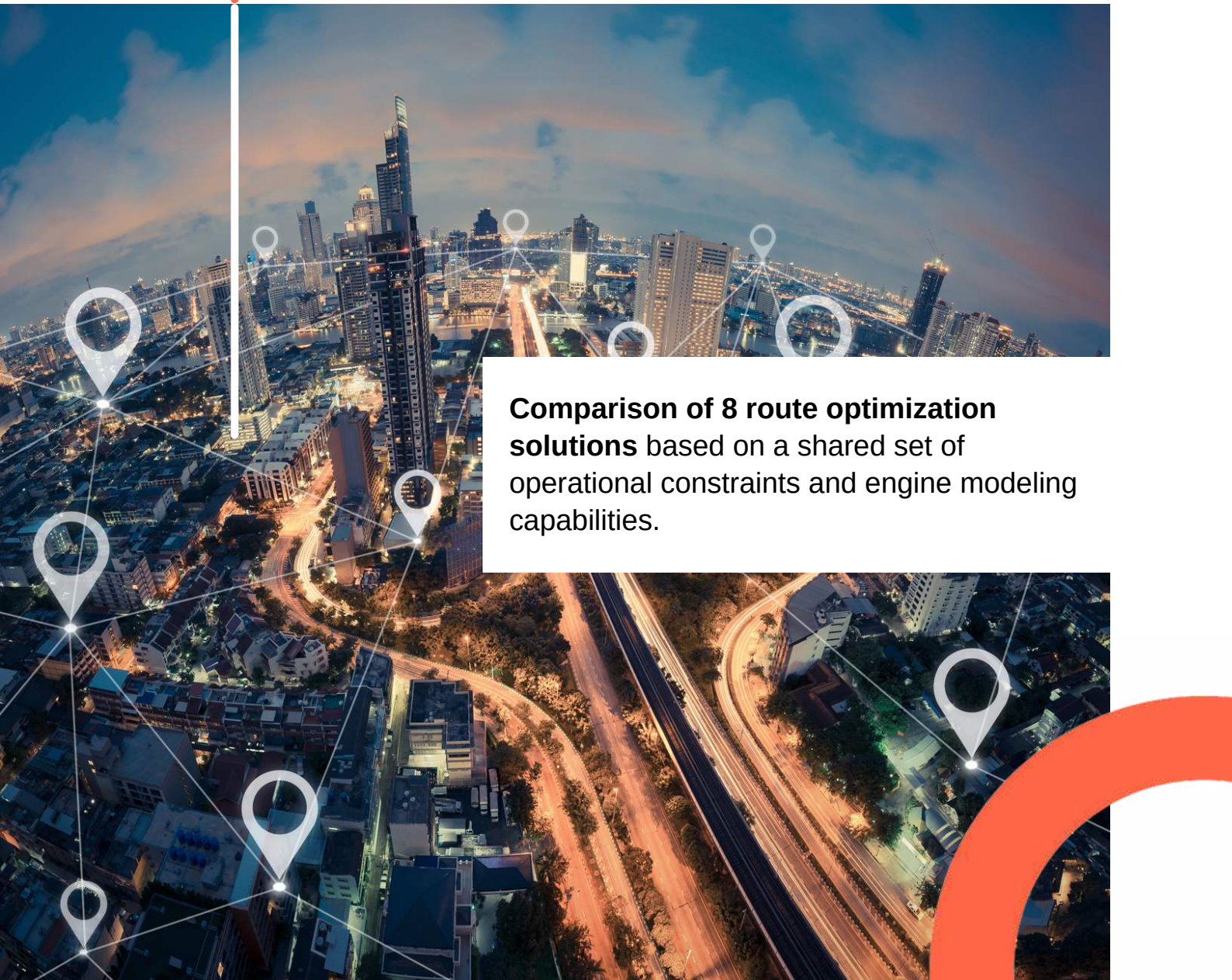




# Kardinal



## 2025 BENCHMARK OF ROUTE OPTIMIZATION APIs



**Comparison of 8 route optimization solutions** based on a shared set of operational constraints and engine modeling capabilities.

# About Kardinal

Kardinal is a provider of innovative solutions dedicated to **transport operations optimization** and **strategic decision-making**.

Its technology stands out with a unique ability to **finely model real-world complexity and the specific business constraints** of each organization—enabling logistics that are more profitable, more sustainable, and truly agile.

---

<https://kardinal.ai/>



## Gartner®

**Kardinal was recognized by Gartner as a Representative Vendor in the 2025 Market Guide for Vehicle Routing and Scheduling (VRS).**



# Introduction

Since its creation, Kardinal has been developing optimization technology with a central objective: enabling accurate and reliable modeling of complex business constraints, specific to each industry and client.

This **algorithmic approach, focused on *operational realism***, is driven by a strong belief: the relevance of a Vehicle Routing & Scheduling (VRS) engine is not solely defined by its computational performance, but by its ability to faithfully reflect real-world operational constraints.

To rigorously assess this capability—both ours and that of the leading VRS API providers—we conducted an **independent and reproducible benchmark during the summer of 2024, and updated in July 2025.**

**The goal: to quantitatively compare the functional coverage of eight VRS solutions based on a shared set of operational constraints and modeling engine capabilities.**



# Methodology

## 01.

### Data source

Only public API documentation was used, ensuring a fair and transparent evaluation.

## 02.

### Scope of analysis

63 representative constraints and features, derived from real-world use cases, and supported by at least two providers to ensure comparability.

## 03.

### Scoring criteria

Explicit, documented, and API-usable support of each business constraint.

## 04.

### Vendors evaluated

Google, NextBillion.ai, Solvice, GraphHopper, Verso, Routific, and Mapbox — in addition to Kardinal.

This benchmark does not aim to compare algorithmic performance (speed or optimality), but to measure **functional modeling capabilities** — a key factor in demanding operational contexts.



# Step 1:

## Building the constraint evaluation panel

The first step of the benchmark involved establishing a **representative reference of business constraints** supported by the main Vehicle Routing & Scheduling (VRS) APIs.

To do this, we conducted a **comprehensive inventory of constraints explicitly documented** in the public APIs of the evaluated providers. This work resulted in a complete database of the features available on the market.

To ensure comparability between solutions and focus on a meaningful common ground, only **constraints or features supported by at least two providers** were included in the final analysis scope (64 selected out of 87 identified). This selection helps exclude edge cases while maintaining a broad and relevant functional coverage.

The full list of selected constraints, along with their definitions, is available [here](#).



## Step 2:

# Classification of constraints by type

### Advanced optimization engine capabilities

This category refers to structural features of the optimization engine such as lexicographical optimization, cost modeling, continuous optimization, advanced predictive traffic management, or incremental optimization.

### Order sequencing constraints

This category addresses constraints that link multiple orders together (for example, sequencing orders in a specific chain).

### Optimization objectives

This category groups the different business objectives that the algorithm can manage.

### Speed profiles

This category includes the variety of vehicle types that the algorithm can take into account.

### Order constraints

This category refers to constraints related to mission orders, such as pick-ups/deliveries, skill requirements, etc.

### Assignment constraints

This category groups constraints that link resources to orders (for example, the compatibility of a resource with specific deliveries).

### Resource constraints

This category brings together the constraints applied to resources (vehicle/driver), such as capacity, time windows, or rest times.

## Step 3:

# Classification of constraints by industry

The constraints/features have been grouped into categories corresponding to the main industry sectors requiring the use of VRS:



Waste transportation



Fresh produce delivery



Urban couriers



Parcel delivery



Long-distance transport /  
Full truckload (FTL)



Less-than-truckload  
(LTL) transport



Freight forwarding



Retail



Field services / On-site  
interventions



# Results

## Part 1: Comparative analysis of business constraint coverage by market players

Each engine was evaluated on a total of 64 business constraints covering the following areas: order constraints, resource constraints, optimization objectives, speed profiles, etc. The final score is based on the ratio of constraints supported by each solution.

| ↓<br>Rank | Provider       | # Constraints | % Coverage | Category |
|-----------|----------------|---------------|------------|----------|
| 1         | Kardinal       | 61            | 95%        | Premium  |
| 2         | Google         | 45            | 70%        | Premium  |
| 3         | NextBillion.ai | 44            | 69%        | Advanced |
| 4         | Solvic         | 41            | 64%        | Advanced |
| 5         | GraphHopper    | 40            | 62%        | Advanced |
| 6         | Verso          | 26            | 40%        | Basic    |
| 8         | Routific       | 26            | 40%        | Basic    |
| 9         | Mapbox         | 18            | 28%        | Basic    |

# Analysis

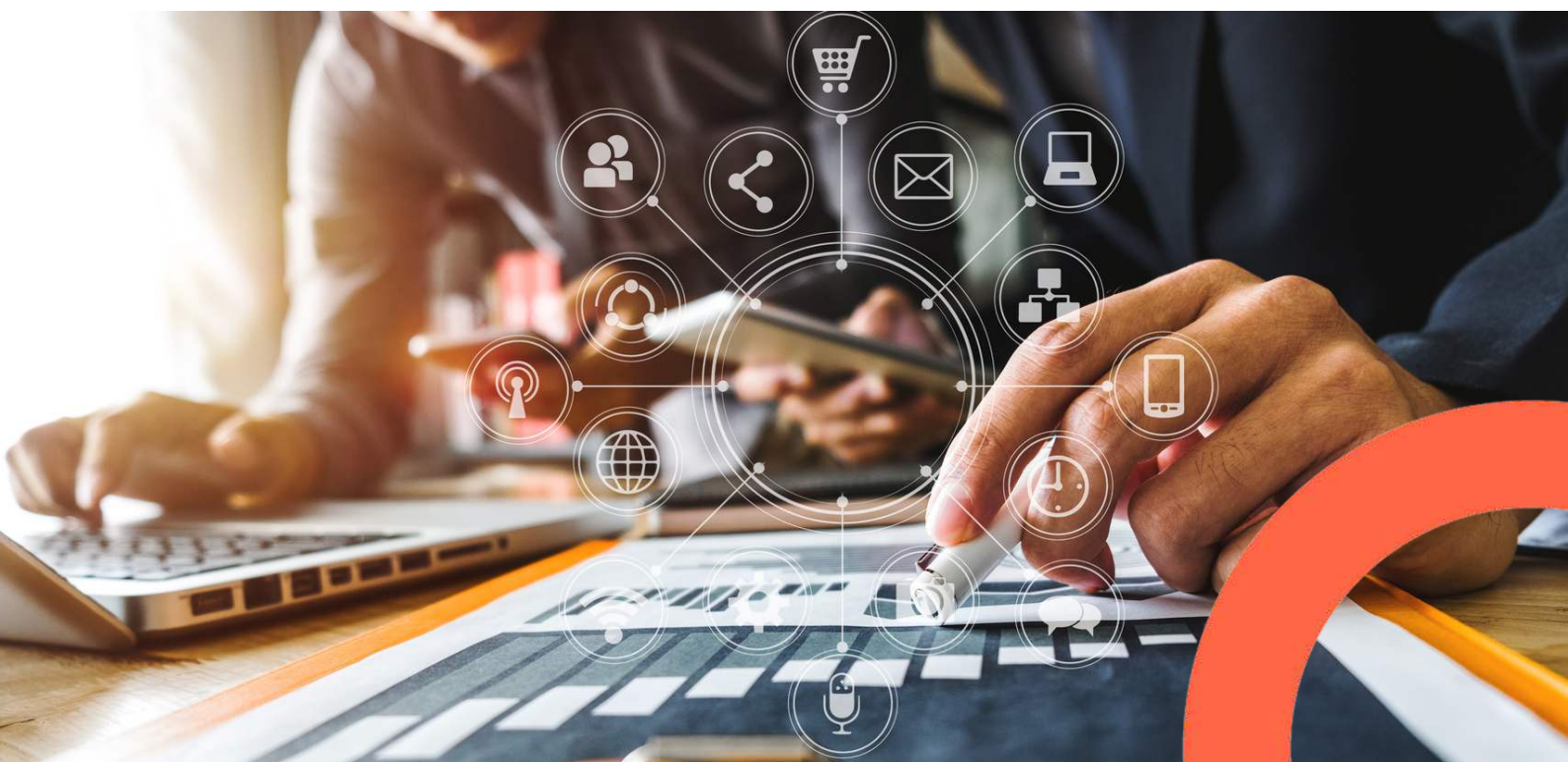
The analysis highlights the gaps in functional coverage between the solutions and identifies the players best suited for complex use cases.

The following typology was defined:

- **Basic VRS:** < 50% coverage
- **Standard VRS:** between 50% and 70%
- **Premium VRS:** > 70 %

**Kardinal** stands out with a significantly superior modeling capability, covering **95% of the business reference**.

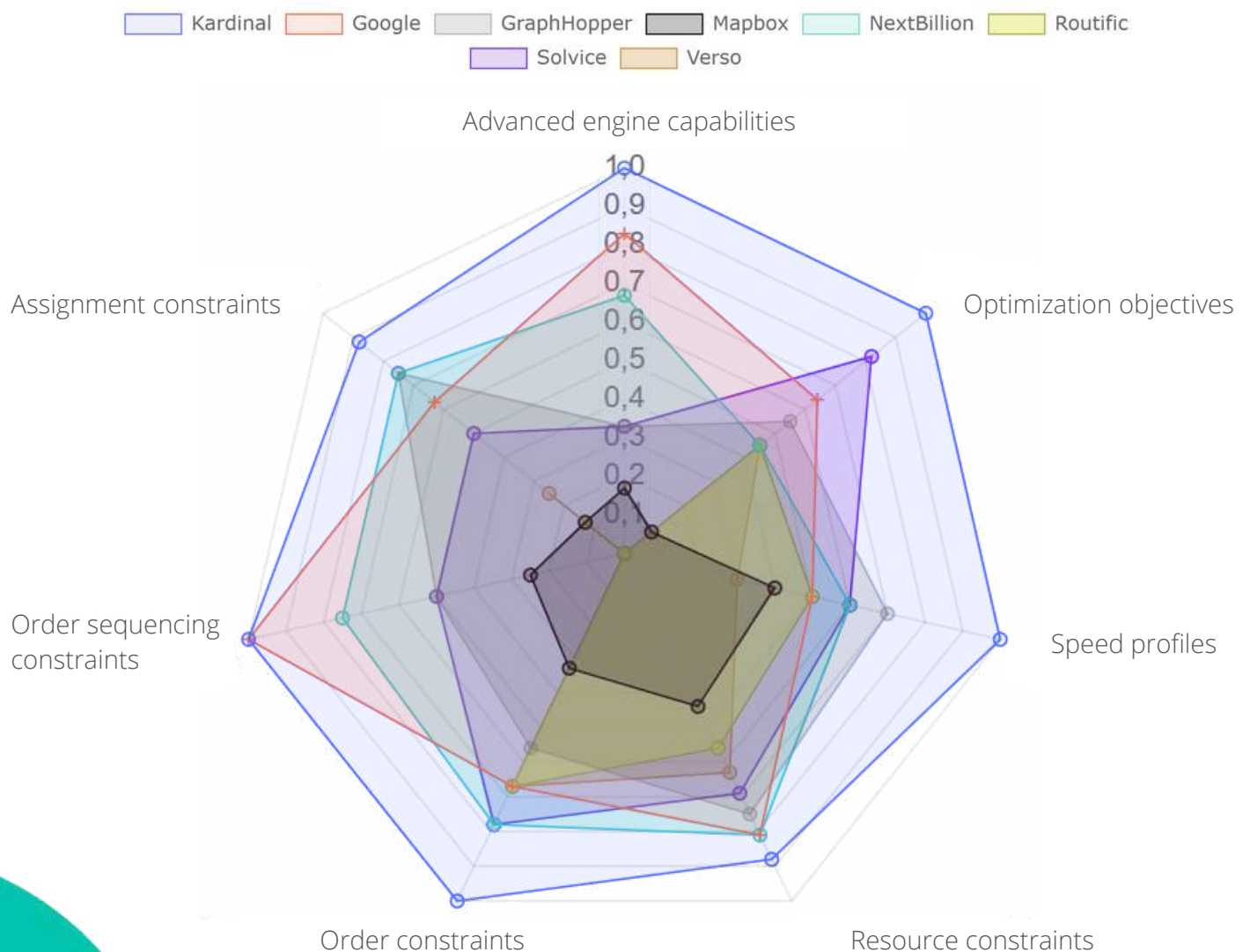
This result demonstrates the technical maturity of its engine and its ability to handle multi-constraint cases with high operational complexity.



# Results

## Part 2: Benchmark of solutions by constraint categories

This radar chart compares the main route optimization solutions according to **7 key categories of features and constraints (detailed in the Methodology section)**. Each axis represents a **key dimension** of an optimization engine, and the scores (ranging from 0 to 1) show the **coverage rate** of each provider in this dimension.





## Evaluated dimensions

- **Advanced engine capabilities:** Continuous optimization, custom cost functions, lexicographic optimization, etc.
- **Resource constraints:** Time windows, breaks, capacity limits, etc.
- **Optimization objectives:** Handling of multiple business-specific objectives.
- **Speed profiles:** Diversity and specificity of vehicle speed profiles.
- **Order constraints:** Handling of pickup/delivery pairs, required skills.
- **Order sequencing constraints:** Enforced logical sequencing of stops.
- **Assignment constraints:** Complex rules linking resources and tasks.

## Comparative summary

- **Kardinal:** Market-leading engine across all dimensions, with scores close to 1.0. Outstanding performance on critical dimensions such as assignment rules, sequencing, and multi-objective optimization. Best suited for regulated or high-stakes logistics environments (e.g., waste management, sensitive deliveries).
  - **Google:** Strong in advanced features and sequencing logic, but less flexible in assignment constraints and fine-grained modeling.
  - **NextBillion.ai:** Well-balanced overall, though less customizable in multi-objective optimization.
  - **Solvic:** Specializes in lexicographic optimization. Partial support for complex constraints.
  - **GraphHopper:** Consistent but lags behind on advanced modeling capabilities.
  - **Verso & Routific:** Designed for simpler use cases. Limited performance on complex constraints.
  - **Mapbox:** Primarily a mapping solution, with minimal support for business-specific constraints.
- 

# Results

## Part 3: Analysis of each provider's ability to meet industry-specific constraints

This section assesses each engine's ability to handle industry-specific constraints. The scores (%) represent the share of sector-specific constraints supported within each domain.

| Secteur                       | Kardinal | NextBillion | Google | Solvix | GraphHopper | Verso | Routific | Mapbox |
|-------------------------------|----------|-------------|--------|--------|-------------|-------|----------|--------|
| Waste transportation          | 97,7%    | 79,5%       | 79,5%  | 68,2%  | 63,6%       | 54,5% | 52,3%    | 31,8%  |
| Fresh produce delivery        | 93,5%    | 71,7%       | 65,2%  | 76,1%  | 65,2%       | 47,8% | 47,8%    | 28,2%  |
| Urban couriers                | 95,5%    | 70,5%       | 75,0%  | 75,0%  | 72,7%       | 50,0% | 47,7%    | 34,1%  |
| Parcel delivery               | 92,7%    | 78,0%       | 68,3%  | 78,0%  | 70,7%       | 56,1% | 53,7%    | 31,7%  |
| Full truckload transport      | 97,3%    | 81,1%       | 78,4%  | 67,6%  | 70,3%       | 56,8% | 54,1%    | 32,4%  |
| Freight forwarding            | 97,6%    | 75,6%       | 75,6%  | 70,7%  | 65,9%       | 56,1% | 56,1%    | 34,1%  |
| Less-than-truckload transport | 93,9%    | 73,5%       | 67,3%  | 67,3%  | 61,2%       | 44,9% | 44,9%    | 26,5%  |
| Retail                        | 93,0%    | 72,1%       | 67,4%  | 79,1%  | 69,8%       | 53,5% | 53,5%    | 30,2%  |
| Field services                | 97,3%    | 75,7%       | 81,1%  | 70,3%  | 67,6%       | 54,1% | 48,6%    | 32,4%  |



## Analysis

**Kardinal** demonstrates **outstanding cross-sector performance**, with **coverage exceeding 90% across all industries**. It is the only provider to offer such a high level of adaptability.

- **NextBillion.ai** and **Google** form a solid duo, with consistent scores around 70–80%, though still **below Kardinal** across all use cases.
- **Solvice** performs well in certain markets such as **retail, fresh product delivery**, or **parcel logistics**, but falls short in more complex sectors like long-haul transport or waste management.
- **GraphHopper** shows average coverage, typically between **65% and 72%**, without standing out in any particular vertical.
- **Verso, Routific**, and **Mapbox** score significantly lower, **often below 55%**, and even **under 35%** for Mapbox. Their ability to serve demanding business sectors is therefore very limited.





Want to learn more about Kardinal's route optimization solution or this benchmark?

[Contact us!](#)

## They trust us

