HERE Peeling the Onion of Enhanced Location Technology

Automotive Multimedia and Communications (AMCS)

The announcements of new products, services, partnerships, and standards for data collection and aggregation have come fast and furious lately from digital map maker and location-based technology company HERE. All of the activity points toward the creation of a comprehensive location cloud platform suited for a wide range of applications from navigation to mobility services and navigation. This Insight examines HERE's activities in light of auto industry trends, such as autonomous driving technologies, and the competitive environment for location data and services solutions.

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Executive Summary

The announcements of new products, services, partnerships, and standards for data collection and aggregation have come fast and furious lately from digital map maker and location-based technology company HERE. What has yet to come is an endorsement and investment by the elusive fourth car company.

All of the activity points toward the creation of a comprehensive location cloud platform suited for a wide range of applications from navigation to mobility services and navigation. HERE has even managed to attract strategic investors — though further developments are anticipated later in Q1.

HERE maps remain the dominant in-dash solution for on-board navigation in passenger vehicles. Despite mighty efforts, the entity owned jointly by Audi, Daimler and BMW has yet to attract any further auto maker investors.

Other investors have stepped forward including Intel, taking a 15% stake; and NavInfo, Tencent, and GIC jointly acquiring a 10% stake. Both investments are expected to reduce the indirect Audi, BMW and Daimler shareholdings in HERE in equal measure.

In addition to these long-sought investments HERE announced partnerships with Mobileye, NVIDIA, Baidu (for mobile phone navigation) and Microsoft, and a collaboration with PSA for the development of self-driving cars. HERE is also being integrated into the Rio fleet management system from Volkswagen's MAN subsidiary. These announcements follow HERE's introduction, in the middle of 2016, of the SENSORIS universal specification for sharing vehicle sensor data and the announcement of its Open Location Platform (OLP).

The following Insight discusses HERE's latest partnerships and efforts in the context of a market moving toward integration of infotainment and safety functions in the near term and automated driving technologies in the long run.

Analysis

HERE topped its strategic location-related announcements with the launch of HERE Electronic Horizon at CES 2017. The company says this new software solution helps vehicles "know and react to what lies ahead on the road without driver involvement." The concept is familiar and has been in development for nearly a decade as part of an effort to turn map data into the equivalent of a vehicle sensor by enabling cars to use the on-board map to anticipate upcoming changes in road geometry.

HERE Electronic Horizon is embedded software for vehicles that pulls in map data and dynamic road event data from the cloud to create a simplified representation of the road ahead that has a range of a few hundred meters to several kilometers. It then feeds that model of the road to the vehicle's advanced driver assistance systems (ADAS) to optimize the performance of its engine and safety systems.

HERE Electronic Horizon is designed to take advantage of HERE's map data and is enhanced by data infusions from HERE's Open Location Platform and the SENSORIS data aggregation specification currently hosted by ERTICO. Piece by piece HERE is building a navigation and map management architecture intended to facilitate the development of a self-maintaining map that will ultimately support the launch of self-driving or autonomous vehicles.

HERE has identified Audi, Daimler, and PSA as partners that are putting its high definition map technology to work in support of automated driving development. In Audi's case, HERE stated that the company is working on implementing HERE"s HD Live Map in future vehicles. With respect to Daimler, HERE stated the OEM is integrating HD Live Map in Mercedes-Benz prototypes. Yet, the three HERE-owning partners — Audi, BMW and Daimler — continue to pursue independent paths to sensor data collection and aggregation even though they have agreed to share vehicle sensor data in the first-of-its kind implementation represented by the Open Location Platform.

In fact, HERE and its owners are at the vortex of a data aggregation cyclone enabling a wide range of application development from vehicle-to-vehicle and vehicle-to-infrastructure communications to road hazard identification and road sign recognition and updating. The enabling technologies include connected smartphones, embedded telecom modules, the Navigation Data Standard for compiling and incrementally updating maps and the vehicle architectures of the auto makers themselves that allow sensor data to be communicated via the vehicle telematics system.

The long-term objective is to create an on-board navigation experience that is connected to servers capable of providing updates as needed, while also being connected to safety systems as part of evolving automated driving technology (and collision and hazard alerts), and connected to other cars for collision avoidance purposes and connected to infrastructure for more efficient vehicle operation. The connected navigation experience is intended to allow on-board navigation to compete more effectively with server/smartphone-based navigation from the likes of Google and Waze while setting the stage for the onset of automated driving.

HERE's goal is to embed and integrate an increasingly accurate and detailed map with on-board safety systems and sensors. The collection and sharing of data between Audi, BMW, and Daimler, a ground-breaking initiative, is intended to more rapidly scale the collection of valuable driving data. More than 150,000 BMW branded vehicles are currently able to contribute data to the platform. HERE says Daimler and Audi are also contributing data, though it is not clear how many vehicles are able to or are currently contributing data to HERE's Open Location Platform.

This unusual three-car-company collaboration is competing with the standalone efforts of Waymo (currently using FCA Chrysler Pacifica minivans equipped with self-driving equipment), Tesla Motors (Level 2 autopilot with robust data gathering), and Uber (making use of cars from Volvo Cars, Ford Motor Company, and Daimler). The challenge for HERE, while enabling the independent development efforts of its owner/partners, is to create a third, enhanced path with the aggregated data from the three companies.

Though cooperating, Audi, BMW, and Daimler maintain their independence when it comes to location strategies. The independence of HERE's owners is manifest in Daimler's and BMW's decisions to enable intra-brand vehicle-to-vehicle connections via cellular technology for communicating select road hazards. Audi opted to not implement this approach. BMW made use of smartphone technology in the form of the ConnectedSignals app to deliver traffic light signal phase and timing (SPAT) information. Audi offers the same solution, i.e. delivering SPAT information, via the embedded modem.

HERE began leveraging the map-as-a-sensor concept approximately 10 years ago. The original effort envisioned enhancing advanced driver assist systems (ADAS) when the company conceived it prior to Navteq's acquisition by Nokia. Now called HERE Electronic Horizon, the software-based system allows HERE to offer what it describes as a "full location technology stack for the car that simplifies and shortens time of development for automakers, and meets their needs today right through to fully autonomous driving."

But HERE Electronic Horizon isn't only about autonomous driving. The full location technology stack is also intended to help drivers avoid collisions and operate their vehicles more efficiently by anticipating upcoming road conditions. The system enhances such functions as adaptive cruise control, adaptive lighting, night vision, and object recognition.

HERE Electronic Horizon also supports the forthcoming ADASIS version 3 specification meaning it also works with high-definition map data and connects to HERE's HD Live Map cloud service. HERE expects this solution to arrive in production vehicles later in 2017.

HERE's success with Electronic Horizon and the Open Location Platform has not suddenly rendered data sharing between brands a simple proposition. To foster wider data sharing, HERE has proposed the SENSORIS forum, hosted by ERTICO, for propagating data sharing throughout the industry supply chain. Companies already participating in the initiative include Aisin AW, Robert Bosch, Continental, Daimler, Elektrobit, Harman, NavInfo, Pioneer, TomTom, and more. More participants are expected soon, HERE says.

The goal of HERE's SENSORIS specification is to define a standardized interface for exchanging information between in-vehicle sensors and a dedicated cloud as well as between clouds. HERE says the goal is three-fold: to enable broad access, delivery and processing of vehicle sensor data; to support the easy exchange of vehicle sensor data between all players; to enrich mobility services including automated driving.

The challenge for HERE is that it set out to compete with Google, but now finds itself competing with Uber, which is creating its own network of connected cars. HERE may soon find itself competing with Ridecell, which is behind the creation of ride sharing/ride hailing networks such as BMW's ReachNow.

HERE is building a broad network of partners, which now includes Microsoft, Mobileye, NVIDIA, and Intel, all focused on enabling automated driving. Uber and Ridecell may have an advantage as they are able to gather data as part of their service delivery strategy.

Part of the reason HERE is building these relationships is that it is facing a market where companies like Tesla, Waymo, and Uber are gathering lower resolution data in real-world circumstances on an ongoing basis, which creates competition for HERE based not only data quality but data quantity.

The reason quantity matters when it comes to developing automated driving technology relates to the enormous volume of miles that must be driven to refine autonomous driving algorithms. The short-term objective of sharing vehicle sensor data via the HERE Open Location Platform is to enable valuable commercial applications with immediate relevance and road safety benefits, including on-street parking, traffic, hazard warnings and road sign updates.

The longer term objective, reflected in SENSORIS, is to enable direct, real-time vehicle-to-vehicle communications for the purposes of collision avoidance and to support other related connected car mobility services. The Intel, NVIDIA, and Mobileye relationships are clearly targeted at supporting the goal of creating automated driving systems with real-time map updates.

Along with Intel's investment comes a commitment to collaborate on the development of "highly scalable proof-of-concept architecture supporting real-time updates of high definition maps for highly and fully automated driving." The two companies also committed to jointly exploring "strategic opportunities that result from enriching edge-computing devices with location data."

HERE's announced partnership with Mobileye revolves around integrating Mobileye's RoadBook landmark and roadway information as a data layer in HERE HD Live Map. Additionally, Mobileye will use HERE Open Location Platform for the ingestion and processing of raw sensor and observation data (a.k.a. Road Segment Data), and the creation of dynamic maintenance of RoadBook products.

For its part, HERE will utilize Mobileye's proprietary Road Segment Data that is collected and aggregated from certain vehicle brands equipped with Mobileye technology to "support change detection and the maintenance of HERE HD Live Map," according to HERE. The commercial terms surrounding the HERE and Mobileye partnership have yet to be released. Mobileye's RoadBook has not yet been deployed, but the relationship puts HERE in a privileged position given Mobileye's market dominance in the camera-equipped vehicle segment — comparable to HERE's map dominance.

Thus far a number of automakers, including BMW, General Motors, Nissan, and Volkswagen, have announced partnerships with Mobileye where they will be making use of the company's REM (Road Experience Management) technology solution. However, it should be noted that none of those OEMs have announced specific plans or dates for implementing Mobileye's REM technology, which provides the data for Mobileye's RoadBook platform, in production models. Mobileye ultimately expects data from various automakers to be aggregated and shared, but the company is still in the process of negotiating the specific data sharing agreements it has with automakers. Mobileye estimates that at least 2 million vehicles produced by automakers in 2018 will be on roads collecting REM data.

HERE also announced it is accelerating the development and functionality of its HERE HD Live Map solution with NVIDIA MapWorks AI technology. NVIDIA is developing localization technology based on HERE HD Live Map as part of NVIDIA DriveWorks software, which is designed to enable automakers to use DRIVE PX 2 in the car to integrate localization capability. Both companies intend to collaborate on the development of a HERE HD Live-Map-based in-vehicle solution that will be capable of perceiving changes in the environment and updating the map in the cloud accordingly.

In light of these announcements, HERE hit the integration trifecta at CES 2017 by building strategic relationships with the three leading autonomous vehicle development platform providers: Intel, NVIDIA, and Mobileye.

HERE has also announced a number of new partnerships in China, as noted previously with Tencent and that company's navigation solutions provider NavInfo and with Baidu, providing map data for 150 countries outside China for that company's navigation solutions.

As part of the new HERE/NavInfo relationship the companies stated they intend to form a "50/50 joint venture in China enabling location services for Chinese and global customers across a range of industries." Related initiatives include:

- Deploying and localizing HERE's Auto SDK.
- Jointly creating and provisioning high definition mapping and location services.
- Extending the range of HERE Internet of Things solutions such as fleet management, on demand services and asset tracking.
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The planned joint venture is subject to Chinese regulatory approvals. Other developments related to the tie-up include:

- Tencent utilizing HERE in its products and services
- HERE and Tencent collaborating to improve one another's services and products

Implications

HERE's combination of in-house map data management strategizing, alliance building, and investment hustling has propelled the company into a leadership role in the nascent automated driving market. More importantly, for the short-term, HERE is redefining the value and nature of the embedded navigation map, building on its already powerful market position.

The company is wrestling with the demands of delivering enhanced in-dash contextual driving experiences while evolving toward the integration of infotainment systems with safety systems where the map is the linchpin. HERE's Open Location Platform, the first of its kind, is a solution that the company revived a little before its time – but the company's Open Location Platform anticipates the world of automated driving and inter-vehicle communications in the interest of safety.

The sharing of vehicle sensor data between Audi, BMW, and Daimler is an industry breakthrough that also helps set the stage for automated driving — as does HERE's HD Live Map. HERE is also finally realizing the dream of using the map as a sensor — a concept reflected in BMW's self-described CARASSO (car as a sensor) strategy.

Perhaps most amazing of all is the ability of HERE's joint owners — Audi, BMW, and Daimler — to continue to pursue their own independent location technology strategies even as they collaborate around creating a more complete, accurate, shared map. It remains to be seen how competitive pressures will play out. HERE is now facing the evolution of Waymo and its relationship with FCA; Uber and its relationship with Volvo, Ford, and Daimler; RideCell and its relationship with BMW; and Tesla's go-it-alone approach to automating driving.

The gathering and standardizing of sensor data presages the time, coming soon, when car companies will need to share data and cooperate on inter-vehicle communications and application development. Clearly HERE has a head start.