily commute, but worries about the headaches of getting the times right when he is working late at night. The last thing he would want is to be stranded at work after a 10 hour shift.

Akio is a photographer who lives in New York. Born and raised in Japan, he has always used public transportation. He is visiting Seattle for an editorial piece that he is working on, and has plans to take photos downtown and throughout the Puget Sound. Akio has looked ahead of time and mapped out the routes he will take in town - at least initially. He knows there is light rail from the airport to downtown. He has high expectations for public transportation - coming from his experience in Japan and New York. On his trip, he doesn't even consider renting a car and assumes getting everywhere he wants to go will be simple, cost effective and efficient.

Appendix D – Rider Alert Process Flow Chart



The rider alert processes in place at Sound Transit and its operators require multiple agencies to be involved in delivering rider alerts. They use multiple channels to disseminate data to the riding public. Each of these channels are accessed manually and create lag time in some of the channels to disseminate accurate data that can assist in helping customers access and efficiently use the system when there are interruptions.

Appendix E – Glossary of Acronyms

Acronym	Definitions
ACD	Automated Call Distribution
ACS	Advanced Communications System
ACIS	VIX/ERG AVL product
ADA	Americans with Disabilities Act
APC	Automatic Passenger Counter
ArcGIS	ESRI produced tool for geographic information system management
ATIS	Automated Transit Information System (trip planning software) (http://en.wikipedia.org/wiki/Trapeze_Software_Inc.)
AVL	Automatic Vehicle Location
BRT	Bus Rapid Transit
CAD	Computer Aided Dispatch
CASR	Computer Assisted Service Restoration
CM	Configuration Management (http://en.wikipedia.org/wiki/Configuration_management)
CMS	Content Management System
CSSAT	Customer Service - Service Action Team
CT	Charlotte Transit
CT	Community Transit
DCUs	Driver Control Units
DECM	Design, Engineering, and Construction Management
DILAX	Manufacturer of Automatic Passenger Counters
EIS	Environmental Impact Statement

EMC Research	A public opinion and market research firm
EmVista	Front end software for the Link VMS
ET	Estimated Time
FSA	Final System Acceptance
GIS	Geographical Information System
GovDelivery	Digital Government Communication Portal
GTFS	General Transit Feed Specification (http://code.google.com/transit/spec/transit_feed_specification.html)
GTFS	General Transit Feed Specification (Google)
HHV	Handheld Validator
IGX	Ingenieux content management system
INIT	CAD/AVL vendor
IVR	Interactive Voice Response
KCM	King County Metro
LCC	Link Control Center
MO	Metro Online (KCM Website)
NTD	National Transit Database
One Bus Away	Mobile real time arrival software
ORCA	One Regional Card for All (Puget Sound transit smart card)
PACIS	GE Software for managing VMS
PCI	Payment Card Industry (security standard for accepting payments) (http://www.pcicomplianceguide.org)
PCI/DSS	Payment Card Industry Data Security Standard

PIO	Public Information Officer
PT	Pierce Transit
SAFTP	Stand Alone Fare Transaction Processor (VIX/ERG contactless validator)
SFTP	Standalone Fare Terminal
SCADA	Supervisory Control and Data Acquisition
SIRI	Service Interface for Real time Information
SOA	Service Oriented Architecture (http://en.wikipedia.org/wiki/Service-oriented_architecture)
ST	Sound Transit
TFS	Team Foundation Server (http://msdn.microsoft.com/en-us/vstudio/ff637362)
TVM	Ticket Vending Machine
TWC	Train-to-Wayside Communication
UCD	User Centered Design
U-Link	University Link Light Rail
VMS	Variable Messaging System
WCF	Windows Communication Foundation (http://msdn.microsoft.com/en-us/library/ms731082.aspx)
XHTML	Extensible HTML (http://en.wikipedia.org/wiki/Xhtml)
XML	Extensible Markup Language (http://en.wikipedia.org/wiki/Xml)
XSLT	Extensible Stylesheet Language Transformations (http://en.wikipedia.org/wiki/XSLT)