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# Smartrail: Integrated City Access Social Transport – Use Case

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## Abstract

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Current situation in Finland is that most of the non-urgent patient transport cost are paid by Social Insurance Institution of Finland (Kela). Wellbeing costs are coming from government (Law on the financing of welfare areas) and not anymore from Cities. Many of the wellbeing areas are exceeding their budget with is causing that public finance debt burden is increasing. This have caused a situation that wellbeing areas need to cut their cost.

This work is targeting to make money savings from patient transport costs by moving patients to use public transport whenever it is possible.

The focus of this work is on planning of this project. Implementation, pilot and market ready product was left out from this work. For pilot phase more detailed patient analysis is needed and for this we got support from Pirkanmaa wellbeing area for analyzing different patient groups for this study.

Digital wallet is a key component in Tietoevry work for social transport use case and based on another upcoming project that can be reused.

The main area that we are solving on this cannot be fully covered but target is to reduce public cost around 10 – 20 .. 30 percent of year 2023 figures that were around 309 million euros based on information from Kela.

Keywords: Wellbeing area, social transport, digital wallet, digital identity

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## List of Abbreviations

GDPR:	General Data Protection Regulation
EUDI:	European Union Digital Identity Wallet
Kela:	The Social Insurance Institution of Finland
Pirha:	Pirkanmaan sairaanhoitopiiri, Pirkanmaa welfare area
PT:	Public Transport
PTA:	Public Transport Authority
PTO:	Public Transport Operator

## 1 Introduction

Currently wellbeing cost are under government budget and responsibility it is increasing public finance depth burden. Patient transportations are next time under price competition in 2026 and there is clear window for creating a new on demand solution for this problem. According to economy of wellbeing areas for coming years there is strong need to reduce costs from public sector and from sector where cost is covered from Social Insurance Institution of Finland (KELA).

This study is ordered by Tietoevry Oy for Smartrail#3 project. Tietoevry Oy is a Finnish public limited company. The company is a leading Nordic provider of digital services and software. The company's services cover data-focused development and consulting services, software solutions, continuous services and transformation services, as well as related expertise, which supports the renewal, innovation and operational efficiency of customers' businesses.

The focus on this thesis is to study and plan a pilot phase and what is needed for market phase product. Patient group analysis is needed before moving to pilot phase on this project. Scope of this research was on planning how to integrate patient information, ticketing system, paying system and Kela system. Also, the target was how to create a digital wallet for saving customers data on it. This research evaluates potential money savings points and points what still needs to be studied further.

Parts that were left out from this research were actual development phase, pilot and implementation of final product. Decisions related to the scope were based on time and amount of work.

This thesis has been divided into 6 sections. The first section introduces the problem. Second section introduces Smartrail#3 consortium project. Third section describes social transport use case that this study is concerning. Fourth section will describe key stakeholders. Sixth chapter will introduce planned solution for social transport use case that introduced in third chapter.

## 2 Smartrail#3

SmartRail#3 consortium project is aiming to improve mobility services in Finland and also targeting to create a product that can be used as product to be sold abroad. Social transport is one use case on this that is specially identified to be used for social and health care transportation solution.

The SmartRail#3 consortium includes GIM Robotics, iQ Payments, Moovy, Nodeon, Solita, Tietoevry Create, the City of Tampere, Finnish Transport and Communications Agency Traficom, Tampere University and VTT, which is acting as coordinator of the joint project. Ecosystem actors are building a joint offering for focused target markets by combining their complementary skills (SmartRail 3 Project 2024).

In the consortium, we use PayIQ mobile ticketing solutions, applying them to customer and patient transport. Varala Engineering uses solutions offered by Tietoevry and PayIQ to develop visually impaired services, the same background services are available for Varala's application.

To target and focus the research group of the SmartRail#3 consortium formed by companies and research organizations, three (3) use cases have been devised together with the consortium and Tampere city operators.

The use cases are linked to the challenges and needs of (autonomous) rail-based urban transport, but at the same time have a wider and more generalizable business potential with the goals and investments set for the digital green transition. This research will focus on Social Transport use case.

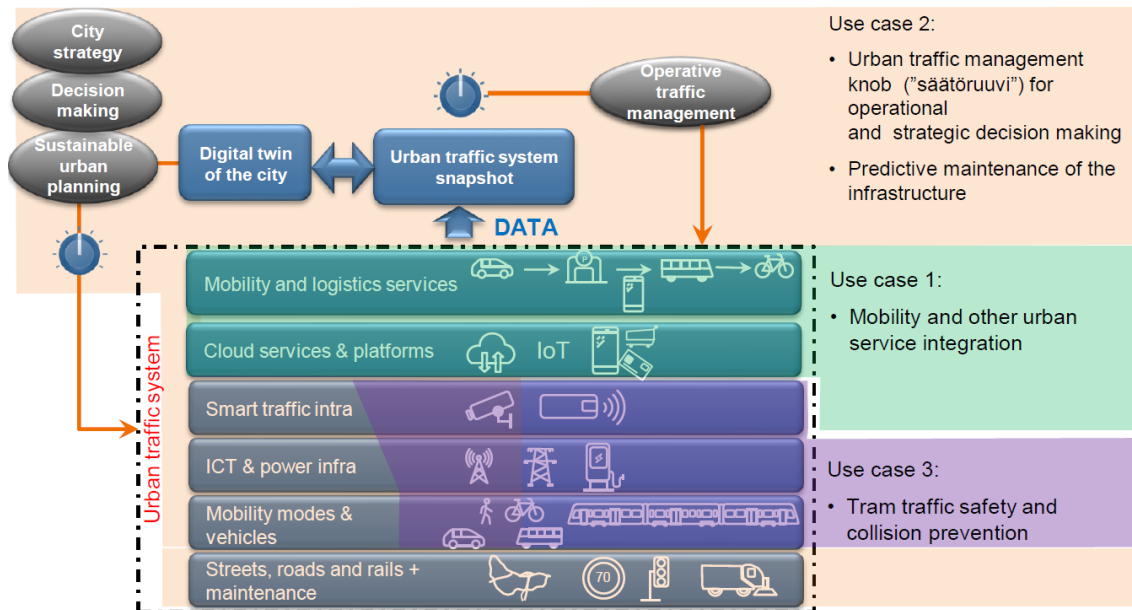


Figure 1. SmartRail#3 use cases in relation to the whole of the future urban transport system.

### Use case 1. Smart City Access & Social Transport

To solve the use case, the joint project researches and creates concepts based on new, innovative and sustainable digital solutions for urban mobility, which make sustainable mobility even more attractive, barrier-free and smooth. The most promising concepts are built by jointly developing demonstrations or pilot implementations, which are used to test the functionality of the concepts to finalize the concept path. The goal is to implement kv. solutions that can be scaled to the market and results that can be used commercially, e.g. market references. Concepts and their verifications can consist of individual separate solutions or together form a larger entity.

The focus is on next-generation solutions that aim to integrate mobility and services for city residents, to connect new emerging forms of mobility into smooth travel chains, and to increase the share of use of sustainable forms of mobility. In Tampere, the focus is on travel chains based on expanding tram-based trunk traffic. In the design phase of the project, the nous concepts are e.g. integration of call-controlled traffic and taxis as part of travel chains, digital mobility services aimed at travelers enriched with city services, utilization of public transport in SoTe and Kela transports (and integrated other services) with the help of digital transaction services and MyData solutions, and the TAYS hospital area advanced guidance as part of a tram-based travel chain.

The key technological ability to create sustainable travel chains at the core of green user-oriented urban mobility is digital identity management and the integrated services based on it. Building digital mobility services and carbon footprint calculation requires the smooth utilization of data with the help of organizational and technological solutions. In particular, the ways of organizing data spaces, business and operating models, and the effects of future legislation

should be examined. The goal is to carry out an experiment called From the City Access service, which combines other services of the city-kilan with movement. A more researched customer segment/solution target is the utilization of digital MyData solutions for social security and Kela transport with the aim of moving customers to use more sustainable modes of movement (than personal taxis). This includes research on dynamic demand control of autonomous feeder traffic & PALI (service line traffic). Figure 2 shows a potential example of using digital identity to build integrated services.

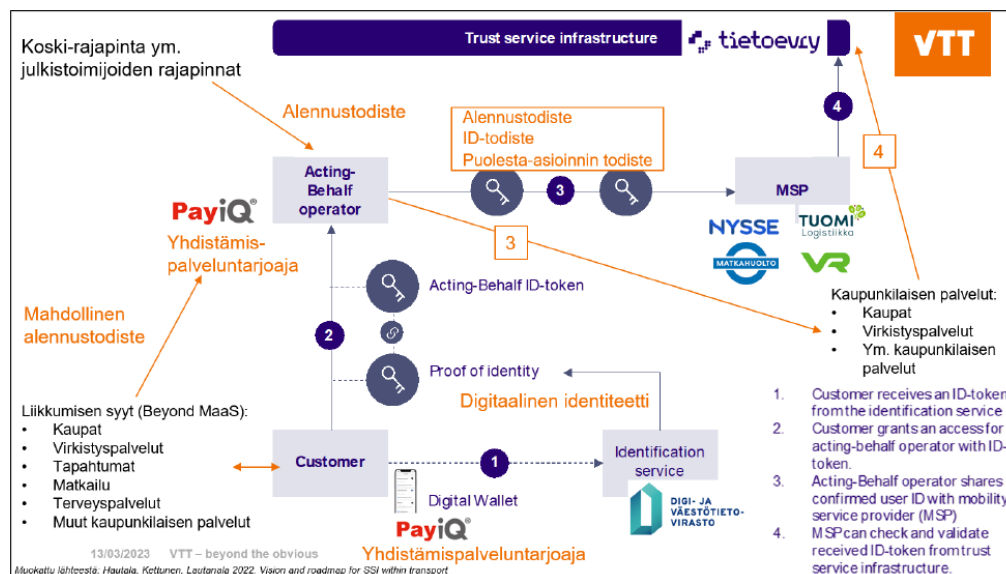


Figure 2. Use case 1: Case City Access & Social Transport

## Use case 2. Urban traffic "adjustment screw"

To solve the use case, the joint project investigates a management tool ("adjustment screw"; see Figure 3) that affects the smoothness, sustainability and safety of city traffic based on a predictive situational picture. The implementation requires a solution set consisting of infrastructure, sensors, data processing/presentation + artificial intelligence. The background is influenced by the need of the city of Tampere (a leader in the implementation of Urban Mobility 2.0) to speed up and actively guide the operation of the transport system to achieve sustainability and energy efficiency goals.

The hypothesis is that both strategic and operational level tools are needed to solve customer needs. Therefore, the joint project will investigate two different control screws: 1) operational control screw (real-time predictive traffic management and control) & 2) strategic control screw supporting urban planning and decision-making (modeling and simulation of strategic choices). The formation of these is supported by the evaluation of the effects of modern tramway systems, which can be used to predict the potential of the expansion of tramway systems and related mobility services.

## Use case 2A: Potential offering and development context in Tampere

VTT

**Use case:** "Urban traffic management knob"

**Description:** MVP implementation of "Urban traffic management knob" based on proactive situation awareness and with the target to improve urban transport systems sustainability, traffic flow and safety.

- Based on present state analysis of urban mobility through selected KPIs and measurement.
- Adjustment either on operational level
- Or on urban planning/ decision making level

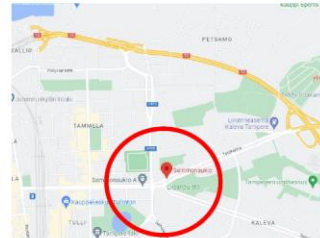
**Joint offering:** Solution entity for "the knob": Infra, sensors, data processing/visualization, AI- and modeling tools etc.

**Clients:** Domestic ja international cities



07/05/2024 VTT – beyond the obvious

**Potential context for development:** Controlling traffic flow of Sammonaukio intersection based on predictive traffic state analysis estimated from the traffic on area's main routes (E12, Rantaväylä tunnel, Hervannan valtavyöly). "Operative knob"



**Example of "Strategic knob":** Implementation of Congestion Charge

Providing decision makers tools to evaluate how parameters like validity area & period, vehicle types etc. affect on emissions, congestions, accidents etc.

Figure 3. Use case 2: Adjusting screw for urban traffic (VTT. 2024).

Utilizing the "adjustment screws" of urban traffic requires the creation of an up-to-date and proactive situational picture, the basic prerequisites of which are cyber-secure communication and the intelligent connection and orchestration of data streams from several data sources. As for the operational adjustment screw, multi-channel, data-secure, fast processing of real-time data and the ability to form intelligent operating models from historical data are highlighted, especially considering the needs of autonomous traffic. Regarding the strategic adjustment screw, historical information is highlighted

### Use case 3. Safety of autonomizing tram-centric urban transport

Safely automated city traffic (including trams) requires new types of solutions, the focus of which are various sensors that collect reliable observation data, efficient edge calculation solutions, data-secure and cost-effective communication solutions, informative user interface solutions and efficient data processing, analytics and the use of artificial intelligence. The operation of autonomous traffic requires the creation of an accurate situational picture of the objects in the traffic, especially the state of the objects and the predicted movement. Various traffic operators, such as pedestrians, cyclists, electric scooters and various vehicles, all have individual characteristics in terms of space use and movement and require an individually optimized algorithmic identification and tracking method to achieve the best possible identification and movement assessment through automatic sensor data analysis.

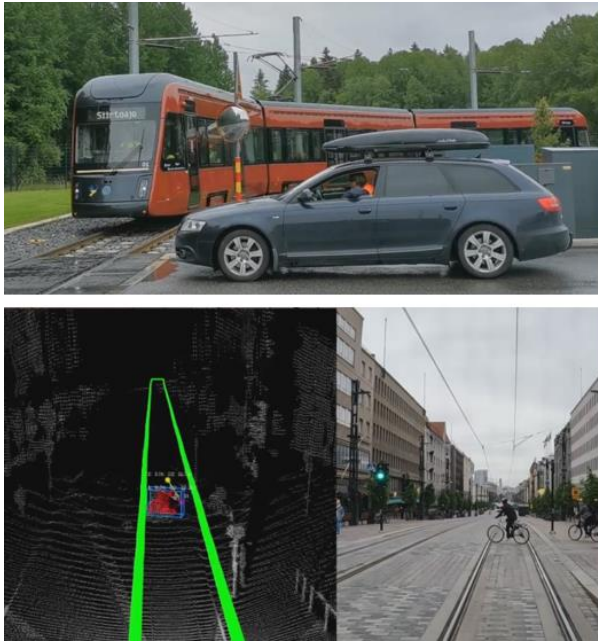


Figure 4. Use case 3: Safety of autonomous tram-centric urban transport

Ensuring the safety of pedestrians and other road users prone to injury in automated city traffic is a key challenge in increasing the share of travel chain services and active movement that improves the health of city dwellers. The focus of the safety challenge is the prevention of traffic collision accidents (especially collisions between light traffic and vehicles) and mobility services, taking special groups into account. The safe automation of trolley traffic is promoted with a two-way detection and warning system for collision situations (walking, cycling, cars). Figure 4 shows what a potential co-development site offers for construction based on a use case.

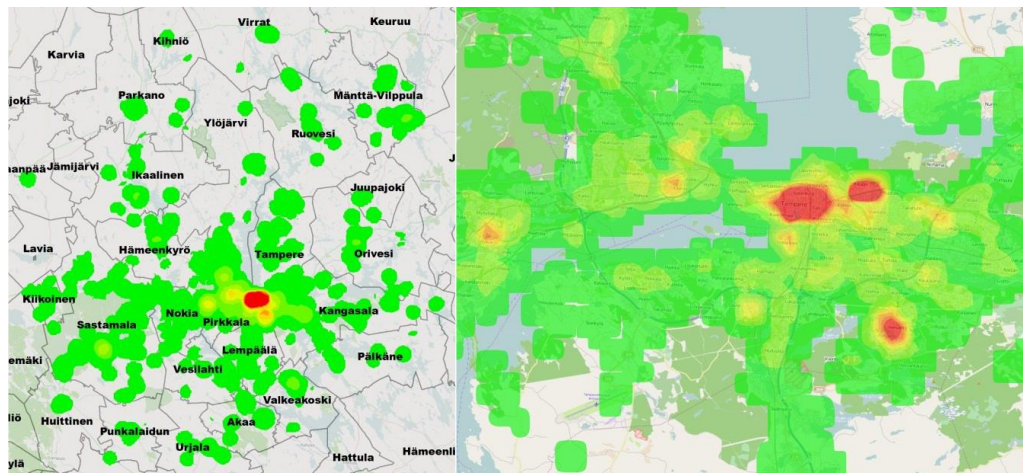
### 3 Social transport

Innovations provided by Tietoevry in this solution are in planning of patient transports in new way. Currently taxi is the most popular transport mode in public funded patient transports, and common practice is that one patient means one taxi ride. Our innovative solution provides tools to combine patient transports in smart way and gain cost savings as added value to whole society. Second way of smarter planning is to provide public transport easily available to patient, including right for free travel to the mobile application. Current subvention model does neither encourage patients to save public money. Added value can be achieved in two areas, firstly by combining more than one patient per taxi ride (when this is suitable) and secondly encourage patients to choose public transport instead of taxi. Patient own share of taxi rides are 25€/trip, with max 300€/year.

New process may mean that patient own share may be significantly cheaper or even totally free. New pricing models are part of research plan and planned to be piloted. Introducing public transport into this scene requires also trust network and rules for acting on behalf of someone else. Tietoevry will establish that in this project in close co-operation with PayIQ consortium partner, that is providing and further developing ticketing solution.

Tietoevry offer digital identity and trust network services to the ecosystem, for use in integrated City Access services and sustainable mobility services, as well as the application of similar solutions also in social security transport. In addition, we jointly offer intelligent planning tools for optimizing travel chains.





Figure

6 and 7, Heat map of the most common departure and destination locations for SHL, VPL and KELA trips. Liimatainen, H., Metsäpuro, P., & Nykänen, L. (2015).

Figure 2 and 3 shows heat map for most common destinations and origins for social travels. Most common destinations and origins are Tampere University Hospital, Hospital in Hatanpää and Healthcare center in Tipotie. On the left is the regional delimitation for Pirkanmaa and on the right for the center of Tampere

Healthcare transports are part of Kela services. Kela reimburses customers for some of the costs of travel to public or private health care. In 2021, the travel costs of reimbursements for medical care amounted to approximately EUR 311 million.<sup>i</sup> In addition to that, municipalities have reimbursed social transports to their clients. Reliable statistics is not available from one source about social transports in municipalities. Baseline to all society reimbursed transport cost is several hundred million euros annually. Responsibility of social transports was also moved from municipalities to wellbeing services counties (hyvinvointialue<sup>ii</sup>) from beginning of 2023.

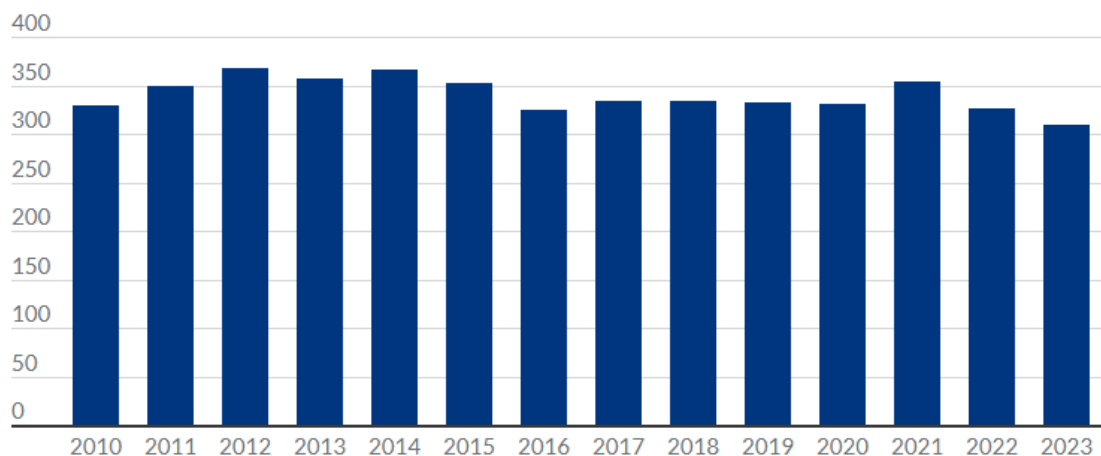


Figure 8. Health insurance travel reimbursements 2010–2023, million euros\*

More about legislation behind links (Vammaispalvelulaki <sup>iii</sup>, and Sosiaalihuoltolaki<sup>1</sup>). Our user journey and work packages around social transport try to address current cost challenges in this area and consortium tries to find innovative solutions to shifting transport mode from taxi to public transport without reducing dramatically customer experience. Even a small percentage of patients using public transport instead of taxi would mean millions of savings annually to society.

### 3.2 Research in other countries

The problem in terms of research was that there are no similar research results in Finland that could have been compared for my study. Exactly similar study was hard to be found even from other countries. However, here is few studies across the world.

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### 3.2.1 Public Transportation Facilities Access to Health Care

The study, led by researchers from the Urban Institute and the Mongan Institute, examined whether the frequency of missed or “no-show” medical appointments declined after the light rail expansion. (Public Transportation Facilitates Access to Health Care, Laura Barrie Smith, Zhiyou Yang. 2021). By comparing no-show rates before and after the expansion, we could assess whether no-shows declined more for patients living near the new line compared with those far from it. We included patients with all types of health insurance to assess if any change in no-show rates was correlated to insurance type. We found the following effects after the light rail opened:

- **No-show visits declined** more for patients living near the light rail than for those living far from it, with a relative decline of 4.5 percent compared with before the light rail opened.
- **These effects were stronger among patients covered by Medicaid**, for whom the relative decline of no-show visits was 9.5 percent.
- **Walk-in visits increased** for all patients near the light rail compared with those far from it, suggesting the rail line promoted more access to same-day care as well as fewer missed appointments.

Although the importance of access to care in promoting health equity has been long recognized, few prior studies have examined how expanding public transportation can improve access. By using a large, multiyear dataset sourced from electronic health records, this study had the unique ability to observe the occurrence of no-show appointments and patients’ proximity to the light rail transit system. In total, the data reflected more than 3 million patient appointments scheduled at 97 clinics between 2013 and 2016. (Public Transportation Facilitates Access to Health Care, Laura Barrie Smith, Zhiyou Yang. 2021)

### 3.2.2 Transportation and the Role of Hospitals

What are transportation issues that affect patients?

Each year, 3.6 million people in the United States do not obtain medical care due to transportation issues (American Hospital Association. 2024) Transportation issues include lack of vehicle access, inadequate infrastructure, long distances and lengthy times to reach needed services, transportation costs and adverse policies that affect travel. Transportation challenges affect rural and urban communities.

How is transportation related to health?

Because transportation touches many aspects of a person's life, adequate and reliable transportation services are fundamental to healthy communities. Transportation issues can affect a person's access to health care services. These issues may result in missed or delayed health care appointments, increased health expenditures and overall poorer health outcomes. Transportation also can be a vehicle for wellness. Developing affordable and appropriate transportation options, walkable communities, bike lanes, bike-share programs and other healthy transit options can help boost health. This guide outlines transportation issues and the impact on health and health care access. (American Hospital Association. 2024)

### 3.3 Future of Social transports

Social transport use case in SmartRail 3 project is planning to create a product that can help wellbeing service counties to cut increasing patient transport costs and to reduce society funding needs from public fundings. This use case can be used for private sector for rehabilitation for patients where cost is usually covered by insurance companies or by Kela in case of cost from wellbeing service county.

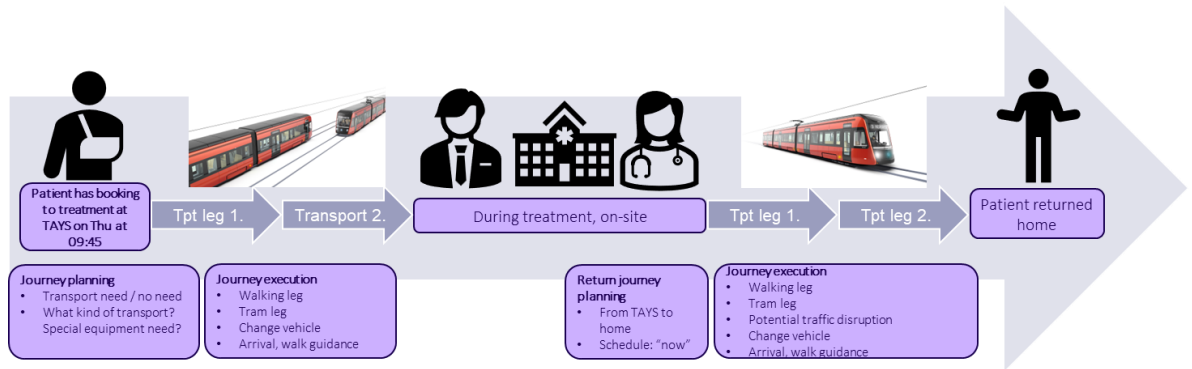


Figure 9. Simplified workflow picture of social transport (Mika Heikkilä, 2024).

According to Ministry of Social Affairs and Health the responsibility for financing travel allowances and the responsibility for organizing trips reimbursed by Kela will be transferred to the welfare regions nationwide in a uniform manner in 2025-2027 at the end of Kela's bidding period, depending on the state of social security preparation. The changes concerning financing and organizing responsibility require the opening of social and health-related laws and financing criteria. (Valtioneuvosto, road map. 2024)

Social transport use case has following main phases:

1. Planning phase, this is first phase of project and on this phase analysis on possible patient groups and detailed use cases are done.
2. Implementation phase, first version for pilot phase includes results from phase 1.
3. Pilot phase, target is to get pilot during 2025
4. Commercial phase, as this project is targeting commercial software and product that can be sold in Finland and abroad. This is the phase that then gets input from all previous phases.

Currently when patient is using taxi service to get into treatment, they have 300 € deductible share for yearly transport payments. One idea from discussion have

been that if patient would be able and willing to use public transport there would not be deductible proportion for transport fees.

### 3.3.1 Arguments supporting public transport

Pekka is frequent user of public transport (PT) and lives close to a stop point so favouring public transport is normal to him. Following arguments supporting to shift transport mode from car/taxi to public transport have been identified:

- Freedom of choice for passenger to choose which part of the trip is travelled by subsidized social transport and if the passenger is willing to pay for some part of the trip be him/herself. Depending on self-risk part in different alternatives.
- Reimbursement part of the social transport with taxis forms a threshold for many passengers subsidizing PT could have no reimbursement part (motivation to use PT) Petra has 10 return rides per month within Pirkanmaa. When driving more with taxi, excess amount needs to pay by passenger. If there would be unlimited public transport (monthly ticket), that probably increases popularity of PT.

Following table shows estimated saving figures from 2023 travel reimbursement with assumption saving percentages from 0 to 30 percent. Assumption is calculated from Information from Kela. Assuming that if 10 percent of travels is done based on PT, then wellbeing area saves about 21 million Euros. Saving is calculated with current PT ticket fares and can change is ticket pricing changes in Pirkanmaa area. Accurate calculation about savings is difficult to predict as all patient groups cannot use PT.

It should be noted that there will be part of patient groups that are resisting changes where they need to give up the gained benefit. Some of the representative organizations of special groups will oppose the change and that need to be considered on planning and communication. Table 1. Raw calculations for cost savings based on cost from 2023

		Amount of passges			
		2023	2025		
			10 %	20 %	30 %
Taxi		426 000	383 400	306 720	191 700
PT		0	42 600	76 680	115 020
		Amount of travels			
		2023	2025		
			10 %	20 %	30 %
Taxi		2 224 800	2 002 320	1 779 840	1 557 360
PT		0	222 480	444 960	667 440
		Pircie of one travel	Expensis		
			2023	2025	
				10 %	20 %
					30 %
Taxi	100,00 €	222 480 000,00 €	200 232 000,00 €	177 984 000,00 €	155 736 000,00 €
PT	3,00 €	0,00 €	667 440,00 €	1 334 880,00 €	2 002 320,00 €
		222 480 000,00 €	200 899 440,00 €	179 318 880,00 €	157 738 320,00 €
	Total costs	€	€	€	€
	Saving		21 580 560,00 €	43 161 120,00 €	64 741 680,00 €

Assumption is that cost is depending on the patient profiles and how many patients can use public transportation services due to their disabilities. This analysis needs to be performed with professionals in wellbeing area of Pirkanmaa (Pirha) that is our pilot area.

Based on current understanding from patient group analysis and discussions with key stakeholders cost savings are not going to be dramatically high in beginning. More detailed estimates can be done after pilot testing and we have common understanding with representative organizations of special groups.

### 3.3.2 User journey example

This subsection describes one typical use case for the planned solution.

User (Pekka) needs to visit Tampere University Hospital (TAYS) for treatment/check-up and uses subsidized public transport ticket to get there and back home.

Trip is in this case from home to TAYS and return back to Lintuhytti home address. User's home address can be also elsewhere.

### Prerequisites for user journey

User either:

- Has a right for subsidized travel and has at least one travel right/ticket in the app's digital wallet or
- Pays the travel personally and has money in the digital wallet (Payment by patient, part of end-to-end story – to be described.)

### Journey planning

Pekka has an upcoming hospital visit Thursday at 09:45 in Tampere university hospital (TAYS) R-building and decides to travel there from home with public transport.

Pekka opens the app and authenticates himself (To be defined whether pin code, Suomi.fi-authentication, or other multi-factor authentication).

After successfully logging in Pekka sees the landing page view. He navigates to digital wallet to see how many subsidized travel rights/tickets are left. Pekka sees that there are 2 subsidized travels left and can proceed with the planning.

Pekka goes to the trip planning section of the app and selects to start planning a new trip.



## Leaving home

App notifies the user when departure from home should take place. (Does the app notify prior to the departure, for example 15-30 minutes before departure? User can modify the notification settings.)

Online supporting service: Weather information in mobile app shows that no rain expected. User leaves umbrella home this time.

From home it is short distance to bus stop, where bus line 13 towards Tesoma is expected to depart at 08:40. User goes to the bus stop.

User's route is tracked at different stages of the travel chain for various modes of transport and, for example, traffic lights. Stakeholders that have subscribed Pekka's trip can monitor progress.

## Entering vehicle

Bus 13 towards Tesoma is at stop point, ready to depart 08:40 scheduled time. User enters bus and in the mobile app selects to start the journey. User shows the QR code displayed in the app to the validator device. Validator approves ticket.

## Changing vehicle

Bus arrives to Hervantakeskus stop. Mobile app notifies about coming vehicle change. Patient leaves bus and walks to neighbour stop where the tram leaves. Tram (line 3, towards Santalahti) arrives 08:53 and patient enters vehicle and shows ticket to validator. Validator approves it. Tram departs Hervantakeskus and passengers are enjoying quiet and bumpy-free ride.

Mobile app notifies user when Sammonaukio stop is approaching. Patient steps out and walks to opposite side of stop area to platform where trams depart towards TAYS.

Tram (line 1 towards TAYS) arrives 09:14 and patient enters vehicle and validates ticket.

Ticket inspectors are within this wagon doing their work. One of inspectors ask ticket from the user, who shows QR-code to inspector. Ticket is valid and inspector continues to other passengers.

### Arrival to hospital

Approaching TAYS area, mobile app alerts from upcoming stop, Kaupin Kampus. Pekka walks out from tram and walks to R-building main entrance door.

App provides guidance to correct building and department. From TAYS area, there is also a 3D map, but indoor navigation not implemented. If there is patient assistance available, that could also help Pekka and other arriving patients.

### Medical treatment

Medical treatment is out of Smartrail scope, what happens inside hospital buildings and departments.

Clear impact to Smartrail basic process is potential delays inside hospital, if there are pre-booked journeys to home. Also, if hospital treatments reduces the ability to utilize public transport. In that case patient can also get a voucher for a taxi ride home.

As a result of this phase, patient is ready to leave hospital and go back home.

### Journey planning, to home

Patient opens app and finds suitable journeys to home. System proposes alternatives, where user chooses next departure in 15min.

App guides patient thru hospital area to correct stop point where tram is driving from TAYS to Tampere city centre. Wagon arrives and patient steps in and shows

ticket to validator (ticket valid). Wagon departs from TAYS stop towards Tampere centre.

#### On-line service - traffic disruption

During journey, there is a car stuck on tram rails and blocking tram traffic. Patient looks journey planner for alternative routing. Application shows relevant alternatives, and patient chooses to change to bus line 29 that is driving same direction. Patient is leaving tram and walking to bus stop (Hippos C) in neighbourhood.

Bus arrives soon to stop, and patient enters bus. Similar ticket validation in bus is made and journey continues. Changing bus to the other tram line happens in Sammonaukio stop. Remaining part of journey is made with tram, without disruptions. Patient walks home from tram stop.

#### Arrival home

Travel wallet balance before next treatment shows remaining tickets. Back-end processes and data flows are not shown to patient.

## 4 Stakeholders

Most important stakeholders are listed into chapter and explained main roles and responsibilities.

### 4.1 Wellbeing service county

Wellbeing service county is responsible for organizing patient health service and arranging transportation when it is needed.

Have responsibility to admit right to subsidized transport to patient.

Makes contracts with PTA and taxi operator about patient transports to get care  
Pays actual transport service reimbursements to PTA, operator or even patient in certain circumstances.

#### 4.1.1 Treatment site

Treatment site is responsible for patient treatment time service. When patient gets appointment time to hospital or health care centre it will be visible on patients digital wallet. Treatment site get information about arriving patient and information when patient arrives to treatment site. In case of issues in transportation system will send information about that to treatment site too. Treatment site get information if patient needs help in arriving to appointment and for leaving from appointment.

#### 4.1.2 Customer service

Customer service will help patients travel related issues and support for any technical issues in travel chain.

## 4.2 Transport services

Transport services cater to individuals with disabilities or illnesses, as well as low-income elderly people who are unable to use public transportation. These services are available for various purposes, including work, education, accessing services, civic participation, and recreational activities within the person's municipality and nearby areas. If necessary, passengers can be accompanied by an escort.

Users can travel by taxi, on-call taxi, or shared transport. Essential and reasonable trips are arranged as part of these transport services.

### 4.2.1 Public Transport Authority

Arranges public transport and collects ticket fares from passengers. PTA Arranges transport either with normal PT or then pickup and drop of from Home to treatment site. Planning depends on patient needs and physical conditions. Patient can see needed information from Mobile application. When patients are picked up from home location information is available for driver.

### 4.2.2 Public transport operator

### 4.2.3 Operative responsibility of public transport, according to contract with PTA. Taxi operators

Service provider has contract with HVA about patient transports. Performs booked transport services according to agreed service level.

Collects patient self-risk part from passenger.

### 4.3 Patient

Can reserve appointments to hospital or healthcare centre and then book ride from system. Can see available routes and possible changes in route plan and available public transportation ticket amount that there is possible to use.

### 4.4 On behalf of patient

Part of patient has possibility to use personal assistant or then they have family members supporting on their daily basis operations including medical or personal business. System needs to support that person on behalf of someone gets same information as patient itself would be able to see or do.

### 4.5 Kela

the Social Insurance Institution of Finland is making needed authority decision for travel reimbursement. On this use case patient's digital wallet have information how many travel rights there is and when travel is used that information is then visible to Kela via reports or travel documents. Integration between Kela system and digital wallet is done with using needed security level and there is high level GDPR information saved in Kela and in digital wallet.

### 4.6 Insurance companies

There is option to include insurance companies in scope of this use case but that is not yet fully decided. This use case will also have capabilities for that same was as it is planned to be done with Kela.

Insurance companies could use same solution to support clients' rehabilitation. This is not planned for pilot delivery, but it was identified as potential further use case.

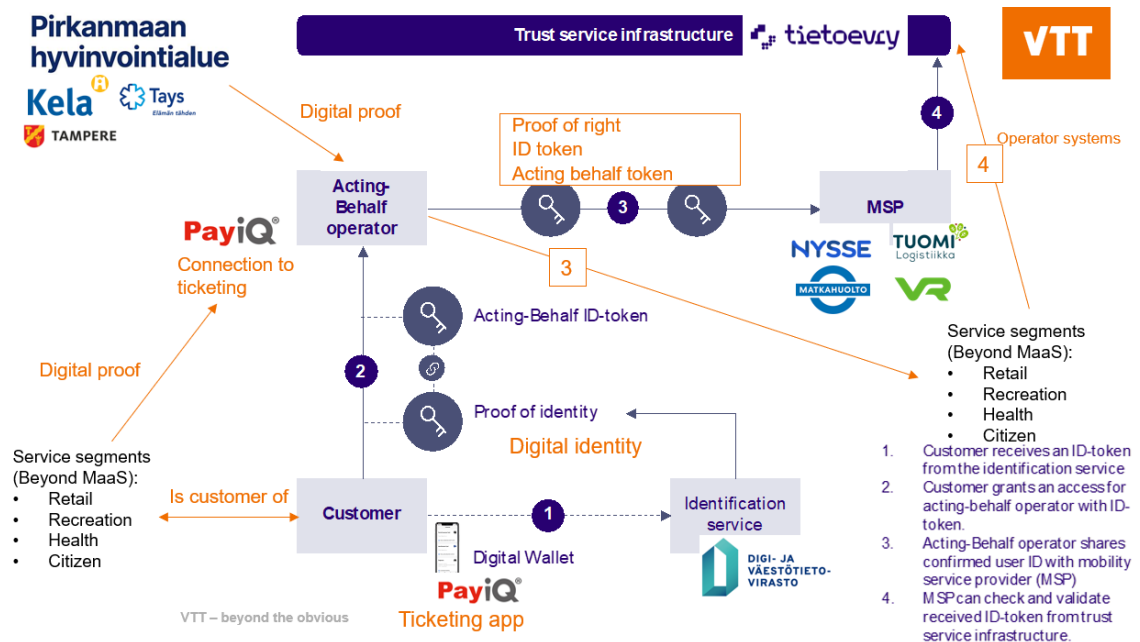


Figure 11. SmartRail#3 project plan

Figure 11 shows information flows between systems. Payment systems have connectivity for customers digital wallet where electronic travel tickets are saved. Proof of travel right is passed from wallet to transport operator digitally. Information about amount of travel ticket is digitally transferred from Kela system to digital wallet. Mobile application gets information from customers digital wallet.

Further discussion around this use case will be taken during project is in phase on commercial application delivery.

## 5 Solution planning

Solution planning is proceeding with technical planning and targeting for pilot during year 2025. Planning and design work have started during summer 2024 and will continue for pilot and from there towards final product.

### 5.1 How To Measure Cost Savings?

Designed solution is planned to create anonymous travel data from used journeys. Data includes data how many times patient have used public transport for healthcare related visit, what kind of travel combination is used. Data can be used to further analyse business case and estimate how much it can reduce cost from public sector.

All points that are affecting to cost saving calculations need to be clearly agreed with all stakeholders prior to pilot. This will help when creating reporting and from implementation design to project delivery.

This data will be shared with other key stakeholders and can be used to demonstrate how project is meeting the targets. Analysing of cost savings after pilot need to be performed with Pirha and Kela as they have more detailed reports from previous years.

When project can deliver reliable figures and reports about cost savings and findings from pilot to key stakeholders, we can consider it have succeeded.

### 5.2 Deliverables

Project has certain deliverables that we are delivering to project. All deliverables are not including details and part of them are owned by Tietoevry. Those parts where ownership stays at Tietoevry can be used also in other projects.

### 5.2.1 Reports

During project planning and implementation phase we are also implementing reporting towards key partners and stakeholders. Reporting is showing how well we can meet our designed goals and targets. Reporting will support for delivering required documents for project steering group, partners and Business Finland.

Based on experience from other projects when reporting is implemented during the project implementation it has been working. In case reporting has been done after project implementation it has been more challenging.

### 5.2.2 Technical Solution

Technical solution used for social transport service are planned to be done by using Microsoft Azure services and solutions. Azure has been chosen for technical solutions as Tietoevry is partnering with Microsoft.

Technical solution needs to support user-specific personalized optimization of travel chains in support of social transport. Technical solution needs to optimize route plan considering accessible routes and passengers with reduced mobility.

Reporting is created with Azure data analysis service and Azure Business Intelligence services. Reports will support business case analysis and further development of use case.

Solutions key component is digital wallet that holds participants digital identity including needed personal information's such as name, address, social security number, phone number, number of journeys patients have right to use on month and other needed information to use services.

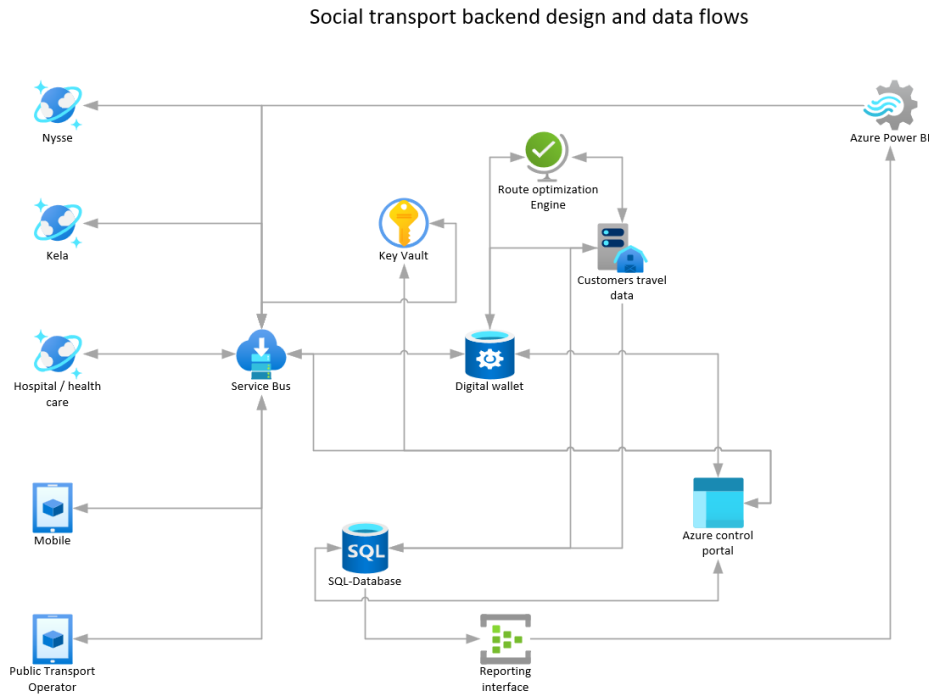


Figure 12. Technical design of flows to digital wallet

Integrations between external systems like Kela system, Mobile application and Software that TietoEvry is providing with Microsoft Azure Service Bus. This will provide secure connections on-premises and cloud-based applications.

Patients can access to their digital wallet via mobile application that is using strong authentication. They can then see all the needed information. Kela, hospital and healthcare Centre connections are designed to use strong authentication as data that is stored into system is sensitive data and processing and holding of that data is defined in General Data Protection Regulation (GDPR).

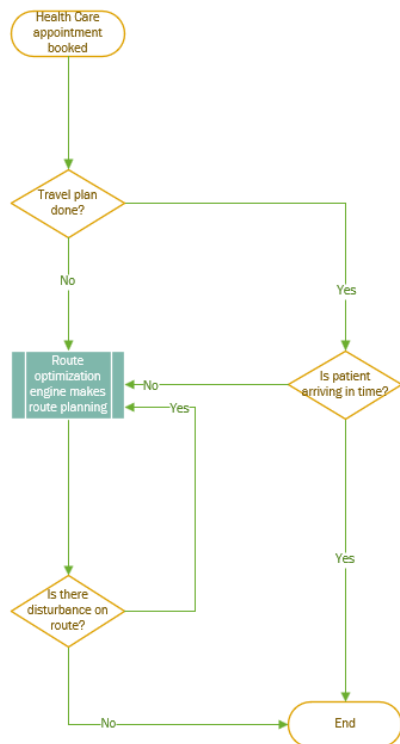


Figure 13. Process flow for route planning engine

Figure 13 illustrates process flow in backend what happens when healthcare time is booked into system.

1. Health care system send information about booked time to customers digital wallet.
2. System checks is there planned route for that appointment.
3. If planned route is not found system will start planning process in backend.
4. Information is available in customer mobile application.
5. If customer is late or there is disturbance on traffic system will automatically start optimizing route planning and informs result for customer. System will make variations for planning. Customer can choose plan based on proposed options.
6. When customer arrives to treatment site system will mark planned route completed.

### 5.2.3 Technical solution design

Here is draft planning how project is design to use different Microsoft Azure software components.

#### **zure Service Bus**

Azure Service Bus is integration software from Microsoft. Technical design on social transport use case is relying on secure connectivity from partner systems to backend systems. Service Bus is used to create secure connection to Azure cloud infrastructure where all connections towards Azure tenant are going through Service Bus integration software.

This will reduce risk of rogue connection attempts. Connections are created to use certificates between Azure and any partner system that are used on this use case. This will ensure that sensitive data is not leaked out from system.

Azure Service Bus can scale up or down according to incoming traffic which improves usability on rush hours.

#### **Azure key vault**

Azure Key Vault is used in this content for saving certificates and user passwords. Key Vault increases cyber security as application does not have direct access to keys.

This will increase performance in system and reduce latency.

#### **Azure Power BI**

Due to nature of this business case, there is demand to be able to secure customers sensitive data and create reports for key stakeholders. Design plan is defining objectives for reporting.

Goal is to have customers travel data separately from sensitive data. Azure Power BI gets anonymized data for reporting.

Reports can be:

1. Distributed to key stakeholders
2. Key stakeholders can directly run reports from Azure Power BI

#### **Digital Wallet**

Digital wallet includes all customer data where usage is controlled by GDPR. Customers need to perform multi-factor authentication to get access to Digital Wallet.

Wallet have information about customers health care appointments and amount of available public transport journeys. Customer digital wallet have Information that is needed to get information from healthcare system and Kela.

Security requirements for digital wallet are coming from GDPR. That defines how strong cyber security need to be.

### **Customer travel data**

Travel data is including customer travel history data without any sensitivity. Data is linked to customer with customer id, This makes sure that customer cannot be identified based on this information.

Customer travel data is not directly used for reporting purposes. Before data is used it will be anonymized to prevent that customer could be identified.

### **Azure control portal**

Azure control portal is used to define all settings and maintaining social transport related azure tenant. This is standard Azure application for administering applications that belong to tenant in question.

### **Azure SQL database**

Plan is to have anonymized data in different database as real time operation data. This database can be changed to data lake data storage during implantation phase if data need to be saved for longer period of time.

Azure Power Bi creates all reports from data that is stored here. This will then reduce risk to have more data than needed in reporting.

As operational data is not used for reporting purposes it will reduce load from actual production used data and reduces risks from unwanted performance issues.

### **Route Optimization Engine**

When customer that is using Digital wallet gets healthcare appointment it comes to customer travel data where route optimization engine makes route planning based from information for available transport connections, customer disabilities and other predefined planning parameters.

When customer opens mobile application it will provide preplanned routes to customer. Mobile application follows customer on route and if customer misses connection or there is distribution in traffic then Optimization engine will reroute customer to next possible transportation.

### **Azure Cyber Security**

Nower days when hybrid operations are common thread factor across global it-systems. It is important to understand that and plan how to mitigate possible threads already on design table.

Microsoft Azure have several in build tools and application to improve cyber security. Plan is to use Microsoft defender to identify possible weaker points after first version is ready. Tietoevry is implementing needed changes to Azure Tenant based on recommendations. Target is that most common cyber security vulnerabilities will be prevented before releasing application to testing.

Project will use needed experts to design and build system with cyber security in good level. Cyber security needs to get update all the time so it is important that it is constant process.

### 5.2.4 EU Digital Identity and Wallet

The EU Digital Identity Wallet is designed as a convenient and secure method for European citizens and businesses to authenticate their identity, using their digital ID for both public and private sector interactions. Users can store various digital documents within the wallet, ranging from academic credentials to transportation passes, and use it for signing into private platforms, such as social networks. This approach is more secure and user-friendly than managing numerous passwords. With a single click, individuals can confidently transmit specific information to verified entities, disclosing only necessary details - like age or nationality -, while withholding additional personal data. This minimises the risk of personal profiling and grants users sovereignty over personal information, a feat unattainable with tangible documents. (Digital Wallet Pilot, European Union, 2024)

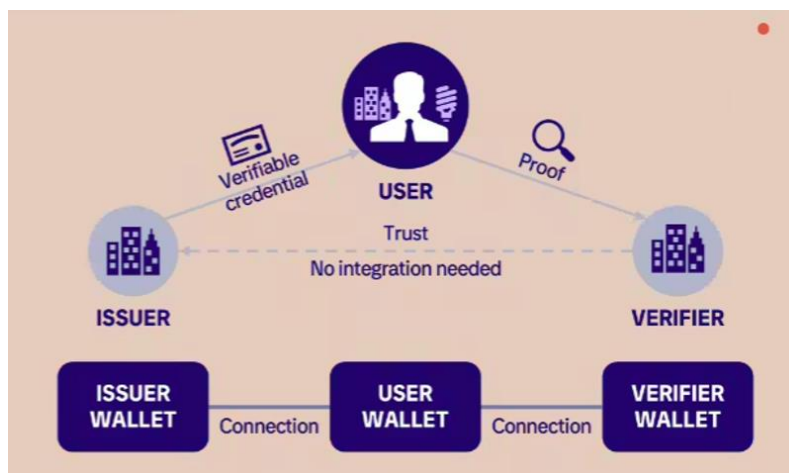


Figure 14. Electronic Identification, Authentication and Trust Services

The EU Digital Identity Wallet will facilitate the exchange of information within an individual's home EU nation, and across other member states.

In 2023, the European Union initiated four major pilot programs to evaluate the EU Digital Identity Wallet prior to its official introduction to the Member States. Four Large-scale pilot projects are collecting feedback on the requirements for the EU Digital Identity Wallet and help for develop the Common Toolbox and ensure a secure deployment. (Digital Wallet Pilot, European Union, 2024)

The Commission will provide a prototype of the EU Digital Identity Wallet (EUDI) conformant to the requirements of the European Digital Identity Regulation. The prototype was procured under the Digital Europe Programme, and includes code libraries and a sample application. It serves as a testing ground, allowing for the refinement and validation of specifications outlined in the Architecture and Reference Framework. (Digital Wallet Pilot, European Union, 2024)

A series of Large-Scale Pilots spanning various sectors - including, financial services, education, and transportation -, offer invaluable insights and provide feedback about the wallet's real-world functionality and usability. The EU Digital Identity Wallet open-source nature ensures that thoroughly vetted resources will be accessible to the public, allowing Member States and interested parties to develop their own digital wallet. (Digital Wallet Pilot, European Union, 2024)

#### 5.2.5 Pilot Planning

During project planning there have been identified need to have proper discussion with representative organizations of special groups, Pirha and Kela. During pilot planning phase project is contacting groups that have interest for participating, social service of wellbeing area, Tuomi Logistic that is responsible for transport service in Pirkanmaa and Pirha.

Dialog with Kela and Pirha have been ongoing, and they are interested to see how project is progressing. Next steps for pilot are:

- Agree patient groups with Kela and Pirha that would meet requirements
- Contact to representative organizations of special groups
- Agree pilot time with all needed stakeholders

- Gathering of volunteers to participate

Ideas for groups and patients who would like to participate to pilot phase:

- During pilot testing phase travelling with PT could be free of charge or lower price than normally to get user experience and feedback.
- Feedback gathered from participants actively
- Limited groups selected with key stakeholders

Before pilot phase project need to agree with Kela that how many patients pilot will have. How many transport tickets can be given to patients participating into pilot.

#### 5.2.6 Integration Documentation

- Solution that we are creating have following identified integrations: Integration from Kela system to Digital wallet
- Integration from mobile application to Digital wallet
- Integration from digital wallet to PayIQ payment system
- Integration from Digital wallet to healthcare system

Created integrations will be documented and shared with needed details to stakeholders that need to have access to those.

### 5.3 Implementation planning

Target of Tietoevry for start of implementation is during January 2025. Implementation is done based on methods from Scrum. Sprint period to be one to two weeks. This will ensure that deliveries are coming with needed timeframes. Current state is that project is on technical design phase and draft technical documentation for implementation is ongoing.

Part of the implementation planning process is to create a plan how to test all created applications. Testing phase is planned to be during the second quarter of 2025

### 5.4 Pilot

Planning for pilot is ongoing and based on current estimates project is targeting for pilot phase during second half of year 2025. Duration of pilot phase has not been agreed yet.

After pilot is over project is gathering data from pilot phase and creates reports for key stakeholders. Reports and analysis need to be ready before the next tender for Kela transports starts in 2026

Project need to make separate reporting towards Business Finland. This is needed as Business Finland is funding project.

## 6 Discussions and conclusions

Problem that this research was aiming to solve was increasing transport costs for wellbeing areas. This research was evaluating potential money savings for non-urgent patient transport by using public transports. Objective was for planning how to integrate patient information, ticketing system, paying system and Kela system. Also, the target was how to create a digital wallet for saving customers data on it.

Bases on discussion and analyses challenge for social transport use case was identified to be:

- It is difficult for patients to give up the benefits they have already achieved
- Identifying patient groups that would be able to move to use public transport from using taxi services
- Project need to agree carefully with representative organizations of special groups to avoid resistance during project pilot phase
- Most of the patient groups cannot move to public transport service due to their health or physical conditions.
- As similar openly shared cases are rare project cannot compare analysis with other research results. All analysis and research need to gain from project planning phase.

Based on discussion with key stakeholders and other stakeholders this business case has a potential, but limitations and other restrictions need to be analysed carefully. Based on those discussions there are following benefits:

- Solution would support poorer patients who do not have enough money to pay the deductible portion of the taxi

- It would also improve social integration. There are research results by VTT about elder people were using public transport it improved their social integration.
- When patient groups that can move from Taxi to public transport start using those, they have possibility to rehabilitate them back to work life or to improve their social life.

Based on investigations from similar research from other countries there was following findings:

- No-show visit declined when there was rail line near by
- Walk-in visits increased for all patients near the light rail compared with those far from it
- Long distance and bad connections decreased accessibility
- Many countries have patient transport services that will take care of non-urgent transport when patient has right to use it.
- Majority of the big cities have proper public transport services available but that is not the case in smaller cities or villages.

As conclusion from study and research it is difficult to predict or estimate business value of this case. It would help for analysing if research data would be available for comparison.

This use case can be used on other business cases as well and there is potential for market business case also.

## 6.1 What next?

Next step is to start implementation work based on technical design and documentation of technical solutions. Project analysis for other use cases will be done on same time and using functionality in travel use case to is under analysis.

Draft time schedule for upcoming year:

1. Before January 2025 design work to be ready
2. Implementation starting January 2025 and first version to be ready during February 2025.
3. Testing phase will start approximately during march 2025
4. Pilot phase during second half of 2025
5. Pilot phase reporting during quarter 4 2025
6. Commercial product planning during second half of 2025

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