D.T2.5.1 DESIGN OF A TRANSNATIONAL TECHNOLOGY BASED SERVICE HUB

D.T2.5.2 TRANSNATIONAL TECHNOLOGY BASED SERVICE HUB - MOCK-UP

D.T2.5.3 SYSTEM TESTING

System Development for the transnational technology-based service hub

Nov 2020

Document Information

Version	Date	Author	Organisation	Comment
1	01.09.2020	Katharina Schweiger	City of Ulm	First Draft of the Document
2	02.09.2020	Katharina Schweiger	City of Ulm	Adaptions
3	03.09.2020	Katharina Schweiger	City of Ulm	Final adaptions
4	30.11.2020	Katharina Schweiger	City of Ulm	Adaption to final project results
5	03.12.2020	Florian Kressler	ATE	comments
6	10.12.2020	Anja Seyfert	Redmint	Final check
7				

Content

Summary

The present report documents the status quo of the deliverable regarding the open-source software component of the service hub.

Chapter 1 and 2 outlay the design decisions of the service hub on a technical and organisational level. The technical part focuses on the open source background of the project digitransit in order to guarantee long lasting advantages of the SHAREPLACE project for future digitransit users and developers. The organisational part concentrates on the role of a solid community behind an open-source project and the advantages this can bring.

Chapter 3 documents the basic architecture of the software and our focus to document the implementation of digitransit as user-friendly and easy as possible, its step-by-step implementation as well as new features developed in the SHAREPLACE pilot. It also describes how the pilot team built up a community around the project and further explains the viability of a solid community behind open source projects.

Chapter 4 then summarizes our learnings so far and gives a brief outlook on what will be achieved until the end of SHAREPLACE in November 2020.

1. Digitransit

Digitransit is a collaboration project providing a service platform for an intermodal public transport journey planner based on OpenTripPlanner. It has originally been developed by Helsinki Region Transport (HSL), the Finnish Transport Infrastructure Agency (Väylä) and TVV LMJ Oy. The code is open-source, which allows all interested parties to use the code and to participate in further development of the service. This offers the opportunity of building up a strong national and international community of developers in order to contribute to better quality, improved security and up-to-date data quality.

HSL develops digitransit transparently on the collaboration platform Github. This allows interested parties to use the code and clone the repository (which is the place, in which all code regarding one project resides), make adaptions in their own repository and/or give proposals for adaptions, improvements, bug fixing or new feature requests to the original source (i.e. make pull requests).
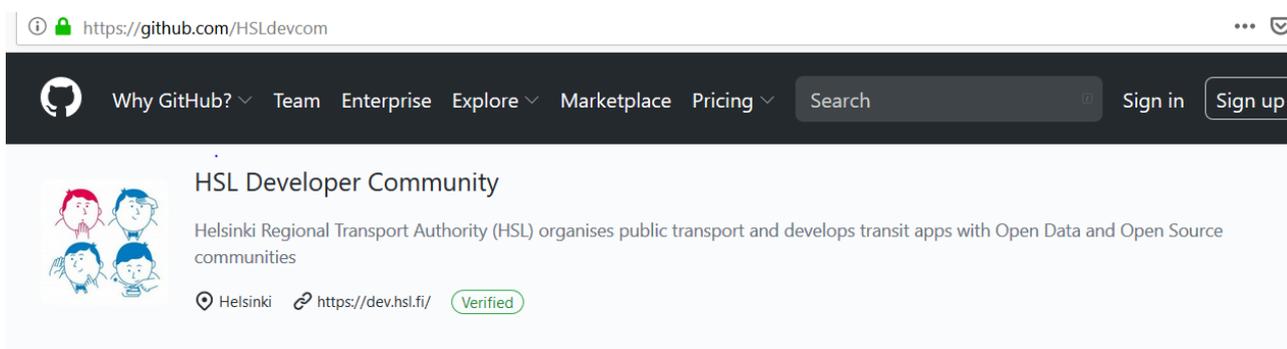

Figure 1 HSL github account (https://github.com/HSLdevcom)

Digitransit allows the integration of various means of transport and the combination thereof: from planes, trains, and buses to ferries, bike sharing and scooters, a lot is possible. Basically, every means of transport for which data is provided according to GTFS (General Transit Feed Specification, Specification for data exchange in public transport) respt. GBFS (General Bikeshare Feed Specification, Specification for data exchange in micro mobility services). Also, real-time information is possible. Underlying are the conditions as stated above: GTFS and GTFS data feeds for the respective modes of transport, preferably as open data.

Why an open-source solution?

Open-source software is licensed under an open/free license, which allows third parties to look at, copy, and extend the underlying code of the software. This makes the software adaptable to different circumstances like different cities, different modes of transport, different topography, customer needs, and many more. Often, people feel like the freedom to use the software unrestrictedly, to check and understand its functions, to copy and distribute the software, and to improve and distribute the software improvements, is only interesting for software developers. In the long run, this is not true: all these opportunities give the freedom to not be dependent on one particular supplier but allow to go look for help somewhere else. Furthermore, it makes software more resilient to unforeseen changes and challenges (like new mobility services in the transport context, new technologies or a software company withdrawing from the market).

2. Digitransit Community

Why digitransit?

The solid community around digitransit makes it a perfect fit for an open source project. Digitransit is used for public transport in Helsinki, but also as national journey planner for the whole of Finland. A solid community behind an open source project guarantees further development and an active and continuous effort in improving the software. The more users the software stack gets, the more stable it gets, the more organisations profit from improvements and the more brains can think about challenges and solutions together.

The following instances of digitransit in Finland are running as:

- National journey planner (matka.fi)
- Helsinki region journey planner (HSL)
- Hämeenlinna journey planner
- Joensuu journey planner
- -Jyväskylä journey planner (Linkki)
- Kotka journey planner
- Kouvola journey planner
- Kuopio journey planner (Vilkku)
- Lahti journey planner
- Lappeenranta journey planner
- Mikkeli journey planner
- Oulu journey planner
- Rovaniemi journey planner
- Tampere journey planner
- Turku journey planner (Föli)
- Ylläs Around -journey planner

Beside these there's also instances of Digitransit running in ...

- Herrenberg, Germany
- Münster, Germany
- Turin, Italy
- Ulm, Germany

And one is coming up in Estonia. The Norwegian national journey planner also has some common history with Digitransit and OpenTripPlanner.

This shows that there is already a broad community around digitransit, which works with it on a daily basis, shares knowledge and improvements and helps each other with problems.

HSL is looking for developers and municipalities using digitransit and collaborating on it, as one can see from their homepage, which again shows that cooperation is wished for and valued.
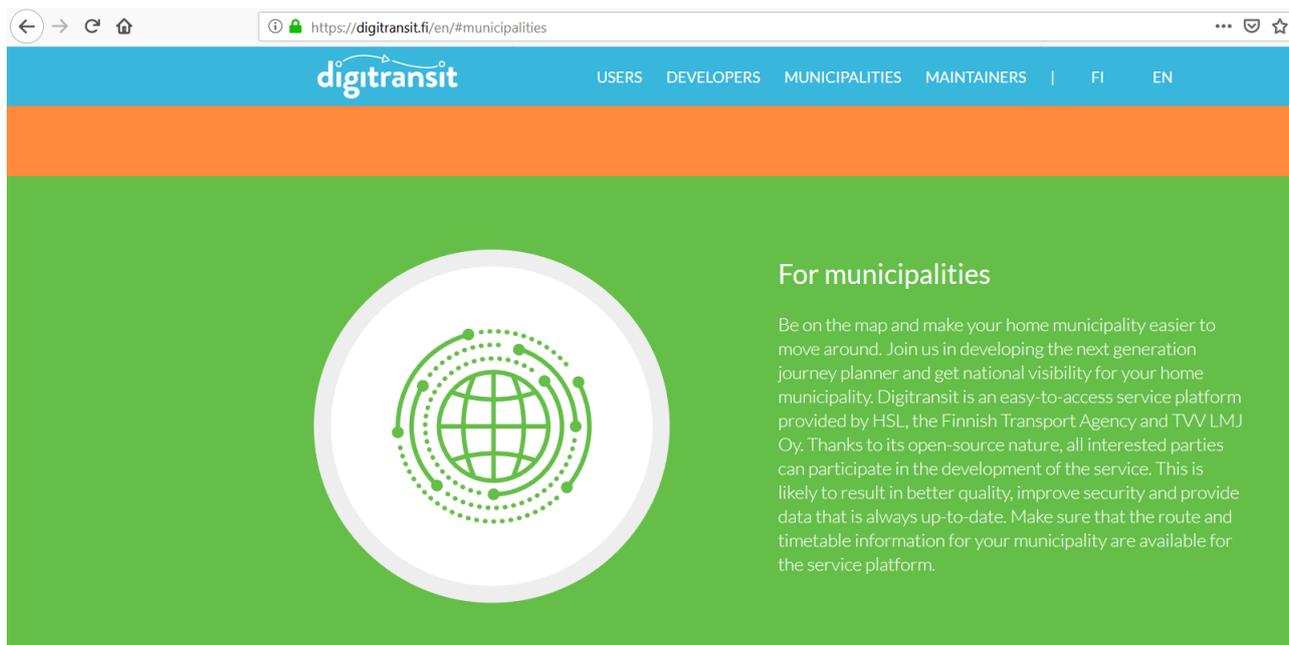
*Figure 2 Community approach of digitransit (https://digitransit.fi/en/#municipalities)*

3. Digitransit as SHAREPLACE pilot

As the driving motives behind SHAREPLACE aim at building a sustainable, digital solution, which is transferrable to other cities and regions, open source software is the way to go. That way, also smaller cities or transport operators with potentially lower budgets have the technical opportunity to provide electronic transport information and integrate different services in a region.

This is why we set one focus on documenting the technical setup very neatly. Our goal is to provide potential implementers with a "cookbook" for digitransit, which serves one very basic setup featuring public transport and then allows adding various flavours to the "mobility menu" like the integration of micromobility services. By doing so, we want to provide other cities and regions with very basic mobility needs but also offer the possibility to integrate other services if the local and regional preconditions allow for it.

3.1. Transferability of the pilot and community building

To further guarantee transferability, development of digitransit within the SHAREPLACE pilot takes place on the collaboration platform Github. The pilot team of the city of Ulm decided in accordance with the rest of the SHAREPLACE partners that no separate SHAREPLACE account on Github will be created. Rather, the repository resides in the account of Transportkollektiv. Transportkollektiv is a consortium of open transport experts who collectively work on topics regarding open transport. The pilot team of the City of Ulm is member of the aforementioned expert consortium. Furthermore, the consortium turned out as a good starting point for building a reliable community around the project that contributes its work via this account. This will give us the best chance to foster a community around the project that will continue working on digitransit after the project's lifetime.
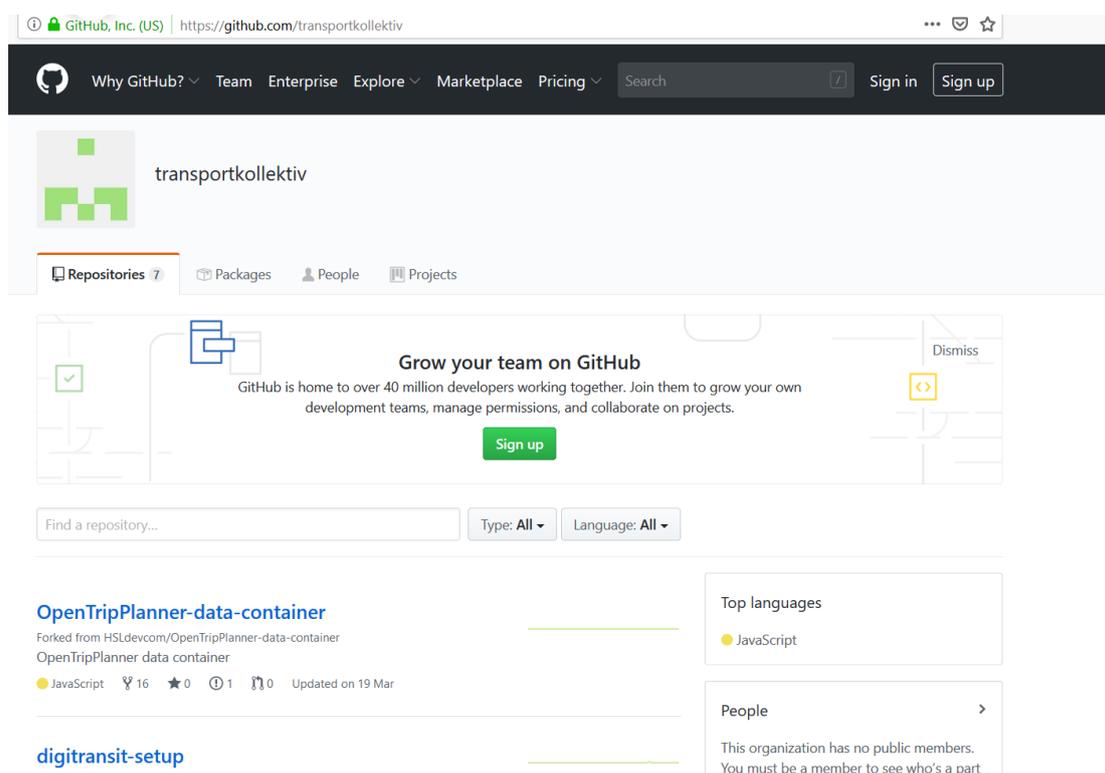
Figure 3 Transportkollektiv Account on Github (https://github.com/transportkollektiv/)

Documentation for transferability

A huge part of the pilot of Ulm's work concentrates on neat and clean documentation of the steps that must be taken in order to get one's own digitransit instance up and running. This gives cities and regions the possibility of not having to reinvent the wheel but to build on already up and running software and rely on the wisdom of the community already using digitransit/any other open source tool.

As a very first step, digitransit needs to be set up for Ulm. In order to do so, the HSL repository on Github needs to be forked and adapted to Ulm's needs. In order to break down the rather extensive set up of HSL shown in Figure 4, the set up for Ulm aims at simplifying digitransit's implementation.
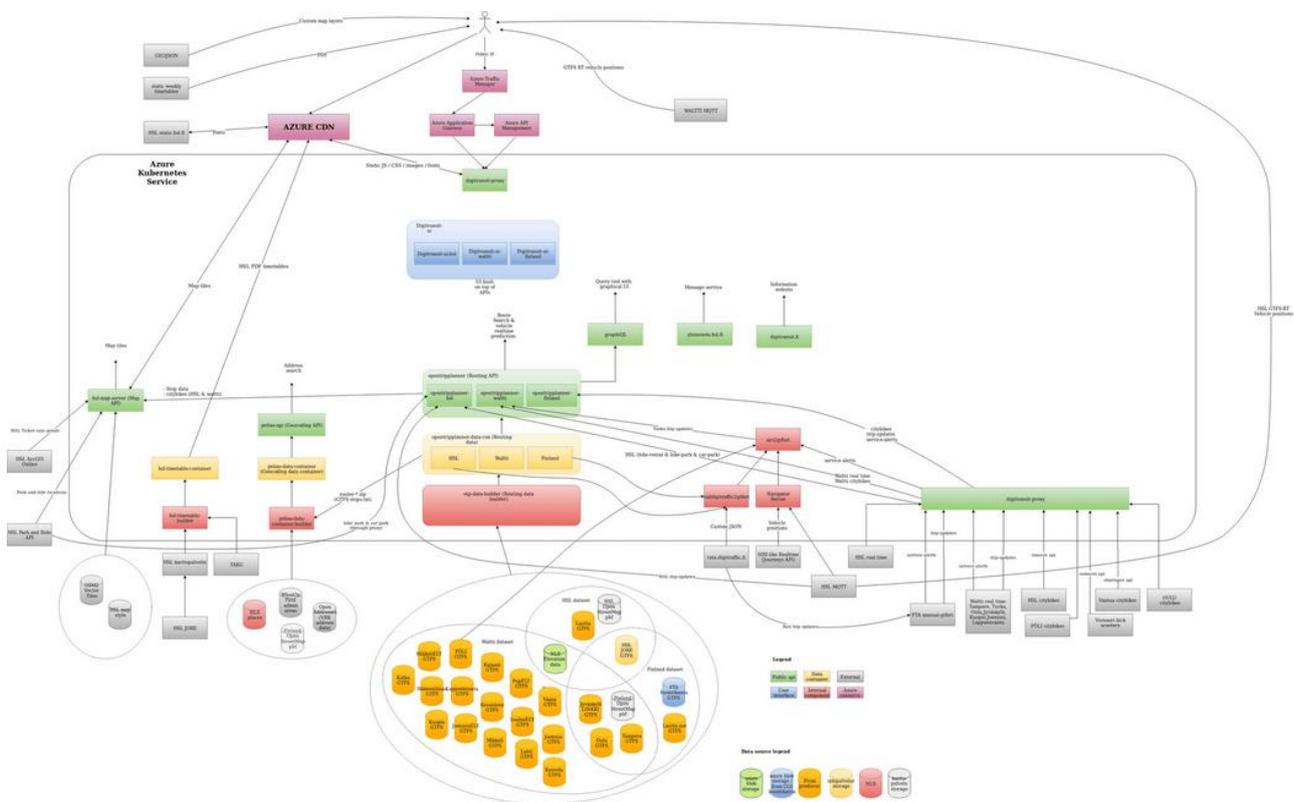

Figure 4 HSL digitransit architecture (https://digitransit.fi/en/developers/architecture/)

The following setup shown in Figure 5 is tailored towards a small-ish rollout on off-the-shelf hardware and with manageable tooling – no enterprise-grade integration service required (although possible to do so at your own peril).
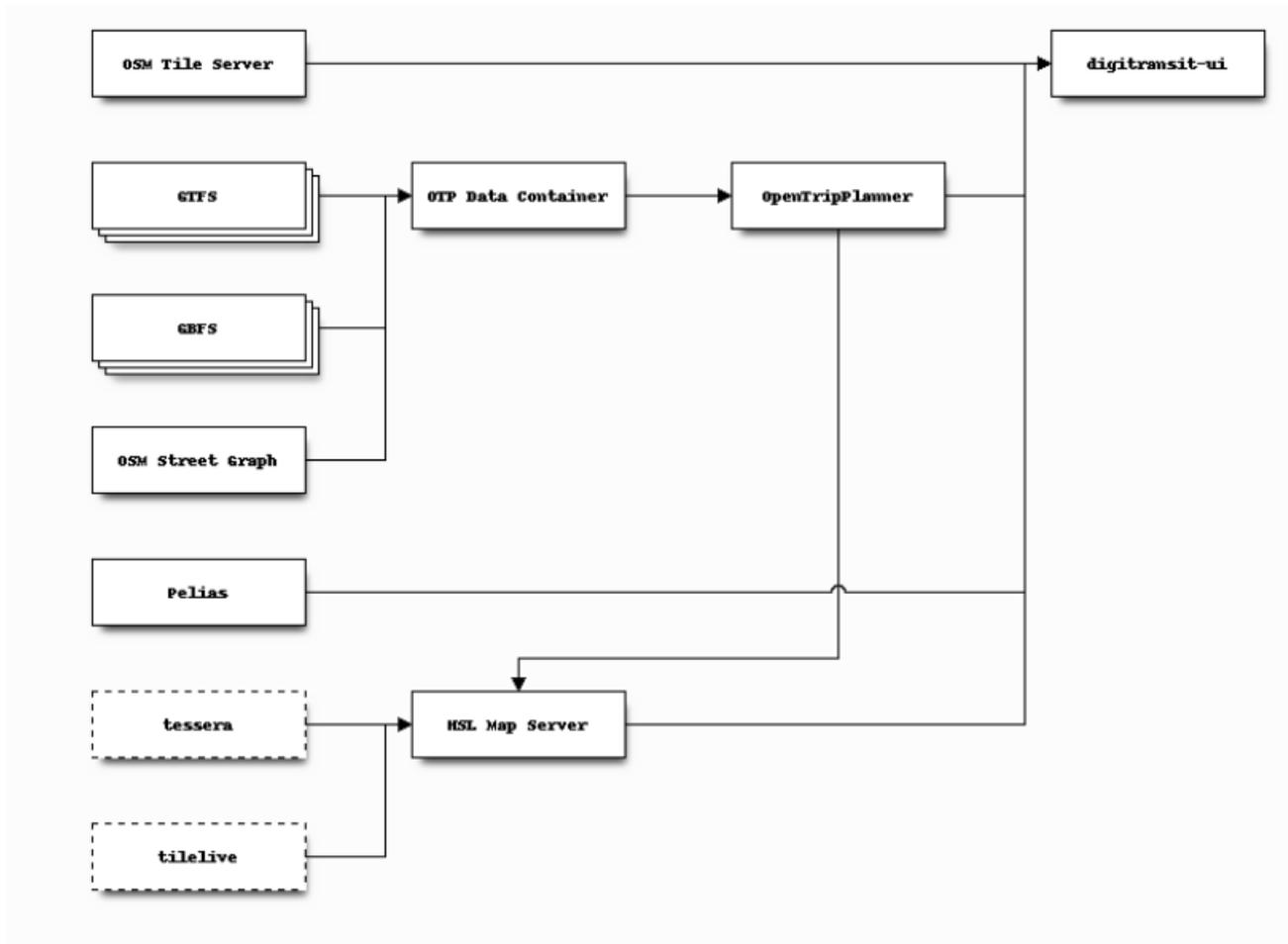
> **❶ Note**
>
> As can be seen in the diagram, some dependencies are circular. This poses a few challenges when first setting up a working instance, which we will address later on.

Figure 5 Transportkollektiv overview (https://transportkollektiv.github.io/digitransit-setup/installation/overview.html)

The pilot team's documentation is published and kept up to date in the Transportkollektiv repository, too. The aforementioned cookbook for setting up your own digitransit is found here https://transportkollektiv.github.io/digitransit-setup/index.html.
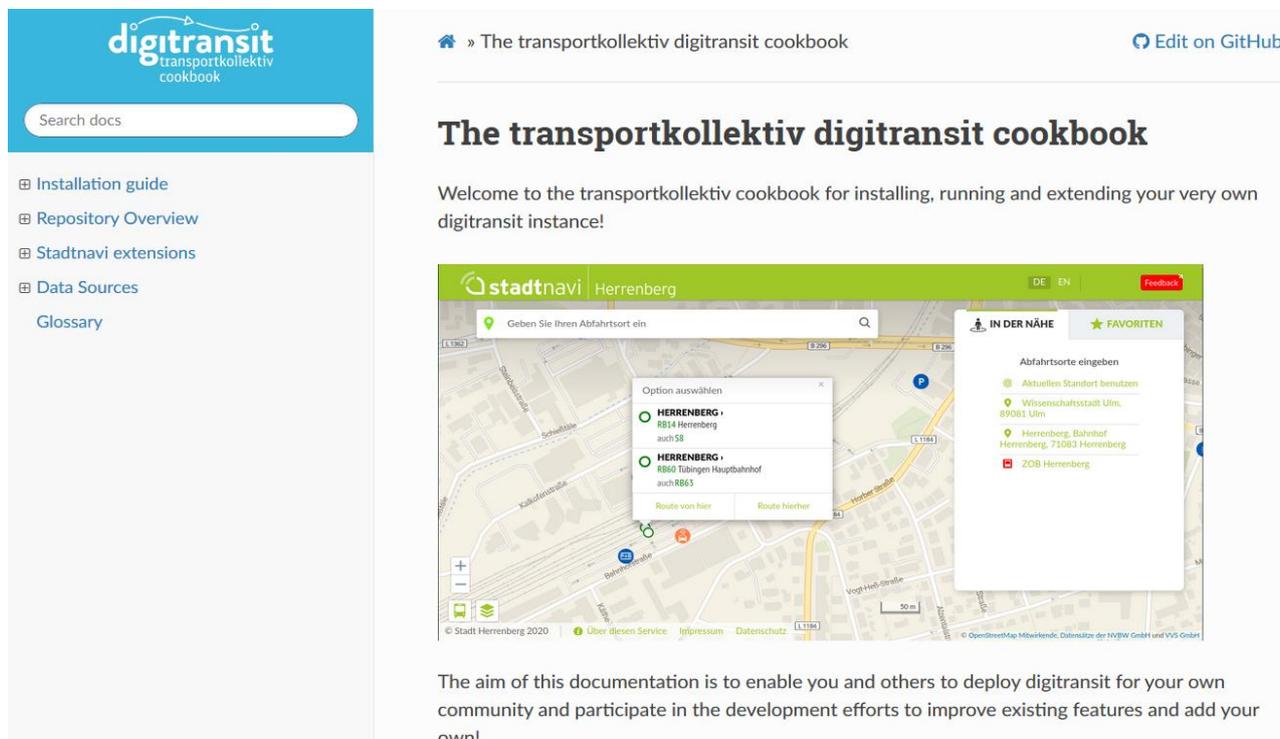

Figure 6 Landing page of digitransit cookbook (https://transportkollektiv.github.io/digitransit-setup/index.html)

The cookbook's structure is of modular nature in order to give flexibility to the needs and expectations of cities and regions who want to set up digitransit in the future.
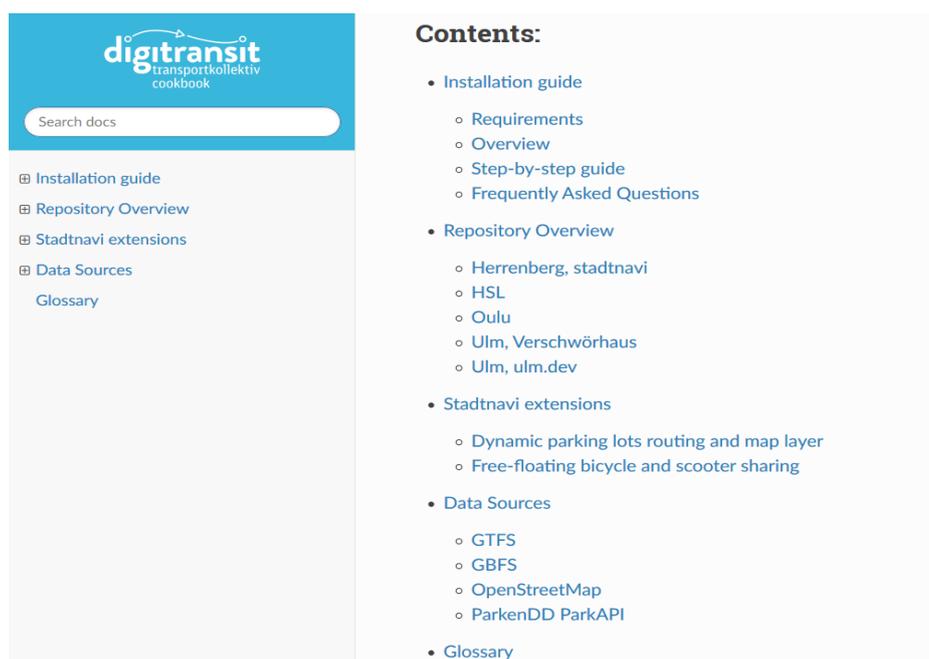
Figure 7 Contents digitransit cookbook

The installation guide prepares the reader for setting up digitransit by explaining requirements in detail and then guiding though the whole process in a step-by-step guide

Figure 8 Step-by-step guide for digitransit setup (https://transportkollektiv.github.io/digitransit-setup/installation/step-by-step.html)

The setup will not be described within this deliverable in detail, as this would only lead to numerous screenshots of the cookbook found online.

See https://transportkollektiv.github.io/digitransit-setup/installation/step-by-step.html for all details to digitransit's installation.

As the step-by-step deployment is completed, the most basic instance of digitransit is ready to use
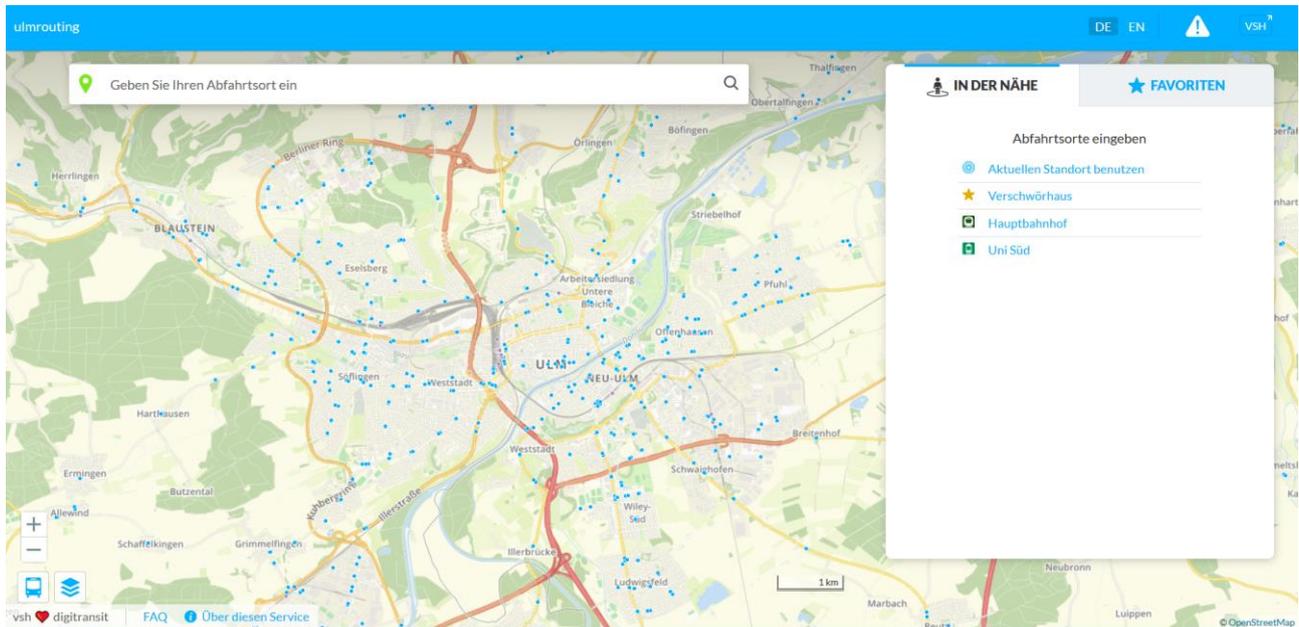
Figure 9 Very basic status after step-by-step implementation of digitransit installation

Community Building

To foster the community around digitransit further, the SHAREPLACE team put a lot of effort in community building measures in order to get national and international developers working or interested in digitransit and open transport topics to get to know each other and work together. On a national level, the Open Knowledge Lab in the city of Münster was the first to experiment with digitransit (https://github.com/codeformuenster/digitransit) and contributed a huge part to simplifying the setup of digitransit. On top of that, two German institutions joined the network around digitransit and share the idea of open transport and are now testing and experimenting with their own digitransit instances. On an international level the SHAREPLACE partner City of Osijek is also implementing digitransit and the developers in the two pilots share their knowledge and solve problems together.
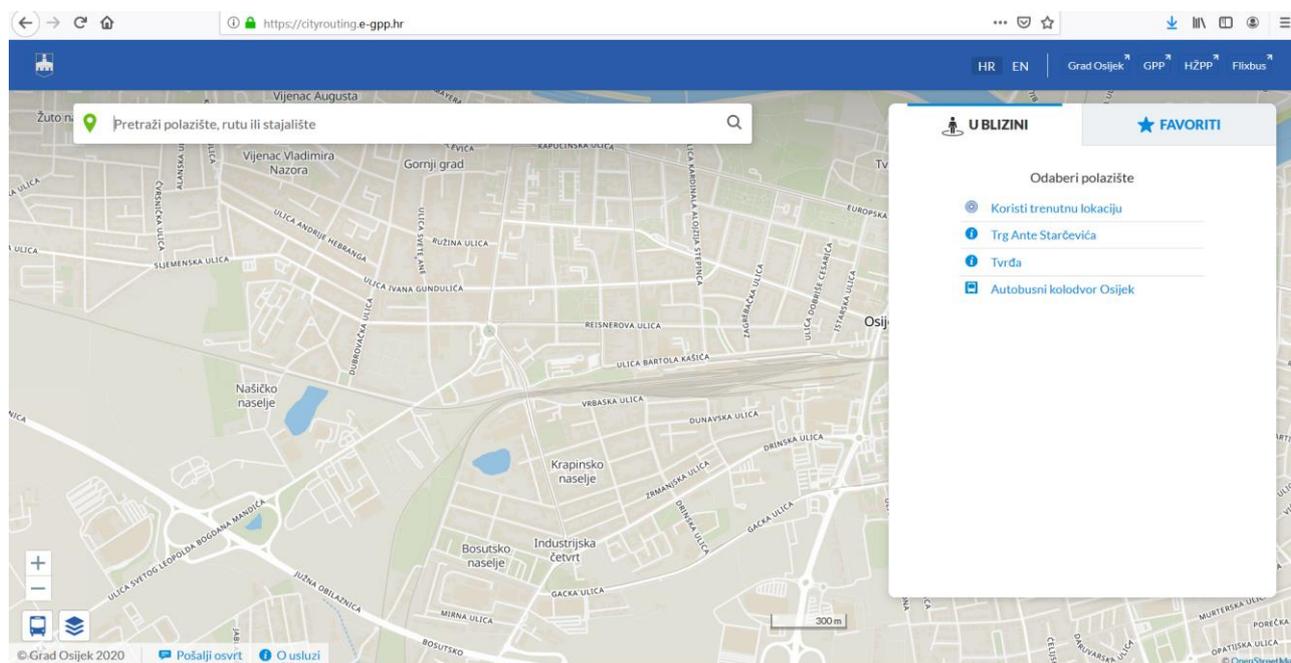
Figure 10 SHAREPLACE pilot Osijek's digitransit instance (https://cityrouting.e-gpp.hr/o-usluzi)

On a national level, the City of Herrenberg, who named its instance *Stadtnavi* and Dataport, an organisation offering software solutions to city and state administrations work with digitransit and take part in the network around the open-source stack.
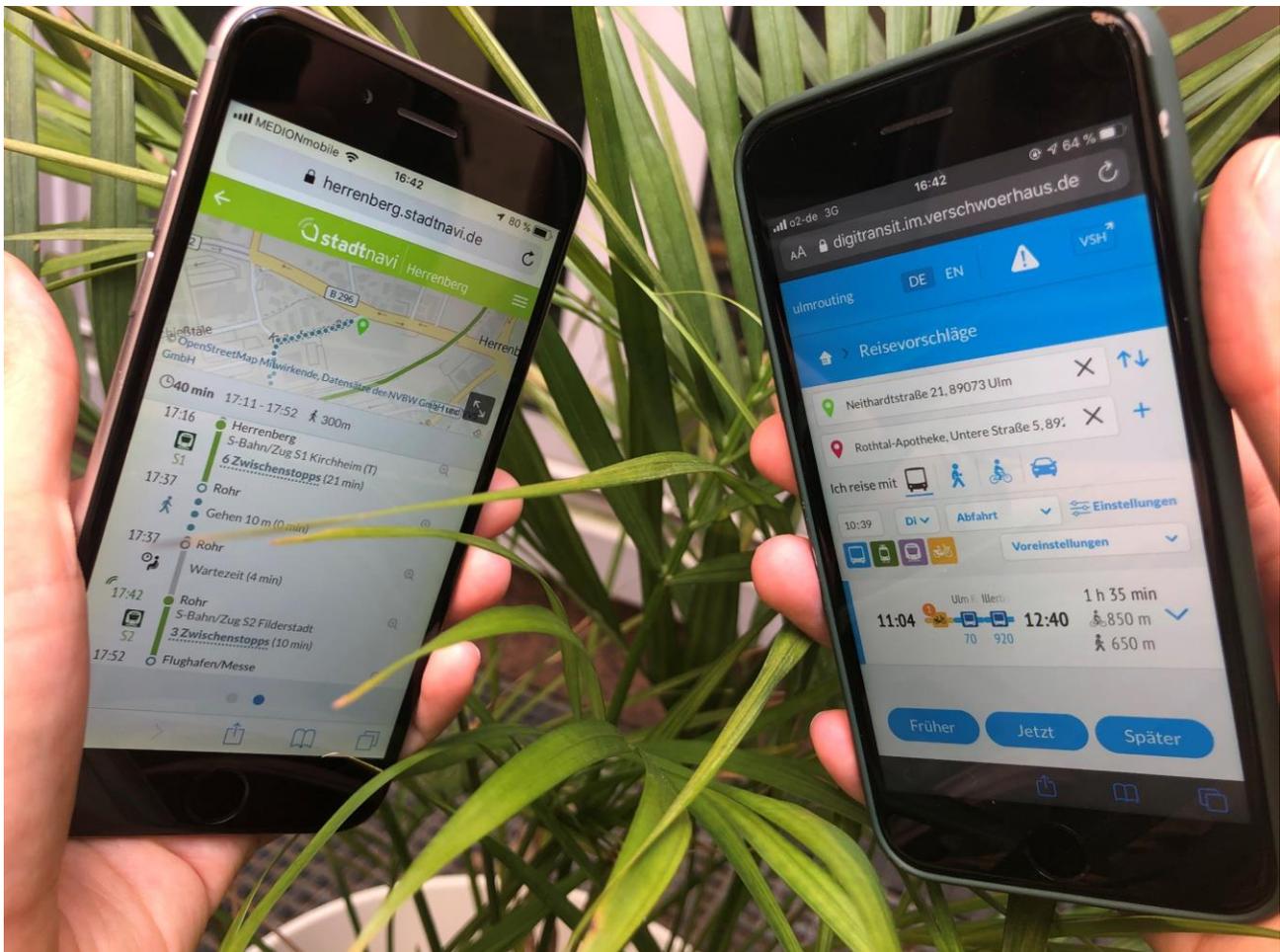
Figure 11 Herrenberger digitransit instance Stadtnavi (https://herrenberg.stadtnavi.de/) and Ulm's staging instance https://digitransit.im.verschwoerhaus.de/)

Miriam @FieteBrand · 20. Mai

Antwort an @FieteBrand

2/2

Eine neue, sehr positive Erfahrung ist dabei der Austausch in der @digitransit Community, insbesondere mit dem @verschwoerhaus 👍

#opensource #opendata #Mobilität #IoT @Datareport

💬 1   🔁 4   ♡ 10   ⬆️

Miriam @FieteBrand · 20. Mai

PS: Ein erster Blick darauf, wie es für #Hamburg aussehen könnte.

#opensource #opendata #Mobilität #IoT

💬 1   🔁 4   ♡ 10   ⬆️

Dataport @Datareport · 20. Mai

Antwort an @FieteBrand @stadtnavi und 2 weitere

Neue #Mobilität für #Länder und #Kommunen. Spannendes und innovatives Konzept. Lasst uns den den #digitalen #Wandel denken und gestalten. #DigitaleDaseinsvorsorge

💬   🔁 1   ♡ 8   ⬆️

Figure 12 Dataport twittered their first experiences with digitransit
(https://twitter.com/FieteBrand/status/1263115073901469696)

Furthermore, the community around digitransit is also working together in Slack Channels. The international channel is in the HSL Slack
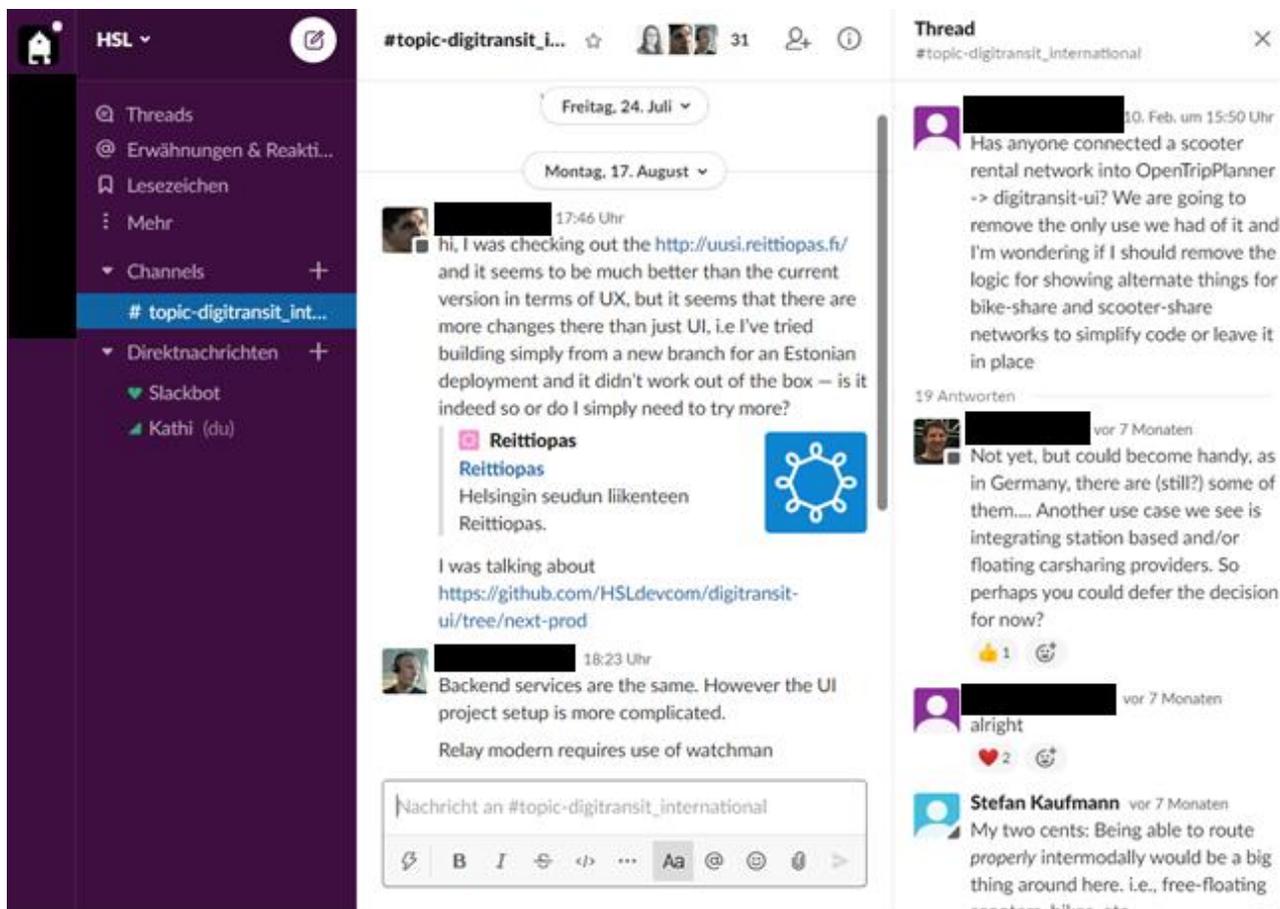
Figure 13 HSL International Channel

The German community also has a Slack account in which they share problems and solutions. This is currently in Germany's Open Knowledge Foundation's Slack Channel, as this is a place where the German open Transport community is organizing itself.
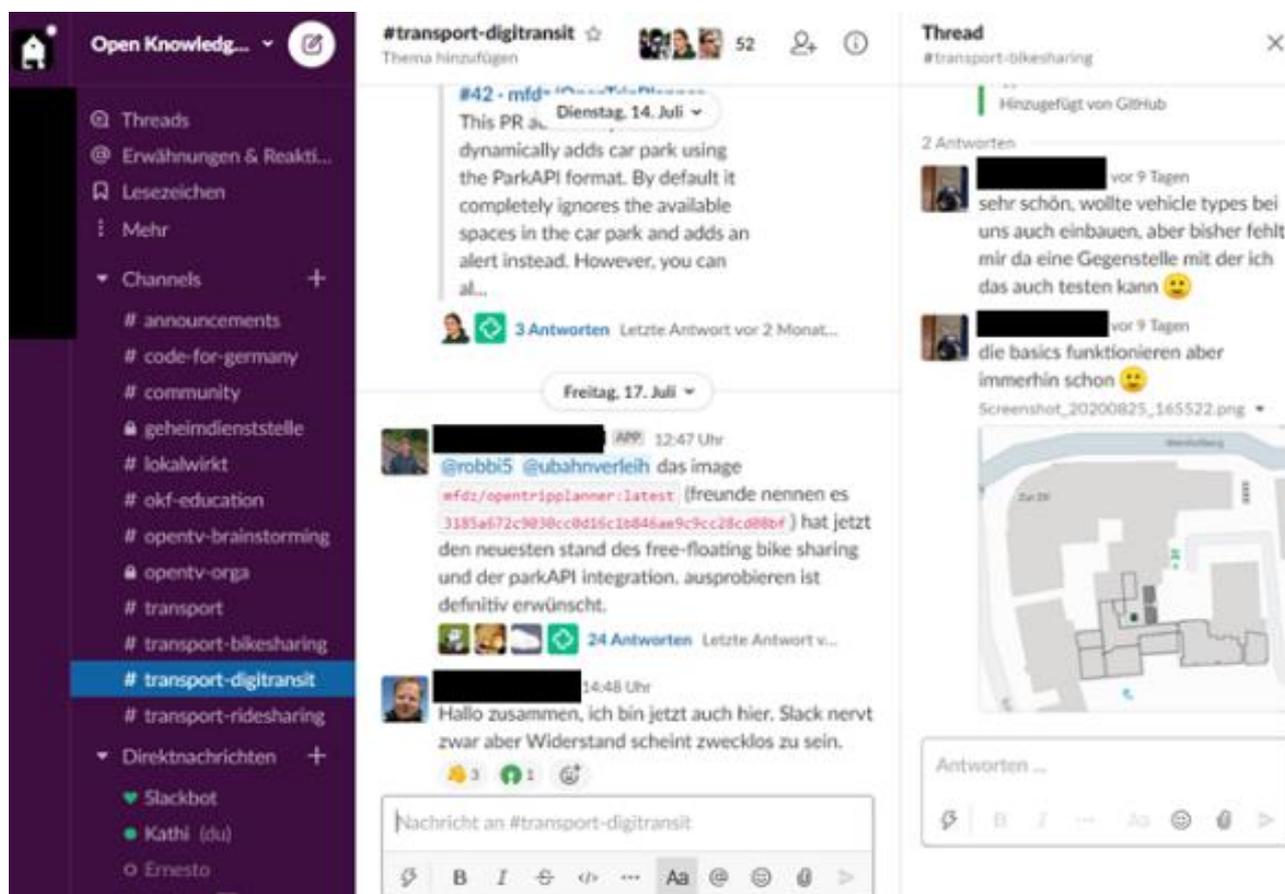
Figure 14 National Slack Channel on digitransit

Furthermore, in July we started a bi-weekly online meetup that is open for people interested to take part. Central topics here are open transport and open data in mobility. Apart from the consortium behind Transportkollekitv, people with different backgrounds are taking part at the events (from transport operators and agencies to open data activists). We experienced this meetup as very fruitful as it brings together the points of view of stakeholders with different perspectives and offers the possibility to lift digitransit to the agenda of decision makers.
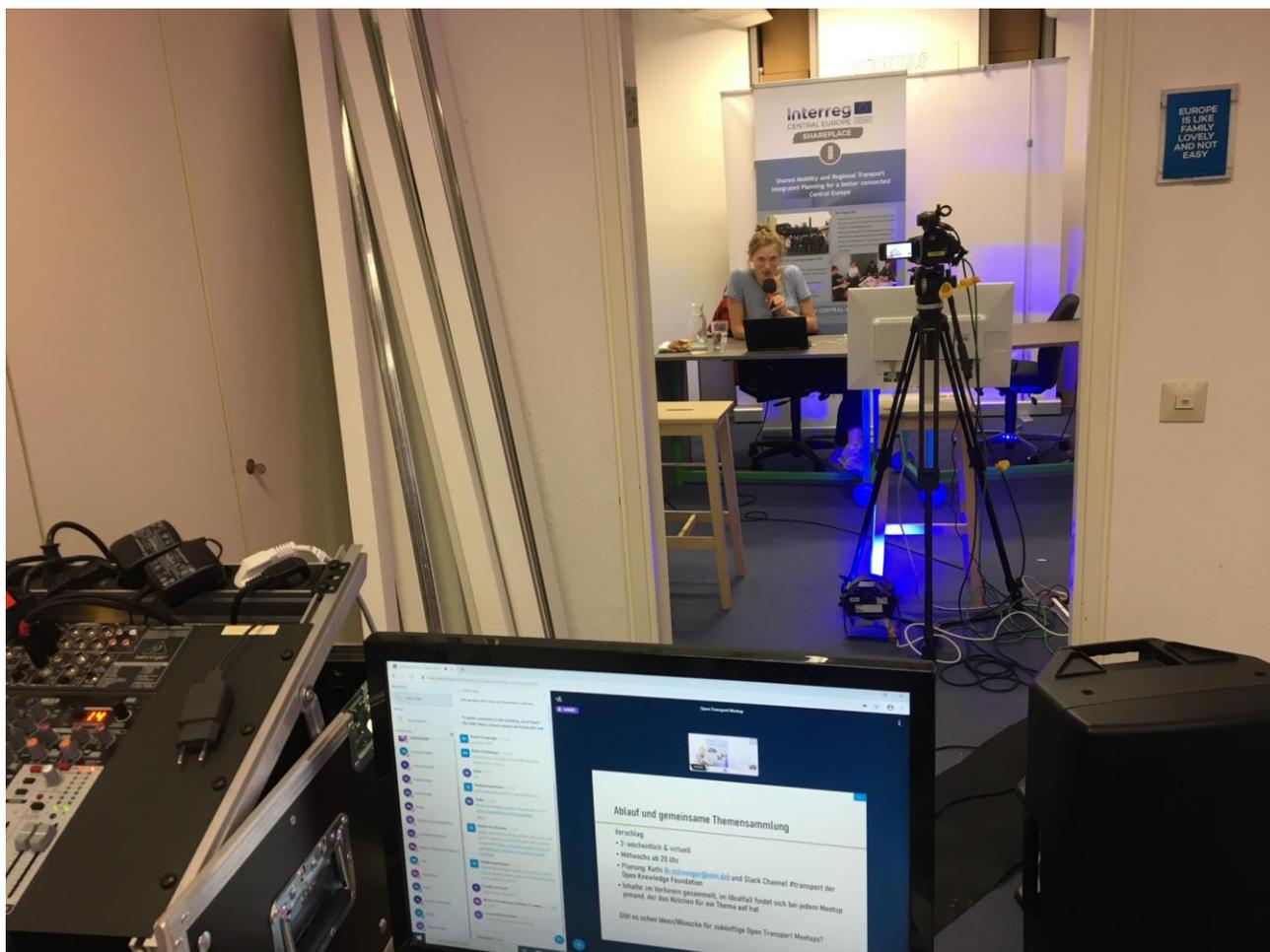

Figure 15 behind the scenes picture of first meetup

The meetings are also documented in the wiki in Transportkollektiv's github account https://github.com/transportkollektiv/meetup/wiki.

3.2. New elements developed within the pilot

Once the installation is completed, the chapter *Respository overview* gives an overview over the most common repos the team of the Ulm pilot consulted whilst working with digitransit. Here one can check out the different instances and find out, what one wishes for within the own instance.

Apart from documentation on how to setup a basic digitransit, the SHAREPLACe pilot also concentrates on adding new features to the software.

New elements developed within the pilot include free floating bike and scooter sharing and dynamic parking lots routing and map layer. The documentation therefore is also included in the digitransit cookbook under the chapter *Stadtnavi Extensions*, as the dev work was done in the Stadtnavi Repository because City of Ulm contracted the Stadtnavi Dev Team to support the implementation of these features. Ulm's developers then again merged the new code to the Transportkollektiv repository.

3.2.1. Free Floating Bikes/Scooters

Digitransit already supported station-based rents of bikes but did not cover free floating bikes. This extension allows digitransit to drop off bicycles and scooters anywhere and has two modes:

- The sharing system is not really a free-floating one, but bikes/scooters are allowed to be dropped off anywhere at the end of a journey. In such a case the UI displays a warning. (rentalMode=free-floating-with-temporary-dropoff)

- The system is a proper free-floating one: you can drop off the bike/scooter anywhere. (rentalMode=free-floating)

With those new features we then integrated data of OpenBike, the prototypical bike sharing system implemented within the city administration in the city of Ulm. OpenBike was built with open APIs that enable third party services to integrate locations and status of the bikes according to GBFS. Furthermore, in August and September, various e-scooter sharers entered the city of Ulm. The city administration tried to negotiate the terms of data provision with the mobility service providers. Unfortunately, in Germany there is no respective law that lays out clearly that mobility service providers using public infrastructure for their business models have to share data on their services in order to ensure that continuous passenger information is possible. The city of Ulm tried get providers to agree on a voluntary cooperation to share mobility data. That cooperation included a) provision of public GBFS/GTFS data and b) provision of MDS data. MDS (mobility data specification) is a set of Application Programming Interfaces (APIs) originally developed by the Open Mobility Foundation. It enables cities and mobility service operators to communicate electronically and exchange data: f.e. of regulatory nature (if streets need to be closed on events f.e) or statistics on vehicles and usage. This allows cities to work together with the operators, know what is going on on the respective cities needs and having the possibility to take regulatory measures if necessary.

MDS is open source software and is the first result of the cooperation between cities, experts on policy, mobility and privacy topics as well as technical experts and mobility operators within the Open Mobility Foundation. The Open Mobility Foundation works, under the lead of cities, on the provision of digital tools for planning the mobility of the future. Within the lifetime of the Shareplace project, the City of Ulm learned lots form the Open Mobility Foundation that found its way into practice within Shareplace and digitransit. A result is also that the City of Ulm aims to become a member of the Open Mobility Foundation in order to join already experienced cities and learn from the extensive network and knowledge base provided by the Foundation.
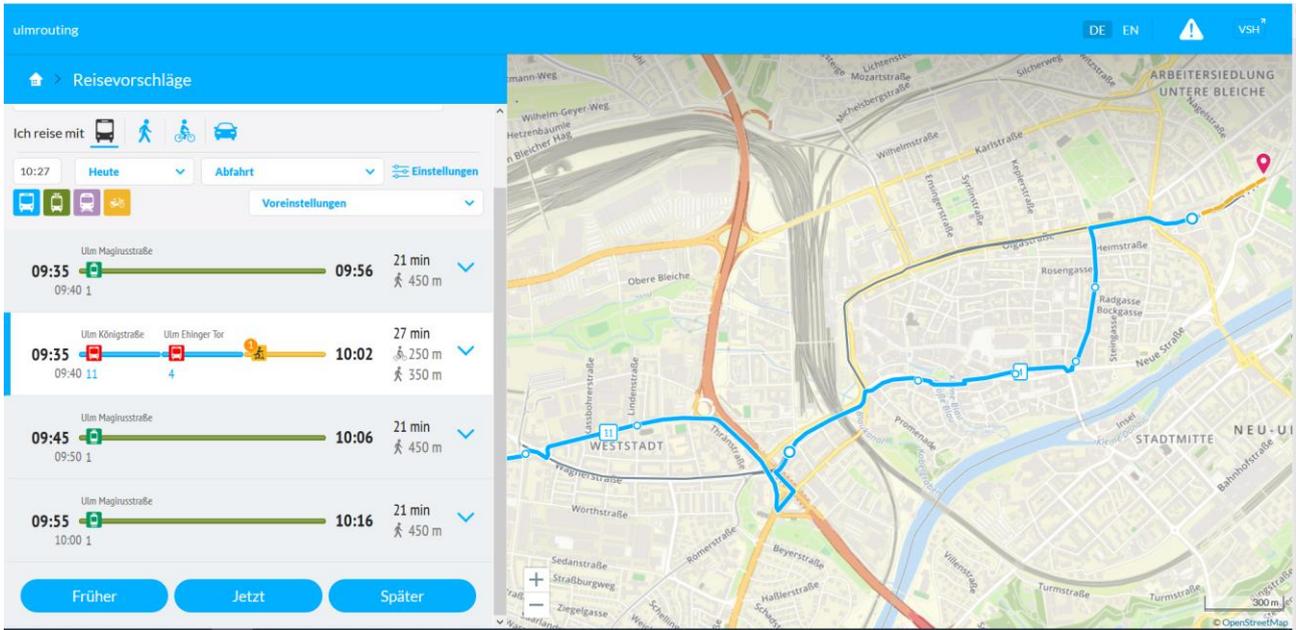
Figure 16 Ulm's digitransit - intermodal transport with bus and scooter
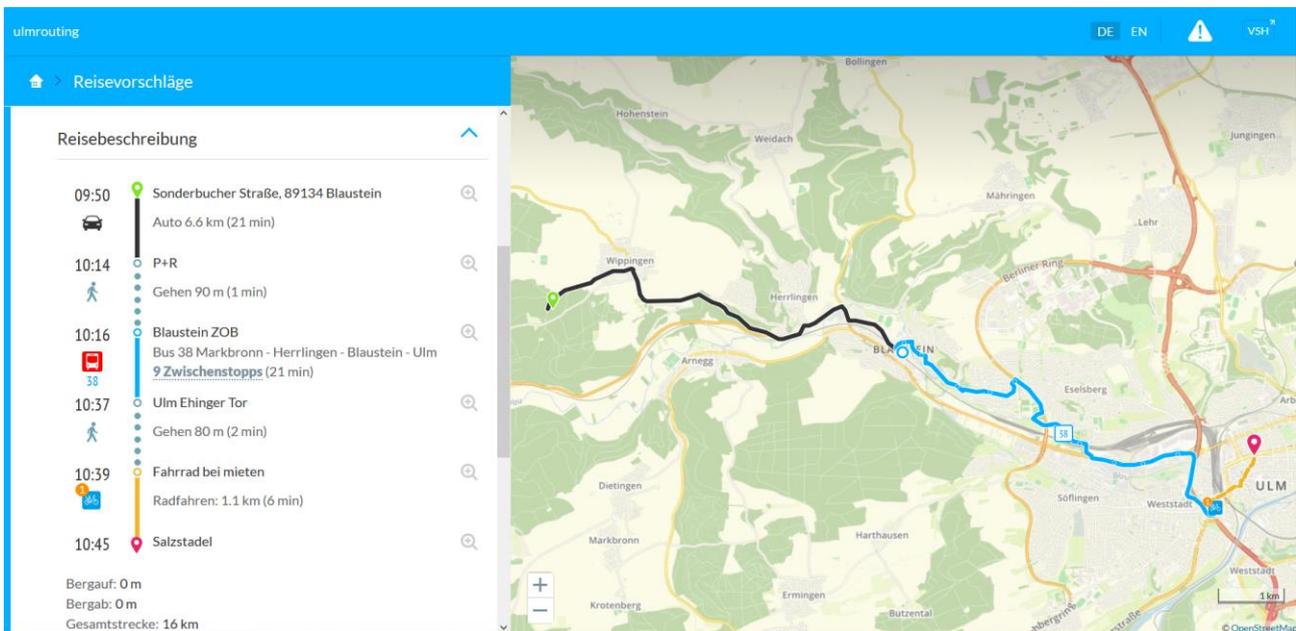
Figure 17 Ulm's digitransit - intermodal transport with car, park+ride, bike sharing
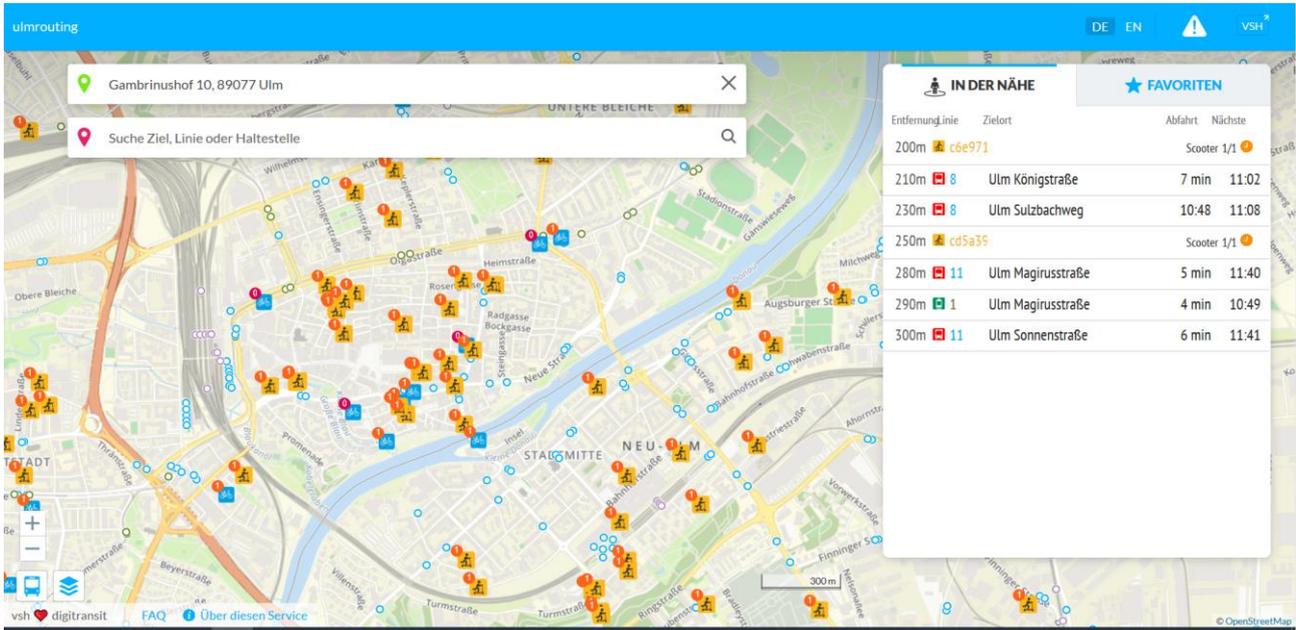
Figure 18 Integration of scooter (orange) and bike (blue) sharing in Ulm's instance

3.2.2. Dynamic parking lots routing

This map layer adds information about car parking lots with real-time information about capacity, free spaces, opening hours and a link to more information. Furthermore, routing to free parking lots is integrated in digitransit. In order to collect the necessary data, a very extensive amount of communication and meetings was necessary. Nevertheless, we were unable to provide the necessary data as open data. We also were not able to get direct access to the data source. Therefore, we had no other possibility than building a scraper that fetches the relevant information and then integrate the scraped data into digitransit.
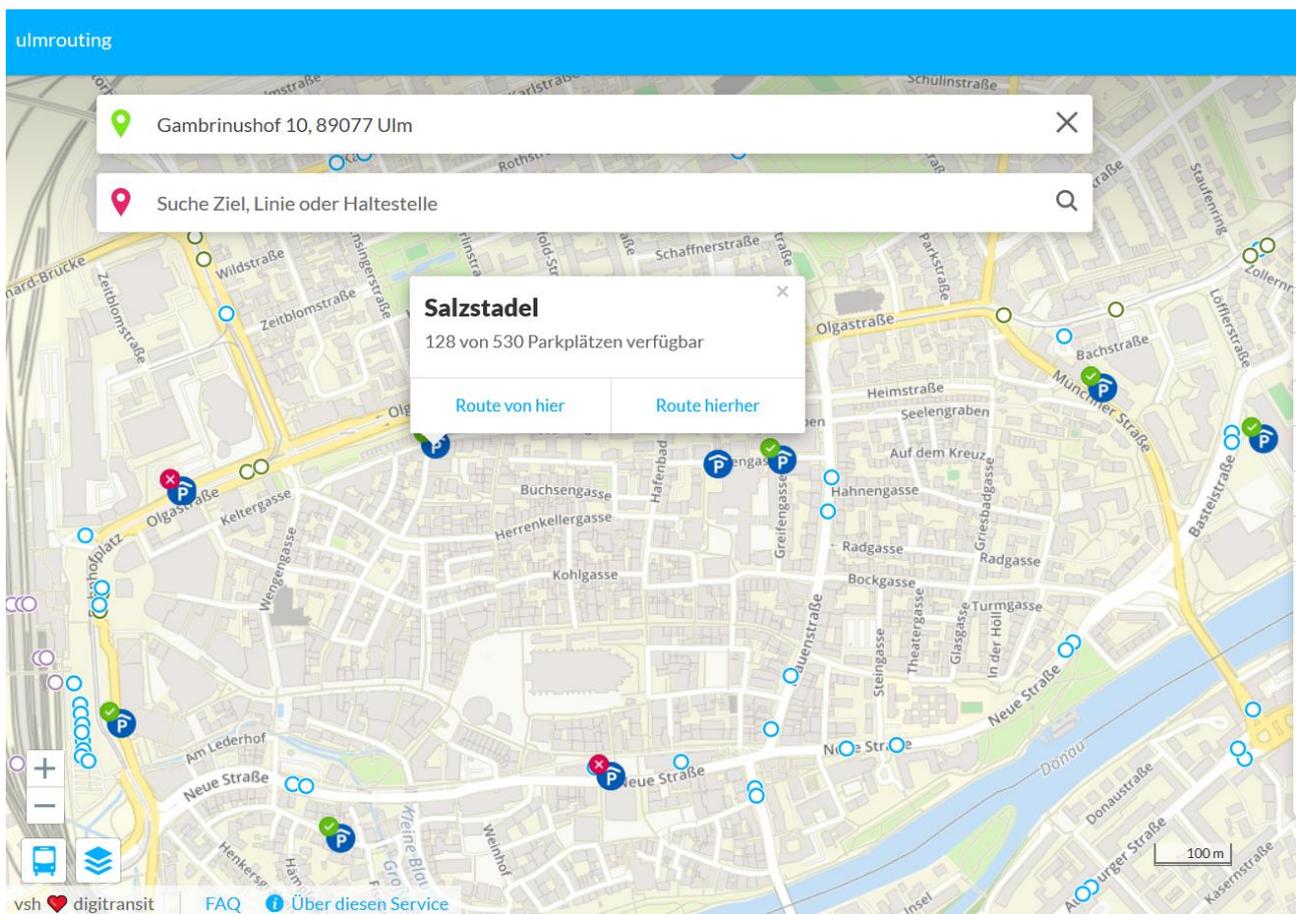
Figure 19 Dynamic parking lots in Ulm's digitransit instance

3.2.3. Electric Charging Stations

Towards the end of the Shareplace project, we were able to integrate data on electric charging stations. We were working on getting that data as open data since March 2020. Unfortunately, it was not possible to achieve that with our public service provider SWU. Within the network of open transport data, another developer provided us with the API of Giro-e and finally enabled us to integrated electric charging stations. They are now integrated with another layer, the geo coordinates, charging spots in total and available charging spots in real-time. Furthermore, spots with no capacity are marked with a grey icon.
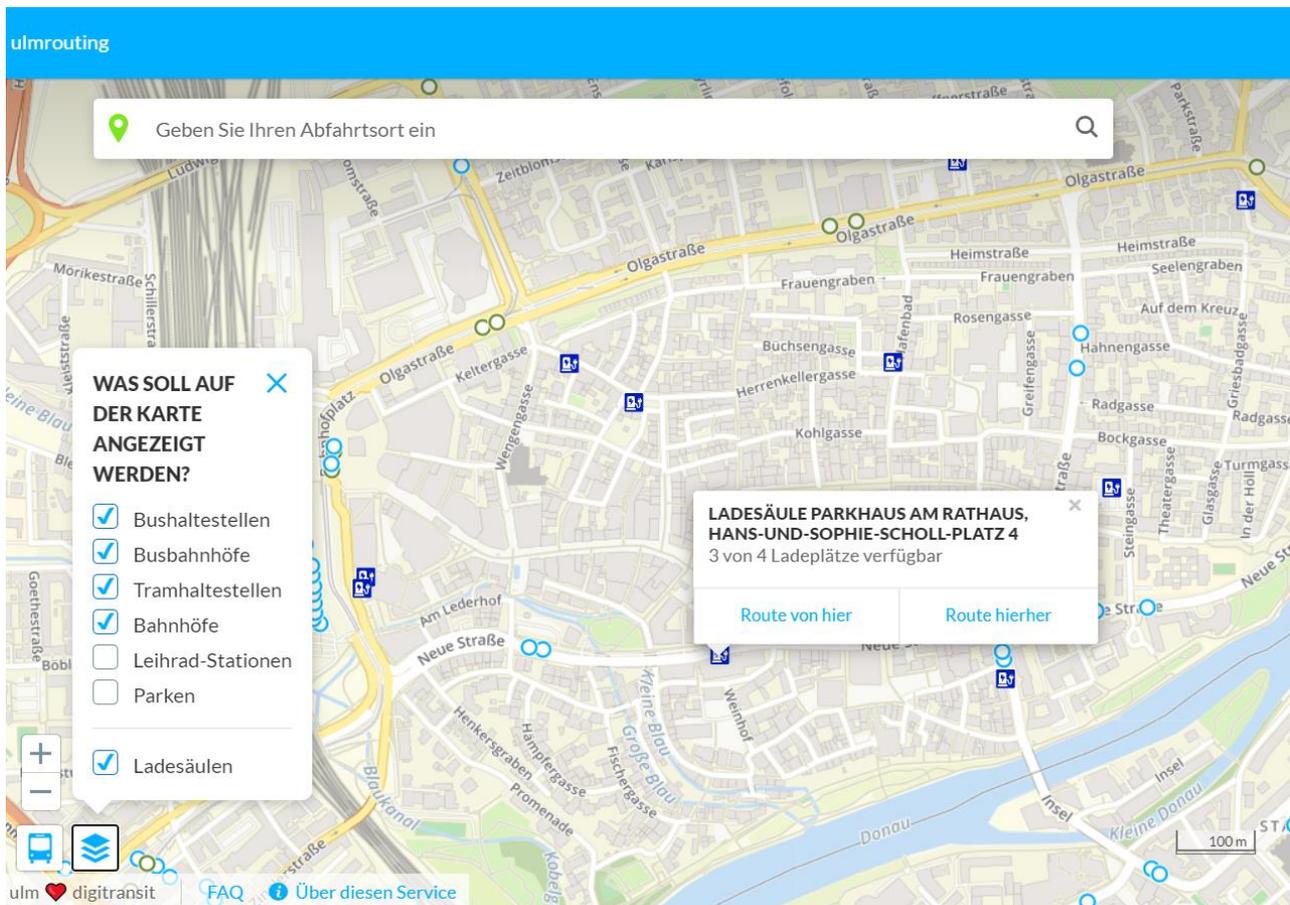
3.2.4. Data Sources

Furthermore, the cookbook includes one chapter on all data sources and formats used in digitransit as well as their capabilities. We choose to integrate that chapter as data availability is the vital source of success for any intermodal mobility solution but mostly does not get a lot of attention in planning processes.

We mainly included what one should check and have in mind, when wanting to set up digitransit.

Finding the data:

It sounds trivial to find the source of a dataset, but it is not always clear who is providing or producing a dataset and who is able to export and provide this data. Often it is more work to acquire the data in the right data format then it is to integrate the data into digitransit. So plan some time for acquiring the data.

Data from third parties:

You will use software from third parties, even if you build your application in the context of a government project. This could, for example, be private sharing providers or public transit agencies. If they have not published their data as open data yet, it is important to provide them with a basic understanding of the data formats you ask for, an explanation on how you want to use their data as well as making an effort to persuade them that this data should be open for everyone to use.

The right to publish data:

If you get data from third parties it is important that you do not only get the rights to use these data in the context of your (digitransit) project, but also ensure the right to publish that data under a free and open license. If the data is already published as open data from the data provider, this step is not necessary.

Data formats and licenses:

It is important to publish the data in internationally used and openly documented standards. Digitransit is doing a good job here and supports the most common data standards for mobility data. You can find out more about these standards in the respective section of the documentation. If you plan to acquire new software which works with mobility data or generates this kind of data, it is very important to have software which is able to export data in an open, standardized data format. This does not only help to publish the respective data and integrate it into digitransit later on, but also gives you more independence from software vendors. OpenData and Open Standars help avoiding lock-in effects and compatibility issues within future projects.

In some cases, it is possible to convert proprietary data formats to open formats. This should only be done if it is not possible to export the relevant data in an open format directly from the main source. Converting data into other data formats can lead to datasets of low quality, missing data or even mistakes in the data. Moreover, it will make your export process more complex

Figure 20 Documentation to data sources (https://transportkollektiv.github.io/digitransit-setup/datasources.html)

4. Learnings

Our learnings within 1.5 years with digitransit showed us that digitransit is a very suitable tool to go into city administration and dig for open data. The positive effects of providing open data become visible and easier to understand within the minute that a new data source is integrated into digitransit. For our city administration, digitransit was not only a public transport platform but also a means of teaching and learning for city employees and transport officials in our region.

It is also of huge importance to align own developments as good as possible with the original digitransit instance and bring new features upstream, so all the digitransit instances can profit.

Nevertheless, the effort we put into talking to officials in the various positions (transport operators, transport agency, public services, city officials and state officials) to explain the concept behind open mobility data, GBFS, GTFS and MDS as well as open data and data sharing in general is not to be underestimated. Often, organisations fear sharing data and providing open data and do not see all the advantages that can be possible once data is published.

Unfortunately, the different service operators in a region often do neither offer open APIs nor publish open data. Furthermore, data formats are mostly not in line with internationally used data standards like GTFS and GBFS. For transport data, dynamic data, at least in Germany, is hardly available in the open. This makes integration into other systems and connection with other services almost impossible.

In Germany, NVBW, as a state supported institution, is currently working on providing timetable data for all means of public transport in Baden-Württemberg as open data with GTFS Feeds, as one step towards fulfilling EU Delegated Regulation 2017/1926 regarding EU-wide multimodal travel information services. This is one very important step because it facilitates the access to, at the moment, often closed data sets, as the Regulation states that at least static travel data shall be provided to users across all transport modes. As the EU Del.Reg 2017/1926 does not only account for public transport but also for transport on demand services (like bike sharing, car sharing,...), the EU Del. Reg. is a great starting point to approach those service operators and ask them to comply with the regulation and open their data.

Bearing this in mind, the aim of digitransit is to give governments, cities, businesses and, in general, all interested parties the opportunity to gather information for trip planning across transport modes in their regions and to be able to connect transport opportunities without being dependent on the individual business territories covered by transport operators.

Often, it seems like officials are making plans on "THE app" without even given the topic of data availability a thought. In the end, availability of open data on the various mobility services is the ultimate leverage when it comes to making an app or web-app usable in different cities and independent of legal agreements with all the different service providers. Until the concept of "data ownership" in context of factual data like data on "where is the vehicle x" and "is vehicle z available?" is neglected as nonsense, every other innovative solution will only be working in that one situation it was created for. What we wish for are applications that work crosstown, cross-country and cross-vehicle-type, independent legal agreements and other artificially constructed borders to real innovative solutions. And for achieving exactly that we need a triad of open-source software, open data and APIs as well as using open, internationally accepted, standards.

Overall, good community building is vital for the success and drive behind any open source project. Therefore, community contact as well as setting up and maintaining a feedback channel for that exact community should always be in the core of any open-source project.

Conclusion

To sum up this deliverable, there are three main points achieved with the implementation of the service hub.

First of all, the use and further development of open-source software, especially in the context of publicly funded projects, is the most sustainable way of implementing software solutions - as public money should always resolve around public code for reusability and transferability reasons. Open-source allows for adaptions to changing circumstances, which does not only apply to future challenges cities and regions have to face but also to the different circumstances in a city or region.

Secondly, a solid community behind an open-source project is important for many aspects of its sustainability. Building a community behind an open source software should therefore be amongst the key goals of implementing an open-source solution

And thirdly, in order to guarantee transferability of an open-source project, good technical documentation is the key to enable as many other individuals as possible to setup the software themselves. Also, if new features are developed, they should work together very closely with the original branch and where feasible be brought upstream to reach as many beneficiaries as possible. Also, larger fixes should always be discussed within the community and be double-checked by others working with the software.

The SHAREPLACE pilot element of the open-source software stack digitransit as a service hub that is transferrable to other cities and regions providing extensive technical documentation on how to set up digitransit (https://transportkollektiv.github.io/digitransit-setup/index.html). Much work went into creating the documentation as comprehensible. The newly developed features described in Chapter 3 are now in their final tests and can already be used under https://digitransit.ulm.dev/.