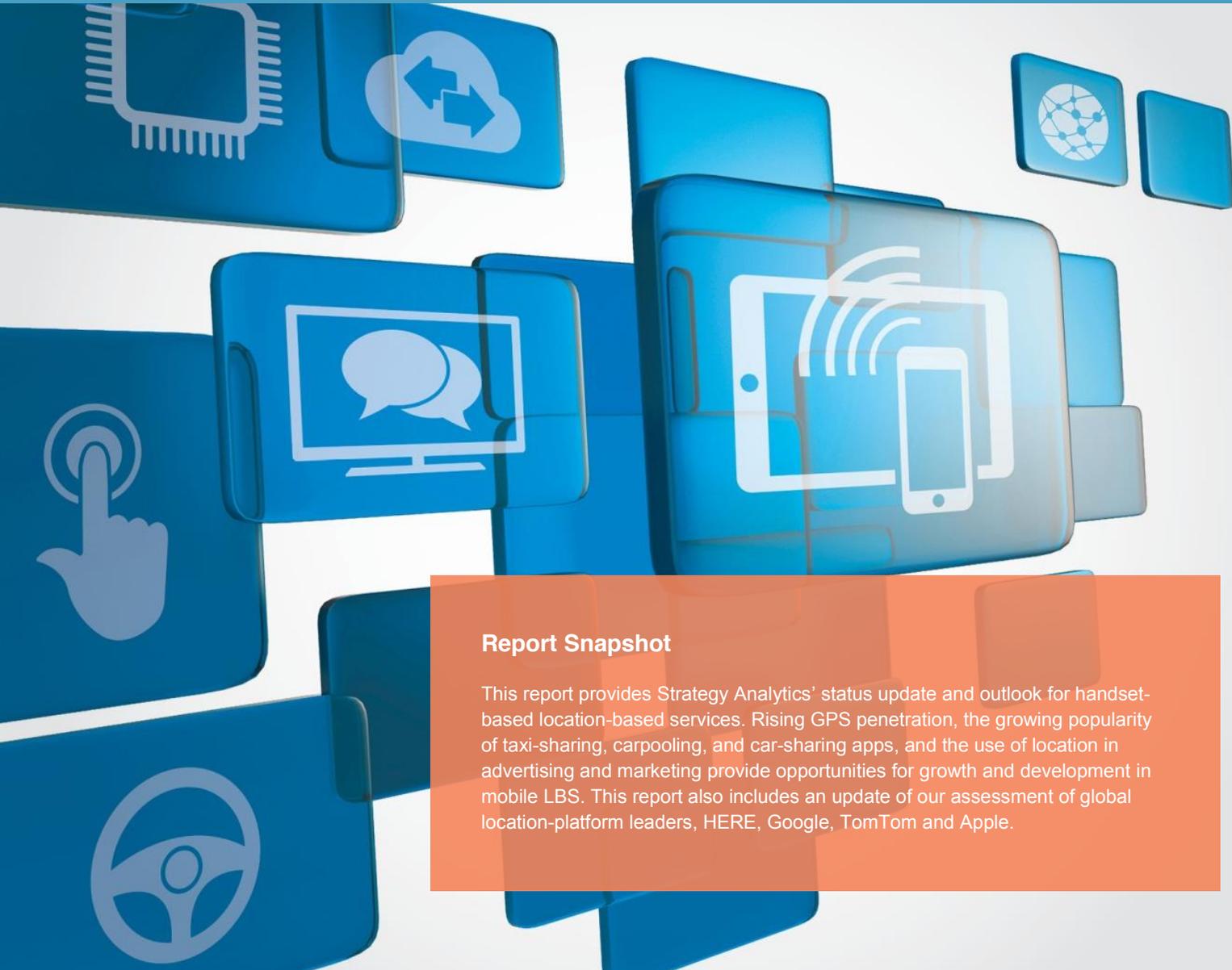




HERE Extends Leadership in Mobile Location Platforms

Wireless Media Strategies (WMS)



Report Snapshot

This report provides Strategy Analytics' status update and outlook for handset-based location-based services. Rising GPS penetration, the growing popularity of taxi-sharing, carpooling, and car-sharing apps, and the use of location in advertising and marketing provide opportunities for growth and development in mobile LBS. This report also includes an update of our assessment of global location-platform leaders, HERE, Google, TomTom and Apple.



Media & Services





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1. Executive Summary

Consumer demand for mobile location services remains healthy though remains largely dominated by all-in-one map and navigation applications that are pre-installed on smartphone operating systems, such as Google Maps on Android and Apple Maps on iOS.

- Strategy Analytics' AppOptix USA panel indicates that beyond Google Maps and Yelp there is a long tail of mobile location applications with relatively limited penetration and modest monthly usage.

Growth of the mobile LBS continues to be fuelled by the rising base of GPS and Wi-Fi enabled devices in lower-tier devices, the rising popularity of taxi-hailing, car-sharing and car-pooling applications, and the use of smartphone location data for advertising and marketing:

- **Rising GPS penetration:** High accuracy device positioning technology is becoming increasingly ubiquitous, as GPS and Wi-Fi penetration on ultra-low and entry-tier devices continues to rise. Our [Emerging Device Strategies](#) service (Exhibit 3) shows the growing penetration of smartphone sales enabled with GPS by region, with total shipments rising from 1.55 Billion in 2017 to almost 2 Billion by 2022. According to Strategy Analytics' [SpecTRAX](#) and [PriceTRAX](#), on a shelf-share basis the proportion of handset models integrated with GPS radios in the ultra-low (sub US\$35) price range has strongly risen from 21% in September 2016 to 32% a year later.
- **Urban mobility trends:** Strategy Analytics expects the growing adoption of taxi-hailing and car-pooling apps from both passengers and drivers will drive increased demand for location based services which underpin those applications, such as routing information and guidance, geocoding (and reverse geocoding), and other location-based content, among others.
- **Advertising and marketing:** Location and place data are being increasingly leveraged by advertisers and marketers for the purposes of creating audience segments, mobile advertising attribution, ad-placement planning, and location-based advertising.

Overall, our assessment of the leading mobile location platforms has not altered significantly since our previous report on location-based services, with HERE increasing its leadership over Google, while TomTom and Apple continue to play catch-up.

- HERE has outscored its major competitors across map and navigation country coverage, indoor venue coverage, visualization, offline map capability and in-vehicle connectivity, with Google coming a close second with leadership in crowd-sourcing and local search.
- Strategy Analytics is impressed with HERE's vision for the broader location opportunity and its approach to engage location-data providers beyond the automotive market through its Open Location Platform (OLP). In contrast TomTom remains highly focused on automotive industry needs, Google on leveraging its map assets to advance its advertising capabilities, and Apple using maps and navigation to drive sales of its hardware.



2. Location Market Developments

Over the past 12 months strategic partnerships have been a key feature of the location-sector with digital map platforms, OEM suppliers, chip makers, and Internet companies seeking to build out their position in emerging and growing areas like [assisted and autonomous driving](#); [urban mobility](#); [IoT](#) and important geographies like China and Japan which have been dominated by local players historically.

In December 2016 HERE announced it had created [strategic partnerships with location providers NavInfo and Tencent](#), to enable it to extend its presence in China. Furthermore, HERE has strategically diversified its ownership base beyond car makers Audi, BMW and Mercedes with chip maker Intel taking a 15% stake in January 2017. In September 2017 HERE and Pioneer announced investment in one other, with Pioneer taking less than a 1% share in HERE and HERE a 3% share in Pioneer. [Intel has ambitions to be a key supplier for autonomous driving](#), while HERE's partnership with Pioneer allows HERE to provide its products in Japan with both jointly focused on developing products to support driverless cars. TomTom has also sought to tap new markets by forming a partnership with Japanese mapping provider Zenrin to collaborate on traffic and mapping services, which announced in late October 2017. Digital map platform MapBox announced it had raised \$164 Million in funding as it also targets growth opportunities in autonomous driving, [augmented and virtual reality](#), IoT and other areas where location adds value.

Despite the well-publicized woes of Uber during 2017 ride-hailing firms continued to attract investment as these mobile-centric service continue to disrupt traditional taxi service.

In October 2017 ride-hailing firm Lyft announced it had raised \$1 Billion in investment from CapitalG, which values Lyft at around \$11 Billion; while in the same month India taxi-hailing app Ola closed \$1.1 Billion with participation from Softbank and Tencent. At the same time both Uber and Lyft moved to take greater control of the driver navigation user experience by integrating driver navigation into their driver apps respectively. In March 2017 Uber introduced its [own navigation functionality](#) into its driver application for both Android and iOS, while its competitor Lyft announced in October 2017 that it will use Google maps and navigation in its app for drivers.

In India the local market for location services continued to mature with MapMyIndia announcing improved revenue but also ambitious growth targets by offering improved navigation granularity.

Indian location platform MapMyIndia announced annual revenue of Rs 200 Crore (US\$31 Million) with an expectation to increase that five-fold to Rs 1000 Crore (US\$150 Million) over the next five years by offering "doorstep level" navigation, in addition to expansion overseas.



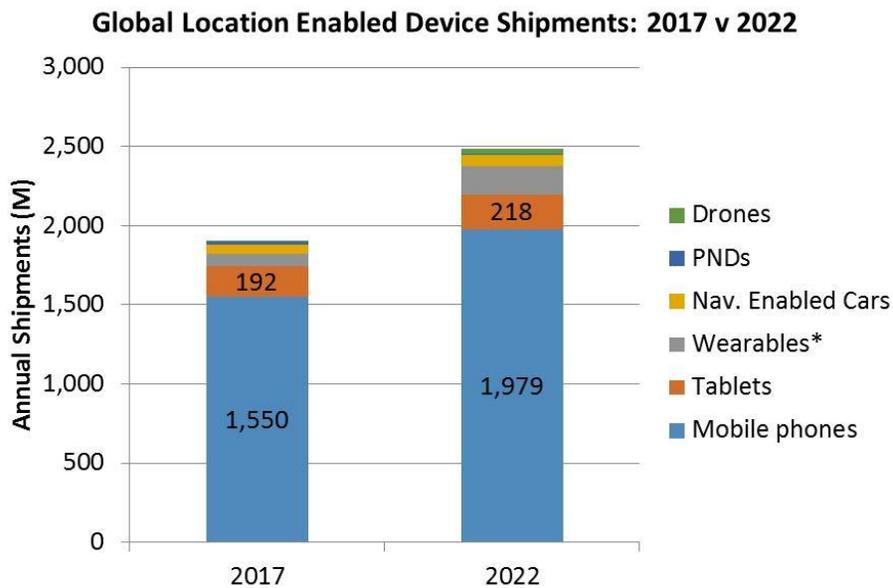
3. Mobile LBS Status Check

3.1 Mobile LBS in Context

Mobile will remain an important platform for location companies because of the sheer scale of mobile devices vis-à-vis other location enabled devices.

Exhibit 1 compares annual sales of GPS-enabled smartphones versus [tablets](#), navigation-enabled cars, portable navigation devices (PNDs), wearable devices and drones. Globally, smartphones and tablets will account for nearly 92% of the total 1.9 Billion shipments of consumer location enabled devices in 2017, falling to just 88% by 2022. Importantly, mobile phones are carried by users at all times and used for a variety of location-based activities including finding nearby places, fitness tracking, hailing taxis, and more.

Exhibit 1 The Addressable Market for Mobile LBS in Perspective



* Smartwatches and smart glasses

Source: Strategy Analytics, [EDS](#), [TTS](#), [WDE](#) & [AIT](#)



3.2 Reported Mobile LBS Use and Adoption

Mobile location-based services (LBS) have become essential for most smartphone owners, whether that is using a basic map, searching for nearby places to eat, getting turn-by-turn directions, using a mobile app to hail a taxi, activity trackers, or accessing localized weather or news. As we highlighted in [last year's report](#) our user research clearly points to the trend that smartphone owners are becoming increasingly dependent on mobile LBS to navigate their world.

During 2017 consumer demand for mobile location-based services (LBS) continued to remain healthy, as reported by a variety of mobile LBS app providers:

- **Oct 2017:** TomTom reports 1 Million monthly active users of TomTom GO, its mobile app.
- **Oct 2017:** DriveNow claims it has exceeded the 1 Million users across Europe.
- **Oct 2017:** Uber reported 40 Million monthly active riders worldwide.
- **July 2017:** US ride hailing app, Lyft, reported the number of rides initiated via its app increased 100% year-on-year to reach a 1 Million per day.
- **July 2017:** Google's Waze claims to have reached 85 Million active users.
- **H1 2017:** Daimler reported announced it had doubled the number of users of its mobility services (car2go, mytaxi, and moovel) year-on-year to 14.5 Million customers.
- **May 2017:** Google reported users of Google Maps navigate over 1 Billion KM each day.
- **Q2 2017:** Monthly active users of the local search app, Yelp, increased to 28 Million, up from 20 Million year-on-year. Monthly active mobile web users also nudged up to 72 Million in the same timeframe. Mobile contributed to 78% of searches and 64% of reviews during the period.
- **Dec 2016:** Active fitbit users increased from 16.9 Million at the end of 2015 to 23.2 Million by end 2016.

3.3 AppOptix USA: Local and Travel Analysis

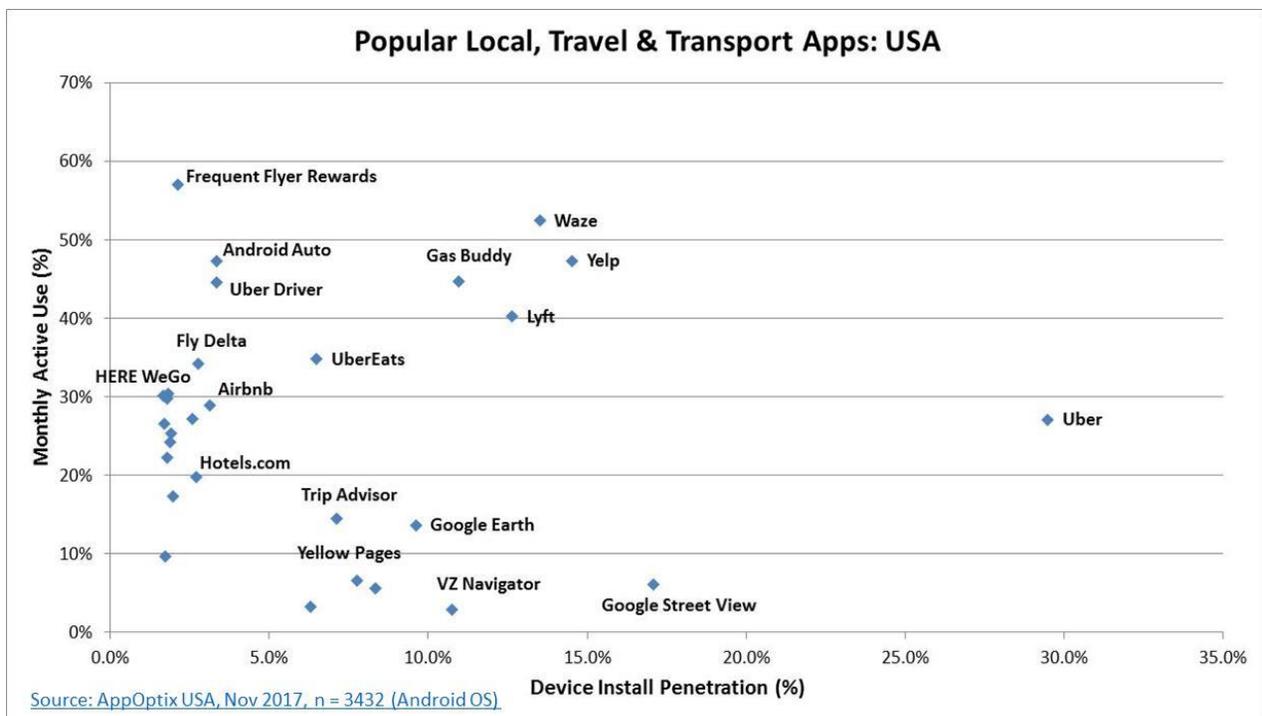
[Strategy Analytics' AppOptix](#) USA demonstrates the relative popularity and use of local and travel related applications via its panel of 3,432 Android smartphone users, Exhibit 2. The Google Maps application is an outlier, with nearly 95% device penetration and over 55% monthly active use; making it by far the most popular local and travel application in our US panel. Such is the dominance of Google Maps in this category we have removed it from Exhibit 2 to show more clearly the most popular and used local and travel apps in the long-tail.

The majority of the top 60 local and travel apps can be characterized as low penetration (sub 20%) and low use (sub 30%). Google Maps, an all-in-one map application and taxi-hailing app Uber both stand out as apps with



higher than average penetration and use vis-à-vis other apps in the local, travel and transport category. They are followed by a cluster of apps with modest penetration and relatively high monthly use, which includes Yelp, a local search application, Waze, a crowd-sourced road traffic and navigation application, taxi-hailing app Lyft, and gas price application Gas buddy. Google’s other applications in this category Google Street View and Google Earth have good adoption rates, but are typically used less frequently than on a monthly basis. In contrast, apps like HERE WeGo, Uber Eats, and Fly Delta are not as widely installed though over 30% of these installed apps are used on a monthly basis.

Exhibit 2 Popular Local, Travel and Transportation Apps - USA





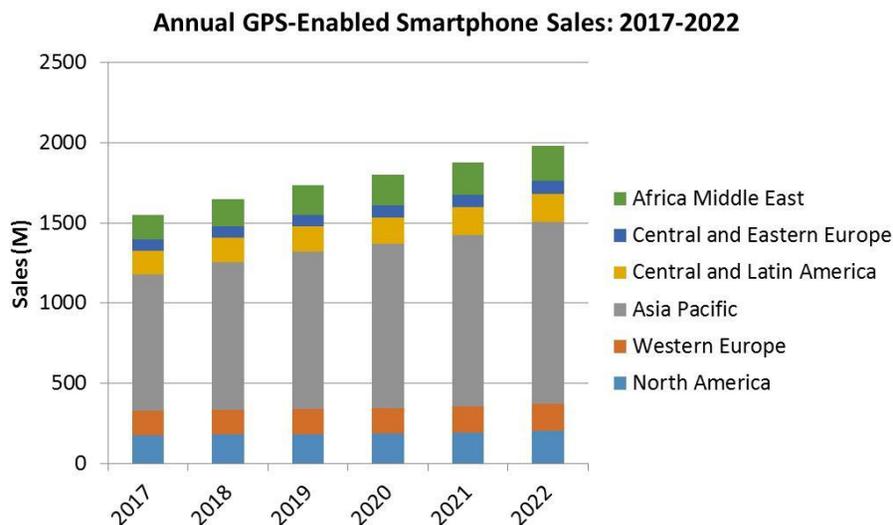
4. Mobile LBS Growth Opportunities

4.1 Emerging Markets Boost the Total Addressable Market for Mobile LBS

Strategy Analytics expects growth in the shipments of GPS-enabled smartphones to come from emerging and developing smartphone markets in Asia Pacific, Middle East and Africa. These regions will fuel the adoption of LBS aided by pre-installation and optimization of mobile LBS on devices and networks.

Automatic handset (and therefore user) positioning is important for providing real-time mobile LBS services such as turn-by-turn navigation, but also to enhance the delivery of contextually aware services, including ride-hailing, location-based news and weather information, and local search, among others. Technologies such as GPS, Wi-Fi and Bluetooth are all currently being used to locate handsets and to provide proximity-based services. Data from our [Emerging Device Strategies](#) service (Exhibit 3) shows the growing penetration of smartphone sales enabled with GPS by region, with total shipments rising from 1.55 Billion in 2017 to almost 2 Billion by 2022. By 2022 the share of GPS-enabled smartphone sales across Asia Pacific, and Middle East & Africa will reach 1.3 Billion, up from 1 Billion in 2017.

Exhibit 3 Annual GPS Smartphone Shipments: 2017-2022

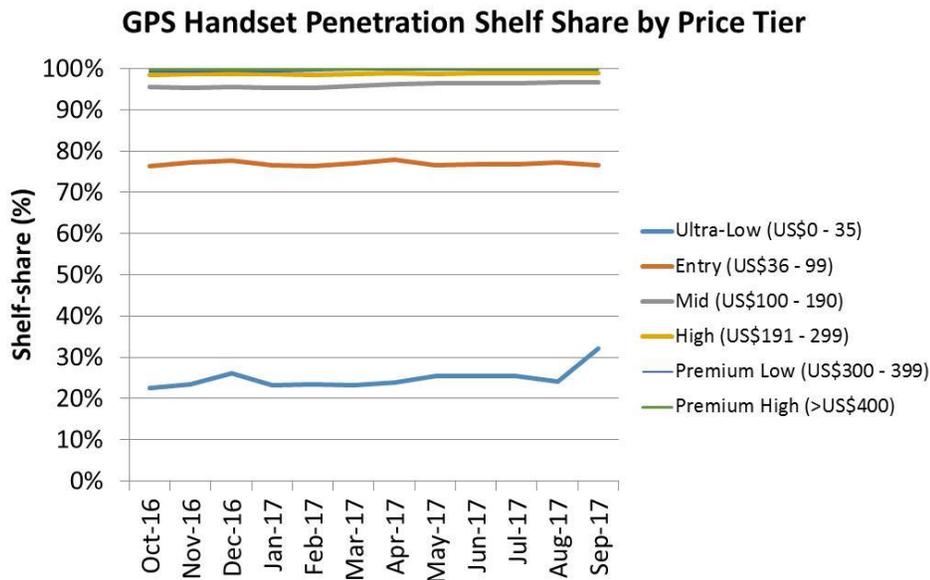


Source: [Strategy Analytics, Emerging Device Strategies \(EDS\), Sept 2017](#)

While GPS penetration has stayed relatively flat across entry (US\$36-\$99), mid (US\$100-\$190) and high priced (US\$199-\$299) handsets Strategy Analytics' [PriceTRAX](#) and [SpecTRAX](#) services has noted a significant uptick in GPS penetration on handsets in the ultra-low price tier which costs between US\$1-\$35, Exhibit 4. GPS penetration on ultra-low price handsets (on a shelf-share basis) has increased from just over 21% in September 2016 to over 32% in September 2017. While the number of ultra-low priced handsets shipments is [set to decline just over 230 Million by 2022 it will account for the equivalent of 10% of handset sales in that timeframe](#).



Exhibit 4 Penetration of Positioning Technologies on Handsets By Price-Tier



Source: Strategy Analytics, PriceTRAX & SpecTRAX, Sept 2017

Beyond GPS, technologies such as [Wi-Fi](#) and cell-tower ID are also essential positioning technologies, particularly when the line-of-sight required for GPS positioning is not possible, such as indoor environments and urban canyons.

Despite the growth in the total addressable market for mobile LBS, expensive data connectivity, and patchy mobile data networks will likely remain a barrier to the adoption of mobile LBS for low-end handset owners in emerging markets, though handset OEMs, operators and LBS providers can boost take-up.

- **Handset OEMs** are well placed to preload essential mobile LBS (like maps, local search, directions and turn-by-turn guidance) onto smartphones.
- **Mobile operators** are in a position to zero-rate data access to their own or partner location services if regulations permit.
- **LBS app providers** can optimize their location services for network and cost conditions. For example, HERE enables users to download maps for offline use, while through its “Building for Billions” developer initiative Google has been working to optimize its services for use over patchy, data constrained networks, and is also encouraging its Android developer community to follow suit.



4.2 Urban Mobility Apps – Ride Hailing, Ride Pooling, and Car Sharing

Strategy Analytics' [Automotive Connected Mobility \(ACM\) service](#) provides on-going insights and in-depth coverage of the emerging mobility services sector. However, as discussed in [section 2.4 of last years' report](#) smartphones based apps have revolutionized how providers of urban mobility apps, such as ride-hailing, ride pooling and car sharing, deliver their services effectively - both for travelers and drivers.

Although ride-hailing companies face increasing regulatory scrutiny in certain cities, because they challenge established business models, labor laws and compete with established licensed taxi-services, they continue to post healthy growth figures, [receive funding from the investment community](#), and continue to fuel growth in mobile LBS:

- **Oct 2017:** Uber reported 40 Million monthly active riders and 2 Million drivers worldwide; across 616 cities in 77 countries. It also claims 10 Million trips are completed each day.
- **July 2017:** US ride hailing app, Lyft, reported the number of rides initiated via its app increased 100% year-on-year to reach a 1 Million per day.
- **May 2017:** French carpooling service Blablacar claims to have 40 Million users worldwide, up from 35 Million members in October 2016.
- **Feb 2017:** Waze began to expand the carpooling feature (which was initially introduced into Israel in 2015) across cities in California. It also launched a separate carpooling application.

One of the major goals of major car makers is to become more prominent in the provision of mobility solutions, as highlighted in the report [Global Automakers Increase Their Efforts in the Mobility Services Market](#); whether that is through developing their own, investing in, or partnering with existing providers.

Ride-hailing companies are taking greater control of the navigation experience for their drivers.

Most notably, over the last year Uber has integrated driver navigation and guidance solutions into its own driver applications in order to improve the ride-hailing experience for both drivers and passengers. In summary, Uber is aiming to improve the process through which drivers find passengers, to provide drivers with instant directions to the next passenger collection point immediately following a drop-off, and to better understand the routes which drivers are taking to reach their destinations. That said, Uber has not mandated that its drivers use its app, preferring to position it as an alternative that is optimized to the needs of ride-hailing drivers versus generic mobility apps like Google Maps. Lyft has moved in a similar direction to Uber by launching a separate driver application which includes navigation. However, unlike Uber which is using its own mapping platform, Lyft is leveraging Google for map and navigation functions.

Mobility apps providers are integrating into all-in-one travel applications to increase their availability beyond their own apps. However there is no evidence of the impact of these integrations yet.



During 2016 popular all-in-one map and navigation apps like Apple Maps, Google Maps, and HERE WeGo integrated ride-sharing information such as likely collection time, ride duration and price, from different providers (e.g. Lyft, Uber, MyTaxi, etc.) as an alternative option for users to travel to their destination. However, while we expect the integration of ride-sharing options in these popular map applications to increase the reach and addressable market for these taxi-hailing applications we are yet to see evidence of the extent to which these have been successful.

Notably, taxi-hailing services have expanded into on-demand delivery of food and also other products. For example, UberEats, is a food delivery service that works on behalf of partner restaurants. For example, users of the UberEats service can order food from the menu of partner restaurants, which is subsequently delivered to its destination by Uber. Deliveroo offers a similar approach, with its network of motorcyclists and cyclists responsible for deliveries.

4.3 Location-based Advertising and Marketing

There are four main ways in which location data gleaned from mobile devices can be used to support advertisers and marketers, including audience segmentation, location analytics, advertising attribution and location targeting:

- **Audience segmentation:** The combination of accurate user location and database of places is being used to provide audience insights that underpin ad targeting. When tied to persistent identifiers the places that people visit, along with other contextual information such as time of day (and inferred home and work locations) can assist digital marketers to build anonymised profiles and personas to support targeted advertising.
- **Location Analytics:** Location data can be used by venue owners to track footfall within stores and identify areas of high or low footfall as well as to determine the ideal location of in-store displays and higher-value products. At a broader level location heat maps based on cell-tower traces can (and is) being used to determine the best location for businesses, such as supermarkets and retail stores.
- **Digital advertising attribution:** Accurate user location information allows advertisers to measure the extent to which digital advertising drives in-store visits. Google has stated that in the last three years Google has measured 7 Billion store visits (anonymously) since it began measuring store visits in 2014 and is using this information to demonstrate the uplift in store traffic as a consequence of digital advertising campaigns. In May 2017 indoor positioning solution provider Sensewhere launched a mobile attribution product called Adwhere to capture store visits.
 - Research conducted by Google claims across 146 advertisers between April-June 2017 adverts on mobile phones generated double the number of incremental store visits compared to desktop and tablet adverts.
- **Location and proximity ad-targeting:** The direct use of location to target users with messages based on their location or proximity to specific physical locations using geo-fencing or beacons. For example, Google AdWords enables advertisers to program bids for searches on keywords based on a specific radius. Equally, local business can explicitly define which areas they want to serve adverts so that they don't pay to advertise to consumers in different towns or cities.



Context and location continue to remain important to the evolution of mobile advertising and we are seeing that reflected in increased demand for location data by advertisers; at the same time advertising and marketing platforms are evolving their capabilities to better leverage location data.

- **October 2017:** ComScore and PlacelQ have partnered to enable advertisers to measure the uplift in store traffic as a result of consumers viewing an advert. PlacelQ matches location data from smartphones on its map, while ComScore provides information on what adverts have been seen (across mobile and TV). Therefore, advertisers can measure and attribute the impact of media buys on store visits and traffic.
- **Aug 2017:** TeleNav's advertising-based revenue, which is predominantly mobile, reached \$26.8 Million for its fiscal year ending June 2017, and accounted for 16% of its total revenue, up from \$21.7 Million during its previous financial year.
- **Aug 2017:** Ground Truth (formerly xAD) announced 35% QoQ revenue growth and 35 clients in the CPG (Consumer Packaged Goods) sector; Ground Truth claims 20% YoY growth specifically in the restaurant vertical;
- **April 2017:** Mobile data exchange, AdSquare, is licensing HERE's Places database to assist with location and context-based ad targeting. Understanding the places that users visit can provide useful insights which can then be used to profile them. AdSquare will combine user location data with place information and data from other third-parties to form more accurate profiles of users which can be used for audience segmentation and therefore improved targeting.
- **May 2016:** A ThinkNear study demonstrated that location data can enhance advertising engagement rates by up to 30%.

As stated in our report ["Where Can Mobile Operators Succeed in Mobile Advertising?"](#) ad-requests often include information about user location which is provided by the publisher. However, the location information provided by the publisher varies significantly in both accuracy and precision depending on the method through which the handset location was acquired.

Strategy Analytics believes in order for location-based advertising to take off advertisers and marketers need to trust the location data being provided and to have visibility into the method of location acquisition, along with a time stamp for when the user location was acquired.

4.4 Indoor LBS

Consumer use-cases for indoor LBS center on wayfinding around indoor venues, whether this is to find a specific store within a large mall or shopping center, locating the right department in a hospital, or visualizing the optimal route to products on a shopping list within a supermarket. Not surprisingly, indoor maps of large and complex venues remain at the heart of indoor LBS, including relevant details e.g. store layouts, entrance and exit information, and the location of toilet facilities, among others. Google, HERE and smaller companies like Micello offer indoor and venue maps to consumers directly and indirectly, with Google and HERE including maps of large buildings (e.g. shopping malls, airports, exhibition centers and train stations) in their respective map applications



and also licensing venue maps. While providing a venue map is useful, indoor positioning, search, and routing clearly both add further value by enabling users to orientate themselves in the venue automatically, search for the location of their destination, and to provide directions on how to get there. In this respect indoor positioning remains far from ubiquitous, is fragmented across different technologies (Wi-Fi, beacons, LED and geo magnetic fields) and dependent on the requirement of venue owners.

Rising venue owner demand for tracking and analyzing visitor location data to optimize in-building layouts while simultaneously improving the in-venue experience for customers, and generating revenue through location target offers, is driving current demand for indoor positioning solutions based on Wi-Fi and Bluetooth (BT) beacons.

- **Improving in-venue experiences for visitors:** Growing smartphone usage is driving venue owners to integrate indoor maps and positioning capabilities into their mobile apps. Examples include Target, Lowes, Macy's and Carrefour, which are enabling wayfinding and blue-dot navigation capabilities into their apps, to help users save time to navigate stores effectively, and to help customers locate desired products quickly while in-store. Not being able to find products can be frustrating for customers and lead to negative shopping experiences. Navigation in venues like hospitals can help patients to reach appointments on time.
 - In August 2017 indoor positioning provider Senion announced Mall of America leverages its Stepinside indoor positioning system to offer step-by-step wayfinding.
 - In July 2017 indoor location service Senswhere claims its indoor positioning system (IPS) has accumulated 50 Billion location requests in total.
- **Optimizing venue layouts:** Venue owners are deploying BT and Wi-Fi-based platforms to anonymously track visitors' in store journeys in a similar manner to how cookies are used to improve website design. For example, understanding the visitor journey could help mall owners to identify mall locations which are most busy according to the time of day and day of the week. Or for shop owners to visualize where customers spend most of the time, the average length of time a shopper stays in the store, and measuring which displays lead to greater dwell times and drive visitors into their venues. These techniques provide an option to replace more expensive and resource intensive video-based analysis of visitors.
 - In February 2016 Walkbase, a provider of venue analytics targeting airports and retailers announced strong growth in 2015, claiming to analyse over 100 m shoppers, up from 50 m in 2014. It also claims a ten-fold growth in contract value, and serves 30 large retailers in the UK and Europe. Walkbase was acquired in October 2017 by digital display marketing company Stratacache for an undisclosed sum.
- **Mobile marketing:** In retail venues BT beacons are also being used to trigger proximity-based marketing offers and coupons to help drive sales, and to upsell complimentary products or services. If combined with an advertising exchange, store owners could also sell aisle level ad inventory to competing brands.



While indoor LBS has yet to take off Strategy Analytics believes it continues to presents a growth opportunity for mobile LBS, with consumers expecting the map-based services they use outdoors (e.g. maps, navigation, food delivery) to also be available in complex indoor environments.



5. LBS Platform Benchmarking

Digital mapping and location platforms lie at the heart of most popular consumer location-based services (LBS), including all-in-one map applications, turn-by-turn navigation services, people tracking apps, ride-hailing, car sharing, or carpooling use-cases, among many others. Location platforms enable app developers of all sizes to build applications that leverage maps, location content, geo-coding (and reverse geocoding), multi-modal routing and guidance, local search, and traffic, among other capabilities, without building these capabilities in house.

Location platforms not only serve mobile phones, but all emerging connected devices that have either direct or indirect access to the device's (or user's) location coordinates, such as connected cars, wearable devices (e.g. smartwatches and smart glasses), drones, robots and relevant connected devices and sensors. Consequently, the capabilities of map and location platforms will be shaped by the current use cases and the evolving demands of these new devices. For instance, to support autonomous driving major location platforms HERE and TomTom are building high definition machine maps with centimetre precision, are moving towards refreshing road maps in near real time, and also using vehicle sensors to report changes in road signs e.g. speed and road restrictions. Similarly, drones used to deliver products to consumers will rely on 3D maps to navigate buildings in cities and towns.

The requirement to deliver fresh up-to-date maps globally means location platforms are all seeking cost-effective approaches to update maps at scale; leveraging automation, partnerships, and crowd-sourcing in order to do so. HERE claims that over the past year it has been able to increase automation by a factor of four, while increasing the volume of data it collects by a scale of 50.

Overall, there has been little change to the structure of the industry with Google, HERE, TomTom and Apple remaining the major global players.

However, smaller location platform MapBox, which leverages Open Street Maps (OSM) map data, has some notable customers, including FourSquare, SnapChat and Samsung, among others, because it enables brands to completely customize the look and feel of their digital maps. In addition MapBox has received funding from investors to expand its presence in maps and location beyond mobile devices and into connected cars, AR, VR and IoT. Similarly, DeepMap has received investment to support its activities in HD maps for autonomous driving.

This analysis of the location platforms, Apple, Google, HERE and TomTom, focuses on the relative strengths and weaknesses of these in supporting both own-branded and third-party mobile location-based services across seven key dimensions which include: Map and navigation coverage; indoor map coverage; location platform reach; visualization; offline capability; social & community inputs; point-of-interest (POI) search; and in-vehicle connectivity.

Exhibit 5 provides a comparison of the capabilities of the major mobile map platforms across seven distinct dimensions, which includes map and navigation country coverage, indoor (or venue mapping) map reach, the capacity to operate in offline mode, the number of mobile platforms supported, map visualization, and local search capability. The purpose of this radar diagram is to demonstrate the relative strengths and weaknesses of the map platforms of each of these key location industry players, and to highlight where improvements can be made to their

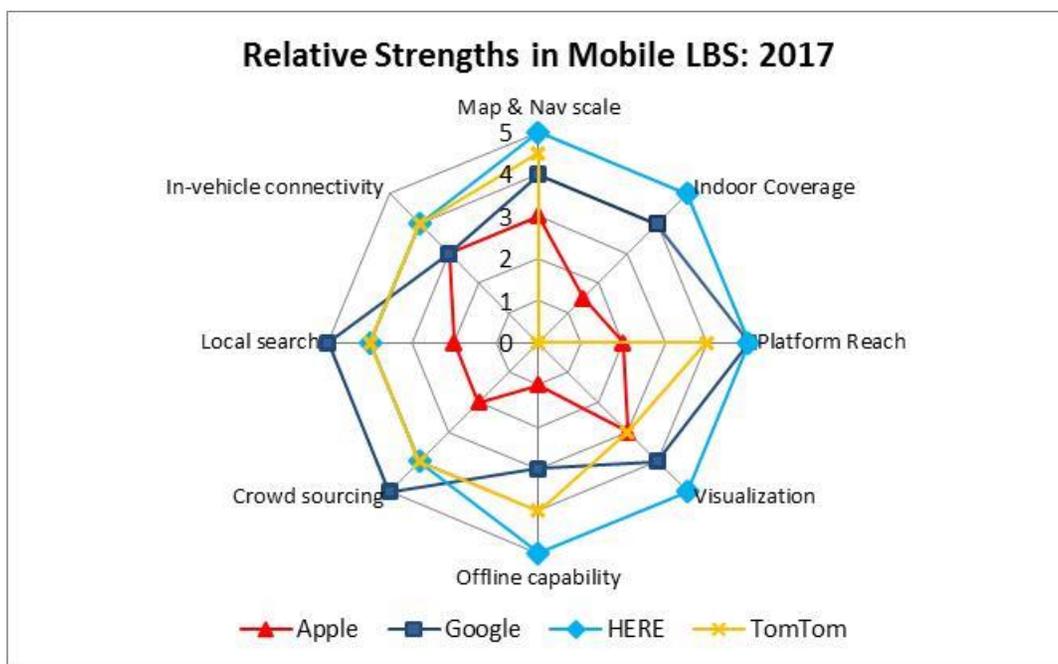


overall offerings. The accompanying table below summarizes our score for each capability, with the number in parenthesis indicating the score we provided in the report last year for comparative purposes.

5.1 Overview

Our overall assessment of the leading mobile location platforms has not altered significantly since last-years comparison, with HERE maintaining its leadership over Google, while TomTom and Apple continue to play catch-up.

Exhibit 5 Mobile LBS Benchmarking Update – 2017



	Apple	Google	HERE	TomTom
Map & Nav scale	3(3)	4(4)	5(5)	4.5(4)
Indoor Coverage	1.5(1)	4(4)	5(5)	0(1)
Platform Reach	2(2)	5(5)	5(5)	4(4)
Visualization	3(3)	4(4)	5(5)	3(3)
Offline capability	1(1)	3(3)	5(5)	4(4)
Crowd sourcing	2(2)	5(4)	4(4)	4(4)
Local search	2(2)	5(5)	4(3)	4(2.5)
In-vehicle connectivity	3(2.5)	3(2)	4(4)	4(3)
Total	17.5 (16.5)	33(31)	37(36)	27.5(25.5)



5.1.1 Maps & Navigation Coverage

There has been little change in country coverage over the past twelve months; TomTom has been most notable, increasing the number of navigable countries and territories from 154 to 169. Apple has added two more countries for which it is able to provide navigation, taking its total to 62. Generally, all four location-platforms provide standard map coverage at a global level (e.g. around 200 countries), though Apple remains a laggard.

Map providers HERE and TomTom are providing map updates on a weekly basis to meet increasing demand for up-to-date maps from its customers and partners; but are also both ultimately evolving to address the demands of assisted and autonomous driving which will depend upon real-time map updates.

5.1.2 Indoor Map Coverage

HERE continues to remain a leader in indoor and venue maps, and has increased the number of venue maps to 15,000 across 87 countries, up from 14,000 last year. HERE claims it has mapped the vast majority of major public venues (e.g. shopping malls, airports, and train stations), and is now switching gears to focus on delivering private venues, like offices and factories, and mixed public and private venues, like hospitals. HERE is also adding in new features to its indoor capabilities, for example an indoor routing API to enable venues (and HERE WeGo) to offer indoor guidance, and also self-service capabilities to enable venue owners to claim their venue map and make edits to it to reflect changes.

Google has not disclosed the number of venue maps but continues to claim the figure to be in the “thousands”. The Google Maps website provides examples from 25 countries where Google does offer indoor floorplans, of which most are in developed countries. These plans primarily cover public venues like airports, exhibition centers, malls, museums and sports venues. Google has also stated it is using Tango 3D sensing to deliver indoor location positioning using visual guidance. TomTom announced its entry into indoor mapping in September 2016 but has provided us with guidance that its efforts remain in pilot mode, leading us to downgrade its score in this dimension. In contrast Apple is actively in catch-up mode for pedestrian maps and has begun to offer indoor coverage in select public venues like airports and shopping malls in major cities like Amsterdam, Berlin, Chicago, London, Los Angeles, Miami, New York, Philadelphia, San Francisco, Tokyo, Toronto, and the Washington D.C. area. Apple aims to add more public indoor locations over time. Given the limited progress Apple has made with indoor map coverage we have increased its score in the indoor maps domain by half a point.

5.1.3 Platform Reach

Our scores for mobile platform reach remain unchanged from last years’ comparison with Google, HERE and TomTom supporting the major smartphone and tablet operating systems (OS) – Android and iOS. HERE’s strategic partnership with Tencent, which was announced earlier this year, enables HERE to address forked versions of Android in China while Google (and its services) remain banned. HERE elected to discontinue support for Microsoft Windows Mobile last year, given the limited market penetration of the Windows Mobile 10 smartphones. In October 2017 Microsoft arrived at the same conclusion and has [decided to kill the platform](#) by not making new Windows Mobile 10 devices.



Beyond traditional mobile connected devices (e.g. smartphones and tablets) wearable devices such as smartwatches and smart glasses represent additional platforms for growth – as wearable device ownership increases and owners begin to engage with map and navigation apps on those devices. HERE supports Tizen while Google Maps is available for Android Wear and Apple Watch. Apple Maps is available on Apple Watch.

Starting with indoor maps HERE is aiming to provide a device agnostic approach by enabling developers to use C++ to access HERE's indoor map capabilities across a variety of established and future computing devices, such as smartphones, cars, robots, drones and watches, among others.

5.1.4 Visualization

Visualization scores remain unchanged in this update. The only change is that HERE has added street views to its platform, thus helping it to maintain leadership in this domain.

HERE offers a full range of visualization options for mobile including 2D and 3D Maps, satellite view, augmented reality (AR) and most recently street view – which Google introduced first. Google's score for visualization remains unchanged as it continues to offer standard map views, 3D representations, satellite imagery and street view. TomTom continues to offer three main visualization modes, including standard 2D, 3D/ Flyover, and satellite and as a consequence remains on the same score as before. Apple continues to support three main map visualization methods of standard view (181 countries), 3D Flyover (300 cities), and satellite (181 countries). Consequently, Apple's score for visualization remains unchanged from last year.

One visualization feature missed in previous reports that is worth highlighting is that Apple enables users to see directions on their lock-screen, which the other vendors do not currently enable. It's also worth highlighting that MapBox has gained traction with companies like Samsung, SnapChat, and Foursquare among others, by enabling its customers to fully customize the look and feel of their maps and to introduce their own branding and styles to their maps.

5.1.5 Offline Capability

Scores for offline capability for each of the location-platforms remain identical to last year. HERE remains a leader, closely followed by TomTom, Google and Apple.

Apple does not support offline maps or navigation, which represents a weakness in markets where mobile network coverage remains limited, or where data pricing remains high. Google's update of Google Maps enables adequate offline access to maps, navigation and local search in a defined area, but fails to provide the flexibility of HERE and TomTom which both offer full offline maps for countries and major cities and towns.

5.1.6 Social & Community Inputs

Google has become a leader in social and community inputs by integrating key editing features from its Map Maker community into the Google Maps app. HERE has been making improvements in this area through its partnership with Mapillary and the pooling of car sensor data from Audi, BMW and Mercedes.



Users of Google Maps can now directly edit maps and places, with Google verifying changes once a threshold number of edits have been reported consistently. Google also claims to have tens of Millions of local guides that are part of a crowd sourced community to build further accuracy and granularity about places at the local level.

In order to avoid inherent risks in crowd sourced edits, which includes malicious changes but also the need to ensure standardization, platforms like HERE have chosen to rely on expert communities to verify map edits. In July 2017 HERE announced a partnership with crowd mapping service, Mapillary, to leverage Mapillary's database of 150 Million street images to improve HERE's street-level data for maps in Europe, the Middle East and Africa. The partnership is slated for global expansion in 2018. As mentioned in [section 5.1.2](#) HERE is enabling owners of mapped venues to claim these maps and to take responsibility for keeping them up to date, for example changes of use. HERE is pooling car sensor data together from multiple carmakers (e.g. Audi, BMW, Mercedes) to provide this information to vehicle owners in order to improve car safety. This data could also be leveraged in mobile apps overtime.

TomTom's has stated its map share program remains stable and continues to deliver around 200,000 map edits per month. TomTom also claims it is also aggregating car sensor data from around 500 Million devices, which generates 11 Billion data points per day, though at this stage this data is not available for developers to leverage. Apple licenses map data from TomTom so benefits from TomTom's map making community to improve its map. Apple enables users of Apple Maps to report errors within the Apple Maps application.

5.1.7 Point-of-Interest (POI) Search

Google remains an overall leader in point-of-interest (POI) search, and both HERE and TomTom have started to narrow the gap and have increased the number of places in their POI database since last year.

Google has been successful in building out its places database and keeping it updated because its dominance as an online map service for consumers means that it has become an important tool for businesses to show their location. Google continues to report that its Places database contains over 100 Million businesses and POI, of which some are owner verified and user moderated via the Google Maps and local guide program highlighted in [section 5.1.6](#). TomTom claims to have made vast improvements to its POI database, raising it to 100 Million across 100 categories and 600 sub-categories. TomTom is aiming to have 80 Million of those POI entries refreshed by the end of the year in order to keep it as up-to-date as possible. It's worth noting that the map platforms are likely to class and group POIs differently, which makes like-for-like comparisons challenging. HERE also claims it has significantly enhanced its POI database, particularly for places, through its partnerships with Amazon, Facebook and Samsung. HERE has increased the number of places in its database compared to 2016, and claims that in some market it provides better coverage than Google Places. HERE states it offers over 88 Million places in its database across 194 countries, up from 75 Million POIs in our previous update. Apple remains a laggard, providing POI data for just 14 countries across its Apple Maps footprint.



5.1.8 In-Vehicle Connectivity

HERE and TomTom remain leaders in delivering maps and navigation both through integrated solutions in the car infotainment unit, but also via their own mobility and mobile navigation apps, respectively. HERE and TomTom also enable car OEMs to build their own-branded navigation companion apps for journey planning and last-mile guidance.

Embedded satellite navigation units are not a typical feature of car models, with PNDs and smartphones providing alternative navigation options in basic car models. Smartphone navigation apps are available for free, come preloaded onto Android and iOS handsets, and provide more up-to-date road and place information than those embedded in infotainment units. The maps in infotainment units can be updated at regular increments via the car dealership, but are also more costly for the end user. However, smartphone solutions are inferior to vehicle infotainment systems because of the limitations in smartphone screen size, human machine interface (HMI), and phone battery life. Therefore, solutions such as CarPlay and Android Auto, which allows driving related apps like maps and navigation to be available through the vehicle infotainment unit, provide the best of both worlds. Car OEMs have recognized this and as a consequence over the past 12 months an increasing number are providing car owners with the choice to use Google's Android Auto and Apple's CarPlay for in-vehicle infotainment. From an end-user perspective Strategy Analytics research shows [high levels of satisfaction for both Android Auto and CarPlay](#).

Despite the rising availability of CarPlay and Android Auto the infotainment system and the infotainment experience remains of strategic importance to car makers. The infotainment system provides car makers with opportunity to provide drivers with an optimal travel experience that reinforces the OEM brand and influences loyalty. It also provides an opportunity for the OEM to deliver revenue generating services, such as local search and sponsored advertising more effectively. Consequently, OEMs are moving to narrow the experience gap between themselves and smartphone makers by issuing more frequent map updates, providing up-to-date local search results, and providing a comprehensive journey experience (from planning to doorstep), enabled by HERE and TomTom. With the automotive industry moving towards connected and driverless cars vehicle makers will be better placed to take control of the driver navigation experience in future.

5.2 Summary

HERE remains the leading mobile location platform and has improved in areas such as place search, social and community, and indoor navigation. Strategic partnerships in China and Japan will create growth opportunities in these markets, while it is also targeting other sectors.

Location platforms like HERE and TomTom remain focused on meeting the needs of the car makers, particularly as the automotive industry transforms towards assisted and autonomous driving where vehicles rely on a combination of highly accurate maps, sensor data, and vehicle-to-vehicle (V2X) communications. Simultaneously, HERE is addressing the broader needs of the mobility market, providing its own B2C mobility application, HERE WeGo, but also enabling developers to leverage its platform to embed location capabilities into apps, websites and other environments. HERE has strategically broadened its ownership to target future growth opportunities in Japan and in emerging fields like IoT, and drones.



HERE has also communicated its ambition to drive the value of location beyond the automotive market and across all relevant verticals and industries, e.g. retail, finance, insurance, government, etc., leveraging its recently announced Open Location Platform (OLP) to achieve this.

HERE wants its OLP to provide companies with an environment to handle their own location-data (e.g. from vehicle sensors) and to develop insights with that data by using HERE's location capabilities and also data made available by other OLP users. The OLP enables companies to create applications that use insights provided by these combined data sets, and also provides a marketplace for those data and applications. HERE hopes that the availability of its location capabilities, relevant data sets from third-parties, tools to ingest, manage and visualize big data, and ultimately the ability to monetize the resulting insights will attract demand from enterprises from industries beyond the automotive sector. During phase one the first examples of OLP capabilities are automotive focused and include HERE's Real-Time Traffic, Hazard Warnings, Road Signs and HD Live Map, which brings together a subset of vehicle sensor related data from its major OEM shareholders (Audi, BMW and Daimler) in addition to Mobileye. HERE anticipates that as it attracts more partners to its OLP the more appealing it will become to other organizations, which in turn will enable it to pull in an ecosystem of developers across industries and verticals.

HERE's location platform is currently licensed by large companies for consumer facing services, including Amazon, Facebook, Microsoft (Bing and Azure), and Samsung (Tizen), among others. South East Asian ride-hailing firm, Grab, announced it is licensing HERE content in Indonesia, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam. HERE will provide Grab with access to its POI database and real-traffic data as part of a data exchange. Grab highlighted HERE's Matrix API as the foundations for its partnership with HERE.

HERE is also intensifying its efforts to reach the long tail of developers. HERE claims to have made progress in acquiring developers to its location platform over the past twelve months, with the population of registered developers increasing 103% while the number of active developers (defined as one API call made in the last quarter) increased by 114%.

HERE has also improved its score for search by leveraging its partnerships with companies like Amazon and Facebook to increase the number of POIs. It is also leveraging sensor data from cars from several vehicle makers to improve driver safety, though these data points are currently more relevant for drivers than mobile LBS, per se.

HERE and Apple are the only two non-local map platforms operating in China. HERE formed a joint venture with NavInfo in December 2016, which was authorized by authorities in China in September 2017. HERE also announced a strategic collaboration with the internet company Tencent to use HERE in its own products.

Google remains in second place in mobile LBS. With the exception of China, Google Maps is the leading mobility app with over one Billion users globally. Google has democratized map making by integrating map and place editing features in to its Google Map properties while automating the edit verification process.

Android Auto has enjoyed increased traction in the car market with a growing number of car makers including it as an option on their vehicles. Car OEMs are leaving it to consumers to decide between navigation solutions via the on-board infotainment system versus hybrid brought in solutions (e.g. Android Auto and CarPlay) versus pure smartphone navigation.



Google is leveraging its scale and power of crowd sourcing to automate the map data collection process. Google has 33 Million local guides, which to some extent are helping Google to improve the level of detail and freshness of its maps. Local guides are periodically polled with a series of set questions about specific locations e.g. "is there access for disabled people." When a threshold number of local guides provide confirmation of these details the details are added to the map.

Google has started to offer "branded pins," which enables Google to charge companies wishing to highlight the location of their businesses using pins customized with their company logo. For example, Costa Coffee may want its store locations highlighted with a branded pin when users search for "coffee" within Google Maps.

TomTom continues to lag behind both Google and HERE in mobile LBS though has enhanced its score by increasing the number of navigable countries and territories that it serves. TomTom is primarily focusing on the automotive market rather than seeking to leverage its location capabilities in emerging areas.

TomTom remains primarily focused on automotive use cases and supporting autonomous (and semi-autonomous) driving, and is actively building out high-definition maps to support this use-case. TomTom claims to have mapped nearly 380,000 Kilometers of road, with the majority of vehicle OEMs using its road data as to develop semi-autonomous driving capabilities. However, TomTom isn't addressing the broader mobility market in the same way that Google, HERE, and Apple are doing. For example, while TomTom offers maps optimised for pedestrian use-cases it has yet to integrate with dynamic public transit information or with urban mobility providers, such as ride-hailing and ride-sharing companies. Furthermore, TomTom's efforts in indoor mapping remain as a pilot at this stage, while Google, HERE and to a lesser extent Apple remain active in this domain. Finally, TomTom's B2C app, TomTom GO is focused primarily on the driving use case, and not all round mobility.

TomTom's entry into the sports and fitness domain, with its smartwatches, has been less successful than it expected and as a consequence TomTom has elected to scale down its efforts and reorganize its business.

Apple continues to license TomTom map data for Apple Maps and during this year has acquired some notable licensees. For example, Michelin has leveraged TomTom's mobile SDKs for its mobile application for truck drivers, and Verizon-owned MapQuest has extended its license with TomTom. French-based map provider, Mappy, announced an extension of its partnership with TomTom to provide map and traffic data for its internet and mobile properties.

Overall, Apple remains in last place but has introduced indoor maps in its largest markets. Apple lacks the country coverage for maps, navigation, and search compared to its competitors as it focuses on markets where it has significant market share and presence.

Apple failed to score above 3 across each of the dimensions in our benchmark and has made limited progress in boosting its map and navigation capabilities, in our view. Naturally, Apple's efforts in mapping and location-based services remain largely focused on its home market and countries where it has the largest share of iPhones, such as the US, China and the UK among others. Apple CarPlay has gained traction with carmakers recognizing the appeal of these hybrid infotainment alternatives for consumers.



Apple has at least begun to make indoor maps available albeit in a handful of cities to begin with. Apple has remains tight lipped about its plans and roadmap for its maps platform.



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