

Huawei Smart Transportation

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From the perspective of Huawei, the definition of Smart City is "Brilliant life powered by Smart City" [1]. A Smart City efficiently handles the information boom and creates value across many sectors. Based on a combination of virtual and physical infrastructure and intelligent functions powered by network and IT technologies, Smart City offers a perfect lifestyle choice for individual users. The Smart City concept includes Digital City and Wireless City. In a nutshell, a Smart City describes the integrated management of information that creates value by applying advanced technologies to search, access, transfer, and process information. A Smart City encompasses *e-Home, e-Office, e-Government, e-Health, e-Education and e-Traffic*. A Smart City is purported to be the fourth in size and importance when it comes to infrastructure after water, electricity and natural gas. The availability of information in a Smart City represents an important standard that measures a city or even a country's ICT level, international competitiveness and influence.

Huawei's Smart City solutions [2], being deployed in more than 60 cities across 20 different countries, are founded on ubiquitous connectivity, information inter-operability (both information sharing and integration), and inter-departmental collaboration. Its solution architecture and platform (Figure 1) integrates the connection service platform, the computing service platform and the data service platform, leveraging the Internet of Things (IoT), integrating innumerable information sources, in an intelligent, collaborative manner. Combined, the platform provides next-generation ICT through which it, in conjunction with its partners, can build Smart City applications.



Figure 1: Huawei smart city architecture.

To realize the Smart City, three essential platforms need to be established:

Data Service Platform: Massive amounts of multi-source data, store the data, and process and analyze it for data sharing and improving operational efficiency.

Connecting Service Platform: Collect and consolidate information from every corner of the city, transmit them to the different functional platforms and applications of smart cities, and manage the overall transmission network. For instance, when a new city district starts construction, IoT networks connecting construction sites, street lamps, trash bins, parking systems, water meters, and environmental monitoring sensors can be integrated to achieve real-time monitoring, warning systems, and management.

Computing Service Platform: Edge computing, cloud storage, cloud computing, and high-performance computing.

1 Smart Transportation

1.1 Intelligent transportation systems (ITS)

Intelligent transportation systems (ITS) leverage IoT to monitor the movement of people and freight on transportation infrastructure such as surface roads, highways, intersections, public transportation (i.e., light- rail, subways, buses), bridges, and tunnels [2] and with the aim of improving traffic safety and efficiency, and optimizing citizen's transportation experience.

The ITS provided by Huawei includes [3]:

- **The command center.** It is the core of the ITS. It manages the operation of urban traffic and activates the inspection and control function based on suspected vehicle information, so as to monitor and trace vehicles.
- **Road surveillance.** It enables to know overall traffic conditions intuitively and acquire traffic information in real time.
- **Traffic signal control system.** It regulates the traffic order of vehicles and pedestrians. Work modes of the system include single point of control, regional arterial control, and green wave optimization.
- **Traffic flow acquisition system.** It enables video analysis and microwave detection, acquires traffic flow status in real time, and has the capability to predict congestions based on integrated analysis of the history and current traffic information, serving as reference to commanding and dispatching, traffic signal control, and traffic guidance.
- **Traffic guidance system.** It releases all kinds of traffic information and notice, diverting traffic flow and reducing traffic congestion. Traffic changes rapidly and efficient ITS systems need an efficient bearer network. Huawei provides E2E network solution to keep services uninterrupted. Wireless backup links are also added for higher reliability in key areas.
- **ANPR (Automatic number plate recognition) system.** It is deployed at entrance/exit or arterial roads of the city to record license plates information, ensuring road safety and fighting against crimes.
- **Electronic police system.** It identifies and records illegal vehicles behavior. The system helps police to investigate and fight against vehicle-related crimes. It adopts industrial HD cameras, capable of continuous snapshots and automatic recognition of number plates and traffic violation. Snapshots can reflect illegal factors, and a video can be provided as evidence.
- **Mobile electronic police.** It is an effective supplementation to the fixed electronic police system. It enables flexible surveillance at feeder roads.

There is a solution example which has been deployed successfully in Langfang, China. The system components of the ITS solution can be seen in the following table [4].

Subsystem	Equipment and software
Traffic Signal Control System	Traffic signal controllers at 64 intersections, 186 units of video-based vehicle-detection equipment, 209 sets of vehicle signal lights, and 60 sets of pedestrian signal lights
Traffic Flow Information Collection System	43 solar-powered microwave traffic volume detectors
Traffic Guidance System	Eight 11.47m^2 traffic guidance screens and related equipment
Traffic Surveillance System	Surveillance equipment at six overview sites and HD surveillance equipment at 60 intersections
Red-light Camera System	100 HD cameras and 100 SD cameras at 33 intersections
122 Alarm Systems	Automatic Call Distributors (ACDs), Computer and Telephony Integration (CTI) servers, Call Control Servers (CCS), Interactive Voice Response (IVR) systems for voice guidance, recording system, data middleware servers, remote communications servers, web servers, database servers, and six alarm agent workstations
Police Car GPS	82 sets of vehicle-mounted GPS devices and GPS servers, and database servers
Command Center Display System	12 HD Digital Light Processing (DLP) displays, six LCD monitors, and two LED information displays
System Integration Platform	One system platform that integrates information about traffic flow, traffic signal control, traffic video surveillance, electronic police and other subsystems, as well as background servers and other hardware

Using a comprehensive Geographic Information System (GIS) and electronic maps as the main operating platform, Huawei's solution integrates systems such as traffic signal control, video surveillance, traffic flow information, GPS positioning, vehicle interception, and police dispatch. Figure 2 shows the overview of this ITS solution.

Furthermore, the intelligent transportation scenario is evolving from a single static, digital display to real-time convergence. The maturity model of intelligent transportation can be seen in Figure 3 [5].

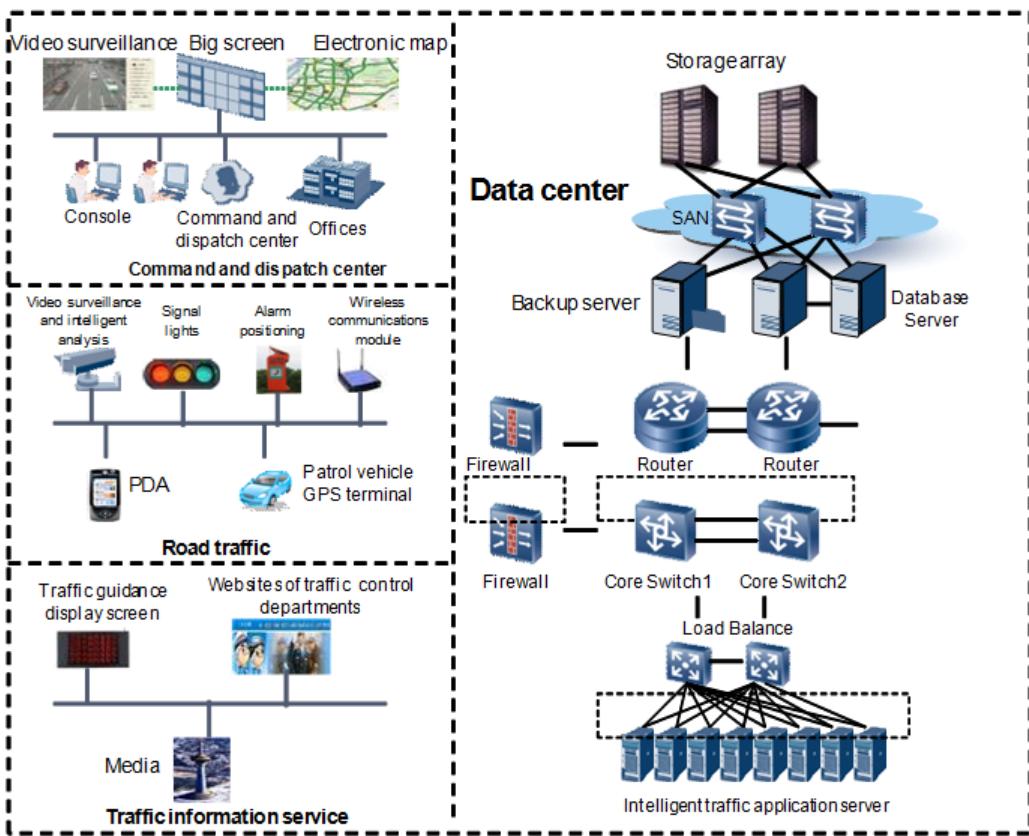


Figure 2: ITS solution overview.

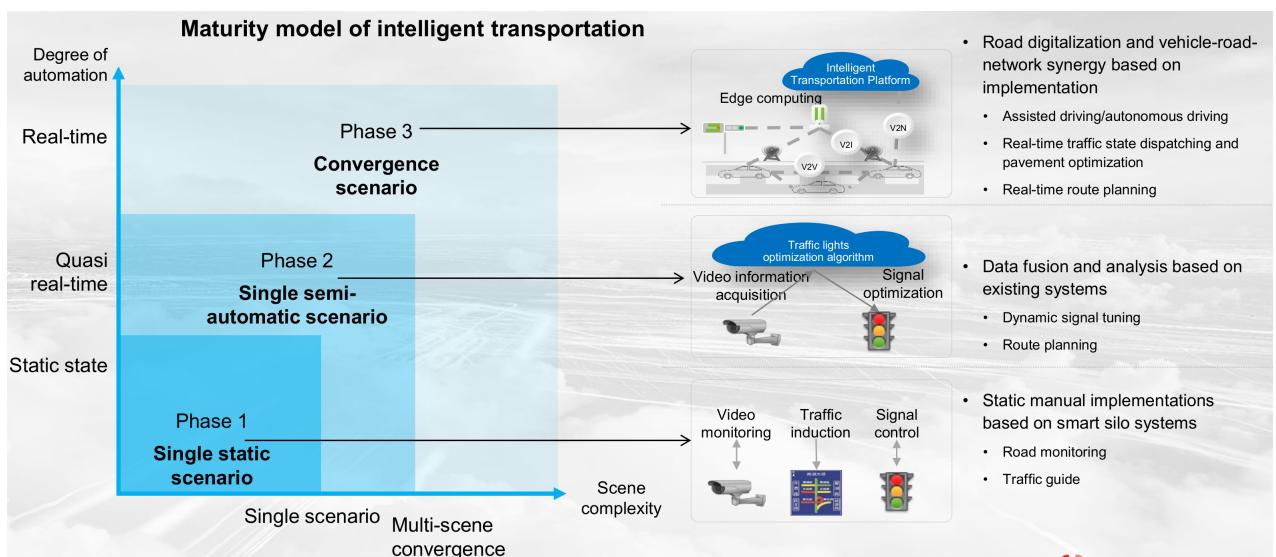


Figure 3: Maturity model of intelligent transportation.

In phase 3, the road digitalization (Figure 4) is able to reduce intelligence requirements of a single vehicle, accelerating commercial use of autonomous driving. Road conditions are digitalized and input into the decision system, which simplifies decision-making and helps achieve high-level autonomous driving under low-level AI capabilities.

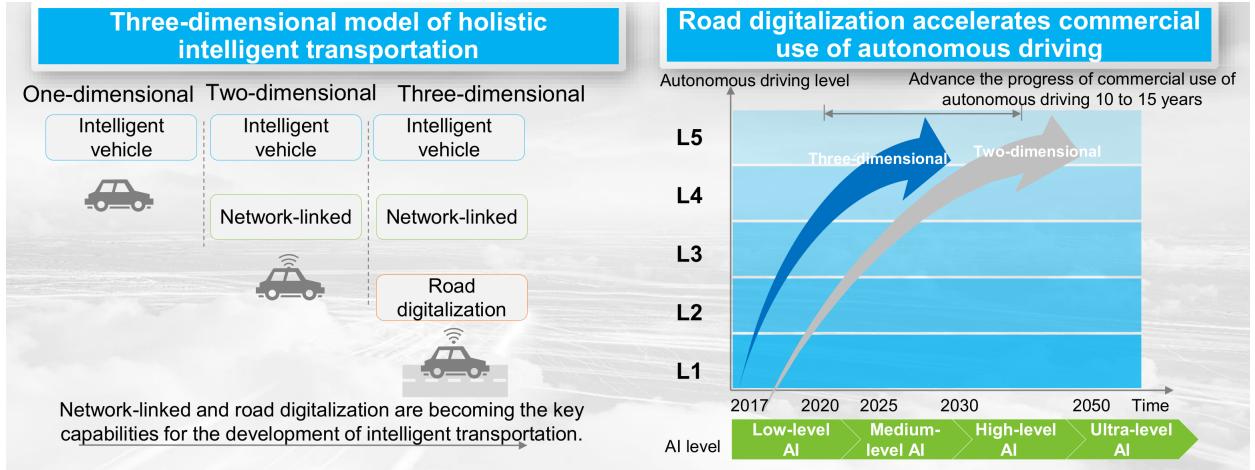


Figure 4: Road digitalization and the progress of commercial use of autonomous driving.

Intelligent transportation platform is able to provide road digitalization and road synergy to enable traffic operation (Figure 5).

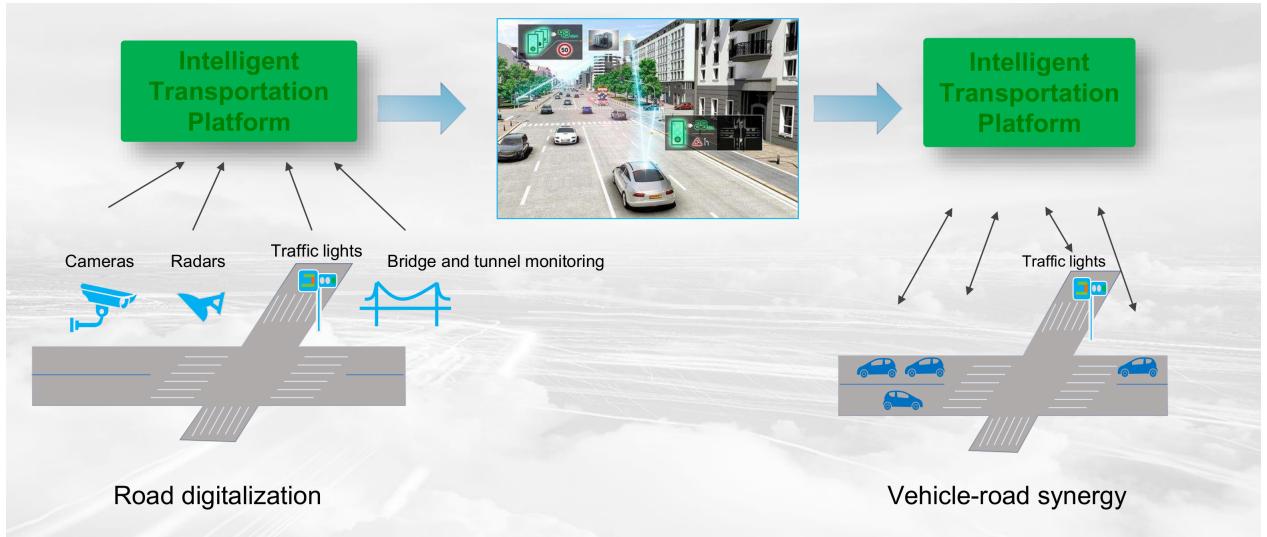


Figure 5: Digitalization and vehicle-road synergy.

Finally, Figure 6 shows the Huawei OceanConnect Intelligent Transportation Platform. Integrated perception of vehicles and roads, cross-domain interconnection, and real-time intelligent control are the core capabilities of the intelligent transportation platform.

1.2 Digital Urban Rail [6] [7]

With significantly increasing scale and passenger volume, there is demand for urban rail lines to be integrated into multiple-line networks that require more efficient, smart operations. Huawei Urban Rail Cloud Solution (Figure 7) offers a secure, efficient, and agile cloud platform that accelerates the transformation from single-line to multi-line operations, helping customers make the most use of Big Data and build smart urban rails.

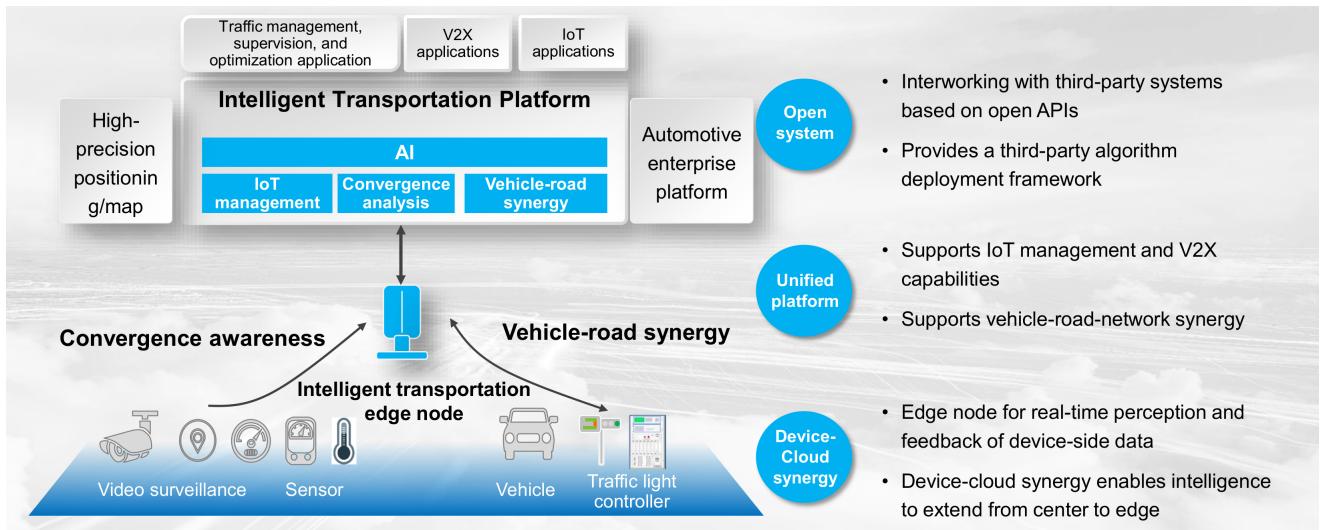


Figure 6: Huawei oceanconnect intelligent transportation platform.

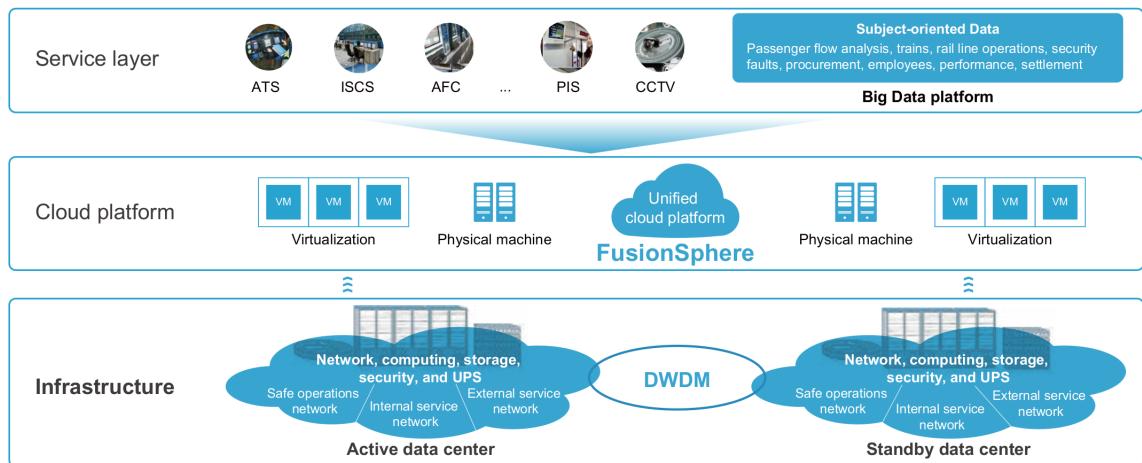


Figure 7: Huawei urban rail cloud solution.

1.3 Digital Railway [8] [9]

Huawei's Digital Railway Solution not only helps railways to further improve efficiency, security and passenger experiences, but also builds up new business opportunities and offer an excellent return on investments. In particular, it includes:

- Huawei's Operational Communication Solution which helps rail operators to build future-oriented train-to-ground radio network and provides reliable connections for operational communications, to boost rail mobility in a cost-efficient way;
- Huawei Railway Agile Station Solution which helps rail operators to build a converged and reliable ICT platform, improve agility, maximize resource utilization and simplify the routine work;
- Huawei Fusion OCC Solution which enables an open and reliable information platform, to build intermodal competitiveness by service transformation;
- Huawei Digital Train Solution which supports unified onboard PIS, CCTV and WIFI services on a single network, enhancing passenger satisfaction and loyalty through an enriched rail journey experience.

1.4 Smart Aviation [10] [11]

Huawei provides a cloud-pipe-device E2E smart airport solution (Figure 8) based on innovative ICT technologies such as eLTE, cloud computing, intelligent video surveillance, and IoT. The solution adopts cameras, sensors, and mobile terminals to form an airport sensing layer, offers transmission capabilities through multiple channels such as eLTE, Wi-Fi, and agile networks, and establishes cloud-based unified communications, video cloud, IoT, and Big Data platforms covering an entire airport. In this way, the solution delivers global data sharing and analysis capabilities, helps build an airport collaborative decision-making (A-CDM) system and airport operation database (AODB), and facilitates visualized operational processes, safety, and services.

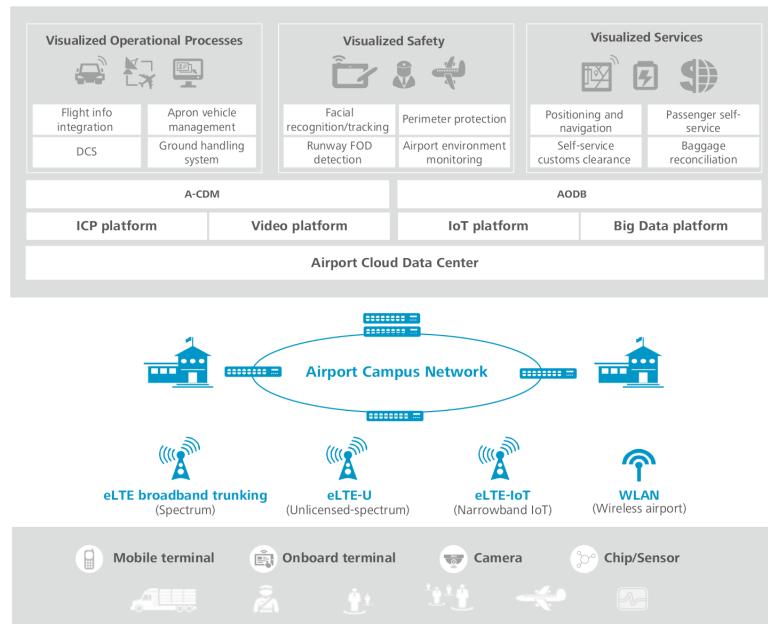


Figure 8: Huawei smart airport solution.

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