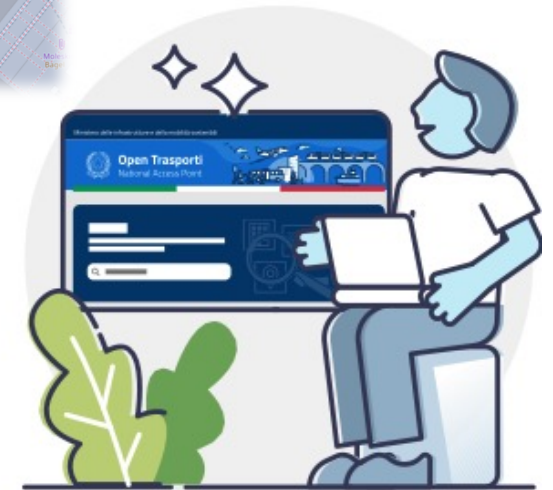
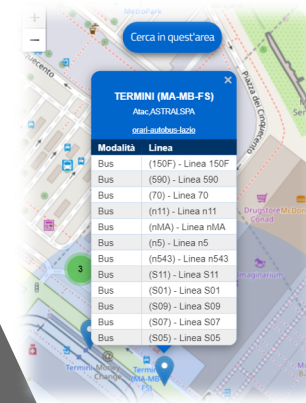


Open Gov Week



Open Trasporti

An enabling platform
for multi modal transportation open data

18th May 2022
Ing. Giorgio Agrifoglio



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e della mobilità sostenibili

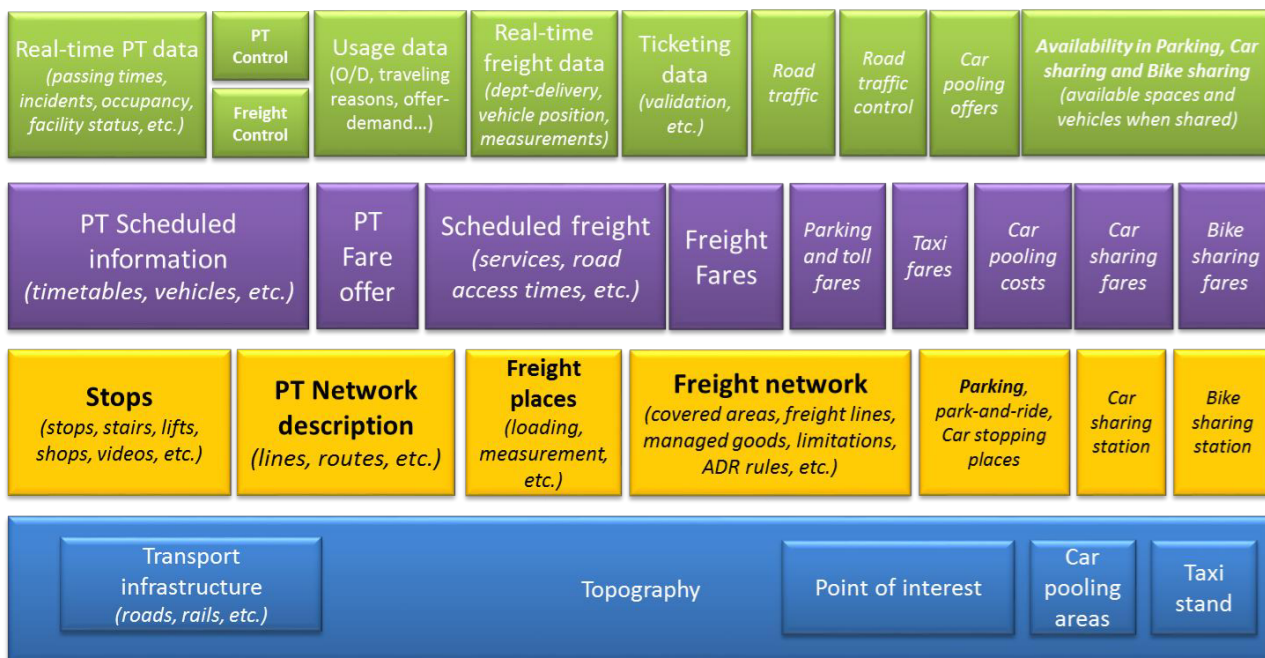


Today's Route Plan

- 01** Scenario
- 02** Data File Formats : NeTEx and GTFS
- 03** Data Quality: Data File Formats and Validation
- 04** OpenTrasporti's components
- 05** Live Demo
- 06** Future Scenarios and Evolutions
- 07** Q&A

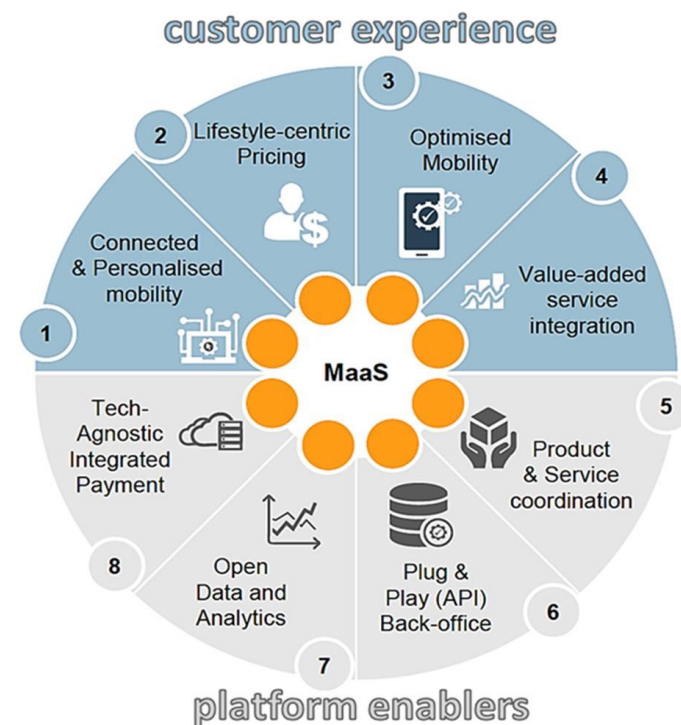


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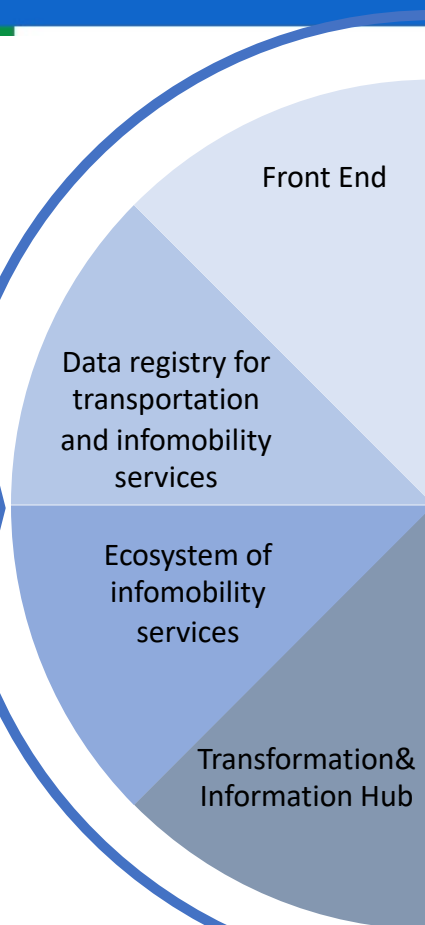
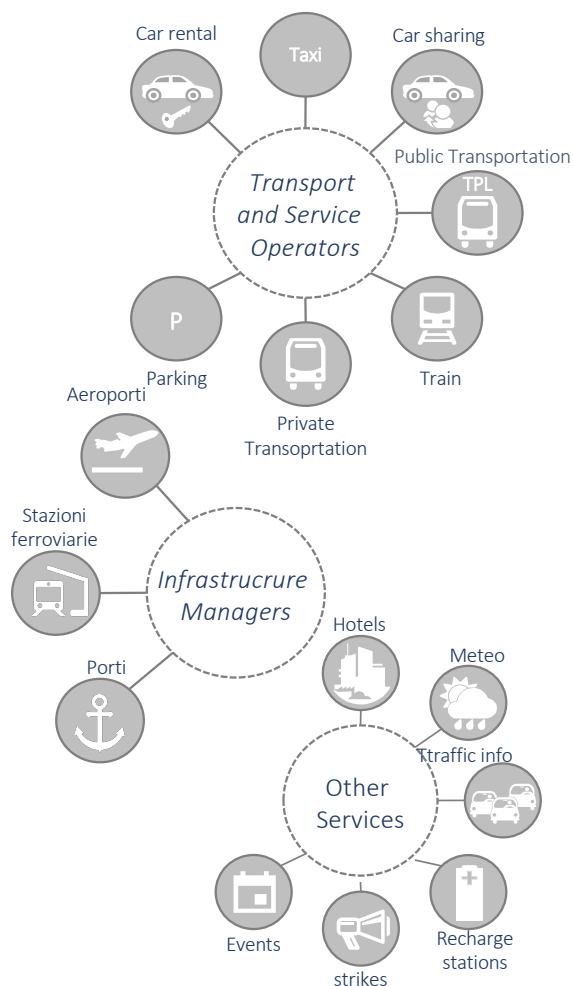
The actual scenario is based on the management validation, correlation and providing of a great amount of different data....

The future scenario is even more complex...





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Creazione del portale informativo di supporto per la pubblicazione di informazioni, l'accesso e l'uso di OpenTrasporti

Portal for:

- publication of data and information,
- access to functions
- use of OpenTrasporti

System for the mediation of third-party services that provide data.
Publishing of MIMS's multimodality services
Publishing of Third Party Multimodality Applications

system for ingestion, transformation data according to European transport standards and Data Analytics

Discovery Of data and operators

Data consultation

Application Enabler

Predictive analytics

Marketplace of data and services

Citizens, Enthusiastic



Technology Providers



Data & Service Provider



OpenTrasporti

Users

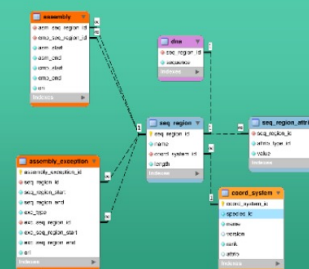


Data File Formats

TRANSMODEL

EUROPEAN STANDARD EN12896

Conceptual data model covering
all the public transport data domaine



STATIC

NeTex

DATA FORMAT

file XML-based

GTFS Google

DATA FORMAT

file CSV-based

DYNAMIC

SIRI

DATA FORMAT

GTFS-realtime

DATA FORMAT Google



NeTExFile Format



Italian NeTEx Profile

The profile is a **subset of the standard**;

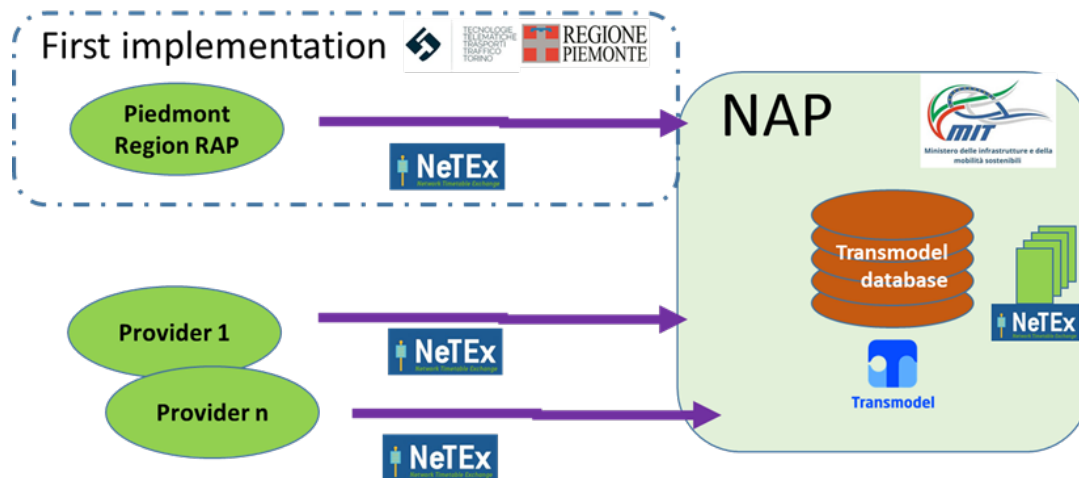
1. Passenger Information profile

- level 1 European Passenger Information Profile (EPIP)

2. Contracts profile (level 2 – incremental)

Typical use case for the *Passenger Information* Use Case is:

- provision of data to journey planner
- provision of data to a mapping tool to show the network on a map (possibly interactive)
- provision of data to a timetable printing/visualisation tool
- provision of data to a stop or line finder.

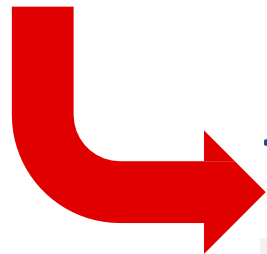


Only experimental datasets
available



GTFS – processes for multimodality

- The records in the Shapes file describe the geometry of the paths and are associated with the leg file. The geometry of the routes must not be connected topologically with the stops, but it is required that these are within a certain distance.



Validation and/or enrichment

- Space and topological analysis between stops and lines to validate or define spaces
- Traditional routing for defining connections and connection times between stops of different itineraries
- Internal mapping for main stations



Stops

Fermate dove i viaggiatori entrano o escono dalla rete di trasporto

Shapes

Geometrie dei percorsi



Transfers

Regole di connessione tra nodi di percorsi diversi



Pathways

Percorsi di connessione delle diverse fermate in una stazione



Levels

Piani all'interno delle stazioni



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Which File Format???

NeTEx
Network Timetable Exchange

GTFS

NeTEx UML model includes a GTFS mapping (and mapping with most national standards like VDV, NEPTUNE, UIC Leaflets, ..)

Every GTFS file can be converted to NeTEx

But NeTEx can tell much, much, much... more than GTFS (planning and AVMS needs, stop description, detailed passing times, flexible transport, organisation and roles, etc. etc.)

But GTFS is still very good for a lot of Open Data needs ...

Accept both of them and use
conversion tools



Open Data is Good! NeTEx & GTFS Interoperation - Timetables

GTFS is useful subset of
timetable data for trip planners

Does not have underlying
reusable elements to
build data sets

e.g. journey patterns, routes.

Simple view for

consuming system:

Layers & times at stop

resolved to single

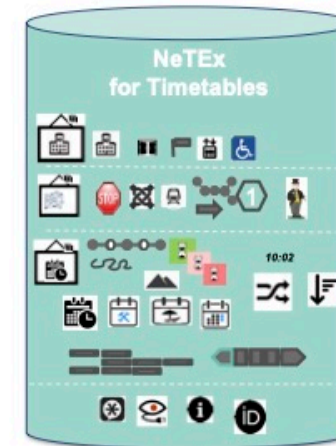
sequence

Does not cover complex
aspects

e.g. grouping, connections,
join/spilt, makeup, etc

Does not cover some
operational data

NeTEx
Network Timetable Exchange



GTFS

GTFS
for Timetables

- Stops
- Agency
- Service
- Routes
- Stop_times
- Shapes

Round trip is "lossy"

- ☐ NeTEx to GTFS: OK
- ☐ GTFS to NeTEx: limited function

dataopt

28/03/2021

13



GTFS—validation and verification process

The GTFS feed validation and verification flow includes a series of specific processes for the various types of control envisaged and for each process it produces a report and a status similar to a traffic light::

- **RED**: the verification failed, the feed is not usable
- **YELLOW**: the verification has produced alerts, which can be consulted in the report, but the feed can be integrated
- **GREEN**: the verification passed



- ☐ Validity of the file structure
- ☐ Completeness of the package of files making up the GTFS, with respect to the specifications of the format and the additional rules introduced (for example, we could request that information on tariffs, not mandatory for the format, is always present)



- ☐ Format of the various fields within the files
- ☐ Duplicate identifiers
- ☐ Rates, Feeds, Frequencies
- ☐ Missing file, reference value or language of the feed
- ☐ Routes, dates and times of the service
- ☐ Stops and stations, Transfers, rides
- ☐ Shapes



- ☐ Correctness of the geometries and significance of the coordinates (e.g. no stop or lines in the middle of the sea, coordinates in the expected bounding box, etc.)
- ☐ Validation of route-node adjacency, on the basis of a defined threshold
- ☐ Graph analysis to identify implausible breaks and disconnected branches
- ☐ Relation correctness



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GTFS – a basic set of validations

Name	Description	Name	Description	Name	Description
BlockTripsWithOverlappingStopTimesNotice_CsvParsingFailedNotice	Block trips with overlapping stop times. Parsing of a CSV file failed. Decreasing shape_dist_traveled in shapes.txt.	InvalidFloatNotice	A field cannot be parsed as a floating point number.	NewLineInValueNotice	New line or carriage return in a value in CSV file.
DecreasingShapeDistanceNotice		InvalidIntegerNotice	A field cannot be parsed as an integer.	NumberOutOfRangeNotice	Out of range value.
ceNotice	equal shape_dist_traveled in stop_times.txt.	InvalidLanguageCodeNotice	A field contains a wrong language code.	OverlappingFrequencyNotice	Trip frequencies overlap.
DuplicatedColumnNotice	Duplicated column in CSV. Duplicate rows	InvalidPhoneNumberNotice	A field contains a malformed phone number.	PathwayToPlatformWithBoardingAreasNotice	A pathway has an endpoint that is a platform which has boarding areas.
DecreasingOrEqualStopTimeDistance		InvalidRowLengthNotice	Invalid CSV row length.	PathwayToWrongLocationTypeNotice	A pathway has an endpoint that is a station.
ce		InvalidTimeNotice	A field cannot be parsed as time. A field cannot be parsed as a timezone.	PathwayUnreachableLocationNotice	A location is not reachable at least in one direction: from the entrances or to the exits.
DuplicateFareRuleZoneIdFieldsNotice		InvalidTimezoneNotice	A field contains a malformed URL.	PointNearOriginNotice	A point is too close to origin (0,0).
DuplicateKeyNotice		InvalidUriNotice		RouteBothShortAndLongNameMissingNotice	Missing route short name and long name.
EmptyColumnNameNotice		LocationWithoutParentStationNotice	A location that must have parent_station field does not have it.	StartAndEndRangeEqualNotice	Two date or time fields are equal.
EmptyFileNotice		LocationWithUnexpectedStopTimeNotice	A location in stops.txt that is not a stop is referenced by some stop_times.stop_id.	StartAndEndRangeOutOfOrderNotice	Two date or time fields are out of order.
EqualShapeDistanceDiffCoordinateNotice	equal shape_dist_traveled and different lat/lon coordinates in shapes.txt.	MissingCalendarAndCalendarDateFilesNotice	Missing GTFS files calendar.txt and calendar_dates.txt.	StationWithParentStationNotice	A station has parent_station field set.
ForeignKeyViolationNotice	Wrong foreign key. Inconsistent Timezone among agencies.	MissingLevelIdNotice	stops.level_id is conditionally required.	StopTimeTimepointWithoutTimesNotice	arrival_time or departure_time not specified for timepoint.
InconsistentAgencyTimezoneNotice	A field contains an invalid color value.	MissingRequiredColumnNotice	A required column is missing in the input file.	StopTimeWithArrivalBeforePreviousDepartureTimeNotice	Backwards time travel between stops in stop_times.txt
InvalidColorNotice	A field contains a wrong currency code.	MissingRequiredFieldNotice	A required field is missing. A required file is missing.	StopTimeWithOnlyArrivalOrDepartureTimeNotice	Missing stop_times.arrival_time or stop_times.departure_time.
InvalidCurrencyNotice	A field cannot be parsed as date.	MissingRequiredFileNotice	Missing trip edge arrival_time or departure_time.	StopWithoutZoneIdNotice	Stop without value for stop_times.zone_id.
InvalidDateNotice	A field contains a malformed email address.	MissingTripEdgeNotice		WrongParentLocationTypeNotice	Incorrect type of the parent location.
InvalidEmailNotice					



GTFS Type	Count
Agencies	1
Routes	28
Trips	19424
Steps	1482
Shapes	222
Transfers	610
Service Periods	11
Fare Attributes	0
Fare Rules	0



GTFS – interactive validation of service calendars



Service Calendars

Direct links to each service id:

[ALL](#) [A20150614SUN](#) [A20151206SAT](#) [B20151206SAT](#) [A20151206SUN](#) [A20151206WKD](#) [B20151206WKD](#) [B20151206SUN](#) [R20150510SAT](#) [R20150510SUN](#)

Legend

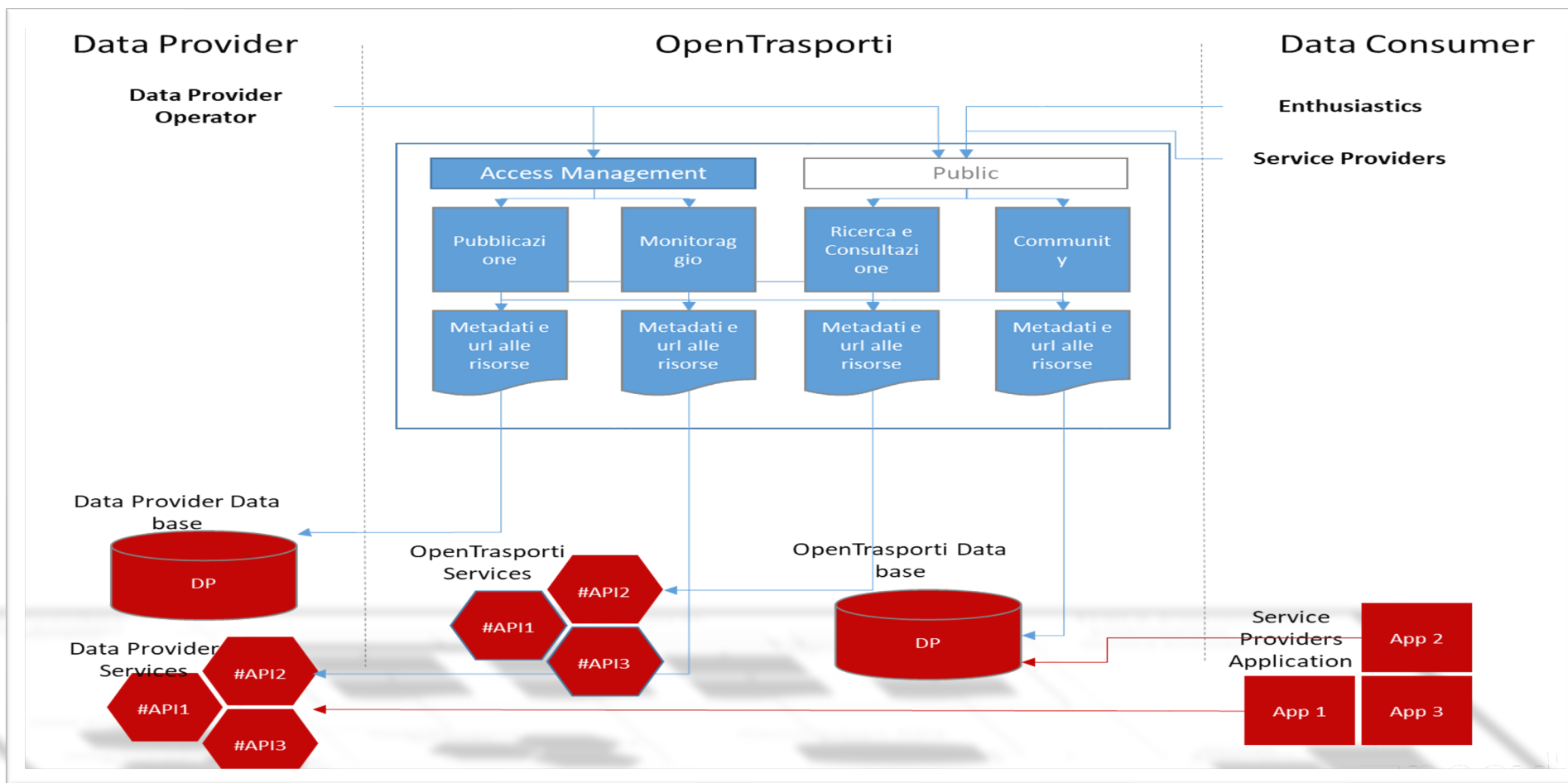
- # - Active service date.
- # - Inactive service date.
- # - Service date outside the range of the first and last service dates of the feed.

Service Id: ALL

May 2015							Jun 2015							Jul 2015							Aug 2015						
S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S
					1	2		1	2	3	4	5	6				1	2	3	4							1
3	4	5	6	7	8	9	7	8	9	10	11	12	13	5	6	7	8	9	10	11	2	3	4	5	6	7	8
10	11	12	13	14	15	16	14	15	16	17	18	19	20	12	13	14	15	16	17	18	9	10	11	12	13	14	15
17	18	19	20	21	22	23	21	22	23	24	25	26	27	19	20	21	22	23	24	25	16	17	18	19	20	21	22
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31																					30	31					

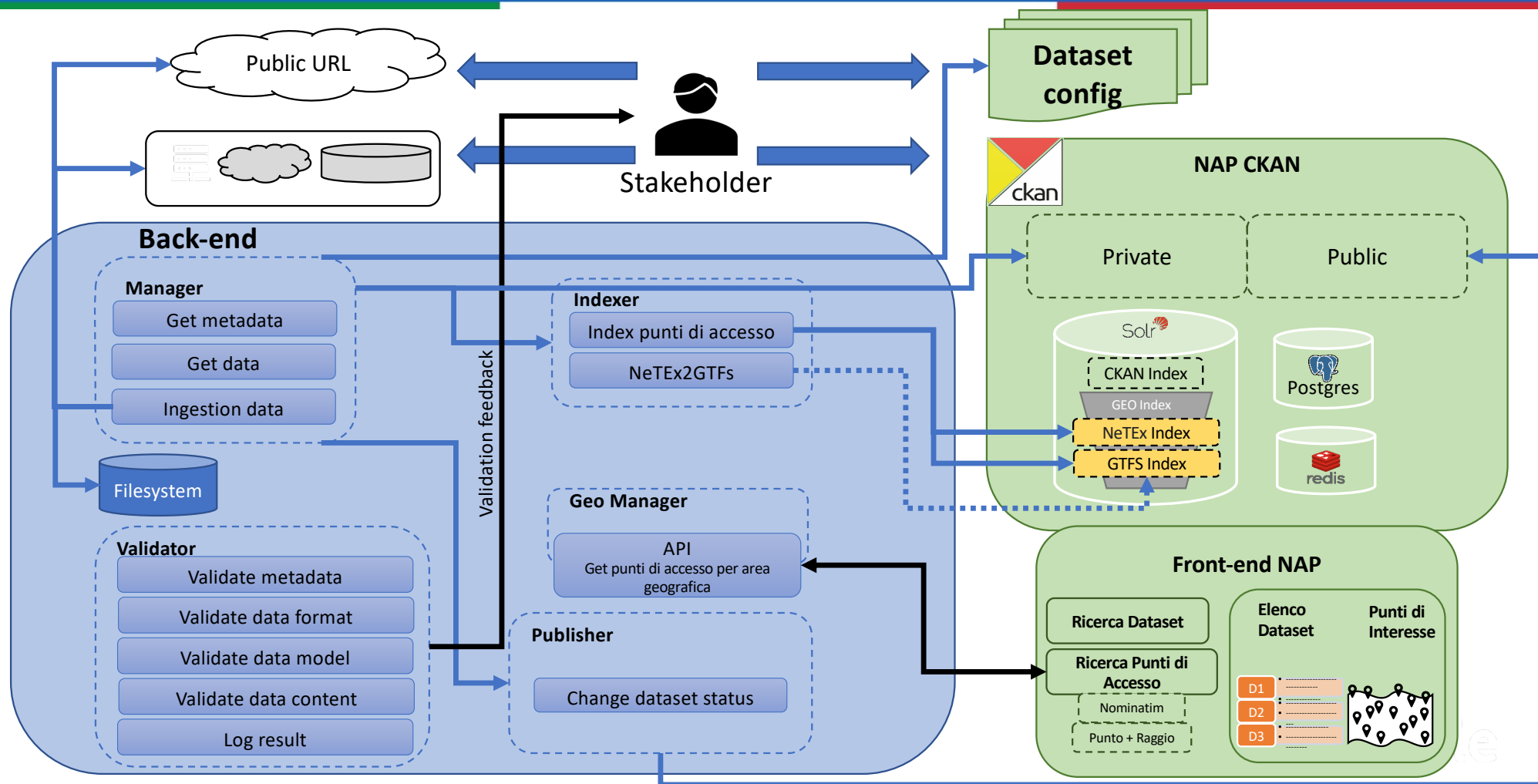


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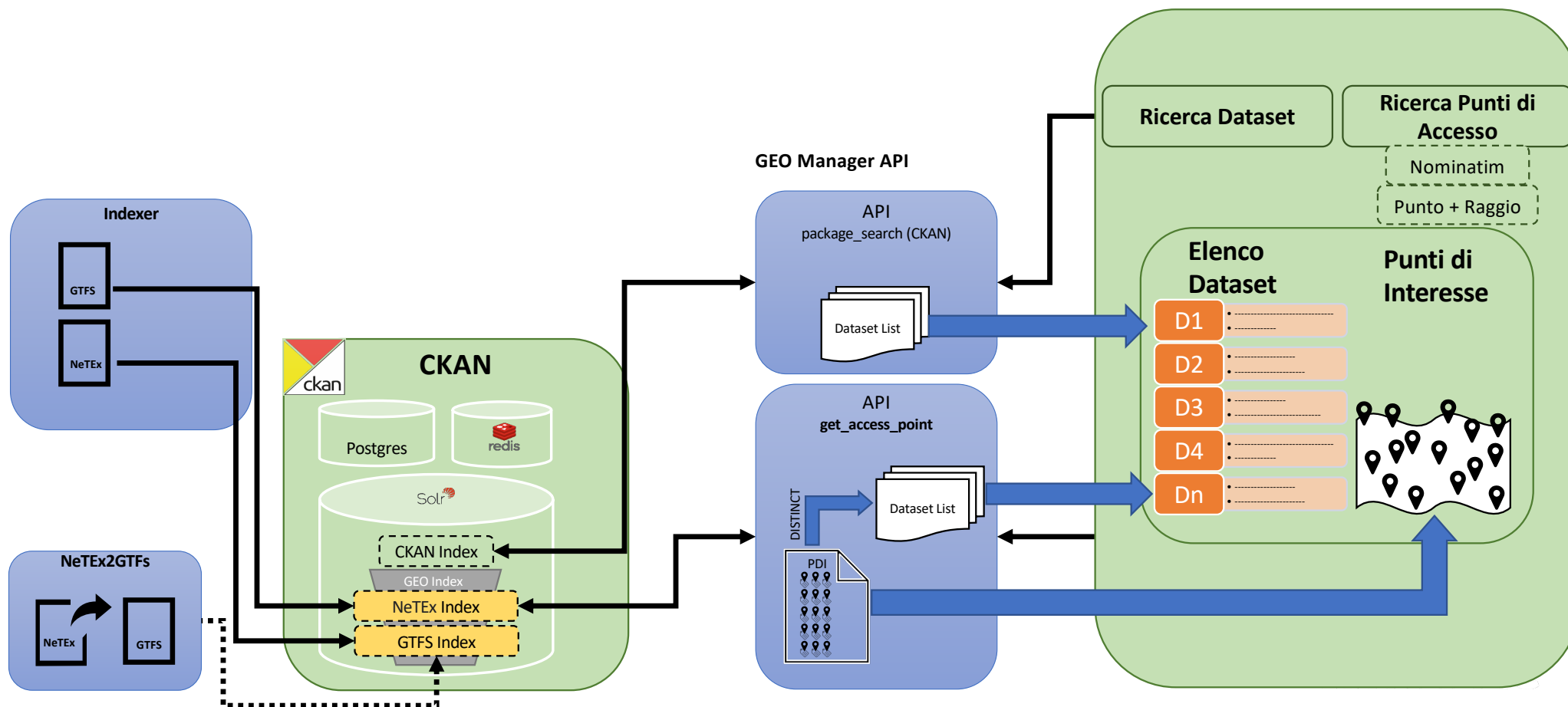


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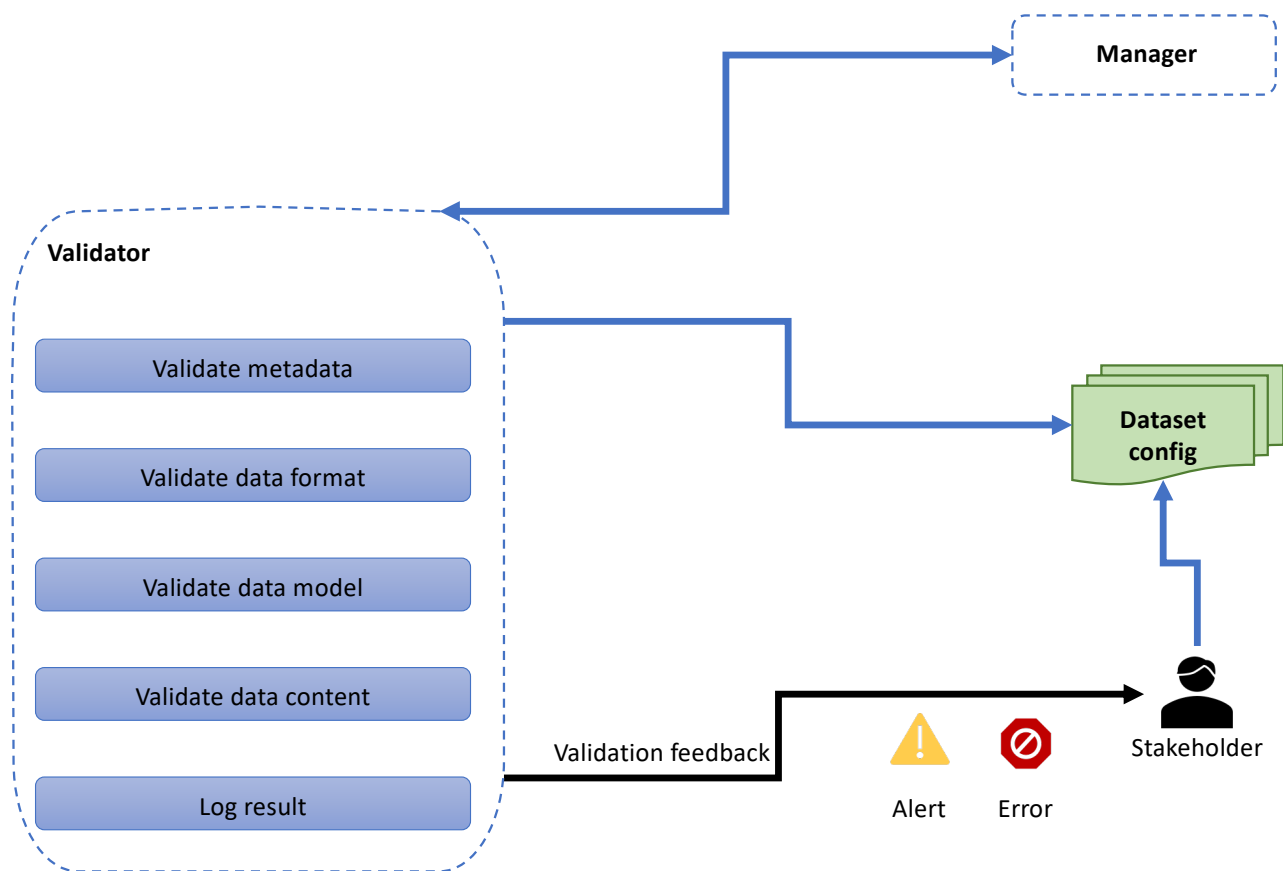


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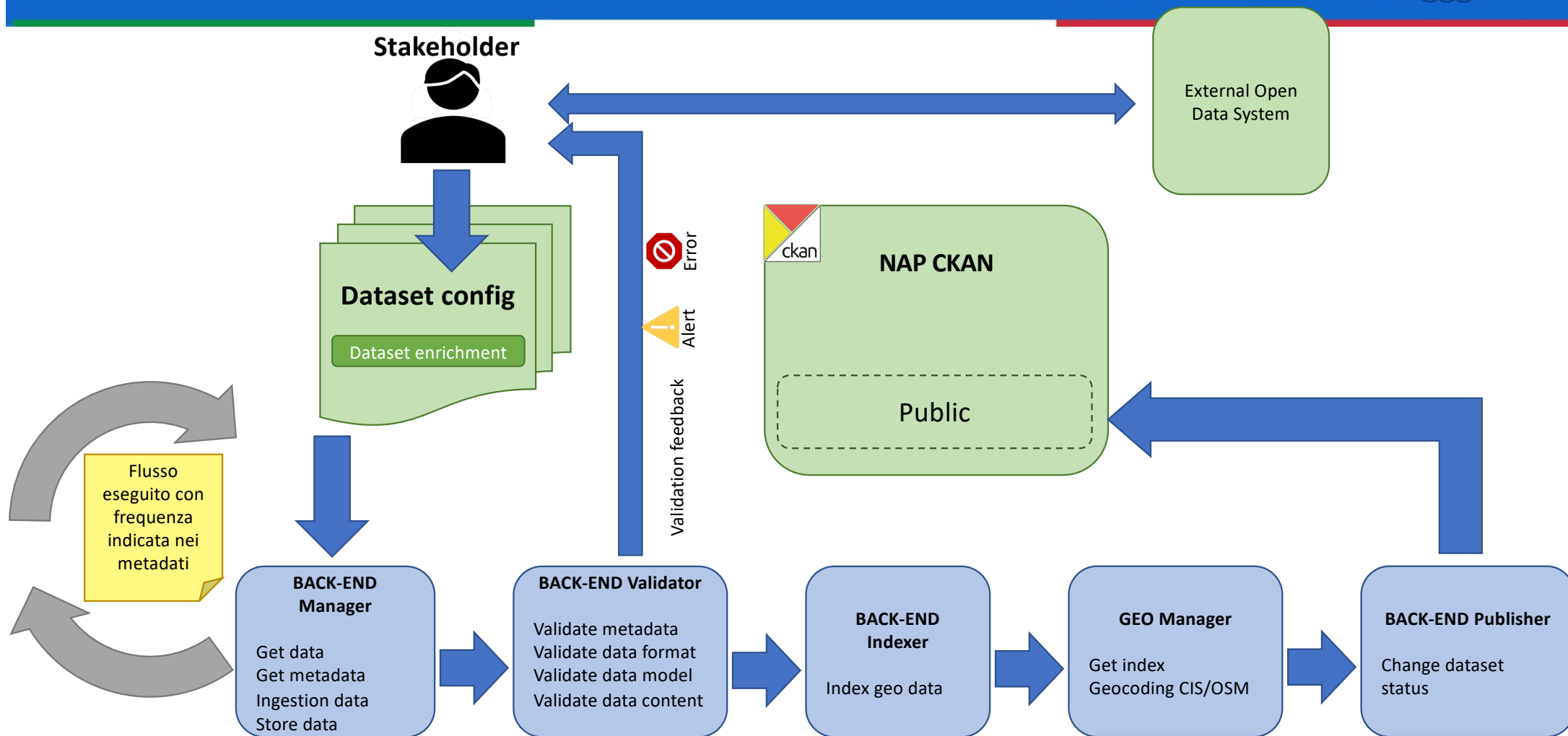


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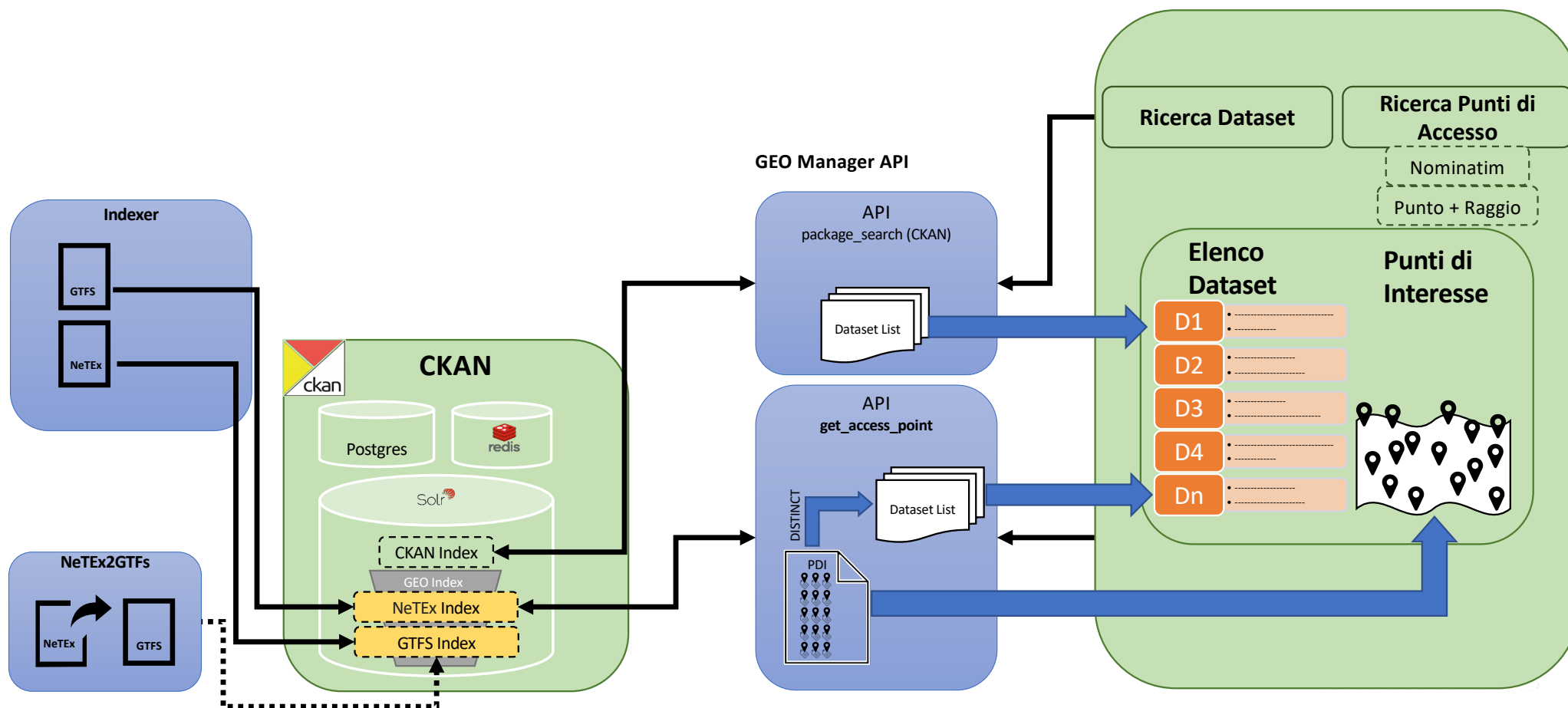


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Common user

Browse freely in the portal. It has access to general information, to search for access points, to view statistics and to API documentation in free mode (APIs will have limits in terms of calls per second).



Transport operator

Through authentication, he accesses the reserved area dedicated to transport operators. In addition to the public sections of the portal, the operator has the ability to access the application for subscribing to the datasets. In this way it can feed the NAP system by validating its data and increasing the catalog of published datasets. At the same time, the single registration of operators makes it possible to register a registry of transport operators for a more fluid communication between the Administration and the Transport Operators



Developer

He is a professional user (independent or third-party) who accesses the reserved area through authentication. Upon registration, the developer will have assigned an authorization token for the use of the API. In addition to the public sections of the portal, the developer has the ability to view an advanced API section in which APIs accessible via tokens are documented (compared to public APIs, APIs with authorization tokens have fewer restrictions to allow for more professional use).



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Ministero dei Trasporti e della Mobilità Sostenibili

ITA



Open Trasporti National Access Point



STATISTICHE

API

INFORMAZIONI

RICERCA

Trova i dati relativi a un luogo, ad un'organizzazione o una modalità di trasporto.

Es. Roma



Come funziona la ricerca?



Luoghi

Ricerca geolocalizzata (Comune, Provincia, Regione)



Organizzazioni

Ricerca l'operatore di trasporto



Modalità di trasporto

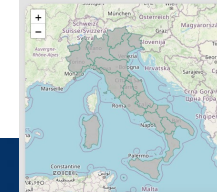
Ricerca la modalità di trasporto



Dati GTFS per regione

La mappa mostra la copertura dei dataset GTFS relativi al trasporto pubblico a livello regionale

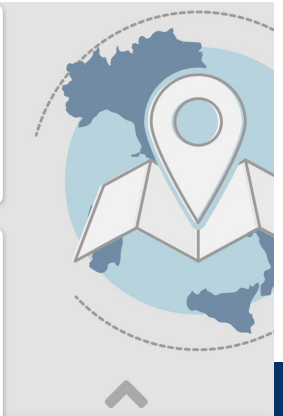
19 Dataset Totali



Dati NetEx per regione

La mappa mostra la copertura dei dataset NetEx relativi al trasporto pubblico a livello regionale

0 Dataset Totali



RICERCA

Trova i dati relativi a un luogo, ad un'organizzazione o una modalità di trasporto.

Es. Roma

Risultato ricerca: **Stazione Tiburtina, Piazza delle Crociate, Municipio Roma II, Roma, Roma Capitale, Lazio, 00100, Italia**

Orari autobus Lazio

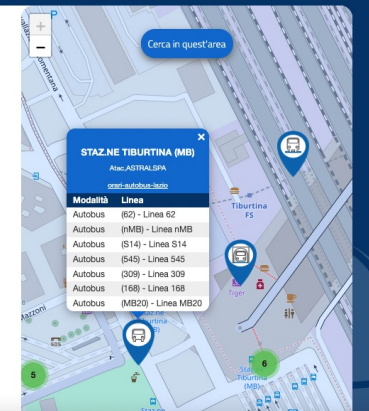
Il dataset comprende: Orari autobus Roma

GTFS

Orari treni Toscana

Il dataset comprende: Servizio ferroviario svolto da Trenitalia S.p.A. sulle linee regionali toscane

GTFS

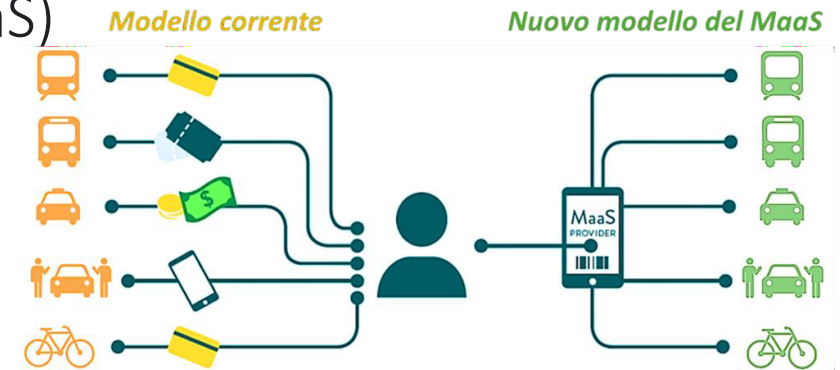


Live Data Navigation



Future Context => Mobility as a Service (MaaS)

- The goal of a MaaS platform: to provide the user with the integration of the various mobility services offered by the various operators, with a unified, simplified and complete user experience.
- To offer different mobility services (eg taxi, carsharing, local public transport, but also parking, toll/ZTL, etc.) it is necessary:
 - To integrate heterogeneous data structures and different formats, feeding from different external sources, in real time;
 - To compose multi-modal mobility itineraries according to different optimization criteria;
 - To offer a single access point and a complete service, from planning to booking, including the economic transaction performed with a single online operation.





Possible future evolutions



The presentation of the itineraries could be enriched with other contextual information useful to the user, provided you have the appropriate data sources from which to extract this information. Some evolutionary scenarios could foresee for example:



- “**carbon footprint**” *rating* associated with the itinerary, to allow the user to evaluate the best route in terms of environmental sustainability;



- **reports of significant events that may increase the density of people in certain areas (e.g. matches, fairs, events), with potential gatherings;**



- information on provisions for temporary restrictions on local mobility (e.g. circulation with alternate number plates, restrictions due to pandemic events, etc.).

Any Questions?



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