



Report 2.2.1.

Mapping of the EU-based requirements, governance and rules to implement MMTIS DR

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Author(s)	Milnael Gómez, UITP
Co-author(s)	[Fabrizio Arneodo, 5T]; [Jaakko Rintamäki, FI-FINTRA]; [Reinhard Otter, DE-NVBW]; [Brede Dammen, XNO-NPRA]; [Andreas Tryti, XNO-NPRA];
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Abstract

This report, "Mapping of the EU-based requirements, governance and rules to implement MMTIS DR", constitutes a deliverable of the NAPCORE project, a Programme Support Action funded under the Connecting Europe Facility (CEF). It aims to facilitate EU-wide coordination of National Access Points (NAPs) for the harmonized implementation of European specifications on the ITS Directive (2010/40/EU), particularly focusing on Multimodal Travel Information Services (MMTIS).



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Within the framework of NAPCORE Task 2.2, the current report presents:

1. The challenges identified for MMTIS data provision at NAPs based on discussions and experiences from countries participating in this task, and information retrieved from the previous phase of NAPCORE.
2. The development of an Excel database that maps MMTIS DR Annex data categories to specific types of services. This database serves as a guide for NAPs and National Bodies to request harmonized information from data holders across different countries.
3. Practical documentation of best practices from the OpRa standard for historical data, and the implementation of the Finnish, Germany (Baden – Württemberg), and Norwegian NAPs including their governance and approach to face the challenges identified on task 2.2.

This report will be complemented by further best practices in other countries and be the foundation for the second deliverable of task 2.2 ‘Roadmap and recommendations to increase MMTIS data provision on the NAPs demonstrated by best practices’, due December 2026.

Abbreviations

Abbreviation	Meaning
ADAS	Advanced Driver Assistance Systems
AFIA	Access to Mobility Services
AFIR	Alternative Fuels Infrastructure Regulation
API	Application Programming Interface
AVL	Automatic Vehicle Location
AVM	Automatic Vehicle Monitoring
BW	Baden-Württemberg
CCB	Change Control Board
CEF	Connecting Europe Facility
CEN	European Committee for Standardization
CKAN	Comprehensive Knowledge Archive Network
COVID	Coronavirus Disease
DATEX-II	Data exchange standard for exchanging traffic information
DELFI	National association for bundling public transport timetable data in Germany
DR	Delegated Regulation
EC	European Commission
EFA	Electronic Timetable System
ERA	European Union Agency for Railways
ERSAT	European Rail Station Accessibility Database
EU	European Union
ET	Estimated Timetable (SIRI sub-protocol)
FAQ	Frequently Asked Questions
FM	Facility Monitoring (SIRI sub-protocol)
GBFS	General Bikeshare Feed Specification
GTFS	General Transit Feed Specification
ID	Identifier
INSPIRE	Infrastructure for Spatial Information in Europe
ITS	Intelligent Transport Systems
Jernbanedirektoratet	Norwegian Railway Directorate
KPIs	Key Performance Indicators
LoS	Level of Service



MaaS	Mobility-as-a-Service
MMTIS	Multi-Modal Traveler Information Systems
MRE	Company behind printed timetables (Norway)
MSPs	Mobility Service Providers
NAP	National Access Point
NAPCORE	National Access Point Coordination Organisation for Europe
NeTex	Network Timetable Exchange
NRP	National Journey Planner
NSR	National Stop Place Registry
NSB	Norges Statsbaner (Norwegian State Railways)
OCPI	Open Charge Point Interface
Odin	Open Data in the Nordics
OpRa	Operating Raw Data and Statistics Exchange
OTP	OpenTripPlanner
PETI	Stop Place Registry in Finland
PTA	Public Transport Authority
PTOs	Public Transport Operators
RTTI	Real-Time Traffic Information
SIRI	Service Interface for Real Time Information
SIRI-ET	Estimated Timetable (SIRI sub-protocol)
SIRI-FM	Facility Monitoring (SIRI sub-protocol)
SIRI-VM	Vehicle Monitoring (SIRI sub-protocol)
SIRI-SX	Situation Exchange (SIRI sub-protocol)
SRTI	Safety-Related Traffic Information
SSTP	Safe and Secure Truck Parking
TC	Technical Committee
TS	Technical Specification
UITP	International Association of Public Transport
UML	Unified Modeling Language
VDV	Verband Deutscher Verkehrsunternehmen (German Association of Public Transport Companies)
VVS	Regional public transport app in Baden-Württemberg
WG	Working Group
XSD	XML Schema
XML	eXtensible Markup Language



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1. Introduction

This report is the first outcome of the Task 2.2, Multimodal Data Availability on the NAPs of NAPCORE (National Access Point Coordination Organisation for Europe), a technical assistance Action - funded under the Connecting Europe Facility (CEF)¹. NAPCORE gathers public authorities of all EU members states and aims at facilitating EU wide coordination of NAPs (National Access Points) for the harmonisation of the implementation of the European specifications adopted in the framework of the ITS Directive ([Directive 2010/40/EU](#)).

[UITP](#) – the International Association of Public Transport - is a partner of NAPCORE for what relates to Multimodal Travel Information Services [Delegated Regulation](#) (MMTIS)² (EU) 2017/1926 and modified by Commission Delegated Regulation (EU) 2024/490. In this role, UITP leads the development of the “Mapping of the EU-based requirements, governance and rules to implement MMTIS DR” which is addressed in this report, and carried out within Working Group 2 on Multimodal Mobility.

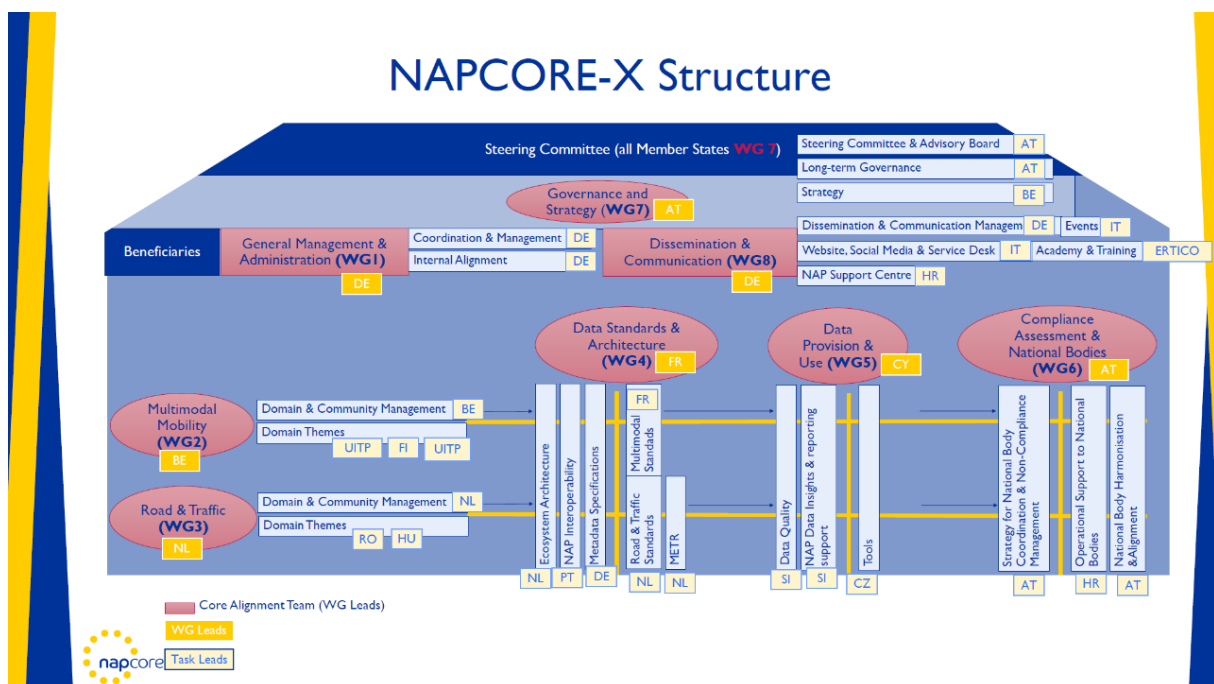


Figure 1: NAPCORE-X structure.

The first part of this task has two parts:

- MMTIS data categories Excel database:** creation of an Excel database for the MMTIS DR data categories³, with tailored data categories for different modes and services. This Excel file will be supplemented by a concise implementation report and Frequently Asked Questions.
- Stakeholder challenge analysis:** presented in this report, analysis of challenges identified by stakeholders, gathered through meetings in the second half of 2025 and findings from NAPCORE’s first phase.

¹ The CEF is a European Union fund established in 2014 for infrastructure investments (in particular the Trans-European Networks) across the union in transport, energy, digital and telecommunication projects, which aims at a greater connectivity between EU Member States.

² Commission Delegated Regulation (EU) 2017/1926 of 31 May 2017 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide multimodal travel information services.

³ Available in the Annex of MMTIS DR.



Good practices and experiences are documented in this report to address those challenges. Including the new European standard OpRa (Operating Raw Data and Statistics Exchange), and insights from NAPs MMTIS implementations and the legal regulations for Finland, Germany (Baden-Württemberg) and Norway.

A follow-up report is planned for the December 2026 to define a roadmap for increasing data provision. This roadmap aims to provide NAPs with tools to expand their data providers and catalogues, ensuring compliance with the MMTIS Delegated Regulation (DR). It will also incorporate experiences from additional stakeholders implementing national access points.

2. Challenges on MMTIS data provision

2.1. Previous NAPCORE

A review of NAPCORE's first phase deliverables identified relevant documents addressing challenges in data provision to NAPs and compliance with MMTIS DR data categories. The most relevant include:

- NAPCORE strategic position and common strategy for EU policies and developments Milestone 1.1
- Work item 2.2.1: Identification of gaps and list of requirements – Milestone 2.4
- An updated list of requirements concerning the use of data standards, profiles and metadata – Milestone 2.7
- Second & Third Report on NAP (National Access Point) Data Availability – Milestone 3.3 & 3.4
- Best Practices and recommendations for harmonised compliance assessment – Milestone 5.2
- Common quality & evaluation criteria for compliance assessment defined – Milestone 5.4
- Frequently asked questions to be published on the website of the National Body/ Competent Authority or NAP operator – WG 5.4
- Strategies and actions to address (private, international) organisations to provide data on the NAPs – Milestone 5.6
- Webinar and workshop (26/06/2024): How to accelerate the provision of data on the NAP?

Two task meetings were held to brainstorm and discuss challenges to accelerate data provision. The challenges identified are presented in the next section.

2.2. Challenges identified

2.2.1. Historic data

Purpose, retention, and usability. Clarification is needed on whether archiving previously uploaded data is sufficient for MMTIS DR Data category 1.4, or if more comprehensive solutions are required.

Data category 1.4 (historic and observed data) supports trip planning, delay calculations, and passenger compensation claims, with retention periods aligning with compensation deadlines. For infrastructure planning and machine learning-based predictions, datasets should cover at least one year (preferably 3-5) to account for seasonal and short-term effects.

The revised MMTIS DR mandates sharing historic and observed data, particularly for linking delays and cancellations to passenger rights. However, it remains unclear how historic data can effectively support calculations for trip plans, fuel consumption, and environmental factors.

The OpRa (Operating Raw Data and Statistics Exchange) standard, led by Fabrizio Arneodo was presented within the task to understand its role on historic data, the key highlights of that presentation are included on this report.



2.2.2. Cross-border data

It remains unclear whether cross-border data should be managed by one country, both, or another entity. Ensuring data provision, quality, and exchange is key for cross-border planning, but it is tied to data reliability, standardization, and proper formatting. NeTEx (Network Timetable Exchange) enables integrated cross-border datasets, but differing national profiles complicates compatibility.

The overarching goal is to ensure cross-border data meets standards to support multimodal travel information services effectively. A unified NeTEx profile is being developed in NAPCORE task 4.3. Task 2.2 will focus on best practices and facilitators to ensure cross-border data compatibility.

2.2.3. Data provision

Lack of awareness and perceived benefits among smaller stakeholders (e.g., shared mobility services), about the benefits of registering data on NAPs. Standards (e.g., NeTEx and SIRI) pose technical and management challenges, making it difficult to convince stakeholders to provide data. Emphasising legal obligations (MMTIS DR) and tangible benefits, such as increased data reuse and visibility is critical.

Limited resources, knowledge gaps, and reliance on third-party services disproportionately affect smaller players. It is proposed to share and document best practices and experiences across Member States.

2.2.4. Data update

Datasets must be updated when changes occur. Infrastructure datasets may require yearly updates, while public transport timetables (NeTEx) should be updated daily or in real-time (SIRI). Content providers and data owners are the primarily responsible for ensuring reliability and accuracy.

The MMTIS Data Dictionary (NAPCORE Task 5.3) may provide guidance, but best practices for update frequencies tailored to data types are required. Proved experiences indicating roles, and dataflow can contribute to solve it.

Automation, clear standards and profiles could reduce the burden on data providers, particularly local authorities and operators.

2.2.5. Data availability

Ensuring data availability for journey planners and other multimodal services was identified as a challenge. This includes providing data that covers all transport modes according to the MMTIS DR and addressing gaps in definitions, such as what data must be registered by different transport types. This was tackled with an Excel database indicating the data categories applicable per type of service/transport mode.

Privacy concerns also arise, particularly for on-demand transport, where live vehicle locations should not be shared during use, though parking availability and service geofences should be visible. For personal transport, ride-sharing data should be included, while for occupancy data, clarity is needed on whether real-time or forecasted data should be shared and at what level of detail. Barrier-free access points and routes must also be considered.

2.2.6. Data categories

Definitions and boundaries between planned and real-time data in rail and public transport remain unclear. There is an alignment need between standards like DATEX-II and NeTEx to improve interoperability. The Level of Service 1.4 MMTIS requirements remain unclear, and data categories applicable to shared mobility face format challenges due to complexity.



Stakeholders (e.g., small mobility service providers) lack awareness of regulations or technical knowledge to comply. Addressing this requires technical solutions and organizational support (e.g., training, tools). NAPCORE phase 1 stakeholder engagement activities provide a starting point.

These challenges were tackled with the Excel database indicating data categories applicable per service.

2.3. Actions and way forward

A methodological schema (Figure 2) outlines the approach for this task:

1. Review of NAPCORE phase 1 information, stakeholder input, and coordination with other NAPCORE-X tasks.
2. Challenges identified and presented in the previous section.

To address these challenges, two actions were developed in this deliverable:

1. Analyse MMTIS DR Data Categories to identify requirements per service type to serve as common guideline for NAPs in Europe when requesting information from data providers.
2. Document good practices and experiences:
 - Clarify OpRa's role in handling historic data
 - Gather experiences from NAPs on addressing the challenges presented.

This report includes the work developed within the Excel File to map Data Categories according to MMTIS DR, and detailed insights from [OpRa](#), the [Finnish](#), Germany (Baden-Württemberg) and [Norwegian](#) MMTIS NAP, the webinar recordings can be accessed via [NAPCORE website](#) and [YouTube Channel](#). The second report (December 2026) will include additional experiences (e.g. Austria), and propose a Roadmap and recommendations to increase MMTIS data provision on the NAPs demonstrated by best practices'.

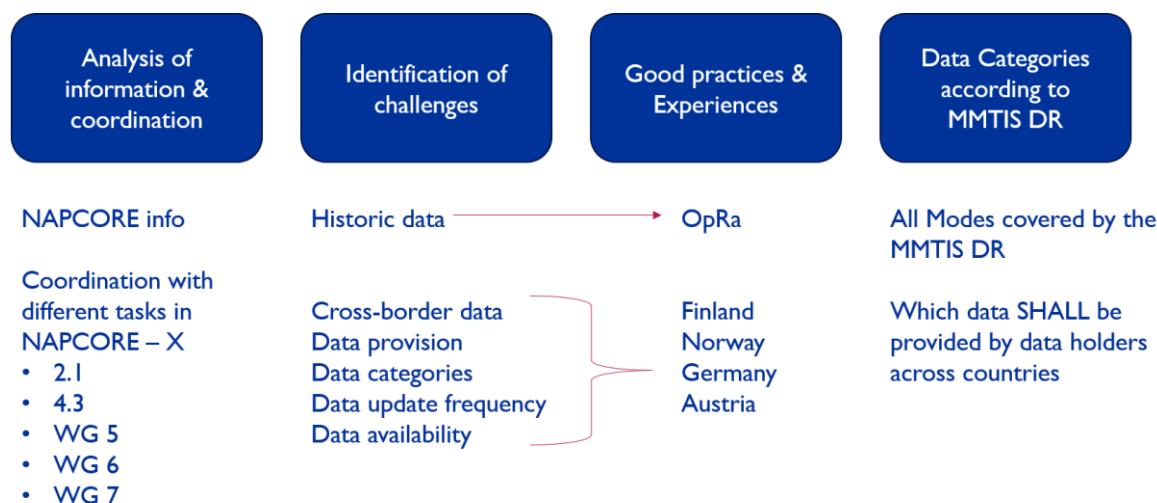


Figure 2. Methodological schema task 2.1.

3. Data Categories Excel File

As part of this deliverable, task members collaborated to map MMTIS DR data categories by transport mode in an Excel file, drawing on shared experiences and challenges across different NAPs. Table 1 outlines the covered modes.



Table 1. Modes covered on the Data Categories Excel File.

Modes covered	
Airlines	Airports
Rail (including High Speed) ⁴	
Medium and Long-distance coach	waterborne (Maritime)
waterborne (inland waterways)	Metro
Tram - Light Rail	Bus & Trolleybus
Shuttle bus or coach	Shuttle Ferry
Water Taxi	Bus on Demand
Taxi	Dial-a-ride (Individual on demand)
Shared cars - free floating	Shared cars - fixed stations
Shared cars - peer-to-peer	Rental cars
Carpooling	Bike hire
Bike sharing	E-Scooter hire
E-Scooter sharing	
Personal Car	Motorcycle & (E) - Scooter
Cycle	Walking
Parking	

On the Excel file, to check the data categories applicable for each mode follow the instructions below

1. Go to the tab "Filter Table"
2. Select a mode from the list available on cell B2
3. The applicable data categories are displayed as a table.

Column A shows the name of the data category

Column B shows the data categories applicable by this convention (you can filter this column on cell B8):

x: data that should be registered on the NAP when it is available in a machine-readable format

xx: data that should be registered on the NAP in any case, even if it is not yet available in a machine readable format

o: data that can optionally be registered on the NAP

Column C shows comments available for specific categories, mostly providing clarification or the rationale behind a category

Column D shows only for rail the mapping with the TEL TSI annex and data requirements.

To ease the implementation and dissemination of this Excel file, a document will be developed as part of the roadmap to increase data provision (expected by December 2026) based on this [NAPCORE deliverable](#).

⁴ From a legal perspective, "rail" legislation applies exclusively to the Union Rail System (SERA). Non-SERA rail systems, including Tram/Light Rail, Metro, and some suburban/regional rail systems, might follow different specifications and are not bound by the TEL TSI specifications.



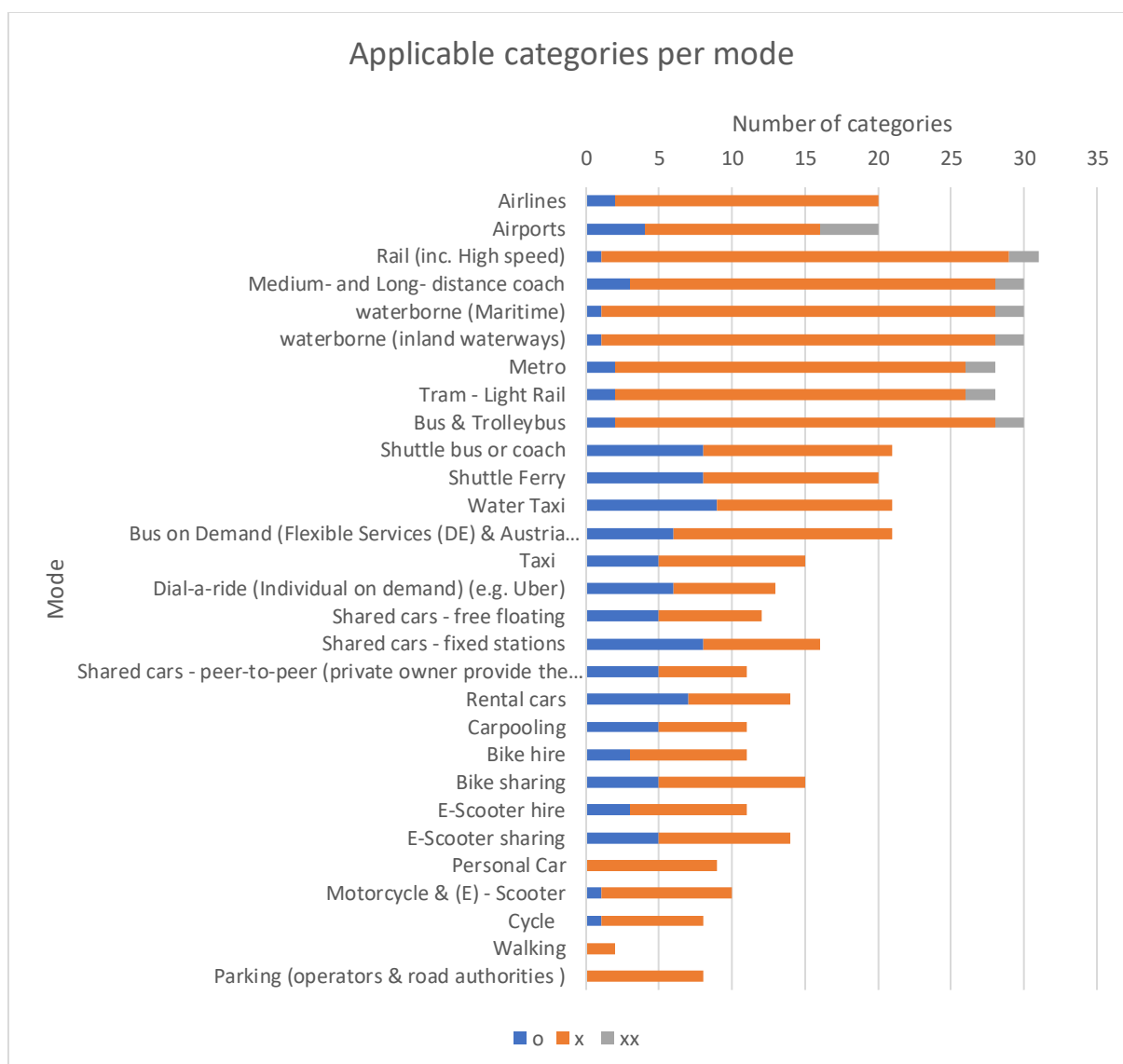


Figure 3. Applicable categories per mode.

Figure 3 shows the number of applicable data categories per transport mode. Rail (SERA), coach, waterborne, and bus & trolleybus each have around 30 categories, while walking (2), cycling, and parking (8) have the fewest. A key challenge is the gap between applicable categories and those actually reported on the NAPs. The following deliverable on this task aims to tackle this issue by providing concrete actions to increase MMTIS data availability on NAPs.

4. OpRa

The Operating Raw Data and Statistics Exchange (OpRa) is a standardization initiative, developed under the CEN/TC 278 committee within Working Group 3, focused on public transport standards. [Presented on February 2026](#) by Fabrizio Arneodo, the OpRa Coordinator, as part of NAPCORE T2.2.

4.1. The need for OpRa

OpRa fills a gap in public transport data standards. While NeTEx handles planned data and SIRI manages real-time information, there was no standardized way to exchange operational raw data — the observed events occurring during service execution. This gap made it difficult for authorities and operators to monitor performance, compare metrics across systems, or fulfil regulatory requirements



like those in the MMTIS. OpRa enables performance monitoring, regulatory compliance, and data-driven decision-making across public transport operators (PTOs) and authorities (PTAs).

4.2. Technical and standardization approach

OpRa initiative began as a CEN Technical Report in 2019 and evolved into OpRa+ project in 2023, funded by the European Commission (EC) to develop a Technical Specification (TS). OpRa will become mandatory for EU Member States once it is published as a CEN Technical Specification and integrated into the MMTIS Delegated Regulation.

Public transport operators (PTOs) and authorities (PTAs) have struggled with inconsistent data formats for performance monitoring. Without a common structure, comparing KPIs across operators or regions was challenging. OpRa defines a standardized way to represent operational raw data, including timestamps, vehicle positions, delays, and dwell times, and linking them to planned data (e.g., NeTEx).

The primary motivation is to enable quantitative performance monitoring that supports:

- Performance-based contracts, where authorities need verifiable data to assess operator compliance.
- Regulatory audits, such as those conducted by national or regional transport agencies.
- Internal improvement processes, where operators use historical data to identify inefficiencies.
- Data sharing in Mobility Data Spaces, facilitating interoperability with other systems like Automatic Vehicle Location/Monitoring (AVL/AVM), ticketing, and Mobility-as-a-Service (MaaS) platforms.

OpRa is designed to be agnostic to the underlying systems—whether data comes from onboard units, control centres, or ticketing systems, it can be structured consistently for exchange and analysis.

OpRa is compliant with Transmodel, and its Part 8 (Operations Monitoring and Control), it reuses structures from NeTEx and SIRI for its XML Schema (XSD). This approach ensures that OpRa integrates seamlessly with existing standards while adding the missing operational data layer. The UML (Unified Modeling Language) modelling for OpRa is done within Transmodel Part 8, and the physical exchange format leverages NeTEx's artifacts (e.g., <JourneyPatternRef>, <DatedVehicleJourneyRef>). The reuse of existing schemas minimizes implementation overhead for systems using NeTEx and/or SIRI.

4.3. OpRa's role on public transport service delivery & stakeholder involvement

OpRa's role within the **five phases of public transport service delivery** is presented below, showcasing how it connects planning with execution and analysis:

Strategic Planning (PTAs)	OpRa provides historical performance data to inform long-term decisions, such as network adjustments or resource allocation.
Tactical Planning (PTOs)	Operational raw data (e.g., vehicle utilization, delay patterns) helps optimize vehicle assignments and crew scheduling.
Before Travel	OpRa enables validation of planned data by comparing published timetables with actual historical performance.
In-Travel	Raw data (e.g., actual departure/arrival times, vehicle positions) is captured for later analysis.
Study and Control	This is OpRa's primary focus, where structured raw data and KPIs drive continuous improvement in service delivery.

Figure 4. OpRa role on public transport service delivery.



OpRa closes the loop between planning and execution, ensuring that lessons learned from operational data directly inform future decisions. OpRa's development has been a collaborative effort involving 58 stakeholders across 14 European countries, including PTAs, PTOs, software companies, and system integrators.

Italy and France account for nearly 70% of active stakeholders, reflecting their leadership in the project. OpRa's stakeholders include technical experts and end-users, ensuring the standard is practical, implementable, and aligned with business needs. The OpRa+ project, further expanded this collaboration by selecting experts to finalize the Technical Specification.

4.4. Use cases

There are 88 use cases in OpRa organized into six categories, each addressing an aspect of public transport operations. This taxonomy was developed based on stakeholder feedback, EU project analysis, and a methodology for grouping related indicators.

Generic High Level	Cross-cutting use cases (e.g., data format design, XSD structure).
• 9 Use cases	Metrics related to offer/supply (e.g., planned/actual seat availability, journey frequency).
Service Offer	
• 18 Use cases	Metrics related to demand/passenger usage (e.g., expected/actual passenger counts, load factors).
Service Demand	
• 17 Use cases	
Service Externality	Metrics for external impacts (e.g., emissions, safety incidents).
• 7 Use cases	
Service Economy	Financial metrics (e.g., revenue, costs, subsidies).
• 21 Use cases	Operational performance metrics (e.g., delays, cancellations, reliability).
Service Efficiency	
• 16 Use cases	

Figure 5. OpRa defined use-cases.

These use-cases are prioritized to focus on the most critical requirements (Generic high level use cases are not classified as P1, P2 or P3):

- P1 (High Priority): Use cases with high relevance for MMTIS regulation (11 use cases), mandatory for EU compliance.
- P2 (Medium Priority): Use cases relevant for contracts management and PTA governance (11 use cases).
- P3 (Low Priority): Other use cases (29 use cases), to be addressed in later phases.

P1 use cases are the focus of the current Technical Specification (TS) development. They are in different stages of competition including modelling, and XSD development. Examples include:

- OFFER-001-002/OFFER-002-002: Planned and measured fleet vehicle seats.
- EFFICIENCY-010/EFFICIENCY-011: Delay calculations and late service tracking.
- EFFICIENCY-012: Categorization of delay causes (e.g., infrastructure, weather, operator).
- EFFICIENCY-014: Reporting of cancelled journeys and reasons.

4.5. Contextual indicators: flexibility



One innovative aspect of OpRa is its contextual indicators framework. This feature addresses how to exchange non-standard KPIs (e.g., local or contractual metrics) without modifying the standard. Contextual indicators act as a placeholder within OpRa's structure, allowing producer-consumer pairs to exchange custom metrics that are not part of the EU-standardized set. For example, a city might require vehicle cleanliness scores, or a national authority might track fuel consumption rates.

To implement contextual indicators, two elements must be defined:

1. ID Tags: Unique identifiers for each custom indicator (e.g., VehicleCleanlinessClassification).
2. Regulation Context: A reference to the governing document that mandates the indicator.

Contextual indicators must reuse OpRa's Transmodel-based reference system, enabling them to link to standard entities like networks, journeys, or stop points. Contextual indicators could include: employee performance on a vehicle journey, signage quality, fuel consumption or emission levels.

4.6. Development timeline and current status

The project is part of CEN/TC 278 workstream with interdependencies between deliverables. It started in September 2023. The TS is expected to be published in September 2026, aligning with the MMTIS integration timeline. In the future the team plans to:

- Expand to P2 and P3 Use Cases: Gradually incorporate other use cases.
- Develop Implementation Guides: Provide practical guidance for PTAs and PTOs, including tender templates.
- Align with Mobility Data Space Initiative.

4.7. Adoption challenges and real-world insights

4.7.1. Italian Case Study: Early Adoption

The National Regulatory Transport Authority is incorporating OpRa principles into new transport contracts. The authority has defined 30 KPIs for public transport contracts, many of which align with OpRa's scope.

In the Milan region, a public tender now explicitly requires PTOs to provide raw data using NeTEx and SIRI Italian profiles, to enable the calculation of National Regulatory Transport Authority defined KPIs, waiting for the OpRa official TS CEN publication and MS adoption. The tender includes detailed annexes specifying which raw data must be provided (e.g., timestamps, vehicle positions, delays). National NeTEx and SIRI guidelines are publicly available for system integrators, ensuring consistent implementation. OpRa experts are supporting PTAs in drafting tenders that reference OpRa.

4.7.1. Portugal Case Study: Evolution of tenders

In Portugal the tenders have had the following evolution:

- First-Generation Tenders: Early tenders omitted critical requirements (e.g., ticketing integration, data standards), leading to interoperability issues.
- Second-Generation Tenders: Now include explicit references to NeTEx and SIRI, but adoption remains challenging due to:
 - PTO Resistance: Many PTOs prefer GTFS over NeTEx.
 - PTA Knowledge Gaps: PTAs struggle to specify technical requirements in tenders.
- Request for Guidance: a guide for PTAs on how to write OpRa-compliant tenders would be highly valuable.



4.7.2. Challenges

4.7.2.1. GTFS – Understanding of Transmodel

Even though many operators prefer GTFS due to its simplicity, GTFS lacks the structural depth needed for operational raw data (e.g., no support for duties, blocks, or detailed event logging). There is a MobilityData GTFS-based project exploring similar concepts, but OpRa remains the EU-standardized solution for historical data exchange.

Many PTAs and PTOs lack expertise in Transmodel-based standards (NeTEx, SIRI, OpRa). This is being addressed in different tasks in NAPCORE.

4.7.2.1. Data retention policies

OpRa does not prescribe retention periods, as this is governed by contracts or regulations, MMTIS requirements vary by transport mode. In Piedmont (Italy), for example, historical data is retained for 5 years due to local regulatory requirements. Flexibility is key: producers (PTOs) and consumers (PTAs) can agree on retention policies based on their needs and regulations. An additional webinar organised between CEN-CENELEC and DG MOVE took place on Jun 25th 2026⁵ to provide further clarifications.

4.8. Next steps

After the publication of the TS a set of steps could speed up the implementation of OpRa.

- PTAs and PTOs: Familiarizing themselves with OpRa's scope and P1 use cases to prepare for MMTIS compliance.
- System Integrators: Review the XSD and NeTEx/SIRI profiles to plan for OpRa integration in their systems.
- Regulators: Align national and regional policies with OpRa's framework to ensure consistent data reporting.
- NAPCORE and CEN/TC 278: Continue dissemination and training to accelerate adoption and address knowledge gaps.

5. Finland Experience

5.1. Transport Act and first NAP generation

Finland's experience was [presented](#) by Jaakko Rintamäki in February 2026. Finland's MMTIS NAP (www.finap.fi), launched in mid-2018 as a metadata catalogue, initially tracking changes in public transport (e.g., new lines, routes, trips, or service reductions). Designed as a metadata network with limited database functionalities, it prioritized implementing Finland's [National Act of Transport Services](#) and partially the [MMTIS Delegated Regulation 2017/1926](#).

Finland's open-data, free-market approach aimed to foster an API economy in mobility, making transport, sales, and booking APIs publicly available without restrictions. This strategy encouraged private innovation, reducing the public sector's burden to develop new services. The 2018 Transport Act opened Finland's mobility market, removing barriers such as permits with strict quotas or geographic restrictions (e.g., taxis and coach services). Under the new framework, any commercially viable actor could operate. The NAP and data sharing served as the "glue" for this ecosystem,

⁵ Recording and Slides are available at: <https://www.cencenelec.eu/news-events/events/2026/2026-06-25-webinar-opra/>



mandating all mobility services (publicly or commercially funded) to open their feeds and provide non-restrictive access to their booking/ticketing interfaces to third parties.

This approach catalyzed a "MaaS boom" with dozens of pilots testing open data and service integration. While minor incidents (e.g., unequal API terms) occurred, they were resolved swiftly. However, the Transport Act was standard- and technology-neutral, avoiding mandates for specific data models (e.g., NeTEx or GTFS), despite the MMTIS DR emphasis on European standards.

Finland strong pre- 2018 foundation in open transport data included:

- Early 2000s: PTAs, train, and flight data were open, with commercial data (e.g., coach services) accessible via permit registers.
- 2001: Launch of [Reittiopas](#), Finland's first digital route planner, followed by [matka.fi](#), integrating multi-modal routing.
- 2003: A centralized timetable database was established, using a local XML-based model until 2011, when GTFS was adopted nationally.

However, Finap 2018) and the centralized timetable database operated separately until 2021, creating dual data pipelines and datasets: the NAP included all commercial connections and some PTA data not in the legacy database. While source data was eventually integrated, this separation caused long standing complexities.

5.2. Challenges as reform drivers

Finland's mobility data ecosystem before 2021 reforms was fragmented (Figure 6), operators and PTAs provided separate datasets to:

- The legacy public transport database.
- Finap (the MMTIS NAP).
- Directly to route planners (e.g., DigiTransit, Finland's national route planner based on OpenTripPlanner).

This meant that major players maintained three different feeds, often with inconsistent data across services. Additionally, hundreds of smaller service providers—from taxi services to harbour operators and parking schemes—were offering metadata and APIs to the NAP but were not operationally connected to the public transport database or DigiTransit.

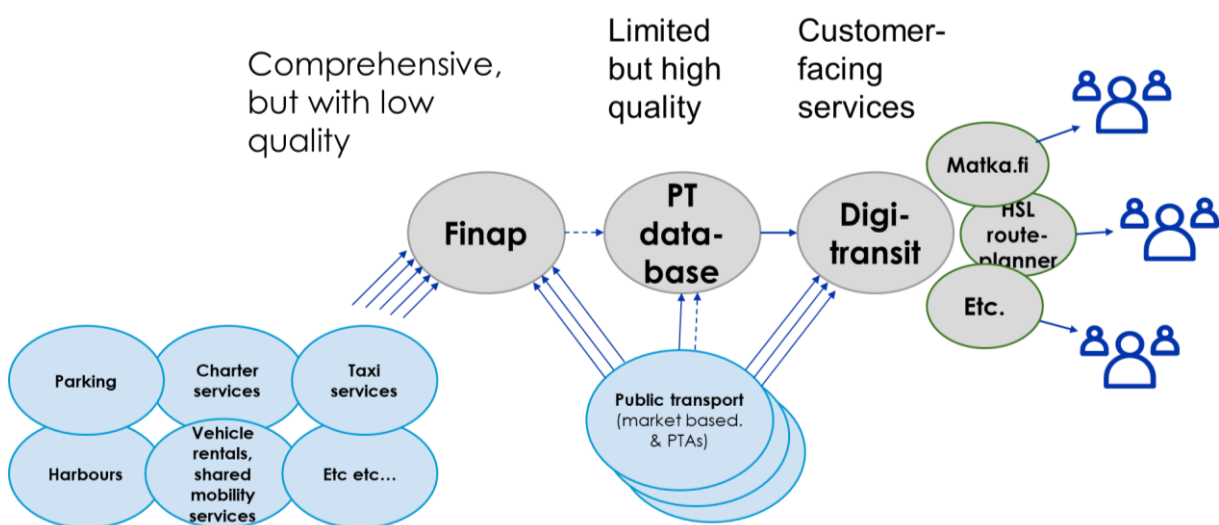


Figure 6. Legacy Service Entity and Data Flows.



The main issues driving the need for change included:

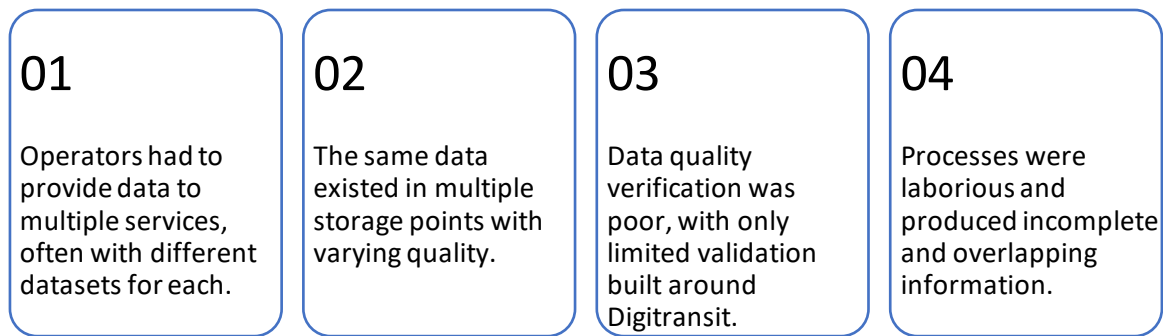


Figure 7. Issues drivers for change.

5.3. New NAP vision and structure

In 2021–2022, Finland initiated a concept project to address these challenges. The new vision (Figure 8) involved a streamlined national MMTIS core service with the following workflow:

1. Data input through:
 - APIs (for static and real-time feeds)
 - Manual editing tools (for publishers digitizing their information)
2. National validation pipeline to check the base quality of data publications.
3. National data warehouses containing master data related to mobility services.
4. Data delivery points providing:
 - Developer services
 - Reports and analytics

While Fintraffic's role includes some end-user services, the primary responsibility for these remains with PTAs and commercial mobility service providers.

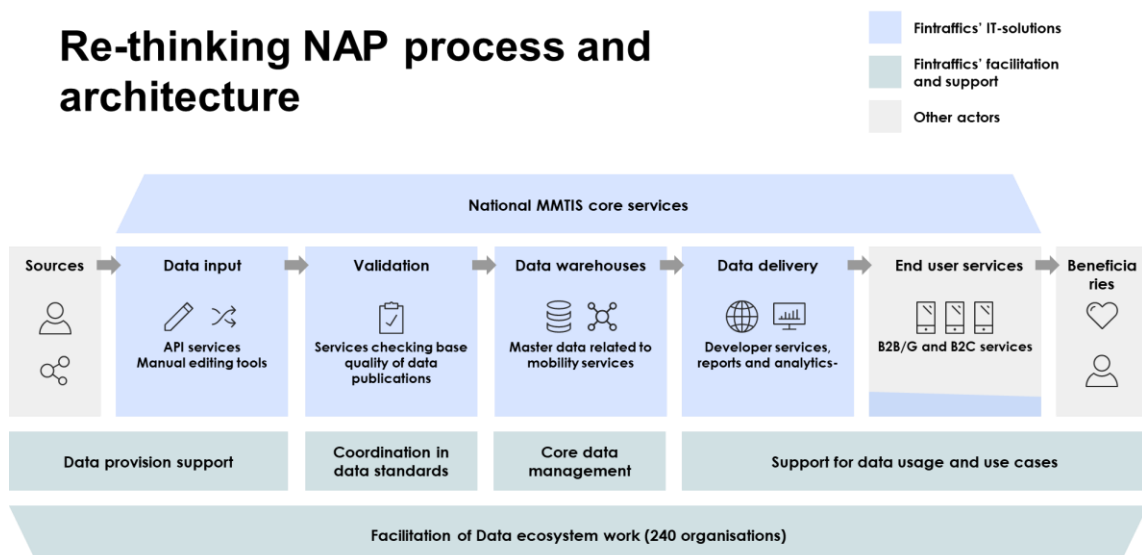


Figure 8. Finland new NAP process and architecture.

Key national services supporting the new architecture (detailed on Annex, Section 9.2) were funded by reallocating existing budgets. For example, the new Mobility Database (supporting also micro-mobility



and historical data) was financed by ending an old contract with the legacy public transport database. This allowed Fintraffic to modernize its infrastructure without a significant budget increase.

5.4. Finland's approach to challenges identified on task 2.2

Data availability for local public transport, flights, ferries, and trains have strong coverage for most MMTIS data categories including location search, trip plans and real-time. However, taxis, carpooling, parking, and rentals show gaps, particularly in real-time data, fares, and historic data.

Historic data became available through NAP APIs in March 2025 via the Mobility Database, including static data, real-time disruptions and delays. This data supports passenger rights regulation, transport system development, and R&D. While all disruptions and delays meeting EU passenger rights regulation thresholds are currently stored, a final decision on whether to retain data for 12, 24, or another number of months is expected in 2026.

Cross-border data is available for ferries and coaches (though the Helsinki–Saint Petersburg train connection was suspended indefinitely in winter 2022). Cross-border travel primarily relies on flights and ferries, with routes to Estonia, Sweden, Poland, and northern Germany.

Traficom is the national body and authority supervising data provision and NAP operations. The Traffic Data Ecosystem acts as a coordinated development and best practices sharing platform. Stakeholder are responsible for providing data as specified in the MMTIS. With static data typically provided as a direct feed links and real-time data usually accessible via the publisher's developer portal.

Under Finland's approach, operators and authorities are required to share booking and sales APIs and offer integrations with other services (e.g., public transport, taxis, trains, flights, car rentals) under non-restrictive terms. However, these commercial APIs lack standardization, leading to varied implementations. Static data is updated daily or when new versions are available. Real-time data updates approximately every 5 seconds. NAPs and catalogues provide links to data sources, though public transport and micro-mobility data is also stored in the Mobility Database.

5.5. Additional modes, additional challenges

Taxi data provision and availability remains a challenge. Despite having thousands of taxi companies registered in metadata and sharing their prices—and some larger operators sharing dispatch or sales APIs—there are no use cases of NeTEx in taxi data.

While dispatch APIs are open, data models in the taxi sector are disperse. In publicly funded services, various implementations use different forks of the Nordic SUTI (Standardized Utilization of Transport Information) standard. There are concerns about forcing NeTEx compliance on the taxi sector, given its dynamic and business-specific nature.

Benefits and use cases for applying a relatively static standard like NeTEx to highly dynamic services (including shared cars, e-scooters, and bike-sharing schemes) need to be clarified, this remains an open question for discussion.

Parking data is a major gap in Finland's ecosystem. Around 95% of data publishers for parking facilities and on-street parking are missing from the national system. The sector is a "wild mixture" of:

- Municipalities
- Publicly owned (or partially publicly owned) parking companies
- Parking apps (which, in some cases, hold the only source of digital on-street parking data)



Dozens of municipalities lack the systems to publish on-street parking data digitally, while two or three parking apps may hold the data for entire regions. This creates a fragmented landscape where data exists in proprietary systems but is not integrated into the NAP. Addressing this gap is a priority for 2026–2027 under the new legislative framework.

5.6. New legislative framework: Act on Information Services for the Transport System

The [Act on Information Services for the Transport System](#) ([Act on Finish only](#)) came into force on January 1, 2026. The main goal is to establish a more unified basis for the interoperable deployment of ITS and the utilization of transport-related information. The act addresses issues with existing laws, including the Transport Act, and the Law concerning digital systems on roads. Key improvements are:

- Data requirements and standards implemented from the [ITS Directive](#).
- Clear responsibility for data holders/producers to deliver data.
- Defined national responsibilities:
 - Fintraffic as the national operator and coordinator.
 - Traficom as the national body and authority.

Additional requirements:

- Creation of national databases for selected datasets.
- Clear scope for other ITS Directive-like national data to remain open (primarily through [digitraffic.fi](#)).
- Enforceable with fines (administered by Traficom).

5.6.1. System Architecture and SingleNAP Development

The new system architecture (Figure 9) includes:

The SingleNAP (2026) that will replace the current RTTI/SRTI and MMTIS NAPs and is based on the existing Traffic Data Catalogue (a CKAN-based mobility data catalogue).

National databases:

- Alternative fuels (AFIR) (e.g., electric charging points, with implementation underway).
- RTTI and SRTI real-time hubs for street and road network messages.
- Mobility Database (for public transport and micro-mobility data).
- Stop Place Registry (PETI): Requires all stop places to have a single national ID, and is interconnected with the Mobility Database as part of master data requirements.
- Road & Street national data.

Developer and re-user services, APIs for third parties (primary focus).

End-user services, limited scope (e.g., Fintraffic mobile app, traffic situation app).

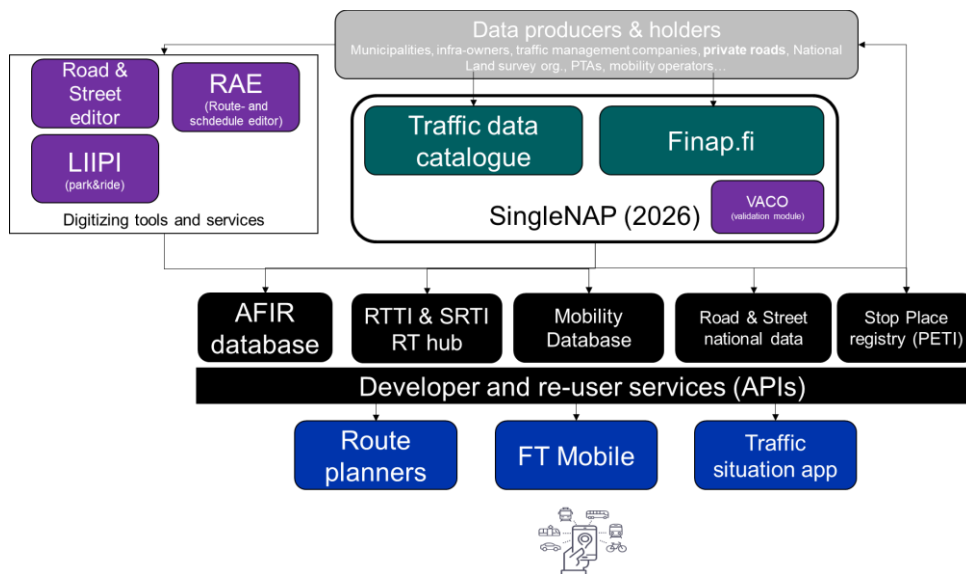


Figure 9. System Architecture and SingleNAP proposed.

The new legislation was primarily based on the ITS Directive, the TAP TSI (Telematic Applications for Passenger Services) was not a major consideration during its development. However:

- Fintraffic (which includes a rail division) has historically published mandatory rail data.
- The new national Stop Place Registry incorporates the ERSAT (European Rail Station Accessibility Database) as part of its base registry.

The legislation doesn't address the European Union Agency for Railways' (ERA) role as repository for rail telematics data. However, Finland will comply with future requirements, such as the mandatory application of organization codes, location codes, and code lists for ticketing expected from 2029.

5.7. Next steps

Legislation alone is insufficient—effective communication and instructions are essential to ensure data is published. Old national processes persist even when their flaws are widely recognized, and changing them requires cooperation and authoritative leadership. Fintraffic's Key Undertakings for 2026:

1. SingleNAP Development:
 - Concept plan and development for a unified NAP covering RTTI, SRTI, MMTIS, SSTP, and AFIR.
 - Will replace the existing MMTIS NAP at www.finap.fi.
2. New National Stop Place Registry Onboarding:
 - Implementation of national IDs for all stop places.
 - Ensuring all actors use the same identifiers for interoperability.
3. Redesign of Road & Street Data Processes:
 - Making road and street data pipelines more compliant with RTTI standards.
 - Addressing legacy processes similar to those previously identified in MMTIS data.
4. Unified Identity and Access Management:
 - Implementing ADAS-compatible (Advanced Driver Assistance Systems) access management for NAP services.

These initiatives will streamline Finland's mobility data ecosystem, improve interoperability, and ensure compliance with European and national regulations. The focus remains on collaboration, standardization, and scalability to support the growing needs of Finland's transport sector.



6. Germany – Baden Wurttemberg (BW)

6.1. MobiData BW

[MobiData BW](#) (open data platform for mobility data) is a multi-modal mobility data platform operated by a state-owned company on behalf of the Ministry of Transport of Baden-Württemberg. Its core mission is to serve as a central hub for mobility data, including MMTIS, AFIR (Alternative Fuels Infrastructure Regulation, data on charging infrastructure), public transport, road infrastructure, and shared mobility services (Figure 10). The platform promotes sustainable mobility by leveraging open data and fostering innovation through collaboration with municipalities, transport providers, and private mobility stakeholders. The team, is divided into:

- Networking and Innovation Management: Focuses on data acquisition, stakeholder engagement, and application development.
- IT & Data Platform Development: Collaborates with external developers to enhance data integration and system interoperability.

To support stakeholders, MobiData BW organizes Workshops, produces fact sheets [on data provision](#), [formats](#) and [checklists](#), and helps municipalities audit and catalogue their mobility datasets- many of which are often underutilized or overlooked. The platform demonstrates how open data can improve local mobility services, and encourages providers participation. For instance, shared mobility operators gain increased visibility in multi-modal apps like VVS or bwegt (local, regional public transport apps).

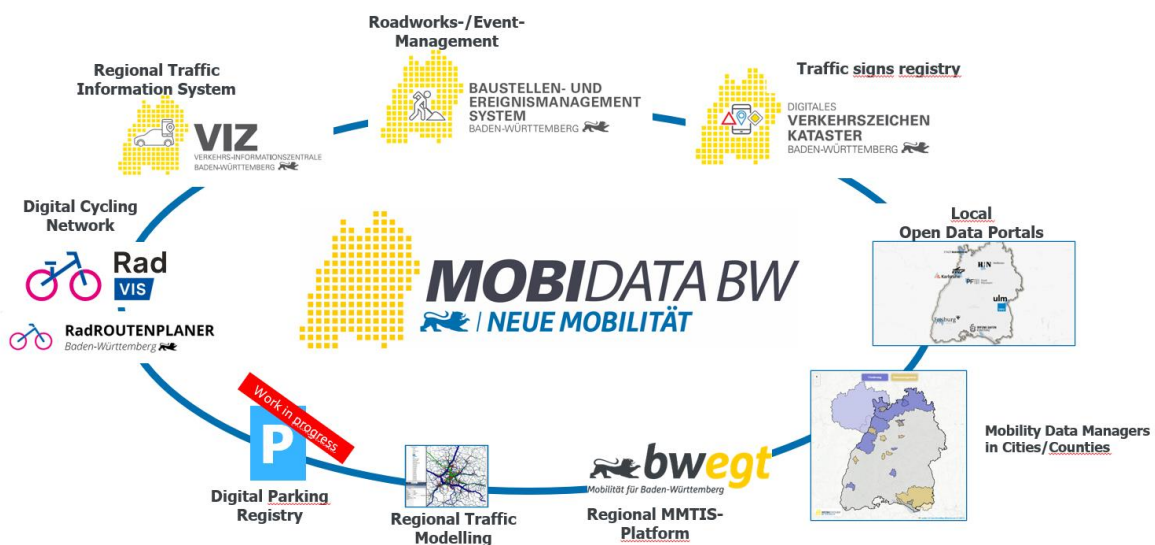


Figure 10. Mobility data network in BW.

MobiData BW simplifies complex regulations into [practical guidelines](#) for mobility providers (e.g., city administrations, transport companies, and private operators) ensuring compliance while reducing administrative burden.

The platform operates within Baden-Württemberg mobility ecosystem, including:

- Public transport administration (e.g., tariffs, timetables).
- Sustainable mobility initiatives (e.g., cycling, walking, climate-friendly urban planning).
- Digital mobility administration (e.g., autonomous driving, car-sharing, mobility data governance).



The 2022 Digitalization Strategy ([Digital.länd](#)) and the [2025 Federal Mobility Act](#) provide the legal foundation for MobiData BW. Key provisions include:

- **Mandate for Open Data:** Mobility data relevant to public use must be gathered and made available via a state-owned platform.
- **Delegated Regulations:** Data must comply with EU and federal laws.
- **Federal State Autonomy:** Baden-Württemberg's approach is independent of political changes, ensuring long-term stability.

MobiData BW collects, standardizes, and disseminates mobility data from municipalities, districts, public transport providers, and private services under three pillars (Figure 11). It serves as digital infrastructure and data access point for Baden-Württemberg, providing bundled datasets to the NAP. The NAP does not store data, but redirects users to the agency or data owner. Large cities with advanced strategies may publish directly to the NAP, public transport data is handled via [DELFI](#).

3 Pillars of MobiData BW

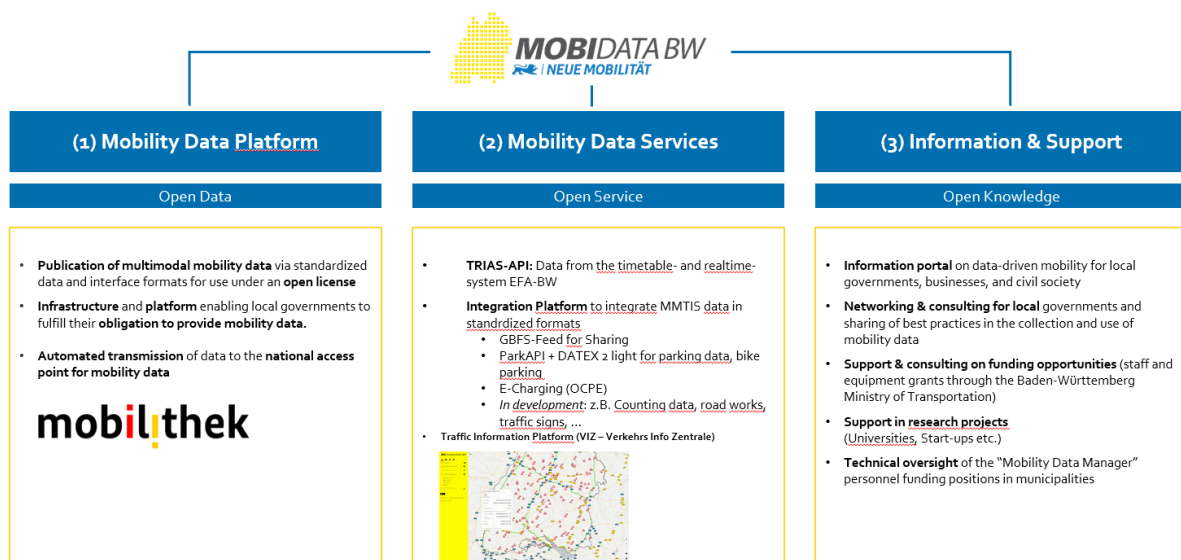


Figure 11. MobiData BW pillars.

6.2. Technical architecture

MobiData BW functions as an open-source, modular integration platform that:

1. Aggregates heterogeneous data from diverse sources (e.g., public transport, shared mobility, parking, roadworks, cycling networks).
2. Standardizes formats to ensure interoperability.
3. Provides unified APIs for developers, researchers, and transport operators.

The platform does not develop end-user applications, instead it enables third-party apps (e.g., regional transport apps like [VVS](#) and the statewide platform [bwegt](#)) to access consolidated data. The open source and data principles are presented on the Annex (Section **Error! Reference source not found.**)

The platform follows a 6-stage workflow for each dataset:

- **Data Input:** Heterogeneous sources (APIs, XML, CSV, Excel sheets, etc.).
- **Input Services (Converters):** Transform raw data into internal formats (e.g., mapping attributes, decoding proprietary formats).



- Data services: Uses existing formats (e.g., GBFS for shared mobility, OCPI for charging points).
- Storage services: Stores processed data.
- Output Services: Converts data into standardized formats (e.g., GBFS 2.3/3.0, GeoJSON, GraphQL).
- Data output: Provides access via GeoServer, GraphQL, or direct API calls.

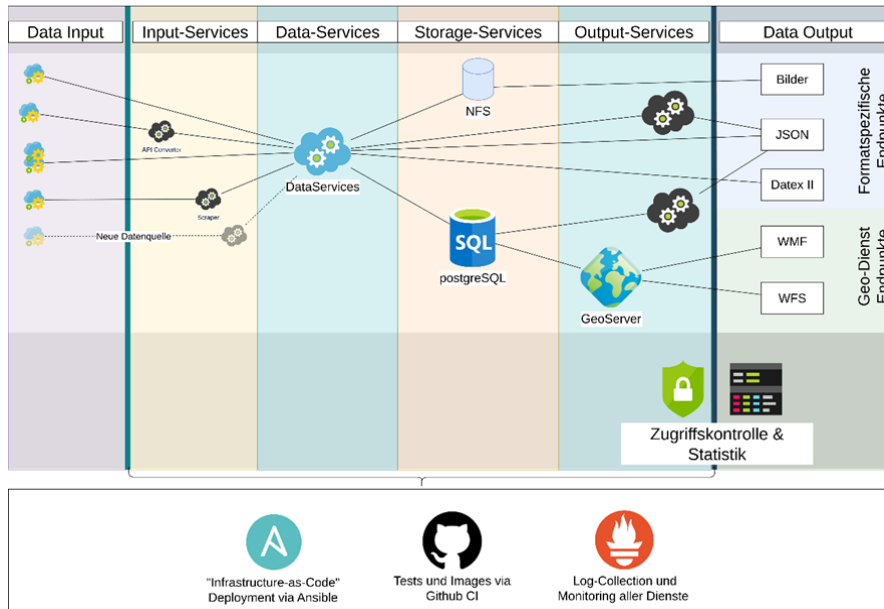


Figure 12. 6 stage workflow – the Engine Room

6.3. Modes and data under MMTIS

MobiData BW ensures coverage MMTIS relevant modes, even if some providers do not contribute data yet. The platform reaches out to stakeholders (e.g., smaller shared mobility operators) demonstrating data sharing benefits and providing technical integration support.

Data is freely accessible via the [Data Catalog](#) and [Integration Platform](#) and covers:

- Public Transport: Timetables, real-time vehicle positions, disruptions, and accessibility data.
- Shared Mobility: Car-sharing, bike-sharing, e-scooters, and ride-pooling services.
- Parking: Static (e.g., locations, capacities) and dynamic (e.g., real-time occupancy) data for both public and private parking facilities.
- Charging Infrastructure: Real-time availability and static data for e-vehicle charging points.
- Road Infrastructure: Traffic counts, roadworks, and speed limits.
- Cycling Networks: Bike lanes, bike parking, and bike-and-ride facilities.

The data is updated accordingly to data type and source:

- Static Data is updated when major changes occur, such as biannual timetable shifts, with ad-hoc updates processed within 24–48 hours.
- Dynamic Data is updated continuously (e.g., every 30–60 seconds for public transport, 5–10 minutes for parking).
- Semi-Static Data (e.g., fleet locations) is updated daily or weekly, based on the provider's capacity.

6.3.1. Historical data



MobiData BW retains historical data to support operational planning, predictive analytics, and passenger claims. Storage periods vary by data type and use case:

- Public transport delay data is archived for predictive modelling of future disruptions and to comply with [Regulation 454/2011](#), which requires historical data for compensation claims.
- Traffic count data and roadwork histories inform infrastructure planning and traffic management strategies.
- Real-time data (e.g., vehicle positions, parking availability) may be retained for short-term analysis, while static data (e.g., timetables, infrastructure maps) is often stored indefinitely for long-term planning.
- The event management system, introduced in 2025, logs historical events (e.g., disruptions, accidents) to improve real-time data accuracy and system resilience.

6.3.1. Cross border data integration

Cross-border data exchange for public transport and road infrastructure is considered by MobiData BW. The platform integrates timetable data from neighbouring regions, such as France's Grand Est, Switzerland, and Austria, into its Electronic Timetable System (EFA), enabling multi-modal routing for passengers. For example, a journey from Freiburg (Germany) to Basel (Switzerland) can be planned using consolidated data from German and Swiss transport providers.

MobiData BW collaborates with DELFI, Germany's national association responsible for bundling public transport timetable data. While DELFI handles line-based public transport data, MobiData BW complements this by providing regional data (e.g., shared mobility, parking) to ensure a comprehensive mobility picture. However, cross-border data sharing for non-public transport modes remains an area for future development.

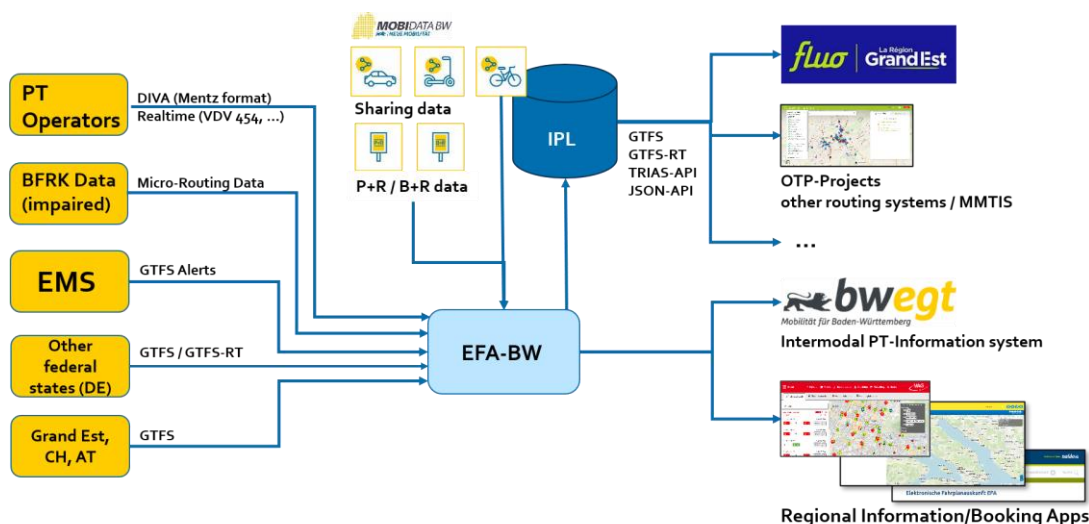


Figure 13. Data flow from PT and other modes at MobiData BW.

6.4. Stakeholders



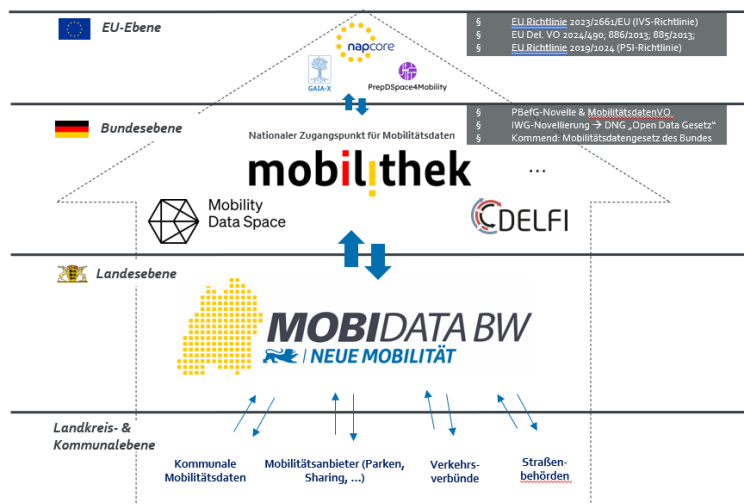


Figure 14. MobiData BW role and relationship with NAP- Mobilithet.

The governance of mobility data in Baden-Württemberg involves:

BW Ministry of Transport	Sets legal and strategic frameworks, funds MobiData BW's operations.
MobiData BW:	Technical and operational hub, responsible for data acquisition, standardization, and dissemination. Engage with stakeholders to ensure data quality and adoption.
Municipalities and Local Administrations:	Provide data (e.g., parking, roadworks, cycling infrastructure) and use MobiData BW's tools (e.g., interactive maps, APIs) for local mobility planning.
Public Transport Operators:	Provide timetable and real-time data (e.g., via NeTEx, SIRI) and integrate MobiData BW's datasets into their apps (e.g., VVS).
Private Mobility Providers:	Contribute shared mobility, parking, and charging data. Benefit from increased visibility in multi-modal apps.
Developers and Researchers:	Consume data via APIs and provide feedback to improve data quality and usability.

Figure 15. Stakeholders involved in mobility data in Baden Wurttemberg.

6.5. Challenges and future outlook

6.5.1. Challenges

MobiData BW faces heterogeneous data formats from providers require the development of custom converters, adding complexity to the integration process. Scalability is another hurdle, the platform must balance regional bundling with local granularity need. Ensuring data quality, particularly for real-time information like parking availability and charging point status, remains a priority. Legal clarity is limited, federal systems are defined but detailed implementation guidelines are lacking, leaving room for interpretation. Finally, stakeholder adoption is a challenge, as small municipalities and private providers often lack the resources or awareness to contribute data effectively.

6.5.2. Future priorities

MobiData BW's future priorities focus on expansion, collaboration, and innovation. The platform aims to expand data coverage by onboarding more municipalities and private providers, particularly in underserved areas. Real-time data for traffic counts and passenger counting will enable more



This project has received funding from the European Commission's Directorate General for Transport and Mobility under Grant Agreement no. 101234721 — 25-EU-TG-NAPCORE-X — CEF-T-2025-TAGENDG

sophisticated applications, such as predictive analytics. International collaboration with NAPCORE and other federal states is essential to harmonize data formats and standards, ensuring interoperable mobility data network. Compliance with EU standards, will facilitate cross-border data exchange. Finally, MobiData BW is exploring scalability solutions, like federated data models, to balance regional consolidation with local customization.

7. Norway

7.1. Entur's value chain

This [presentation](#) explored how Norway implemented MMTIS, open data, and open services through collaboration between the transport sector and public authorities, and Entur's role in building a national infrastructure that delivers consistent, reliable travel information across apps and channels.

Entur is a state-owned company founded in 2016 with the mission to "work together to enable simple, sustainable journeys." As of 2026, it employs ~500 people, (~290 work in digital solution development). Its governance involves the Norwegian Government (direction), the Ministry of Transport (funding and oversight), and the Norwegian Railway Directorate (Jernbanedirektoratet) (regulatory oversight). Entur aligns with MMTIS open data requirements, and national transport policies. The presentation was delivered by Brede Dammen (Head of Journey Planner and Mobility), and Andreas Tryti, (Team Lead for Journey Planner and Mobility). Andreas led the technical aspects of the National Journey Planner (NRP) and data systems integration.

Entur's value chain (Figure 16) focuses on creating a unified mobility data ecosystem, replacing the previous fragmented landscape of mode- or operator- specific apps.

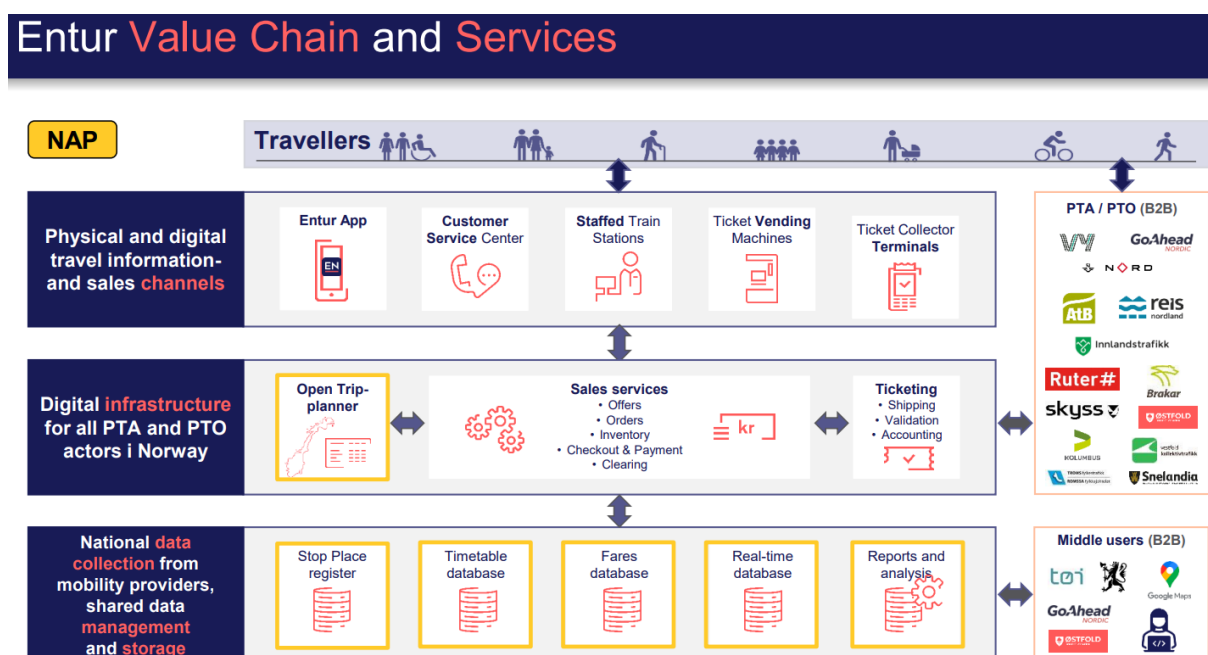


Figure 16. Entur Value Chain and Services.

Data Sources and Infrastructure:

- NAP: Central hub for data, including the Stop Place Registry, Timetable Database, Fares Database, Real-Time Database, and Analytics/Reporting systems.
- Digital Infrastructure: Includes Open Trip Planner (OTP), sales services, and ticketing systems.



User Layers :

- Travelers: Access data through the Entur App, customer service centres, staffed train stations, ticket vending machines, and handheld devices used by train staff.
- PTAs/PTOs: Include operators like Vy, GoAhead, NORD, AtB, Ruter, Skyss, Brakar, and others.
- Middle Users (B2B): Agencies and organizations that consume data for their own services.

Entur's platform allows access at three levels:

- Raw data (bottom layer) for developers and technical users.
- Service-level APIs (middle layer) for easier integration.
- Customer-facing channels (top layer) for end-users.

Data is accessible to all stakeholders, from raw feeds to user-friendly APIs and public-facing apps.

7.2. From 1869 to 2017' railway reform

Norway's national transport data system began in 1869 when book dealer Albert Cammermeyer launched *Norges kommunikasjoner* (Norway's Communications), a bi-weekly publication consolidating steamboat and railway timetables. It later evolved into *Rutebok for Norge* (Timetable for Norway), a quarterly phonebook-style catalog where operators were legally required to publish their timetables, with costs calculated per millimeter of display space.

By the early 2000s, Norway faced a highly fragmented data ecosystem with:

- Nearly 400 different data sources, each using the Norwegian format in inconsistent ways.
- Manual reconciliation was required daily, as the same data field often had different meanings across sources.

In the 2010's 20 regions (counties) each took responsibility for public transport data in their area, leading to the adoption of regional planning tools, which reduced the number of data sources from ~400 to ~60. However, private operators, cross-regional operators, railways, air services, and some ferries remained as individual data sources outside the regional structure.

In 2017 the Norwegian government reformed the railway sector, splitting the state-owned NSB (Norges Statsbaner) into separate companies:

- Bane NOR (rail management)
- Spordrift (rail maintenance)
- Mantena (rolling stock administration)
- ENTUR (information & ticketing)

This reform introduced competition in rail operations, with four railway operators serving Norway.

7.3. The National Journey Planner (NRP) Project

The National Journey Planner (NRP) project was a government-funded initiative aimed at:

- Building a new, neutral national journey planner.
- Developing infrastructure for all relevant data.
- Helping PTAs/PTOs improve data quality.
- Providing new opportunities for the sector.

The project was funded by The Ministry of Transport, owned by the National Public Road Administration, and led by Ruter (Oslo's PTA). Additional project partners included NRI (the company



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behind printed timetables), all PTAs/PTOs, railway operators, infrastructure managers, air transport providers, and all county representatives.

In 2015, the project team spent a year on analysis and strategic planning, leading to three decisions that paid off and set the stage for Norway's success in transport data management.

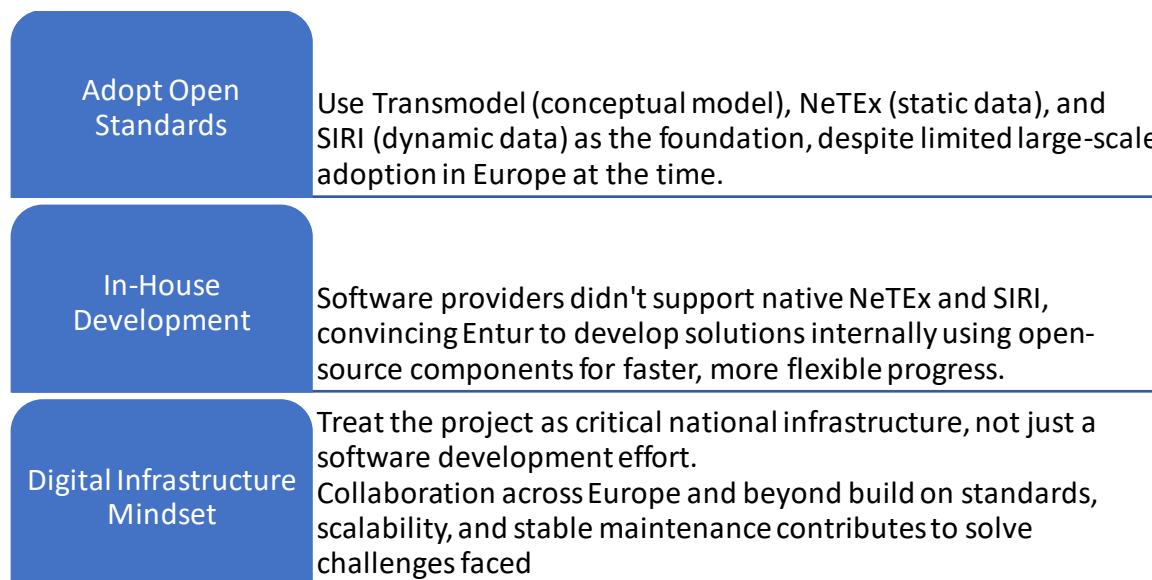


Figure 17. Norway's NRP strategic decisions 2016.

The following figure shows the timeline of milestones for NRP.

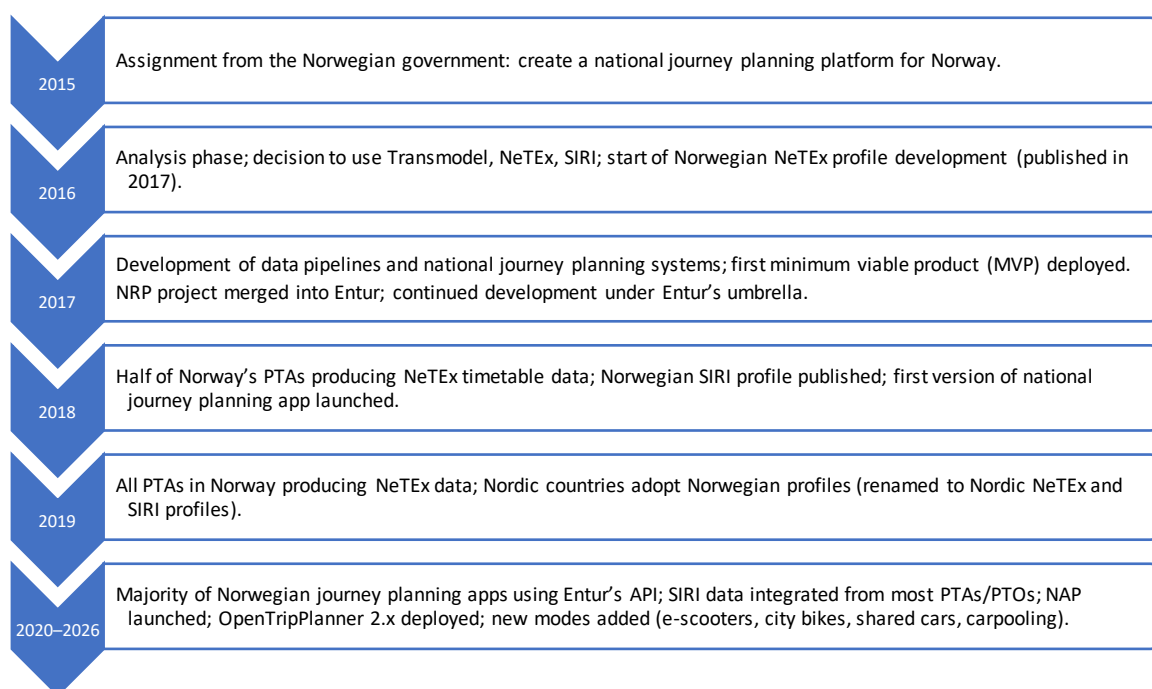


Figure 18. NRP Table of Milestones.

The core development team of the NRP consisted of 10 people from 2015 to 2025, scaling up only recently. All tools developed are open-source, making it easier for other countries to replicate Norway's success.

7.4. Standardisation



This project has received funding from the European Commission's Directorate General for Transport and Mobility under Grant Agreement no. 101234721 — 25-EU-TG-NAPCORE-X — CEF-T-2025-TAGENDG

A core challenge in building a national transport data platform was establishing common terminology and concepts. Questions like *"How do you describe a StopPlace?"* or *"How do you update a real-time forecast for a journey?"* became complex when multiple parties needed to exchange data consistently. The Need for Common Standards has highlighted by:

- Terminology: Even in a small country like Norway, different regions had widely different definitions for the same concepts, making data exchange difficult.
- Exchange Formats: A common way to exchange data was essential to avoid national or sector-specific formats.
- Avoiding Duplication: Since all Nordic countries were solving the same problems, a harmonized approach was necessary to enable collaboration and data exchange.

To address these challenges, ENTUR works with three standards:

1. Transmodel: The conceptual data model for defining transport concepts.
2. NeTEx (Network and Timetable Exchange): The exchange format for static data (timetables).
3. SIRI (Service Interface for Real-Time Information): The exchange format for dynamic data (real-time updates).

7.5. Nordic profiles

To ensure consistency, Entur developed Nordic profiles for NeTEx and SIRI. The Nordic profile was a result of the French made extensions to the UK profile, Norway extended the French and collaborated with the French experts, in the Odin (Open Data in the Nordics) collaboration it was agreed on making a joint Nordic profile by extend and change the Norwegian profile and establishing the Change Control Board (CCB). The CCB develops and maintains the Nordic Profile by members from Denmark, Finland, Norway and Sweden. When this profile is adopted by other countries Entur hopes to extend CCB membership.

7.5.1. Nordic NeTEx Profile

The Nordic NeTEx profile is a living document that specifies which parts of the NeTEx standard are used in Norway. It defines frames, objects, fields, and values required for Nordic use cases. It explicitly clarifies how data should be interpreted. It is backward-compatible, allowing for continuous expansion and revision. Documentation available in English [Nordic NeTEx Profile](#).

7.5.2. Nordic SIRI Profile

The Nordic SIRI profile scopes the data needed for Nordic use cases. It Defines protocols for:

- ET (Estimated Timetable): For real-time estimates. Documentation: [SIRI ET](#).
- VM (Vehicle Monitoring): For positioning data. Documentation: [SIRI VM](#).
- SX (Situation Exchange): For deviation messages. Documentation: [SIRI SX](#).

The future expansion will include FM (Facility Monitoring).

7.6. Dataflow architecture and governing principles

The dataflow architecture at ENTUR is presented in Figure 19 jointly with its five governing principles. ENTUR's data flow architecture is designed to be simple, efficient, and transparent. Any party operating public transport in Norway must fulfil three requirements:

1. Stop Place Registry



- All stops must be correctly registered in the National Stop Place Registry (NSR), a fully NeTEx-based system containing ~70,000 stops (bus, rail, ferry, boat, airport, tram, etc.).
2. Timetable Data Exchange
 - All timetable data must be exchanged in the Nordic NeTEx profile.
 - Legal requirement: Data must be provided at least 120 days in advance.
 - Automated validation: Entur applies extensive validation to ensure compliance with:
 - i. NeTEx standards
 - ii. Nordic profile rules
 - iii. Logical consistency
 - The validation scheme has tightened over time, it is a quality gateway for incoming data.
 3. Real-Time Data Exchange
 - All PTAs/PTOs must exchange real-time data via SIRI protocols (ET, VM, SX).
 - Automated validation is also applied to real-time data in ENTUR's real-time hub.

Validated data is fed into an OTP instance for data processing, which maintains a complete overview of Norway's public transport network. For distribution, ENTUR provides an open API for journey planning, used by ~10–15 major journey planning apps in Norway. This creates a national back-end system, ensuring all users receive the same, reliable information.

Dataflow

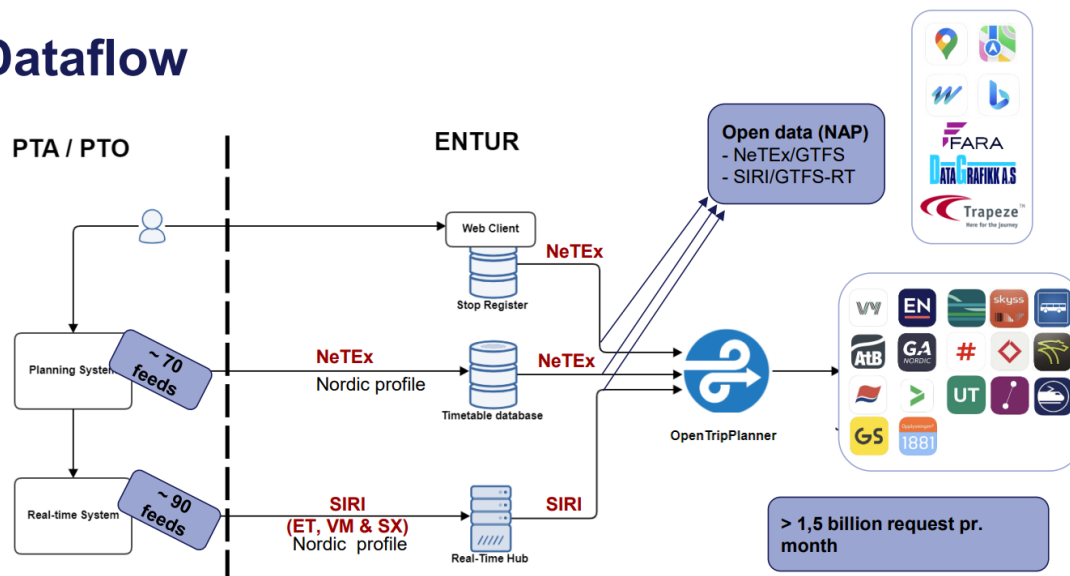


Figure 19. Feeds dataflow - ENTUR.

All collected and validated data is openly available at Norway's NAP. The scale of the system includes:

- ~70 timetable data feeds
- ~90 real-time data feeds
- ~1.5 billion API requests per month

ENTUR follows a "NeTEx and SIRI first" strategy, maintaining these standards throughout the internal platform. GTFS and GTFS-RT conversion occurs only at the NAP for compatibility with mapping systems (Transit App, Citymapper, Apple, Google Maps, etc.).

Five core principles have guided ENTUR's development of the dataflow presented above from its inception. These principles (Figure 20) have been instrumental in creating a trusted and efficient digital infrastructure that serves Norway's transport sector effectively.



Follow Defined Standards End-to-End

No data conversion is performed, as it inevitably degrades quality.

The public transport industry often converts data between national or vendor-specific formats. Entur avoids this to maintain data integrity.

All Data Should Be Visible/Available Throughout the Whole Platform

No "black box" elements—data providers can trust how their data is handled.

Full transparency in all processes.

Self-Service and Automation

Feedback loops and no manual steps in the platform.

Ensures efficiency and consistency.

No Compensation for Missing Data Quality

Entur does not fix broken data at the platform level. Instead, it helps data providers correct errors at the source.

Entur provides validation reports and quality dashboards to facilitate understanding to providers and help them improve their data.

All Data and Services Shall Be Openly Available

Low threshold for access—APIs are free to use with no registration required for basic usage.

Critical national infrastructure status ensures stability and reliability.

Figure 20. Principles guiding ENTUR dataflow.

7.7. National Journey Planning & collaborative approach

ENTUR's national journey planning system uses a OpenTripPlanner instance and API to handle both local transport authority needs and cross-regional queries. This approach gives end-users a seamless view of the transport network as one integrated system. The API's flexibility allows:

- Simple trip planning
- Complex multimodal journeys
- International contexts

The system's validation and quality control ensure high-quality data is used for journey planning, resulting in reliable and accurate travel information.

Data quality is key for ENTUR, with emphasis on transparency and continuous improvement. Therefore, ENTUR has developed extensive open-source validation tools for NeTEx and SIRI data, configurable for different profiles. These tools are publicly available on [Entur's GitHub](#).

7.7.1. Data Quality Reporting

The [SIRI Data Quality Report](#) is a public dashboard assigns an overall quality score for real-time data feeds (SIRI – ET, SIRI – VM, and SIRI-SX). The SIRI-ET report assess four key categories:

- Content: Evaluates data's informational value based on 45+ checks.
- Consistency & Coverage: Data logical coherence, comparing schedules with SIRI ET data.
- Data delivery: Measures technical reliability based on the percentage of successful updates.
- Frequency & completeness: Averages the proportion of journeys receiving frequent updates, and the percentage of stops updated after departure.

Released in fall 2023, the automated dashboard acts as both a "wall of fame" and "wall of shame". By displaying data quality publicly of real-time data, it drives provider accountability and long-term improvements through transparent tracking. ENTUR can now track improvements over time. It is open access, anyone can view the dashboard, and data providers can drill down to identify specific issues.



7.7.2. From Silos to added value

ENTUR engages in international open-source software contribution and adoption. Its approach balances direct use of un-modified open-source tools with active co-development alongside partners through weekly alignment meetings and shared product backlogs. ENTUR shifted the mobility landscape from isolated, one-way data pipelines to a collaborative, multi-tier ecosystem:

1. Data flows upwards from operators to ENTUR.
2. ENTUR adds value (e.g., validation, enrichment) and provides feedback downward.
3. Operators use this feedback to improve their own systems.

When counties request operational data outside MMTIS scope, ENTUR adds it to the Nordic NeTEx profile. This multi-purpose dataset serves NAPs, real-time feeds, and internal planning, eliminating the cost and complexity of maintaining separate data streams.

PTAs co-develop non-core solutions independently. Example: AtB (a county PTA) built an app, web store, and school bus service systems, used now by other PTAs who develop solutions reused by AtB.

7.8. Cross border services

7.8.1. Nordic Marketplace

ENTUR is working on cross-border ticketing, driven by the Ministry's goal to simplify travel abroad for Norwegians and make Norwegian transport more accessible for international travellers. To deal with this challenge a Nordic Marketplace tool has been integrated:

- Example: A trip from Trondheim to Copenhagen can:
 - Query the Norwegian sales system for prices/products from Trondheim to Göteborg.
 - Query the Swedish system for Göteborg to København.
 - Allow the customer to buy a single ticket in one step and currency.
- Currently in production with different operators.
- Scalable: More sales systems can be added as long as they adhere to standardized APIs.

7.8.2. Challenges & solutions in Cross-Border Data

The technical aspects of cross-border journey planning are largely solved. The primary obstacle is the lack of harmonized data across countries:

- Different countries use different NeTEx profiles, leading to inconsistency, data loss and duplicates in data.
- Profiles are often tailored to existing systems rather than a common standard.

To address this challenge ENTUR advocates for:

- More open collaboration among countries.
- A unified profile used by all.
- Reference validation tools and reference implementations to ensure data consistency.

Entur is part of ITS Nordic+ project [NEMU](#), the Living Lab for EU MMTIS, which:

- Demonstrates creation and fulfilment of multimodal travel plans within and across borders.
- Uses MMTIS regulation principles.
- Aims to show that multimodal booking and payment can work seamlessly across borders, similar to how mobile phones automatically connect to networks when traveling.



7.9. Additional topics

This section presents additional topics raised during ENTUR's presentation and relevant for other NAPs.

7.9.1. Data Processing Speed

ENTUR's system processes NeTeX data in 30 minutes to 1 hour from submission to full deployment in production, including integration with OpenTripPlanner and mapping services. The process is fully automated and continuous, ensuring rapid updates and minimal delays.

7.9.2. System Performance and Rate Limiting

Hosted on Google Cloud, ENTUR's infrastructure handles 1.5 billion API requests per month and is classified as critical national infrastructure, guaranteeing stability. Rate limiting is flexible: no registration is required for basic usage, while identified users (e.g., major app providers) receive customized, higher limits based on their needs.

7.9.3. Intermodal Connections

The system uses map data to calculate walking distances (inside stations and open areas) and automatically adds a 2-minute security buffer for connections. Real-time updates dynamically influence calculations, and users can customize connection times via the API. A future enhancement will include historical delay data to help users assess connection risks.

7.9.4. Open Source and Collaboration

ENTUR's technical components are fully open-source on GitHub, including configurable validation tools for NeTeX and SIRI. While the data quality measurement tool is not yet open-source, it remains a collaboration priority for the team.

7.9.5. Costs and Implementation Challenges

The primary costs include personnel (10 people over 10 years for the core platform) and cloud hosting. A hidden cost is the time invested in stakeholder collaboration to adopt common standards, requiring persuasion that short-term harmonization efforts yield long-term benefits.

7.9.6. Future of NAPCORE and EU Data Registry

ENTUR advocates for NAPCORE to focus on supporting National Access Points in producing usable cross-border NeTeX and SIRI data, with standardization work kept separate. Key needs include: a joint common profile across Europe, better funding for technical experts, and coordination to prevent duplicate NeTeX versions for the same operator.

ENTUR's approach—rooted in standardization, open-source development, quality control, and collaboration—has transformed transport data management in Norway and positioned the country as a leader in multimodal transport interoperability. As ENTUR continues to expand its cross-border initiatives and refine its systems, it offers valuable lessons for other countries seeking to develop their own NAPs and improve transport data harmonization. **Entur invites agencies from other countries to collaborate and joint efforts to develop a pan-European approach to face mobility data challenges.**

8. Outlook & conclusions

This report analyses the challenges and solutions related to MMTIS data provision in Europe. based on stakeholder meetings and insights from NAPCORE's previous phase. The challenges include:



1. Historic Data: Need for clarity on purpose, retention, and usability, particularly for passenger rights, infrastructure & service planning. OpRa constitutes a solution for structured exchange of operational raw data to be included in new contracts.
2. Cross-Border Data: Lack of harmonised NeTEx profiles and standardised data formats across countries. A unified NeTEx profile (NAPCORE task 4.3) and open-source validation tools are proposed to improve compatibility.
3. Data Provision Barriers: Smaller stakeholders, (e.g., shared mobility services) often lack awareness of data-sharing benefits and face technical/organizational barriers (e.g., limited resources, knowledge gaps). A database to guide data requests to service providers is proposed as solution.
4. Data Update and Availability: Data shall be updated and made available accordingly, with static data (e.g., infrastructure) requiring less frequent updates than real-time data (e.g., delays). Ensuring data availability for all transport modes, as mandated by the MMTIS DR, remains a challenge.
5. Data Categories and Standards: Ambiguities in definitions, particularly between planned and real-time data, and the need for alignment between standards like DATEX-II and NeTEx were identified.

To improve MMTIS data provision at NAPs and cross-border interoperability the following preliminary recommendations are proposed:

- Advance the use of OpRa, NeTEx, and SIRI standards to ensure consistent, high-quality data exchange. A unified NeTEx profile and validation tools will reduce duplication and improve compatibility.
- Strengthen collaboration among NAPs, PTAs, PTOs, and stakeholders to share best practices, address technical barriers, and align on solutions. Initiatives like the NAPCORE Living Lab and Finland's Traffic Data Ecosystem demonstrate the value of coordinated efforts.
- Ensure effective implementation of national and EU-level regulations with clear guidelines, enforceable requirements, and incentives for compliance.
- Leverage automation, analytics, and open-source tools to streamline data validation, update frequencies, and quality control. Integrating historical data (OpRa) and real-time updates (SIRI) will enhance reliability and usability of data.
- Encourage stakeholders to adopt standardised data models and share datasets via NAPs, particularly for taxi, parking, shared mobility, and cross-border services. The Excel database developed in this task will support this effort.
- Finland's transition to a Single NAP integrating RTTI, SRTI, MMTIS, SSTP, and AFIR, serves as a model for other countries to consolidate their data ecosystems and improve efficiency.
- Collaborate across Europe to advance the standards, data provision, use and re-use at NAPs.

The second report (December 2026) will build on these insights, incorporating additional experiences from Austria, and other stakeholders. It will provide a roadmap and recommendations to accelerate MMTIS data provision, ensuring NAPs across Europe can meet the growing demands of multimodal travel information services.



9. Annexes

9.1. OpRa conceptual example

OpRa models delayed and cancelled journeys (two P1 use cases for MMTIS compliance). A fictional example is presented below.

1. One delayed journey: A 5-minute delay caused by the late return of a vehicle from a previous service (Event: LateReturnVehicleEvent).
2. One cancelled journey: A cancellation without replacement due to vehicle damage (Event: ReportDamageToVehicleEvent).

OpRa's physical exchange format reuses NeTEx artifacts, ensuring compatibility with existing systems. The examples below demonstrate the structure:

Delayed Journey Entry. Each delayed journey is logged with:

- A reference to the journey pattern and dated vehicle journey (from NeTEx).
- The delay duration (e.g., PT5M for 5 minutes).
- The triggering event, including its type, ID, and summary.

Cancelled Journey Entry. Each cancelled journey includes:

- The journey pattern and dated vehicle journey references.
- The control action type (e.g., JourneyCancellation).
- The triggering event(s) (e.g., ReportDamageToVehicleEvent with ID eid730 and summary "vehicle tire damage").
- A flag indicating whether a replacement journey was created (false in this case).

Statistical Aggregation. OpRa also supports statistical summaries of delays and cancellations, such as:

- Duration intervals (e.g., 0–10 minutes, 10–20 minutes) with counts and percentages.
- Cancellation counts with percentages of total journeys.

The statistical summary for this example and period showed and saved on OpRa:

- 72 journeys delayed by <10 minutes (97.3% of total).
- 2 journeys delayed by 10–20 minutes (2.7% of total).
- 3 total cancellations (0.04% of total journeys).

In this example, OpRa's design considers the following principles:

Event-Driven	Every delay or cancellation is linked to a specific operational event, enabling root cause analysis (e.g., identifying patterns like cascading vehicle failures).
Time-Bounded	Data is scoped to a reporting period (e.g., a day, week, or month) using <code><netex:validbetween></code> .
Journey-Centric	Indicators are tied to specific journey patterns and vehicle journeys, ensuring traceability to the planned service.
Extensible	The log entry structure can accommodate new event types (e.g., strikes, weather disruptions) without breaking existing implementations.

Figure 21. Principles followed on the example presented.



9.2. Finland national mobility services

Key national services underpinning the new architecture:

- MMTIS NAP: [Finap.fi](https://finap.fi) (to be discontinued in 2027)
- Data input tools:
 - [Parking.fintraffic.fi](https://parking.fintraffic.fi) (Park&Ride)
 - [Rae.Fintraffic.fi](https://rae.fintraffic.fi) (Route & Schedule Editor, based on [ENTUR Nplan](https://entur.nplan.com))
- Validation & Conversion: [Validator.fintraffic.fi](https://validator.fintraffic.fi)
- Data warehouse: [Mobility.mobility-database.fintraffic.fi](https://mobility.mobility-database.fintraffic.fi)
- Data delivery & analytics:
 - Independent APIs (developer portal under construction)
 - Analytics integrated into different services
- End-user services:
 - Fintraffic mobile app
 - [Liikennetilanne.fintraffic.fi](https://liikennetilanne.fintraffic.fi) (traffic situation)
 - [Matka.fintraffic.fi](https://matka.fintraffic.fi) (national route planner)

The Traffic Data Ecosystem is a network of ~240 organizations facilitating coordinated development and best practices sharing. It includes 10–12 national groups with dedicated tasks, such as:

- Travel information data group
- Stop data group

These groups include representatives from:

- Governmental organizations
- PTAs
- Operators
- Technology providers
- Municipalities and cities
- Mobility Service Providers (MSPs)

The ecosystem operates under a rule book and code of conduct, with a coordination crew handling issues and best practices, and a steering group that includes participation from:

- Fintraffic directors
- National authorities
- The Ministry of Transport
- Major PTAs
- MSPs
- IT companies

Participation on this network is voluntary, but the structure provides a coordination forum, data standards development (e.g., the Nordic profile), core data management, and support for data usage and use cases.

9.3. MobiData BW Open-Source and Open Data Principles

MobiData BW prioritizes open, interoperable formats to ensure data integration. The platform supports:



- **Public Transport Data:** GTFS (for timetable and real-time transit data) and query interfaces for real-time transit information in the regional PT systems including neighbor states and regions. (These formats are adopted in Germany and align with VDV standards (national benchmarks for public transport data). NeTeX and SIRI are provided Germany-wide by the national PT data association Delfi to the Mobilithek.
- **Shared Mobility Data:** GBFS for bike-sharing, e-scooters, and car-sharing. The platform uses GBFS 2.3 and 3.0 for output, ensuring compatibility with global shared mobility systems. MobiData BW aggregates data (e.g., car-sharing, bike-sharing) into single, state-level datasets, reducing fragmentation and simplifying access for developers. For example, an app can retrieve all Baden-Württemberg bike-sharing data from MobiData BW's GBFS endpoint.
- **Parking and Charging Data:** OCPI (Open Charge Point Interface) for charging stations and custom JSON-based formats for parking data. Converters are developed to transform proprietary formats (e.g., Excel sheets, XML) into these standards. Chargepoint- and parking data are also provided in bundled datasets in DATEX II, following the requirements from AFIR and RTTI.
- **Road and Cycling Infrastructure:** GeoJSON and INSPIRE-compliant formats for geospatial data, ensuring alignment with European directives.

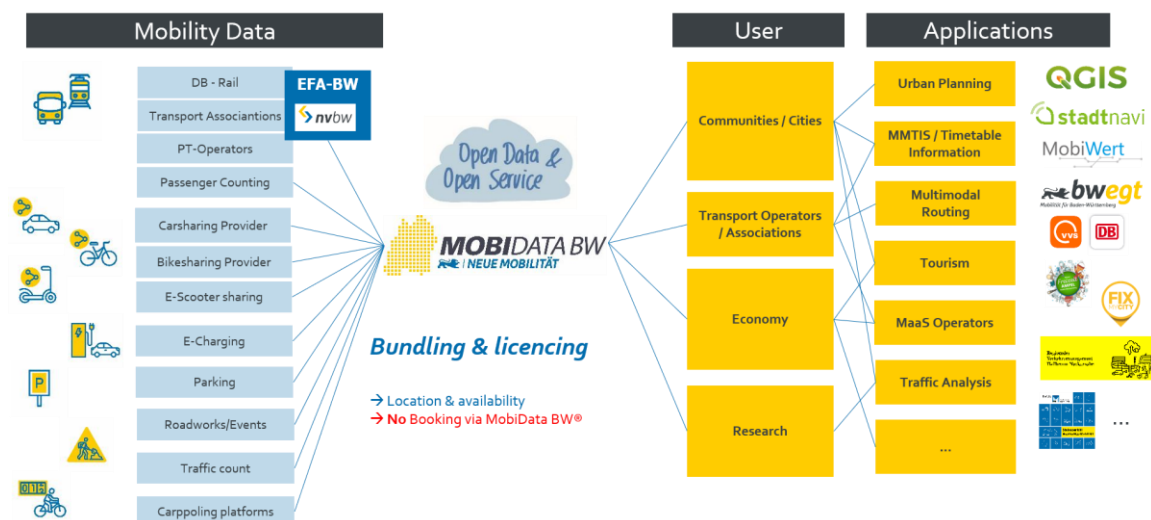


Figure 22. Data bundling and provisioning.

For providers using non-standard formats, MobiData BW develops custom converters to map their data into the platform's internal structure. This flexibility is critical for onboarding smaller providers who may lack the resources to adopt standardized formats. All developed tools (e.g., converters, APIs) are published on [GitHub](#).

To identify which datasets are most used, MobiData BW uses analytics tools within its API endpoints and data catalog. Metrics such as API call frequency, download counts, and user feedback help prioritize data maintenance and expansion efforts. For example, if parking data is frequently accessed by developers, MobiData BW may prioritize its updates or coverage. Additionally, the platform conducts regular surveys with data consumers to gauge satisfaction and needs.