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Autonomous Driving Map Industry Report, 2024

Dec. 2023

Players respond to the development of new-generation autonomous driving maps

As the supervision of HD map qualifications tightens, issues such as map collection cost, update frequency, and coverage stand out. Amid the boom of urban NOA, the "lightweight map" intelligent driving solution has become a hot topic in 2023. This solution lessens the dependence on offline HD maps, posing a challenge to the development of HD maps.

From the development process of autonomous driving, it can be seen that human-machine co-driving will exist for a period of time. The need for maps in this phase is not necessarily HD maps. Multi-source maps that integrate the complementary characteristics of different maps may be more suitable for the needs of autonomous driving in this phase.

How do players respond to the development of new-generation autonomous driving maps?

Government: while tightening the Class A qualification for HD map surveying and mapping, work to enhance the review of ADAS maps and Class B surveying and mapping qualification.

In June 2023, the Map Technology Review Center of the Ministry of Natural Resources announced the phased progress in review of ADAS maps of ordinary urban roads across China, and allowed companies to submit ADAS maps of nationwide ordinary urban roads for review in batches. Currently, NavInfo's approved nationwide urban ADAS map data have covered 120 cities in 30 provinces; Baidu Maps has ADAS maps of 134 cities approved.

OEMs: relevant departments' stricter review of the Class A qualification for navigation electronic map surveying and mapping has discouraged OEMs to deploy the Class A qualification for map surveying and mapping. At present, some OEMs use neural network model algorithms for real-time mapping and lower reliance on offline HD maps, and the ADS-enabled models of Tesla, Li Auto, Xpeng, and Huawei are typical cases; some other OEMs prefer stability, and obtain surveying and mapping qualifications by way of applying for Class B qualification or establishing new joint ventures with map providers. For example, GAC together with its partners such as Nanjing Institute of Surveying, Mapping and Geotechnical Surveying Co., Ltd. co-funded "Guangdong Guangqi Yutu Equity Investment Partnership (Limited Partnership)"; Anhui NIO Smart Mobility Technology Co., Ltd., a subsidiary of NIO, applied for the Class A qualification for Internet map services.

Map providers: to meet the market demand, they launch "lightweight map" solutions, putting SD data, HD data, LD data, etc. on one map to ensure the continuity of navigation. One example is Tencent which introduced the "Intelligent Driving Cloud Map" to support the cooperative construction by map providers, automakers, autonomous driving companies and other players, after launching its "three-in-one" intelligent driving map.

Approval for ADAS Maps of Mainstream Map Providers

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Map Provider	Approval for ADAS Maps
NavInfo	• In May 2023, the ADAS map submitted for review was approved, becoming one of the first ADAS maps approved with a map approval number in Beijing. • The ADAS map submitted by NavInfo for review covers all the intelligent connected vehicle HD map pilot areas in Beijing and has been on a par with the 60 square kilometers in Phase 2.0 of Beijing's high-level autonomous driving demonstration zone. • The data of NavInfo's first approved national urban ADAS maps cover 120 cities in 30 provinces. In addition to the previous 6 pilot cities (Beijing, Shanghai, Guangzhou, Shenzhen, Hangzhou, and Chongqing), they also cover other major cities like Chengdu, Wuhan, Zhengzhou, Nanjing, Suzhou, Tianjin and Changsha.
Baidu	• In October 2022, Baidu was approved for urban ADAS maps in Guangzhou and Shenzhen; • In December 2022, Baidu was approved for urban ADAS map in Shanghai; • In April 2023, Baidu was approved for ADAS maps in Hangzhou and Chongqing; • In April 2023, it submitted for review ADAS maps of another 15 major cities in Guangdong Province except Guangzhou and Shenzhen, and was approved for self-testing; • In May 2023, Baidu was approved for urban ADAS map in Beijing; • In August 2023, Baidu Maps' ADAS maps of 134 cities were approved by the Map Technology Review Center of the Ministry of Natural Resources.
Tencent	• Tencent Tongtu Data passed the review of the Class A surveying and mapping qualification in early 2022, and then was approved for ADAS maps of pilot cities such as Guangzhou, Shenzhen, Shanghai, and Hangzhou.

Source: ResearchInChina

Emerging carmakers take the lead in launching "lightweight map" solutions

Emerging carmakers take the lead in launching "lightweight map" solutions.

At present, OEMs' solutions that do not rely on HD maps don't mean that they do not use maps at all, but subtract elements from HD maps or add them to navigation maps instead.

It is mainly emerging carmakers that are more active in "lightweight map" solutions. One reason is that they implement urban NOA functions very quickly, and HD maps fail to answer their relevant needs.

"Lightweight Map" Solutions of Some OEMs

OEM	Model	Lightweight Map Solution
Li Auto	Model with AD Max 3.0 (L9)	• Technology from Tsinghua University • Static BEV network algorithm (used to restore the static world) • Dynamic BEV network algorithm (recognizing changing traffic participants) • Occupancy network algorithm (recognizing universal obstacles)
Xpeng	Models with XNGP (Max version of G9 and P7i)	• Based on the XNet deep learning algorithm (without relying on HD maps, Xpeng XNGP now mainly enables LCC-L (enhanced lane centering control, which can bring such scenarios as traffic light recognition, start and stop, and detour in no lane lines), and forms memory maps; • There is also another mode AI Valet Driver, which is more of a mode between "crowdsourced map" and "non-map". In the learning process, it only memorizes waypoints and turning information, and depends on "non-map" capabilities in actual operation. Learning is only to improve experience and safety.
NIO	Models with NAD solution	• NIO's "non-map" mode prefers crowdsourced mapping solutions.
Tesla	Models with FSD	• The shadow mode collects static information on roads, such as topologies and traffic light positions. After the information is compressed into several layers, the layers will be input as perception data, and will be combined with the real-time perception data at the vehicle BEV via the Transformer language model to restore a "HD map-like" map.

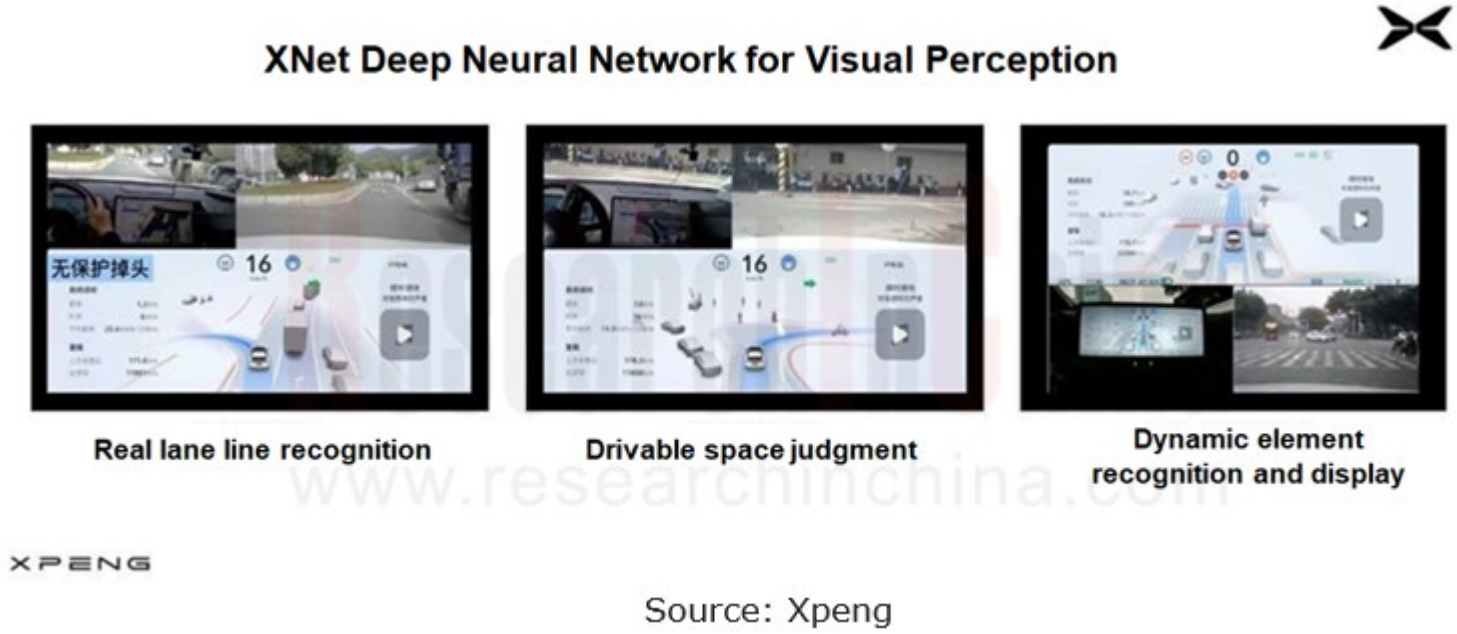
Source: ResearchInChina

Xpeng

In the first half of 2023, Xpeng started developing intelligent driving solutions based on SD maps. NGP that uses HD maps or does not use adopts the same technology stack. The only difference is that the original HD map input is replaced by the navigation map input, and the understanding of navigation information in real-time perception.

Xpeng's solution that does not use HD maps has the advantages of 4 to 10 times faster generalization speed, completely solving the problem of data freshness, reducing costs, and popularizing intelligent driving, compared with the solution using HD maps.

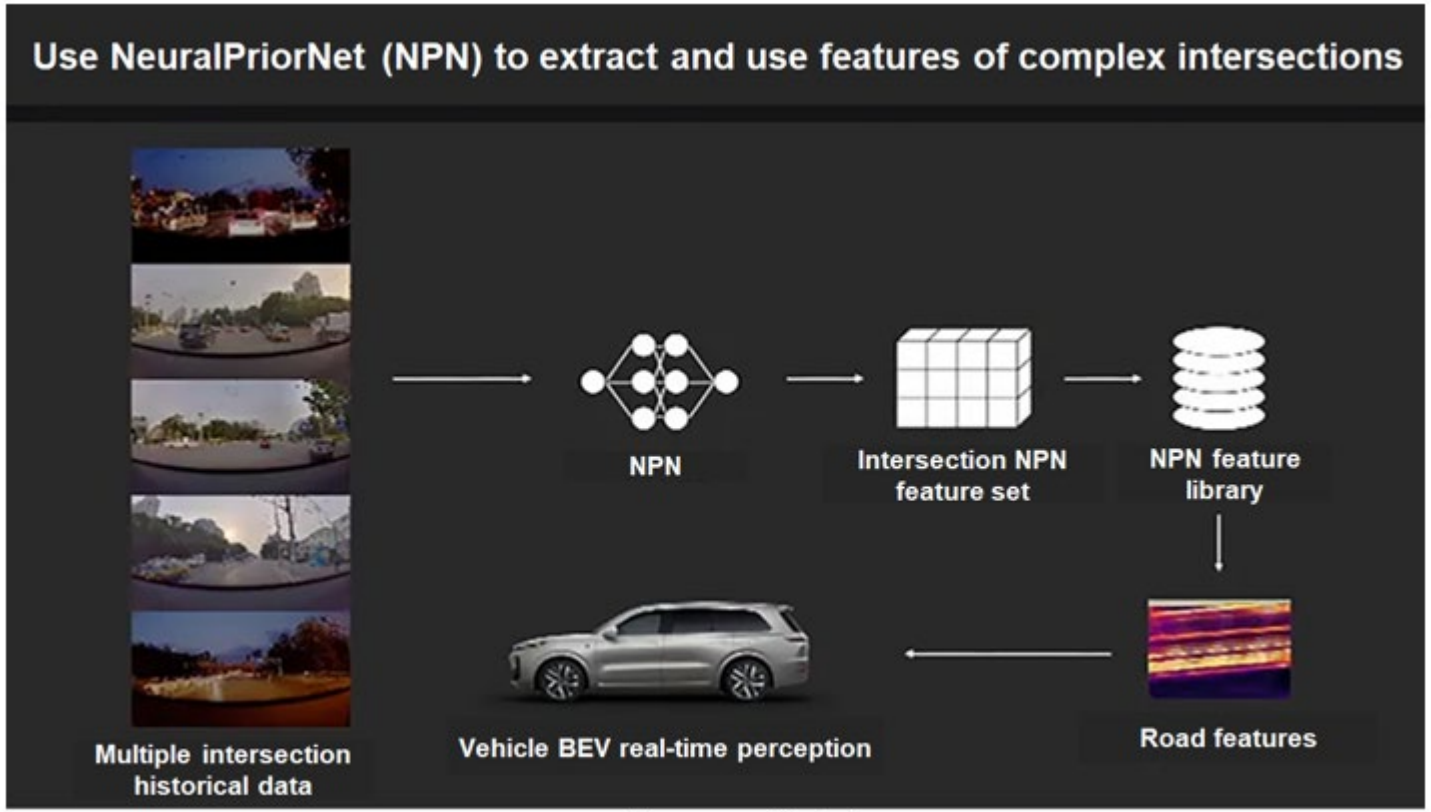
The "no offline HD map" solution implemented by Xpeng relies on XNet to build a "HD map" in real time.



Source: Xpeng

Li Auto has launched urban NOA in 2023. This solution does not rely on HD maps. It aims to construct the features of intersections to assist in real-time perception and mapping. In a word, road sections are "unmapped", and intersections are mapped by crowdsourcing.

Li Auto is now promoting the NPN solution, hoping to solve the problem of online map updates.



Source: Li Auto

Lightweight autonomous driving map solutions

In terms of OEMs' solutions, despite less dependence on HD maps, the "lightweight map" solution has higher requirements for vehicle perception and algorithms.

Conventional map providers launch lightweight autonomous driving map solutions to meet demand.

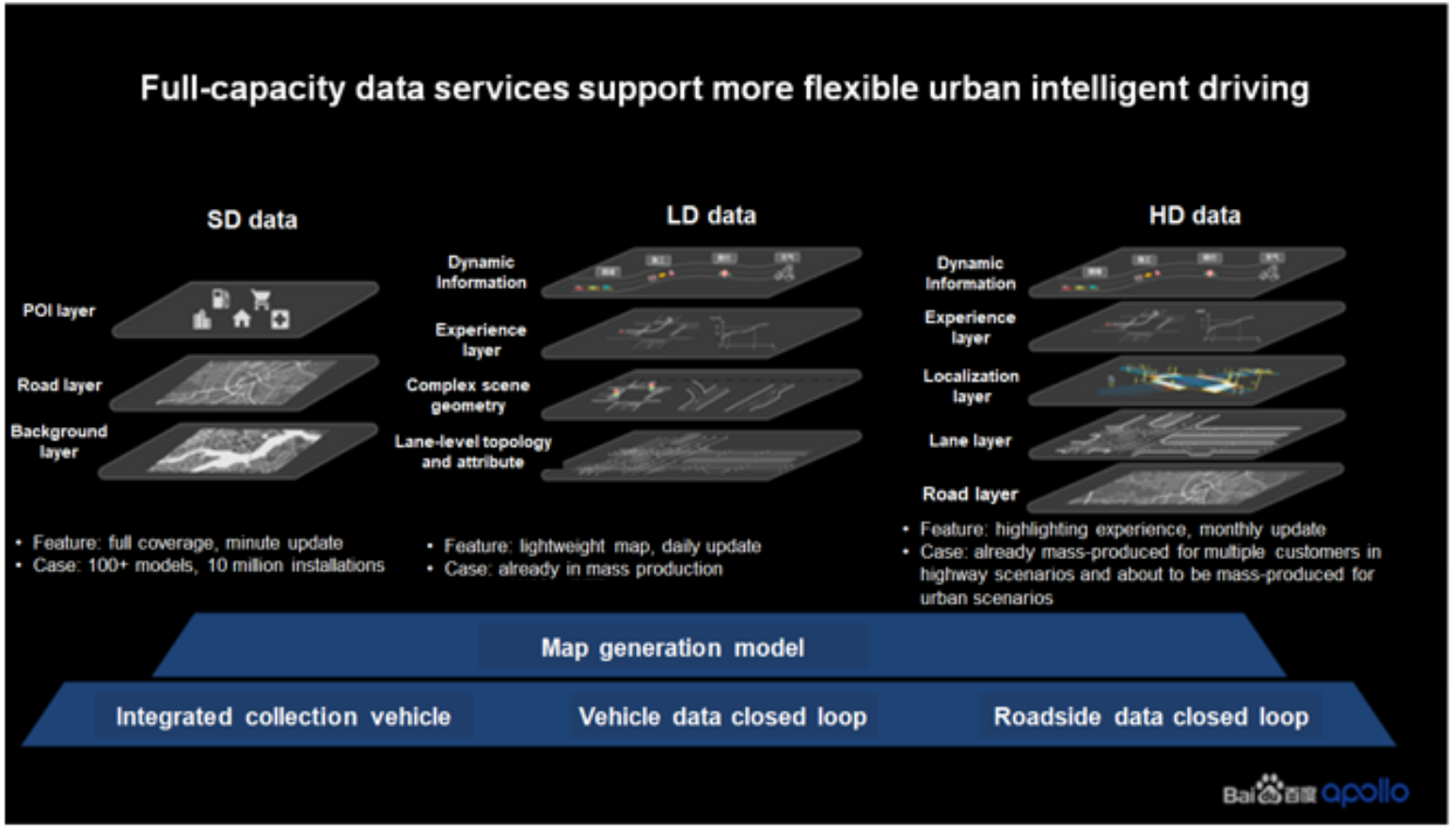
The voice of OEMs to "not rely on HD maps" is growing ever louder. To cater to the market demand, conventional map providers also make changes, trying hard to solve the three enduring problems of HD maps: update frequency, coverage area, and cost, and launching map products that more fit in with the current needs of autonomous driving.

Intelligent Driving Map Layout of Mainstream Map Providers

Map Provider	Time	Intelligent Driving Map Layout	Focus	Features
Baidu	Dec. 2022	Lightweight Solution	Lower cost	• Apollo City Driving Maxm, an urban intelligent driving system, uses "only vision + LiDAR" to achieve perception redundancy. The enhanced algorithms and less dependence on road elements allow it to be promoted in multiple cities at a reasonable and acceptable cost.
	Aug. 2023	Lightweight Map Solution		• When launching the HD maps of 134 cities, Baidu mentioned that it uses a lightweight map solution, with the cost nearly 80% lower than common HD maps. • Maps and intelligent driving solutions can provide LD data and HD data for automakers. LD does not provide the localization layer data, and there will be some differences in lane data. For some places where "driving" capabilities perform well, only topological connection of lanes will be supported. • LD will have more crowd-source data coming in, so routine weekly updates are enabled, and some scenes can even be updated rapidly every day.
Tencent	Apr. 2023	HD Air Lightweight High-Precision Data Product	Increase update frequency	• It is a member of Tencent's Unimap data product matrix. Its element richness and accuracy not only meet the needs of L2+ autonomous driving, but also further reduce the cost of mapping; • Focus on providing the necessary elements for intelligent driving, present complex lanes and intersections in the form of "points", and concentrate on lane information, enabling a smaller amount of data and more concise presentation mode; • Support more three-dimensional, realistic, and real-time map rendering; • More information sources, more lane change points, more lane attributes, more lane markings, etc.;
	Sept. 2023	Intelligent Driving Cloud Map		• In synchronously online update, achieve element-level and minute-level update efficiency; • Environmental data, driving experience data, and autonomous driving operation data can all become part of the cloud, making transmission and storage more convenient;
Amap	Jun. 2023	New HQ Live MAP for Automotive Industry	Lower cost and increase update frequency	• Simplify unnecessary map elements in ordinary urban road scenes, and thus lower the production and deployment costs to achieve lighter but more practical effects;
NavInfo	Apr. 2023	Intelligent Driving Scene Map	Lower cost	• Directly cut down the cost of HD maps from "tens of thousands of yuan to hundreds of yuan";
	Oct. 2023	HD Lite		• Oriented to urban NOA; • Reduce the procurement cost of urban NOA map solutions to half of HD Pro map;

Source: ResearchInChina

In July 2023, Baidu MapAuto 6.5, a human-machine co-driving map, was launched. It is a full 3D lane-level map and also an all-scenario human-machine co-driving map. It can provide three types of data: SD, LD and HD. Wherein, SD data has covered the whole country and is currently available on 10 million vehicles. Baidu's LD lightweight map data service consists of lane-level topology, complex scene geometry, experience layer, and dynamic information layer, allowing for daily update.



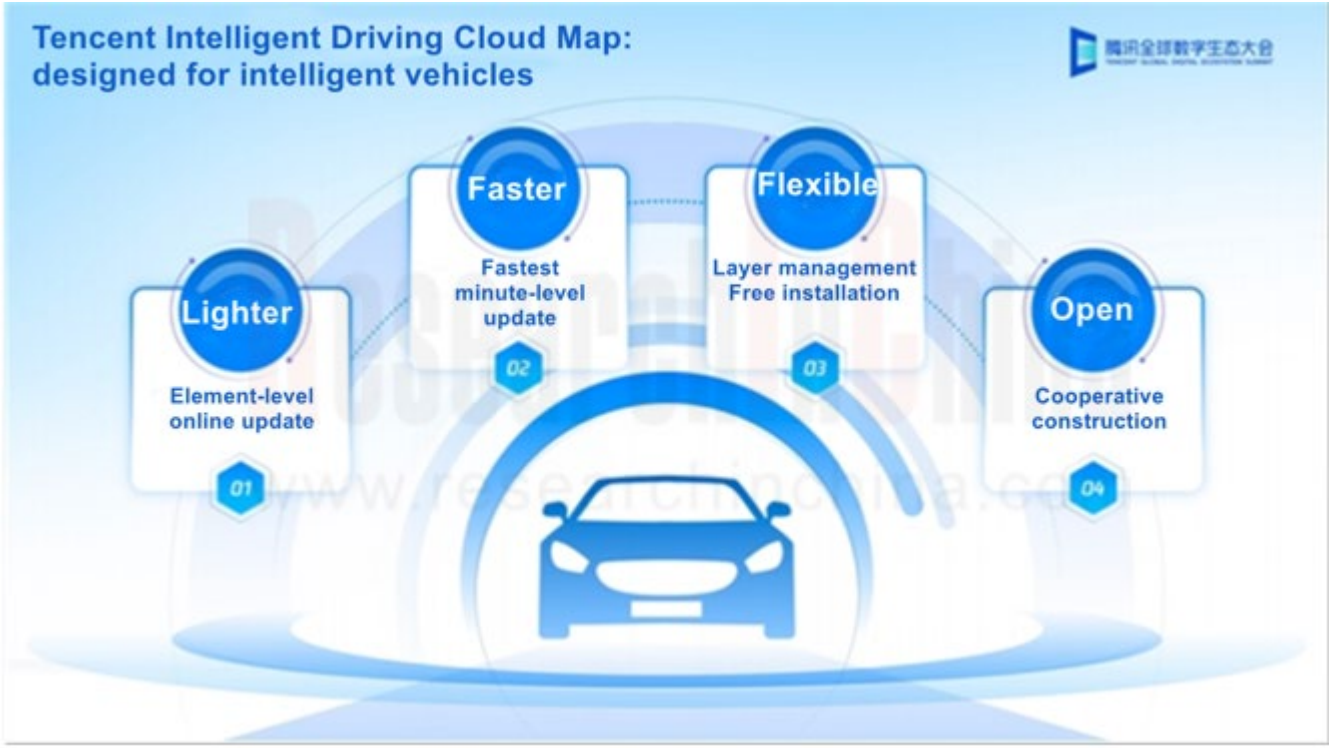
Source: Baidu

Amap and Tencent

Amap
The new HQ Live MAP, launched in June 2023, combines the merits of HD MAP and SD MAP. In spite of a lower accuracy than HD MAP (absolute accuracy: 50cm, relative accuracy: 10cm), HQ Live MAP is enough for ADAS scenarios (highway and urban expressway scenarios: absolute accuracy of 1m, and relative accuracy of 30cm; ordinary urban road scenarios: relative accuracy of 1m), and it also simplifies unnecessary map elements in ordinary urban road scenarios, further reducing production and deployment costs.

Tencent
The latest Intelligent Driving Cloud Map, released in September 2023, enables fully cloud-based autonomous driving maps, supports element-level and minute-level online updates, and allows for the cooperative construction by map providers, automakers, autonomous driving companies and other players.

Tencent Intelligent Driving Cloud Map features scalable multi-layer forms, covering basic map layer, update element layer, ODD dynamic layer, driving experience layer and operation layer. Automakers can flexibly configure and manage the layers as they need, and build a data-driven operation platform suitable for themselves by combining it with their own data layer.



Source: Tencent

Highlights of Autonomous Driving Map Industry Report, 2024

Autonomous Driving Map Industry Report, 2024 highlights the following:

- Autonomous driving map (formulation of policies, regulations, standards, etc.);
- Vehicle map amid the development of urban NOA (development direction, coping strategies of conventional map providers, main types of maps used in urban NOA, etc.);
- HD map (market status, market size, company pattern, business model, development challenges, etc.);
- Application scenarios of intelligent driving map (high-speed autonomous driving of passenger cars, low-speed parking, autonomous human carrying, autonomous object carrying, etc.);
- Major Chinese and foreign map providers (map product series, new product layout, product application cooperation, etc.);

* HD map technology companies (technology layout, new technology R&D, etc.).

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