CONCEPT ON-DEMAND SKI+

BUSINESS CONSIDERATIONS OF ON-DEMAND OFFERS

System tasks Customer information (SKI)

Status	Binding
Version	2.0
Last amended on	Monday, 5. February 2024
Last modified by...	Geschäftsstelle SKI

Document information

Description	This document is an automatic but human reviewed translation of the original document written in German. In case of unclarity we kindly refer readers to the German version, which is the accountable representation. This document serves as the basis for on-demand in Switzerland. It includes background information, customer/provider journeys, definitions and models, as well as insights into the architecture in the context of SKI.
Focus group	People who want to understand the topic of on-demand, as well as those who want to understand the implementation within the framework of SKI.
Electronic document storage	https://transportdatamanagement.ch/de/standards/

Change history

Version	Status	Change	By	Valid from
2.0	Draft	Fundamental reorganisation of the predecessor document on the topic of on-demand	David Rudi, Matthias Günter, Markus Meier	27.03.2023

Contents

1 Abstract

"On-demand services are services where the customer can order a journey via a booking process, often regardless of a timetable." [1]

This document forms the technical basis for understanding and implementing the topic of on-demand. For the implementation, please refer to the technical concept of on-demand [2].

By way of introduction, we analyse the background to on-demand in Switzerland, present the system tasks of Systemaufgaben Kundeninformation (SKI, in English: Customer Information), explain the mandate of SKI and SKI+ (by the Federal Office of Transportation (FOT) and Swiss Federal Railways (SBB)), and establish the link to on-demand. We conclude with a reference to the topic of deep integration.

In the following chapters, we describe two important aspects of the topic of on-demand, the customer perspective (customer journey of end users and partners) and the operator perspective (provider journey).

The section on the specialist model presents the on-demand characteristics that form the basis for fulfilling the customer and provider journeys.

Before the summarising chapter, in which we also give an outlook on our further work, the chapter on the specialist architecture provides an overview of the integration of the on-demand offers into the SKI(+) system world. The technical details can be found in the corresponding concept [2].

Important Note: this document is a translation of the German original. Not alle terminologies, and acronyms can be well-translated. Therefore, we use the original German terms, e.g., we do not translate our organisational unit, i.e., SKI.

2 Introduction

2.1 On-demand in Switzerland

The on-demand concept has been around in Switzerland for several decades. On-demand services (ODV) were and are offered by both licensed transport companies (KTU) and private companies (taxis, shuttle buses). In addition to the term on-demand, the terms on-demand transport, on-call bus or call-collecting taxi are used synonymously in the DACH region (Germany, Austria, Switzerland).

In pre-digitalisation times, for example, quotation scheduling (including smart bundling) was usually carried out manually. Technological progress has been able to support these processes (and has also made them cheaper to a certain extent).

One challenge that remains is the many applications from the various mobility providers and brokers, most of which are only valid locally. Customers also lack easy access to consistent passenger information, especially along longer journeys.

2.1.1 Overview of on-demand interest groups in Switzerland

The topic of on-demand affects several interest groups in Switzerland, which we would like to highlight in the table below. The most relevant stakeholders for us are underlined:

Actor	to me	Objectives
Alliance SwissPass	Accompanying working group to ensure compliance with applicable industry standards (V580 and others) Has written a document on on-demand: [3]	Integrability of ODV in traditional public transport (processes, products and systems)
Office for Public Transport	Cantonal regional transport customers	Ordering and financing of specific services, supervision, performance review. Sets the regulatory framework at cantonal level for everything that is not regulated by the Passenger Transport Act (PBG), e.g., taxis
Swiss Federal Office of Energy (BFE)	Leading federal office for e-mobility Financing PoCs (KOMO platform)	Regulatory framework CO2 neutrality (green footprint)
Swiss Federal Office of Transport (FOT)	The FOT is the client for SKI and SKI+ and therefore also for this specialised concept.	The FOT wants to improve overall mobility in Switzerland. To this end, it has launched the National Data Infrastructure Mobility (NADIM) programme, among other things. Among other things, on-demand offerings will also be considered. The FOT defines the vision and strategy and assumes regulatory oversight of the corresponding work.
Business unit SKI	Contractor from FOT	SKI collects, consolidates and publishes passenger information data from the mobility industry
ioki GmbH	Provider and operator of complete on-demand solutions (whitelabel app for customers, vehicle and driver scheduling)	Current (as of 06.12.2022) provider of the IT solution for PubliCar from Postauto
its-ch	Working group for demand-led mobility in Switzerland	*Currently unknown. Still to be discussed with them.*

Actor	to me	Objectives
	Conceptual basis for typification and technical definition of ODV in Switzerland	
Mentz GmbH	Strategic partner SKI (based on STRASKI tender) Supplier and operator OJP / EFA	Concept and technical realisation
On-demand support group	Working group of companies interested in on-demand. Not all providers have a direct link to on-demand.	Exchange of experience and collaboration to promote the success of on-demand in Switzerland
PostAuto	Operators of on-demand services (e.g. PubliCar). Members also in ASP and on-demand support group	Leading national provider of various on-demand offerings (including varying degrees of digitalisation) in selected regions service providers with the help of ioki's IT solution, among other things: App for customers, driver app, backend (dispatching drivers and vehicles, billing, master data management, customer base)
Fare networks	Pricing and distribution requirements in the respective territory	*to be defined*
Taxi industry	Provider of ODV services outside of public transport Partners (contractors, if applicable) of public transport in the provision of services	Use Case Alpentaxi
Verband öffentlicher Verkehr (VöV)	Legal positioning (interpretation and gap filling) of the public transport sector Privacy	*Currently unknown. Still to be discussed with them.*
Verkerhsnetz CH / swisstopo / (ASTRA)	Logical data model for spatial reference	Support primarily for mapping virtual stops and service areas

Table 1: Overview of the interest groups (underlined: most important contact outside SKI/BAV).

2.1.2 Preliminary work Alliance Swiss Pass (ASP) and Association of German Transport Companies (VDV)

Of the interest groups presented, the preparatory work carried out by the Alliance Swiss Pass (ASP) and the Association of German Transport Companies (VDV) is the most decisive for this document.

Both the ASP [3] and the VDV [4, p. 117 ff.] (VDV 462) have published a paper on the subject of on-demand. They each present a definition of on-demand and describe various topics related to on-demand. While the ASP described the issues from a sales and operational perspective, VDV publication 462, with its reference to the NeTEx standard, is close to implementation.

Both views are to be reflected in this specialised concept, i.e., the definitions are consolidated and then applied to the SKI and SKI+ situation.

In addition to the technical orientation of VDV Guideline 462, one of the main differences to the ASP document is the explicit reference to regular "entry and exit stops". These are considered to a lesser extent in this specialised concept and by the ASP. Another difference between the three approaches lies in the forms of expression, which are explained in more detail later in the corresponding section on on-demand forms of expression.

In contrast to the aforementioned differences in the preparation of on-demand offers, the definition of on-demand in VDV Guideline 462 does not differ significantly from the definition provided by the ASP and the definition presented (later) in this technical concept.

Note: In addition to these two references, which are crucial for us, we would also like to take this opportunity to refer to the work of the Federal Ministry of Transport and Digital Infrastructure from 2019, which was also taken into account [5], in which both a generic holistic view of an on-demand architecture and implementation-related aspects were analysed.

2.1.3 Further work

The cantons of Appenzell AR, Appenzell IR, Glarus, Graubünden, Schaffhausen, Schwyz, St. Gallen and Thurgau have commissioned RAPP to prepare the following document: "ÖV ohne Fahrplan-Erfahrungen, Entwicklungen, Zukunft" [6] The authors point out the opaque developments in the area of on-demand transport and formulate the key question to be answered by you: "Can public transport on-demand services be used to provide basic public transport as part of the public service in areas with low demand or at off-peak times more cheaply or in a more customer-friendly way than conventional scheduled services?" [6, p. 6] In their work, the authors reference, among other things, the preliminary work of the ASP (see above), as well as similar work by the EU and OECD (Chapter 2 in [6]), and other international offerings (Chapter 5 in [6]). The characteristics of public transport on-demand services derived in [6] (Chapter 3 in [6]) are subsumed by the characteristics described in this specialised concept. The survey of on-demand offerings in Switzerland in Chapter 4 (in [6]), which provides interesting insights into the existing offerings and their profitability, offers great added value. Chapter 7 (in [6]) shows the high potential of on-demand offerings and at the same time points out the necessary prerequisites and hurdles to be overcome from the authors' point of view.

2.2 On-demand for system tasks Customer information (SKI)

Making customer information data available for on-demand offers is one of the aims of the Customer Information (SKI) and SKI+ (the multimodal extension of SKI) system tasks. Today, many on-demand offers are not visible to the public because they are not integrated into the SKI systems or are not publicised.

2.2.1 Mission of the SKI

The central mandate of the Customer Information (SKI) system tasks is (extract from the contract between the FOT and SBB):

- With the customer information system task, the FOT is pursuing the goal of creating a standardised and efficient basis so that transport companies and other companies and public transport customers can be provided with up-to-date, consistent, complete, uniform and coordinated information about their entire journey, regardless of the selected means of transport and company.
- To this end, information on planned, actual and forecast departures and arrivals (target, actual and forecast timetable data), delays, track and edge information, vehicle compositions and connections, planned and spontaneous events and the accessibility of stations for all public transport in Switzerland is collected, processed and made available to interested customers. [The exchange of information that facilitates the linking of public transport with other mobility offers in the sense of multimodal mobility will also be promoted for a limited period.

This mandate from the FOT to SBB is based on Section 2 of the timetable obligation (Art. 13) of the Federal Passenger Transport Act (PBG) [7] and the Timetable Ordinance (FPV) [8].

The SKI thus regulates the national exchange of data between all licensed transport companies in the area of customer information. The annexes to the contract describe the content in more detail, but do not specify which data types and attributes are to be exchanged. The SKI office publishes various standards on its web-site in which specific data types and attributes are partially defined [9].

However, the SKI's mandate lacks a clear vision for dealing with on-demand offerings from public and private providers for data integration and publication. This document is intended to close the gap.

2.2.2 Private and licenced on-demand provider

On-demand transport services are operated by both licensed and non-licensed private mobility providers. It is essential that the licensed transport companies must fulfil the Timetable Ordinance (including the obligation to publish timetables). This and, among other things, the financing requirements result in different motivations and therefore also requirements:

- Private on-demand providers tend not to be subsidised[1].
- Private on-demand providers are in a competitive situation (often with taxis).
- Private on-demand providers must be profitable.
- Private on-demand providers can compete with regular public transport.
- The publication obligation does not exist for private on-demand providers.
- Private on-demand providers are even less familiar with the interfaces used than the licensed on-demand providers (Transmodel, NeTEx, Siri)

2.2.3 Deep integration

The FOT's mandate to SBB or SKI and SKI+ does not define other aspects that are closely linked to the topic of on-demand:

- Standardisation of data and process integration of supply and sales: (search), book, pay, use.
- Deep integration and roaming (use of services via a third-party provider without direct registration with the provider): the option to (search for,) book, use and pay for on-demand offers with an app other than the provider's app.
- Governance: Standards and regulation that enable interoperability and roaming.

The deep integration, i.e., the booking, payment and use of services, together with the search, forms the basis for Mobility as a Service (MaaS). The search aspect is already covered today by the Open Journey Planner, among others [10]. The other aspects mentioned are explained further in the following description [11].

[1] More precisely, private on-demand providers may not be subsidised at all or may be subsidised by municipalities. A subsidy from the federal government/canton would entail follow-up obligations.

3 Customer Journey

In this chapter, we would like to examine the topic of on-demand from the customer's perspective and describe various customer journeys, some of which are illustrated with mock-ups.

3.1 Customer views

There are two main customer bases for on-demand, the end customers who want to be transported and, especially in the case of public transport, also the municipalities and/or federal/cantonal authorities who order certain services from the mobility providers.

3.1.1 Municipalities and Confederation/Cantons

From the perspective of the municipalities, the Confederation and/or the cantons, it can be assumed that an appropriate cost-benefit ratio is particularly important. This means that the transport needs of its citizens must be adequately covered within an appropriate financial framework.

One example of a poor cost-benefit ratio is empty journeys caused by buses travelling on circular routes, as in this case no transport service is provided, but costs are incurred. Another example is school buses, which, however, are subject to a stronger time constraint and where the demand is usually continuous (i.e., a child is usually picked up every Mon-Fri at a certain time and taken to school/to the public transport connection).

One example regarding the involvement of the entire population is transport to less densely populated areas of a municipality. On-demand offers a strong alternative for such community use cases. This is because journeys would only be made when there is a corresponding need, and citizens could be driven to/from their front door, if necessary, at regular times.

At the same time, it must be mentioned that on-demand vehicles are usually smaller and therefore less suitable for larger volumes of people, for example in the mornings and evenings when people commute to work.

Accordingly, hybrid solutions with a normal route network and on-demand are probably the preferred alternatives for most municipalities. Today, on-demand is often used to serve off-peak times on the regular route network or geographically remote locations.

In the following, we will focus on the end customers in the customer journey, to whom the municipalities would like to offer added value in order to make their municipalities more attractive.

3.1.2 End customers

The perspective of the end customers (i.e., the citizens of the municipalities, cantons and the federal government) is primarily about flexible transport, i.e., the use of public transport at off-peak times or the possibility of door-to-door transport, for example. A possible reduction in municipal expenditure with the same mobility offer is also in the interests of end customers. On-demand also offers more flexibility. Customers can order and use an on-demand offer without much advance planning.

One challenge for on-demand providers is that it is difficult to guarantee pick-up and delivery times, depending on the service. In addition, booking a long time in advance is usually an operational challenge and therefore often limited.

3.2 Customer Journey

The following use cases are of particular interest for on-demand offerings: 1) The journey from a starting point (A) to a destination (B); 2) Travelling away from a place (A).

Each travel chain is divided into different sections, the so-called "legs". Each leg is carried out using one mode of transport, for example on foot, by bus, taxi or similar. In general, the first and last leg of a door-to-door journey describes a journey on foot.

In the following, we will look at the two use cases described in the customer journeys ("from A to B" and "from A"). We consider on-demand for mono- and multi-modal use.

3.2.1 The journey from A to B

This is **Anna**

Anna now wants to travel from **home** to the **office**, she:

1. opens the app
2. indicates your destination
3. receives several offers that can take them (with the exception of walking) directly (mono-modal) or indirectly (multi-modal) to the office
4. chooses an offer where she (multi-modally) covers the "last mile" of her journey with a Car-Sharer
5. then decides in favour of a taxi instead of the Car-Sharer and receives a new expected departure and arrival time as well as the expected costs for the taxi with the note that she will have to pay for it after the journey
    a. Alternatively, she would not receive this message from a taxi provider with fixed prices
6. books the travel chain, pays for her public transport ticket and is told again that she has to pay for the taxi after the journey
    a. Alternatively, it pays the fixed price
7. goes to the bus stop in her village
8. takes the bus to the destination stop and gets off
9. goes to the street next to the destination stop
10. is picked up by the taxi and identifies himself when getting in
11. receives information about the progress of the journey during the journey
12. is transported to the office and pays for the taxi
    a. Alternatively, she only gets out
13. walks 20 metres further to the office

Anna wants to travel from **home** to the **supermarket for lunch (12:00)**, she:

1. opens the app
2. indicates your destination
3. receives several offers that can take them (with the exception of walking) directly (mono-modal) or indirectly (multi-modal) to the supermarket
4. chooses an offer where she travels (mono-modal) to the supermarket by on-demand bus
5. books the travel chain and pays a surcharge for the on-demand offer
6. receives an estimated time of arrival and can track the position of the bus
7. goes to the side of the road by her flat as soon as she sees the bus approaching

8. is transported to the supermarket by the on-demand bus and goes shopping

Anna wants to travel back **home** from the **supermarket after shopping (13:00)**, she:

1. opens the app
2. sees her previous journey and states that she wants to go back
3. again receives several offers and again selects the mono-modal option
4. books the travel chain and pays the on-demand surcharge
5. is transported back home

3.2.2 The journey away from A

This is **Boris**

Boris would now like to be picked up from his evening **out**, he:

1. opens the app
2. selects collection
3. receives several offers on how he can be transported away from his current location, for example:
    a. he could walk to the nearest bus stop where he can be picked up on-demand by a night bus
    b. he could call a taxi
    c. he could search for an eScooter in the neighbourhood (not classically on-demand) and drive off with it
4. selects the option to be picked up at the bus stop by an on-demand bus
5. books the journey and receives the estimated pick-up time (in 30 minutes)
6. goes to the bus stop
7. Receives a push notification that the bus has to stop slightly away from the stop due to traffic and will arrive in 5 minutes
8. Goes to the new pick-up location
9. takes the on-demand bus to the final stop at the railway station and reorients himself from there

3.2.3 Book, use and pay for your trip

While the booking and payment steps are already described as a matter of course in our customer journey, these steps are currently (as of 2022) still being discussed intensively.

With regard to the use cases presented, these aspects have already been intensively analysed and discussed in 2022 as part of a proof of concept [11] and are represented in the following figure.

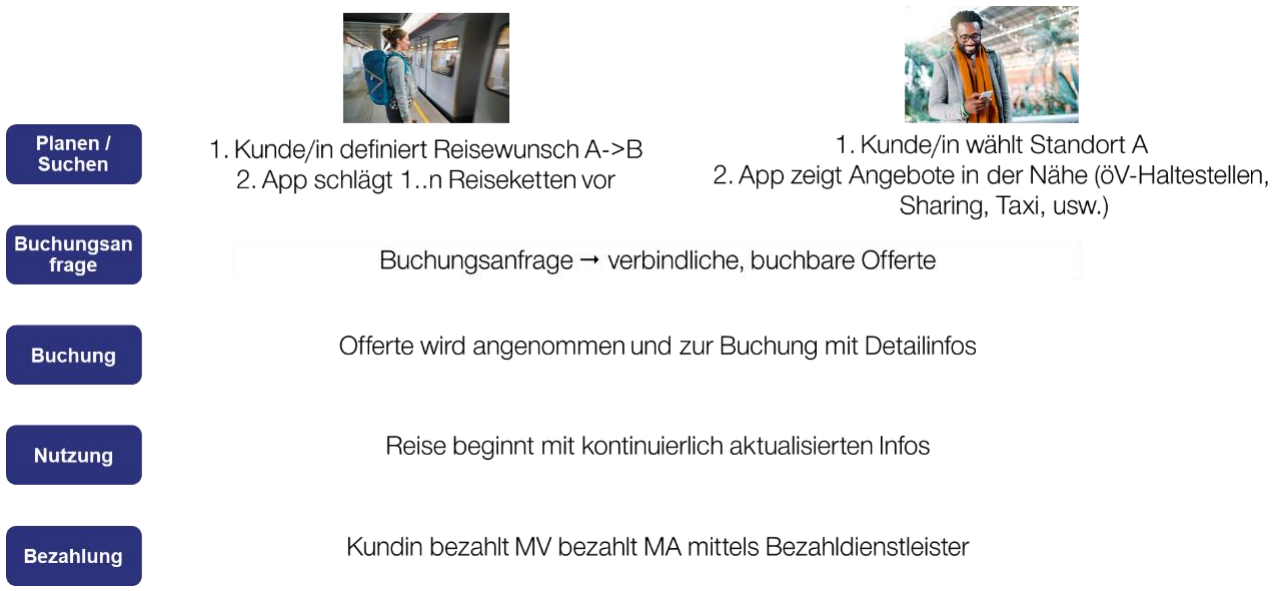


Figure 1: Exemplary presentation of the MaaS steps: Search, book, use, pay

4 On-demand offers

4.1 Properties

From the perspective of the basic functionalities of the system tasks of customer information (data collection, provision and publication), three specific characteristics in the context of on-demand should be emphasised, which differ from classic timetable-based public transport:

Characteristics	Brief Definition	Basic functionalities of SKI/ SKI+
Timetable and timetable*	The structure of an on-demand service is more flexible in terms of time (flexible pick-up and drop-off times) than a traditional public transport service, which has fixed arrival and departure times. * See also chapter 4.3 for the definition of quotation plan	• Data collection • Data provision • Data publication
Space	The served stops in the ODV do not necessarily have to be official public transport stops listed in the national DiDok register, but can also be Sammelstelle ("collection points"): Points of interest (POI), collection points in the neighbourhood, or even address-based.	• Data collection • Data provision • Data publication
Booking and access	According to the definition, on-demand offers are subject to reservation. The booking (or ordering of a journey) of an on-demand service is increasingly taking place digitally (e.g., via app).	• This is dealt with separately in the context of the PoC Sales (status 2022).

Table 2: Overview of the important properties in the context of ODV.

Other characteristics must be taken into account, e.g. the size of the vehicles, which plays a central role in the availability enquiry and booking, or the concessions that distinguish the ODV of public transport CH from private providers (concessionary transport companies are obliged to draw up timetables/schedules [12]).

4.2 Characterisations

On-demand traffic is very diverse and can be categorised according to several characteristics. While licensed on-demand services are often operated according to a predefined route and stop concept, there are some licensed and unlicensed on-demand services that operate according to an area concept, such as PubliCar Appenzell or myBuxi.

The purpose of this chapter is to present the main on-demand forms in order to achieve a common understanding. The characteristics defined by the ASP [3] and the VDV in VDV publication 462 [4] are considered.

The definition of the service characteristics and the underlying stops and stopping points of the ASP differ from those of VDV Guideline 462 (VDV 462). The ASP defines 4 on-demand characteristics, while VDV 462 assumes 5. Contrary to VDV 462, the definition of stops and stopping points in the ASP is not based on current standards. We will not elaborate on the differences between the ASP and the VDV at this point, but provide a new, consolidated and standard-compliant description (for a mapping between the standards and the path to consolidation, see Appendix).

In the following, we first describe the places or locations that form the basis for the characteristics and then use these in the later definition of the characteristics.

4.2.1 Stops, collection points and any locations

All "real" (because official) stops are DiDok stops with the following properties:

- They are BehiG-compliant.
- They are included in DiDok.
- You have been through a hearing.
- They have a unique name with a maximum length of 30 characters.
- They have fixed coordinates.
- They are subject to a public transport licence for regular services and regional services.
- You have a SLOID (Swiss Location ID).

There are concessionary public transport services where the official stops are also used as stops. However, there are also Sammelstelle ("collection points") and pure door-to-door offers, e.g., between any locations or coordinates and thus without any permanence.

It does not make sense to record all coordinates. Similarly, it makes little sense to adopt the collection points in DiDok, as they are only relevant in a local context and can change frequently. Furthermore, there would otherwise be a risk that such a location would be used for regular public transport, which is not permitted.

Collection points should therefore be characterised by the following properties:

- You have not been through a hearing.
- They are based on area-based transport (whereby a public transport concession is also possible here).
- They have no official name (although the existence of a name assigned by the operator cannot be ruled out).

The Sammelstellen ("collection points")[2] are entirely the responsibility of the operator and are delivered with the offer plan (NeTEx). When assigning IDs, please note section 6.2.

In the context of the SKI, the collection points will be maintained in the timetable collection in future (see also chapter 6). Area-based services that operate on an address basis (so-called door-to-door services) have no stopping or collection points at all. If collection points are relevant for the journey calculation, these must be transmitted in the offer plan.

The processes for lines with collection points make operators responsible. They must maintain their stops in sufficient quality and provide all the necessary information in the NeTEx timetable or in communication with the timetable collection.

Recording the collection points has consequences for timetable collection and publication. These new "collection points" are not maintained in DiDok, as they are not official public transport stops and are only managed and used by the provider itself. The SKI core systems and their customers must be able to handle this. In principle, all necessary data should be transmitted in the quotation plan (NeTEx file). In fact, they have to be adopted in full with every timetable import.

4.2.2 Variants

We propose the following three forms of on-demand transport: On-demand Linienverkehr (scheduled transport), Korridorverkehr (corridor transport) and Flächenverkehr (areal transport):

[2] The definition of collection points given here replaces the "virtual stop" of the on-demand support group. The latter will therefore not be repeated here.

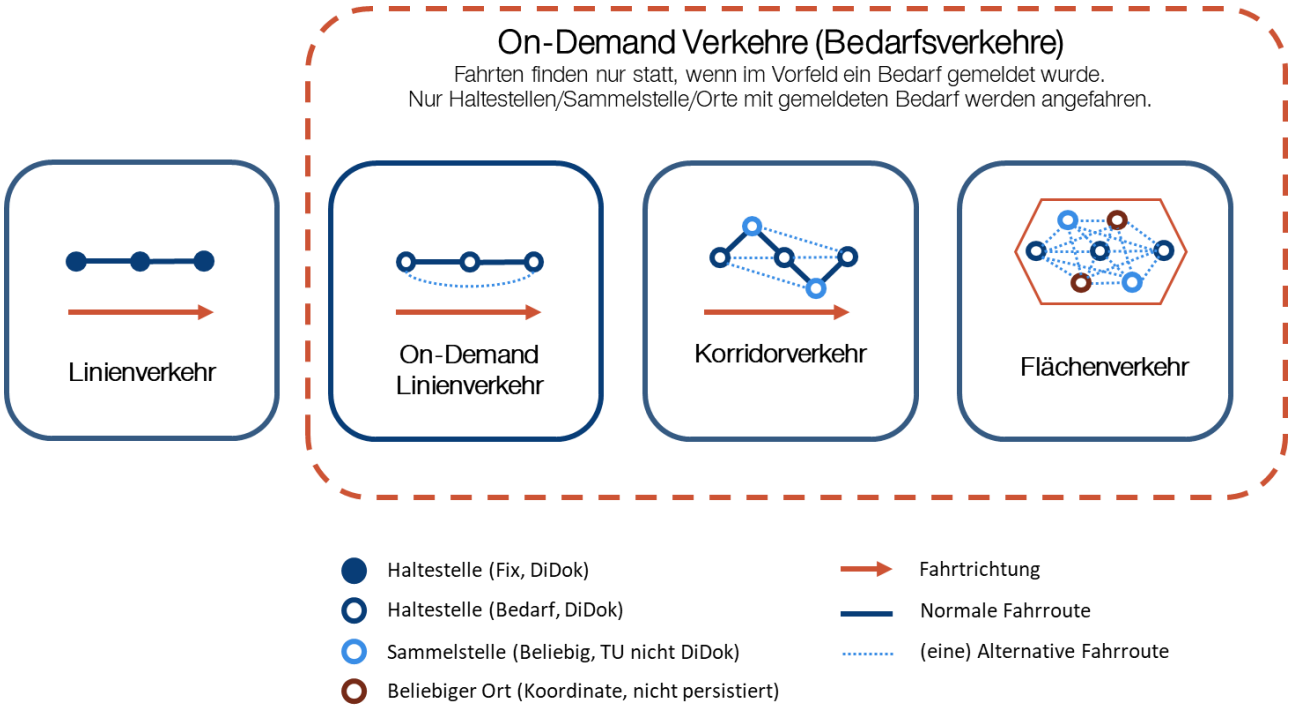
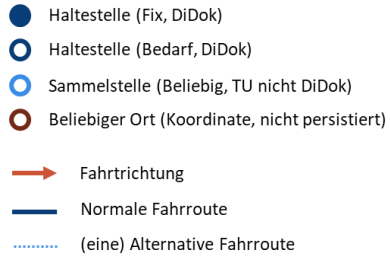


Figure 2: The range of on-demand transport services.

Type	Definition
On-Demand Linienverkehr **(scheduled on-demand)**   	The on-demand service serves the same stops as the normal service, but only on demand (travellers must book their journey in advance). Accordingly, this can also be shown in the classic timetable. For example: Only the first and last stops on a regular timetable are served, as a journey is only booked in advance at these stops. **(Demand)stops:** they are registered in DiDok and are subject to all relevant regulations, laws, V580 rules etc. for public transport stops. **Fixed direction of travel:** the vehicle generally moves in a fixed direction of travel. This means that an indicative timetable and connection protection can be defined. **Fixed sequence of stops/points:** The order in which the stops or static stops are served is predefined. **Fixed timetable:** With a fixed direction of travel with a fixed sequence of stops/points, a fixed timetable can be defined. The times must be strictly adhered to (see also the comparison with the timetable below). **Connections defined:** The service plan defines which connections should be maintained on arrival and departure at a station or other junction. A (indicative) timetable is required to define a connection guarantee.
(On-Demand) Korridorverkehr	On-Demand Korridorverkehr (corridor transport) has Sammelstellen ("collection points") in addition to the on-demand stops of On-Demand Linienverkehr (scheduled on-demand). This creates a corridor (i.e., visually, if you imagine horizontal boundaries above and below the "main route" in the figure above). The bus will still only travel to locations for which a journey has been booked in advance. The on-demand stops and collection points can be described in a timetable as a logical sequence. Either a fixed timetable or an indicative timetable can be created. For example, the indicative timetable (for the figure above) could

Type	Definition
 Haltestelle (Fix, DiDok) Haltestelle (Bedarf, DiDok) Sammelstelle (Beliebig, TU nicht DiDok) Beliebiger Ort (Koordinate, nicht persistiert) Fahrtrichtung Normale Fahrroute (eine) Alternative Fahrroute	provide for the departure from the two Sammelstellen ("collection points") and three on-demand stops, which would serve all 5 locations. If there were only reservations for the on-demand stops, then only the on-demand stops would be served (i.e., as a line). Note: If the sequence cannot be adhered to, a timetable is excluded and only an indicative timetable is possible. **Sammelstelle (collection points):** are defined by the on-demand provider and have a fixed designation and a fixed geo-localisation. However, they are not available in the DiDok or cannot be handled by it (according to the current status). **Richtfahrplan (indicative timetable):** With a fixed direction of travel, possible service times are defined for individual stops/points. An indicative timetable can be defined, even if the sequence of stops/points is not fixed. It does not necessarily have to be possible to adhere to an indicative timetable (with a single vehicle).
(On-Demand) Flächenverkehr  Haltestelle (Fix, DiDok) Haltestelle (Bedarf, DiDok) Sammelstelle (Beliebig, TU nicht DiDok) Beliebiger Ort (Koordinate, nicht persistiert) Fahrtrichtung Normale Fahrroute (eine) Alternative Fahrroute	With on-demand Flächenverkehr (areal transport), any stopping points within a zone are served during predefined (zone) operating times. The booked journeys can be bundled by the operator (depending on the business model). This service does not have a pre-planned timetable. Instead, the demand request generates an "ad hoc" journey with different routes and without a fixed route. This means that journey times can vary from journey to journey. For example, a person could request transport from any location (their own front door) to a bus stop and use a taxi to get there. If several journeys are booked to/from the same location, a kind of shared taxi/bus could be formed. **Any location:** represent geo-coordinates at which a destination, intermediate or end point of a journey is located. Although these must be stored in the form of a log (e.g. for billing purposes), they do not have to be persisted in a data storage system. In particular, the geo-coordinates themselves are already uniquely defined and do not require any special technical processing.

4.3 Angebotsplan (offer plan)

On-demand providers operate without fixed timetables and, in some cases, without fixed stops. In order to describe the static details of the on-demand service, different information is needed than is known from classic timetable-based public transport. For example, service areas and service times, stopping points/ Sammelstellen ("collection points") and various journey rules must be described.

The static description of an on-demand service is referred to below as a **service plan** in order to distinguish it from the familiar public transport term "timetable". This is also handled in the same way by the public transport industry organisation ASP. This can be used to describe area-based services that do not have a fixed timetable.

To define the attributes of an offer plan, it is sufficient to distinguish between the two basic on-demand types Linienverkehr (scheduled) and Flächenverkehr (areal transport).

Type	Definition of offer plan
On-Demand Linienverkehr	The service plan contains the timetable for the line-based on-demand transport services. Necessary information includes the journey number, days of service, route, arrival, departure and transit times at the operating points and the permitted speeds in the individual sections of the route. There are also various other attributes such as low-floor buses, bar trolleys, bicycle transport and the obligation to make reservations.
On-Demand Flächenverkehr	These services do not have a pre-planned timetable with journeys, but operating times and a predefined service area. If stops or Sammelstellen ("collection points") are used, these must also be defined. In addition, rules (see below) must be specified. An "ad hoc" journey with individual journeys and without a fixed route is generated via the demand. The journey times can vary from journey to journey, with the aim of ensuring that the operators organise the most ideal pooling and journey schedules possible. Measuring quality in terms of punctuality in the conventional sense is only possible to a limited extent. It still needs to be checked what waiting times are acceptable for customers. The description of the area-type ODV offer is provided as an offer plan with the following information: • Service areas and possible subdivision into zones • Public transport stops, collection points or addresses • operating times • Rules o Zone rules (e.g. restrictions for journeys between zones) o Stop rules (e.g. a stop may not be approached by regular traffic) o Competition rules (the journey must not run parallel to a regular bus) o Waiting rules o Connection rules (e.g. for feeders) o Ordering and reservation rules o Further rules

On the regulatory side, the term "roadmap" continues to be used. Licensed providers are subject to the Timetable Ordinance [12]. However, this refers to their supply plans.

5 Specialised data model

The specialist data model is at the heart of modelling on-demand traffic. This must be correctly mapped in the SKI+ systems. Ideally, it is harmonised with the CEN specialist data model "transmodel". The specialised data model makes it possible to define which data is to be exchanged and processed for an on-demand offer. All interfaces must be able to transmit this data. The data suppliers must be able to deliver it and the recipients must be able to process it. It is important that the technical definition of the possible on-demand offers does not go beyond the scope of the specialised data model.

5.1 Domain model on-demand (based on Transmodel)

Domain models are used to model complex software systems. They represent the most important data objects of a department from the user's point of view and their relationships with each other. In doing so, they define a "common language" for the partners involved. They serve as the basis for the design of specific data models for applications and interfaces to be developed. It is deliberately not found in the domain model:

- Concrete data types in the sense of a specific programming language or a specific SQL dialect. If necessary, a distinction is made between text, integer, floating point number or similar.
- DB-technical modelling of uniqueness conditions, foreign key references etc.

The domain model described here was created by MENTZ after analysing various types of on-demand traffic. The description of the following table was updated as part of the amendments to the technical document:

Type (according to VDV 462)	Description	Example
Demand line (/ virtual line)	All stops on the predefined route are on-demand stops; the journey only takes place between booked stops.	Mobicité
Korridorverkehr (Corridor transport)	On a predefined route, there are on-demand stops that vary in the actual route to be travelled. There are also Sammelstellen ("collection points") along the way that can be approached.	MobiChablais - tpc
Free Flächenverkehr (areal transport)	Area without time differentiation, service within time bands, any journey routes within the area. Subdivision of an area into several sub-areas possible, possibly with fixed departure times for directed service from sub-area to sub-area.	Publicar Appenzell / Publicar Vaud (several zones)

Table 3: Types of on-demand services in accordance with the technical concept, considering VDV 462 and ASP.

The data objects are described here in a UML class diagram by Mentz, with strong reference to VDV 462:

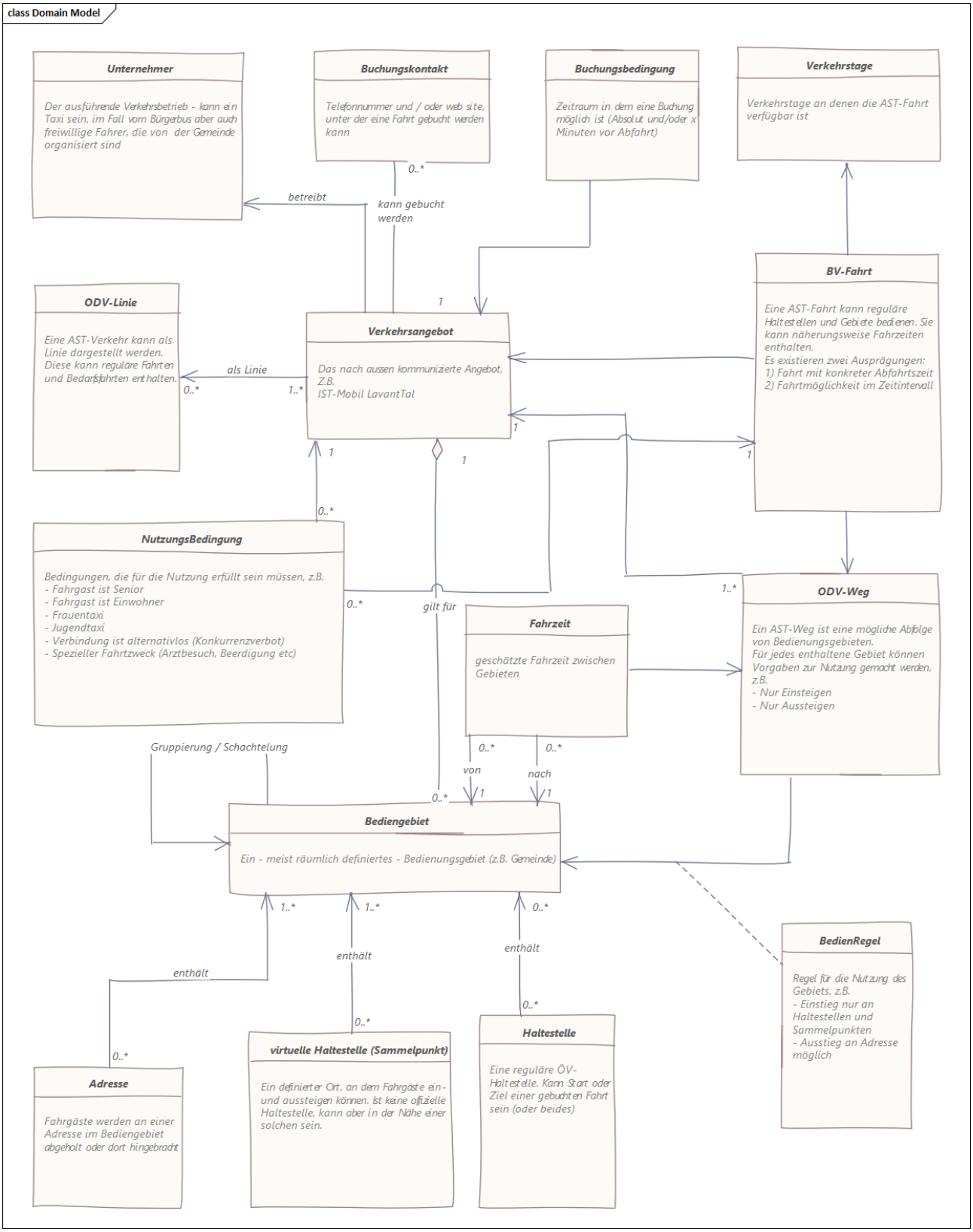


Figure 3: UML class diagram of on-demand transport (based on MENTZ assumptions)

The arrows indicate relationships. The relationships are labelled according to their role in the model. The numbers at the ends of the connectors describe the "multiplicity". If you look at the relationship between "service area" and "stop", then 0...* on the side of the stop: A service area can contain no stops, one stop or

several stops. On the operating area side, 0...* means the same relationship: A stop can be included in none, one or more service areas.

The domain objects are described in detail in the following chapters.

5.2 Verkehrsangebot (Transport offer)

The central object is the transport service, which must be available as a line. Each transport offer includes a booking contact and booking conditions. Use may be restricted by certain terms of use. A transport service always has at least one operator (TU).

In Transmodel (or NeTEx), this corresponds to the MobilityService, as shown in the following diagram:

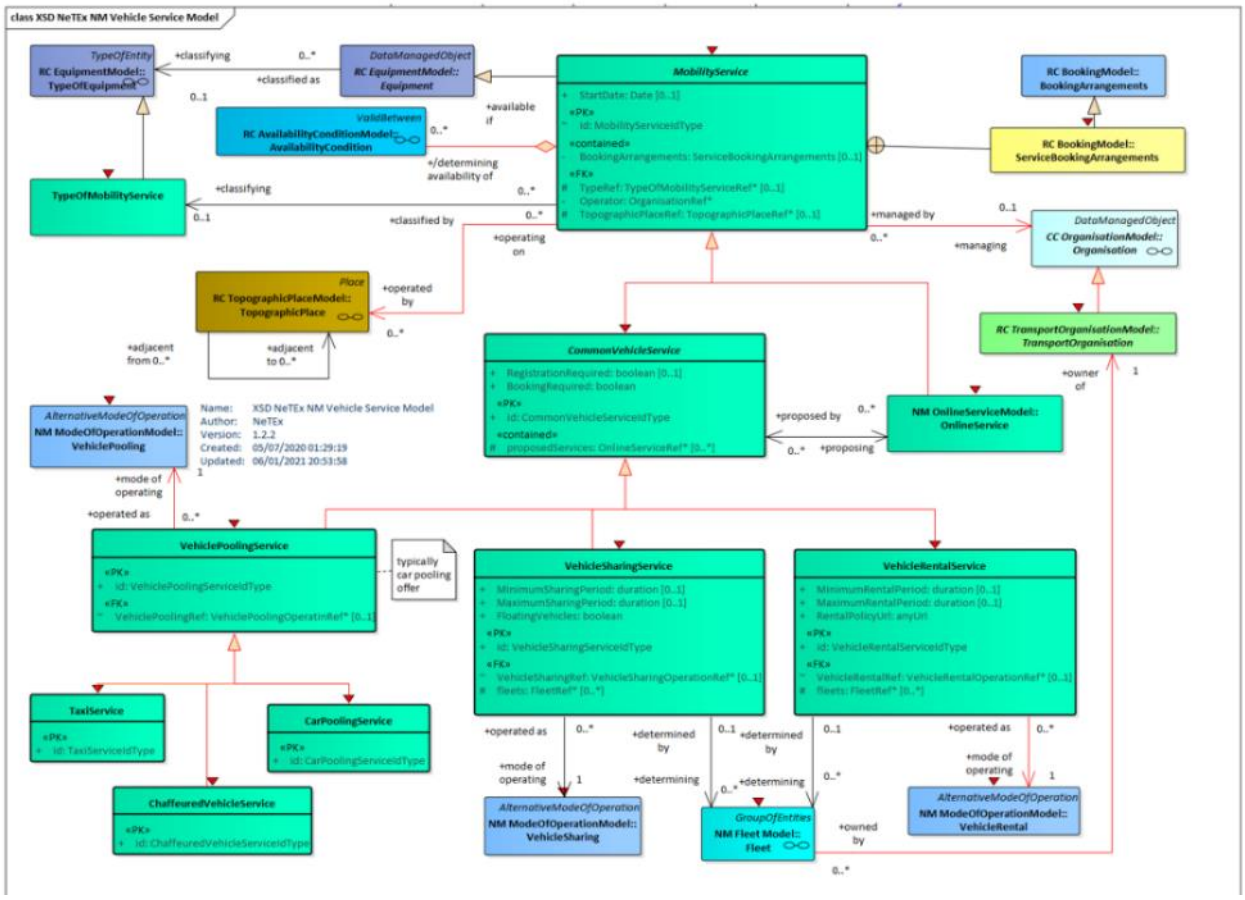


Figure 4: MobilityService (NeTEx).

5.3 Booking contact

Contact between passengers and operators can take place in various ways. The order is according to the degree of digitisation:

- App of the operator: Requests run via a special app / deep link
- Website: Enquiries via a website
- Telephone number: Enquiries via a "call centre"
- Direct enquiry to the driver: (mostly for on-demand services with fixed departures and directional band). According to the ASP, this form should not be supported.

5.4 Booking conditions

Booking conditions describe the time window in which a journey can be booked. You can either enter the latest time before the desired departure or the earliest booking period. Depending on the provider's type of operation, there are a wide variety of different forms.

5.5 Terms of Service

The use of on-demand transport can be restricted to certain groups of people, e.g.

- Senior taxi
- Women's taxi
- Youth taxi

In some cases there are also restrictions designed to prevent competition with existing public transport, e.g. "Use only if there is no equivalent connection 30 minutes before/after the desired journey".

5.6 Service areas (zones)

The offer includes one or more service areas, which are geographically defined and can be displayed on a map. Service areas can also be grouped or nested, see the example of the zones at PubliCar Vaud. Service areas can include stops, Sammelstellen ("collection points") and addresses.

5.7 Sammelstelle (collection point)

On-demand services often serve not only regular stops, but Sammelstellen ("collection points"). These are not official stops and therefore do not have a DiDok number. They may be labelled with special signs, but do not have an official stop sign.

5.8 Operating rules

It must be defined whether stops, Sammelstellen ("collection points") or even addresses are possible as the start or destination of a connection. Such rules (see also sections 4.3) are defined by default for each operating area, but it is possible to override them for certain journey routes.

5.9 Lines

Line-based ODV services are usually presented like a regular public transport line, i.e. there is a line number, a means of transport and a defined route and timetable.

5.10 On-demand journeys

The on-demand journeys describe either a specific departure at a specific time or a time range in which the service is available. In the case of line-based services, this refers to a defined ODV route to describe the sequence of areas served. Similar to regular public transport journeys, ODV journeys also indicate the days on which journeys are available.

5.11 On-demand routes

The ODV routes describe a possible sequence of served stops/stopping points.

5.12 Days of operation

The transport days of an on-demand journey are usually communicated via a textual description such as "Saturday, Sunday and pre-holidays". These definitions are assigned a validity calendar in technical systems.

5.13 Travel time

In the case of Flächenverkehr (areal transport), no specific arrival and departure times are usually given at individual points. In some cases, however, approximate journey times are given within/between the service areas.

6 Specialised architecture

The current overall architecture of the systems involved in SKI and SKI+ is described below at Figure 5.

Both private and public transport companies provide information about their on-demand offers according to a scheme (expressed in Excel) specified by the SKI and SKI+. The scheme is based on the principles described in chapter 5. In addition to the schema, companies must also provide a technical description of the areas they serve (in geoJSON format).

The information provided is then manually incorporated by the SKI team responsible for the timetable collection (dialogue-controlled traffic management and information system). From there, the data is made available to the Open Journey Planner (OJP) system via an internal interface. This provides the data in OJP interface format for handling route requests. In addition, the NeTEx export will be developed by ODMCH (Open Data Platform Mobility Switzerland) in 2023.

As part of the 2023 work, the system for recording disruption reports (VDV 736) will be expanded so that disruptions in on-demand transport can be recorded and used by the OJP.

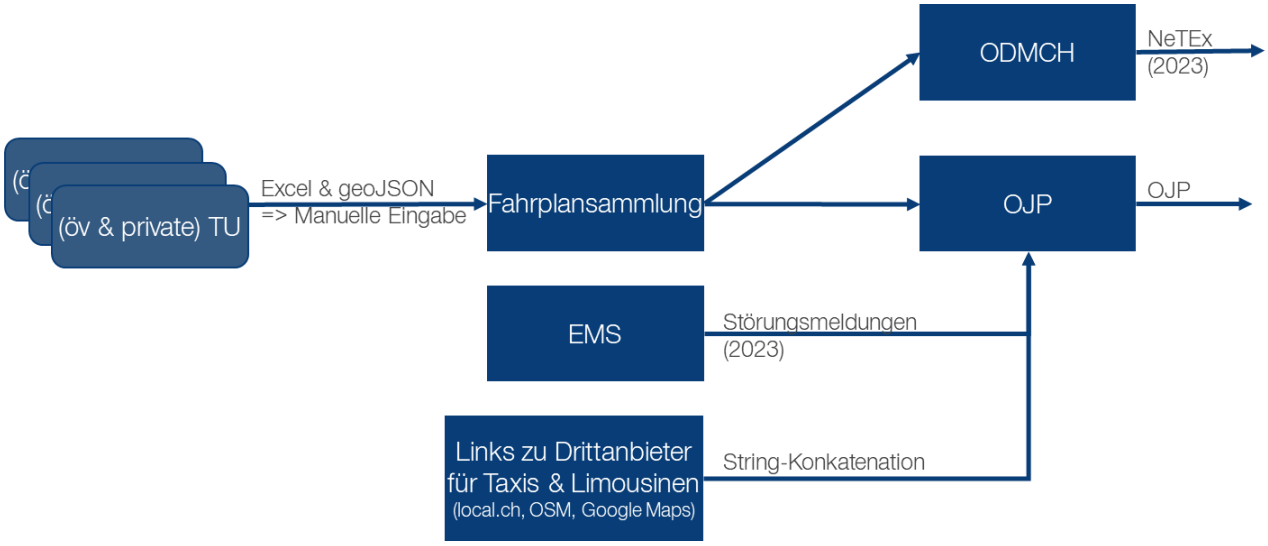


Figure 5: Architecture/Workflow On-Demand in the SKI(+) system world.

An adjustment of QuoVadis is not planned at the moment. On-demand transport services are linked there directly as a PDF at https://www.fahrplanfelder.ch/rm/rufbus.html. As a possible addition, the existence of a line is indicated in the timetable fields, which can then be called up via the timetable information or via the PDF: https://www.fahrplanfelder.ch/rm/rufbus.html.

A description of the interface required in connection with the on-demand activities of SKI and SKI+, in particular NeTEx, can be found in the technical documentation at [2]. Topics such as faults, real-time data and vehicle positions are described there. The document on deep integration deals with topics such as booking and payment, as well as availability [11].

In the following sections, special aspects of architecture are highlighted.

6.1 Operator / Lines

From a professional and technical point of view, Flächenverkehr (areal transport) services are managed as lines, although in colloquial terms they do not describe "lines". The line definitions are considered analogue to Transmodel and NeTEx. This means that one line describes the supply and if certain characteristics change fundamentally, it is a different line. This is used in the modelling.

Ideally, all services and lines with a public transport licence should be included in the timetable collection / timetable publication. If no massive HRDF adjustments are to be made for existing customers, it makes sense to limit the information in the HRDF to the following:

- Only official stops
- No Flächenverkehr (areal transport)
- "Reduced" offers. This means that the ODV behaviour is only inserted as an indication and, if necessary, with an increase in speed[3].

A NeTEx file is provided on ODMCH for all "enhanced" features.

The timetable collection will be converted at the earliest when the switch to NeTEx has also taken place there. This currently has the following consequences:

- In the ODV area, the master system for service plans is only available in the timetable collection for line-type, licensed services.
- All other information (ODV aspects for journeys of line-type and area-type traffic) can be found in the specific NeTEx file.
- The overall status must be determined by loading the HRDF file and the specific NeTEx file.

The following applies in principle: With ODV, the data from the NeTEx file overrides that of the HRDF file. However, they must be mixed together at the line level (which is done by OJP, for example).

6.2 Swiss Identification for Public Transport

The locations, the routes, the journeys and the companies involved must be clearly identifiable for standardised, efficient and effective transport planning and execution. This section describes the work of the System Leadership Customer Information (SKI) in relation to the topic of on-demand. The basis for all of the following information comes from [13].

In principle, the following structure applies to the structure of all IDs:

<Country>:<Authority>:<IDName>:[<AdminOrg>]:<InternalID> / Example: ch:1:sjyid::

with:

- <Country> = "the country that assigns the ID" (e.g. ch)
- <Authority> = "designates the national awarding authority" (e.g. 1 for SKI)
- <IDName> = "denotes the name of the corresponding object" (e.g. sjyid for the journey ID)
- <AdminOrg> = "If the <InternalID> is not assigned nationally by the <Authority>, but by a transport company, for example, then the <AdminOrg> is also required for differentiation. It corresponds to the Swiss Administration ID." (e.g. 100648 for Zurich transport company)
- <InternalID> = "means the ID assigned within either the <Authority> or the <AdminOrg>.
- will" (e.g. "loc:12345" to designate a specific location in PubliCar)

6.2.1 Swiss Location ID (SLOID)

"With the SLOID, [...] the stop, meta-stop, stop area and stopping edge are identified. It is also possible to identify other objects at and around the stop. This is currently not specified. […]».

[3] Trips in HRDF require strictly ascending times. Arrival at the earliest etc. cannot be mapped. One way of achieving a correct result with a classic trip planner is to split the individual journey with flexible times into various overlapping partial journeys with suitable boarding and alighting restrictions.

"Due to the national control of the stop name, the awarding authority is always SKI and therefore '1'.".

"The structures are roughly as follows [...]:"

ch:1:sloid:<Location> / ch:1:sloid:<Location>:<Components>

Note: The Sammelstellen ("collection points") described in this document are not yet included. A suggestion for a possible integration can be found at 6.2.6.

6.2.2 Swiss Journey ID (SJYID)

"The SJYID identifies the journeys and thus determines which journeys belong together over the entire planning period and when it is a new journey or when a journey is cancelled."

"The assignment is made by an <AdminOrg>".

"The general structure is as follows."

ch:1:sjyid:<AdminOrg>:<InternalID>

6.2.3 Swiss Business Organisation ID (SBOID)

"The SBOID is used, for example, to identify the operator or the licence holder, etc."

"The <InternalID> corresponds to the SAID".

"The structure is as follows."

ch:1:sboid:<InternalID>

Note: The non-licensed operators must also be included in the GO list (SAID) accordingly.

6.2.4 Swiss Line ID (SLNID)

"SLNID is used to identify all lines (or partial lines) and line directions in Swiss public transport. It is also possible to differentiate between a licenced line and a technical line with the SLNID."

Please refer to the separately defined document for SLNID [14]: "The SLNID, including all key elements, must consist of the character set [...]". The following applies to their structure: "For the line, regardless of the type [...] an automatic and arbitrary character string is assigned by the LiDi [...]." The same applies to the partial lines, i.e. "[...] regardless of the type [...], a ':' is added after the <Line>. [...] and an automatic and arbitrary character string is assigned by the LiDi [...] It **is therefore not possible to draw conclusions about the line as it is communicated to the customer**."

The structure is as follows

ch:1:slnid:<Line>:<Subline>

Note: For the ODV, the non-licensed lines (and areas) should also be shown here.

6.2.5 Swiss Administration ID (SAID)

This ID is equivalent to the current business organisation ID (see LINK). It is contained in the SBOID, which in future should be the reference basis for international exchange, among other things.

6.2.6 SID4PT for On-Demand

The details for the implementation of the IDs as part of the on-demand programme, which includes both private and public companies, are currently being worked out.

The aim is for all companies to be able to record (SLO) IDs for Sammelstellen ("collection points"). They must also be able to record SLNIDs, as lines are used to map Flächenverkehr (areal transport). The prerequisite is that they receive a SAID.

7 Conclusions and next steps

7.1 Summary

This document describes the technical view of SKI+ on the topic of on-demand. It is based on the latest discussions, in-depth analyses and the previous version of the document, the work of ASP [3], and VDV 462 [4].

The three most important differences between the previous and this version include:

- Customisation: The functional aspects are documented separately from the technical aspects. This document focusses on the functional aspects, while [2] focuses on the technical aspects.
- Customisation: A simplified model of the characteristics of on-demand services (e.g., no separation of Korridorverkehr (corridor transport)), as well as the associated components (e.g. Sammelstellen ("collection points") instead of dynamic/static stops).
- New: The introduction of the identification number for locations, especially for non-DiDok-based Sammelstellen (vehicle meeting points). This enables transport companies to identify physically fixed locations in a standardised way.

7.2 Conclusions

The following conclusions are based on this concept and the work carried out to date.

7.2.1 Standardised specialist model

The various stakeholders should use a standardised specialist model in accordance with the chapter 5. The current specialised data model is a synthesis of previous work in Switzerland.

7.2.2 Use of standards

Transmodel as a conceptual basis and the technical standards of CEN, OSDM and TOMP form a good basis for all technical illustrations.

7.2.3 Partial integration of non-licensed ODV

Non-licensed ODV should be integrated into SKI and SKI+ processes, services and services as far as possible.

7.2.4 Standardised offers as far as possible

Providers should simplify and, where possible, standardise their offerings. The main reason is that potential customers need to understand the business model. At the moment, it sometimes seems as if providers are unable to describe their own model sufficiently. Customers must be able to trust the offers. Standardised offers across regions are a prerequisite for this.

7.2.5 Better descriptions of the offers on fahrplanfelder.ch

The offers must be described better and more simply in PDFs or on websites. Non-licensed services should also be able to be communicated on fahrplanfelder.ch.

7.2.6 Routers must be able to handle the offers

Routers must be able to handle the offers, otherwise the offers will not be issued. It must be possible to form stable, reliable travel chains without long waiting times. The offers and descriptions must be able to be optimally processed in common routers.

7.2.7 Extensive use of existing pipelines for data preparation

SKI has an existing infrastructure for ODV processing. Where possible, this should also be used for non-licensed ODVs (in accordance with Art. 4 and 6 PBG).

Alternatively, a 2nd pipeline can be set up. But this should also include taxis. Taxis can be seen as a special form of an area-type ODV.

7.2.8 SAID, SBOID and SLNID

The basic data on the organisation and lines must be recorded in the FOT list at SKI.

7.2.9 Record faults manually in the SKI EMS

Faults should be recorded directly in the EMS of SKI.

7.2.10 School buses

School buses and taxis should be officially registered, and additional passengers should be allowed. The FOT should make it possible for these to be provided as easily as possible.

7.2.11 Real time for licenced providers

Since licensed providers must also provide real-time services, a roadmap is required for the line-type services.

7.2.12 Support for fares, availability and booking

Licensed TUs must offer fares, booking via NOVA or via TOMP. The TOMP offer can also be made via the SKI+ enabler.

Availability must be provided via TOMP or OJP.

The necessary information must be published in the SKI+ ServiceDirectory.

7.2.13 Publication of offers in NeTEx

All area-type offers are published as NeTEx. The line types are integrated into the timetable collection. Properties that cannot be mapped in HRDF must be found in NeTEx. Elements that cannot be mapped in NeTEx indicate a business model that should be adapted, as not even the European experts have understood it.

7.3 Next steps

- In the following, we would like to use the existing specialised model to depict characteristics that have so far only been dealt with in passing. These include dealing with school buses, hail-and-ride and sequenzielle Korridorverkehre (sequential corridor transport). Even if some of these are not available in Switzerland, they should be dealt with in order to be able to support emerging business models or the companies implementing them in their realisation. (Version 3.0 of the concept)
- The technical concept is consolidated with all stakeholders (to finalise version 2))

- The technical document will be expanded based on the findings in 2022 and 2023.
- The TOMP profile for Switzerland is intended to support ODV in accordance with this specialised concept.
- The operating procedures for licensed and non-licensed ODVs for SKI and SKI+ are set to productive.
- The first providers are integrated into the EMS (fault management).
- Availability, fares and bookings for ODV should be possible via the enabler (with TOMP).
- Licensed ODV is integrated into NOVA.
- OJP 2.0 fully supports ODV.
- The processes for optimising trips with ODV in OJP are being finalised (e.g., the footpaths and the travel chain may have to be recalculated after an availability query).
- Publication of the work of the PoC Distribution from 2022.

A Release Notes & Roadmap

IMPORTANT: Please note that the current version 2.0 of this document differs significantly from the description of version 1.0. In particular, we deviate from the definition of the ASP [3] (as at 2022) and present a simplified model.

Among other things, this version does not describe any changes to version 1.0 with regard to the "Hail And Ride" form of expression[4]. This will also be usefully integrated into our model in a subsequent version. The topic of school buses is also examined in more detail.

Furthermore, the comparison or the processing of the terminology between the ASP and VDV 462 standards must be taken into account:

In contrast to ASP, VDV publication 462 (VDV 462) [4, p. 119] distinguishes between 5 ODV characteristics. We compare the characteristics, map the definitions to each other and derive a consolidated definition. Before we do this, we will compare and consolidate the definitions of stops and stopping points in the ASP with those in VDV 462:

Offer characteristics ASP	Offer characteristics VDV 462	Consolidation
Stop point: A "virtual stop" that is not recorded in DiDOK and is NOT subject to the ordinances, laws, V580 rules, etc. for public transport stops. There are two types of breakpoints: • Dynamic (see above) • Static (see above)	**Stop point:** ►Network point at which a ►vehicle stops to allow passengers to board and/or alight. A stopping point is always assigned to a ►stop. *Network point:* Logical point in the network. Network points are classified, for example, as stopping points, depot points and beacons. Network points can optionally be geo-referenced. *Vehicle:* A means of public transport with its own drive (as opposed to a carriage) for transporting passengers. Each vehicle must be described with at least one licence plate number and can also be given an operational and technical number, an assignment to a vehicle type and other vehicle-specific characteristics. *Stop:* see below.	Here the nomenclature of the ASP is **contradictory** to the standard definition of stopping points described in VDV 462. On the basis of VDV 462, or in the extended sense NeTEx, there is no differentiation between static and dynamic stopping points! Instead, both points are defined as ScheduledStopPoint. In the case of static breakpoints, the familiarity of this location can then be reflected, for example, by a specific designation using the Name or Id attribute. Note: The term "Scheduled*" in the element name does not imply that the points *must* be approached. **For this document, this means that we will no longer refer to stop points (and no longer differentiate between dynamic and static ones), but to ScheduledStopPoint or SSP for short.** This fulfils the technical requirements and at the same time does not overload an existing nomenclature.
Stop place: registered in DiDOK and is subject to all relevant regulations, laws, V580 rules etc. for public transport stops.	**Stop place:** A stop is a place that is served by public transport vehicles on a scheduled or at least regular basis to enable passengers to board and/or	There is **agreement** here.

[4] With Hail and Ride, boarding and alighting is possible in the centre of a defined line. A message is sent to the driver to get out of the vehicle. Boarding by waving at the side of the road.

Offer characteristics ASP	Offer characteristics VDV 462	Consolidation
	alight. The stop is divided into stop areas and stops.	

Based on the previous findings, the following table validates the professional/technical view of ASP against the implementation-oriented approach of VDV 462. In other words, whether the technical models can be implemented with the given standard and to what extent the rough technical specifications of VDV 462 correspond to those of the ASP:

ODV Characterisation ASP	ODV Characterisation VDV 462	Comparison	Consolidated definition
On-demand Linienverkehr (scheduled services)	Demand line (1 - L)	The technical definitions match. VDV 462 does not explicitly deal with the implementation, but only refers to the difference to the normal representation of regular services.	The comparable definition of ASP is used here (see Chapter 4).
On-demand Korridor sequentiell (Sequential corridor transport)	Collective call traffic (2 - A) && "Directional band, locally scheduled bus" (3 - Ö)	The "Anrufsammelverkehr" definition in VDV 462 consists of just one sentence without any further explanation, which makes comparison difficult. Assuming that "placeholders for stops" correspond to SSPs, the definitions here can be regarded as similar. The definition of the "directional band, locally scheduled bus" is also not very detailed. With the given definition, however, this is adequately reflected by the definition of the "sequential corridor". The VDV 462 definition is more specific than that of the ASP and can therefore be regarded as a subset. In particular, the definition of VDV 462 assumes the integration of non-demand stops.	The more comprehensive definition of the ASP is used here (see chapter 4).
On-demand Korridor Selektiv (Selective corridor transport)	Time-related surface traffic (4 - Z)	Time-based surface traffic, as described in VDV 462, can be used to model the "selective corridor".	The definition of the ASP can be retained (see chapter 4).
On-demand Flächenverkehr (Areal transport)	Free area traffic (5 - F)	Definitions consistent.	The comparable definition of the ASP is used here (see chapter 4).

B Glossary

Term	Brief Definition
ASP	Alliance Swiss Pass - Swiss public transport industry organisation
AST	Acronym for Anruf-Sammel-Taxi. Although there is a fixed network of stops in these systems, the route from stop to stop is arbitrary and adapted to the respective wishes of the passengers (often service to the front door). This system differs from a shared taxi, which usually uses large taxis or minibuses, but can be better described as a "shared taxi".
Offer plan	The static description of on-demand offers that do not include classic timetables. Essentially, these are service areas, stops or other definitions of stops (e.g. address-based), operating times and other utilisation regulations (e.g. whether it is possible to travel between zones). This term was coined to differentiate the services from the classic term "timetable".
Accessibility	The findability, accessibility and usability of facilities, equipment and transport systems for people with disabilities.
BAV (FOT)	Swiss Federal Office of Transport
Bedarfsverkehre (On-Demand Services)	German term for on-demand services. Term from the Passenger Transport Act (PBG).
CEN	(European Committee for Standardisation)
CUS	The Customer Information System (CUS) is the centrepiece of SBB's dynamic passenger information system. CUS is operated by SBB Infrastructure on behalf of the Swiss Confederation and is the real-time data platform for public transport in Switzerland.
DiDok	SKI application. The Service Centre Documentation system is the master system for managing the master data of all Swiss public transport service centres, including SBB.
DIVA	Dialogue-controlled traffic management and information system (system from MENTZ and others for journey planning and data management)
Dynamic information	Non-binding or binding availability information, which is queried in real time by the on-demand backend system. A snapshot that could expire immediately if the information is not blocked.
Real-time data	Data transmitted directly, without a time delay, which is used, for example, to inform passengers about the arrival of public transport.
EFA	Electronic timetable information (MENTZ system for timetable information).
First mile	First section between the bus stop and the front door.
Query journey	Customer information, specific enquiry about a (customer) seat reservation.
GeoFences	A boundary of an area (inside-outside) with geolocalisation. E.g. a service area.
GTFS	General Transit Feed Specification
HAFAS	HaCon timetable information system
Stop point/stop place	Can be an existing public transport stop or stop edge or a virtual stop.
HRDF	HAFAS (HaCon timetable information system) raw data format
KI	Kundeninformation in German: Customer information
KIDS	KIT working group on customer information data interfaces for public transport in Switzerland
KIT	Commission IT systems
KTU (LTC)	The term KTU (licensed transport companies (LTC)) covers all licensed public transport companies and railway infrastructure managers. A licence is required for regular commercial passenger transport and for the construction and operation of railway infrastructure. The term KTU does not differentiate between the various modes of transport and includes railways (including trams), buses, trolleybuses, ships and cableways.

Term	Brief Definition
Last mile	The last stretch between the bus stop and the front door.
Transport operator	Carriers and operators that offer (usually commercial) physical mobility services. (source: FOT - Concept paper on multimodal mobility / federal mobility data infrastructures 10 May 2021)
Mobility provider	Companies or organisations that broker and sell mobility offers and services to end customers. They take over certain parts of the contractual relationship between mobility providers and end customers, such as the combination of services, reservations or collection. Intermediaries can also be carriers and/or operators at the same time. (source: FOT - Concept paper on multimodal mobility / federal mobility data infrastructures 10 May 2021)
NADIM	The NADIM ("National Data Networking Infrastructure Mobility") comprises mobility data and IT systems that serve to use this data in a standardised way and to network users. Further information here.
NeTEx	Network Timetable Exchange (network and timetable data exchange)
NOVA	NOVA is Switzerland's public transport sales and distribution platform (ASP)
ODPCH	Opendata platform customer information public transport Switzerland
ODV	On-demand traffic. According to the report its-ch: Services where the passenger can book a trip via a booking process, often without a timetable.
Public transport (öV)	Öffentlicher Verkehr (öV) in German or public transport in English, comprises transport services with regular journeys according to a defined timetable that can be used by all persons on the basis of predefined transport regulations. In Switzerland, public transport not only includes rail, tram and bus services, but also boat and cable car services.
OJP	Open Journey Planner. Open routing backend system for calculating routes with public transport and footpaths, which was implemented by the SKI office on behalf of the FOT in accordance with the EU standard "CEN/TS 17118:2017 Open API for distributed journey planning" and is being further developed inter- and multimodally as part of SKI+. The OJP API is available at www.openmobilitydata.swiss.
öV CH (Public transport CH)	Public transport Switzerland
PAG	Postauto AG
PBG	Passenger Transport Act
Block a seat	System blocks the required space (temporarily). Must be on dynamic information.
Reserve a seat	The traveller reserves the required seat and undertakes to pay (purchase decision), same meaning as "reservation". Must be on dynamic information.
Pooling	Bundling passengers into a carpool with a common destination.
REF-AUS	Timetable information target data service (reference), daily updated target timetables for medium-term information.
RICS	Actually Railway Interchange Coding System, but is used in the sense of UIC Company Code
SBB	Swiss Federal Railways
SIRI	Service Interface for Real Time Information
SKI	Customer Information System Tasks
SLOID	Swiss Location ID --> see also: https://transportdatamanagement.ch/de/standards/
Static information	Non-binding availability information that calculates an on-demand itinerary based on static data without directly querying the on-demand backend system. (See Basics of timetable information - Approach 1). Specification of the number of travellers and/or special conditions that could have an impact on the availability of a reservation (e.g. wheelchair, bicycle, etc.). Independent of personalisation.

Term	Brief Definition
Taxis	A taxi service is defined as door-to-door passenger transport on demand that does not require a licence but is subject to the relevant cantonal and communal taxi law and the FDJP ordinance on taximeters.
TOMP, TOMP-API	TOMP-API stands for Application Programming Interface (API) from Transport Operator to MaaS Provider, i.e. programme interface from transport companies to MaaS providers. From the outset, TOMP-API was developed specifically and primarily for MaaS deep integration, i.e. the "look-book-use" business process chain. More concretely: • Planning: planning a journey from A to B by querying transport companies or route planners. • Booking: The actual booking of individual legs of the journey with the respective transport companies, with the disclosure of a small amount of personal information. • Trip execution: The realisation of the trip with all necessary travel information, e.g. tickets, QR codes, activation codes, etc. • Billing and payment between the MaaS provider and the transport company.
TU (TO)	Transport operator
Door-to-Door	Door-to-door transport services do not require stops and transport passengers directly from door to door.
VDV	Association of German Transport Companies
VDV 452	The standard format for exchanging timetable data is VDV 452 (VDV = Association of German Transport Companies). The purpose of the "VDV standard interface route network/timetable" is to transfer route network definitions and timetables from a source system to a target system
VDV 454	Bidirectional actual data interface timetable information (Verband deutscher Verkehrsunternehmen-Schrift 454), consisting of the target data service 'REF-AUS', with daily updated target timetables (reference) and the actual data service 'AUS', with actual data from operations.
Check availability	Static or dynamic information as to whether a passenger could be transported at the specified time and route without special circumstances (unplanned events, disruptions, etc.).

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