SPECIAL REPORT 319:
BETWEEN PUBLIC AND PRIVATE MOBILITY
*EXAMINING THE RISE OF TECHNOLOGY-ENABLED TRANSPORTATION SERVICES*

# Taxonomy of Established and Emerging Personal Transportation Services

Paper prepared for the
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Appendix A

# Taxonomy of Established and Emerging Personal Transportation Services

The diversity of travel services on the continuum between private vehicle travel on one hand and traditional fixed route public transit on the other is expanding seemingly on a daily basis. The growth has been so rapid that even transportation experts have trouble keeping track of them all. Accordingly, this appendix describes these many transportation services, noting which we address in this report. We have organized these existing and new services into a matrix that identifies the role technology plays in each service and current public policy and planning problems and issues that need to be resolved.

Broadly, we examine person-travel services (and not freight services), surface transportation services (as opposed to waterborne or air services), and intra-urban travel applications (as opposed to inter-city and rural services). Within these parameters we describe below many of these innovative services, including carsharing, bikesharing, employee bus systems, transportation network companies (TNCs), new taxicab applications, dynamic transit systems and pop-up transit routes, real-time vehicle/service information, service aggregator applications, mobile payment systems, and so on. It also includes information on how each of these systems is insured, regulated, and taxed.

## TAXONOMY OF INNOVATIVE MOBILITY SERVICES

| Service | Role of Technology | Problems Technology May Solve | Factors for Success |
|---|---|---|---|
| Traditional ridesharing (carpooling/ vanpooling) | Matching riders and drivers , often for recurring trips on an ongoing basis | Finding people traveling the same or similar routes and the same or similar times | Minimizing additional time required for pick-up and drop-offs. Comfort with sharing rides with others. |
| Carsharing | Reservations and tracking vehicles; billing | Convenience in making/changing reservations and in locating/dropping off vehicles. National branding encourages use while traveling. | Critical mass of users to support availability of vehicles at a sufficient array of and pick-up/drop-off locations |
| Bikesharing | Reservations and tracking bikes; billing | Convenience in finding bikeshare stations and information on bike availability; management of rebalancing | Critical mass of users to support a sufficient array of bike stations. Rebalancing bikes to ensure availability |

| | | | |
|---|---|---|---|
| Microtransit (examples: Bridj, Leap, Chariot) | Reservations and tracking vehicles; determining routes from public demand; billing | On-board Wi-Fi and efficient routing to match customer demand. Customer tracking of vehicles and wait times reduces uncertainty. | Critical mass of users to support a variety of routes; comfort riding with strangers; price points that, while higher than standard transit, allow for regular commuting |
| Employee bus | Reservations; on-board services | On-board Wi-Fi helps make bus attractive | Geographic concentration of employee residences distant from large employee sites |
| Transportation network companies – sequential sharing (examples: Uber, Lyft) | Reservations and tracking of vehicles; billing; quality control via online customer feedback | Convenience of arranging ride just prior to travel; customer tracking of vehicles and wait times reduces uncertainty; national branding encourages use while traveling | Critical mass of users to support widespread vehicle availability |
| Transportation network companies – concurrent sharing (examples: UberPool, LyftLine) | Reservations and tracking of vehicles; billing; matching of riders for shared rides; quality control via online customer feedback | Convenience of arranging ride just prior to travel; customer tracking of vehicles and wait times reduces uncertainty; national branding encourages use while traveling | Critical mass of users to support widespread vehicle availability; comfort with riding with strangers; critical mass to match riders for shared rides |
| Taxi apps (or e-hail) | Easier reservations, both advanced and just prior to travel | Apps may cover multiple taxi companies and estimate wait time, reducing uncertainty. National branding could encourage use while traveling. | Critical mass of participating taxi companies; integration with traditional taxi operations; app use by traditional customer base. |
| Aggregator apps | Aggregating accurate, comparable travel information across a variety modes | Clearly presenting accurate, comparable information (cost, travel time, “next bus/train”). Participation by all (or most) providers. National branding could encourage use while traveling. | Accuracy, consistency, and comprehensiveness of information. Participation by various agencies. Ease of use. |

| | | | |
|---|---|---|---|
| Parking/navigation apps | Real-time information on the availability and price of on-street and (potentially) off-street parking | Enables driver to go directly to and pay for an available parking space; reduces congestion and emissions associated with "cruising" for parking in congested areas | Accuracy and immediacy of information. Ease of use. Often coupled with variable "performance-based" pricing to insure that some available spaces are usually available. |
| Mobile payment for an array of transportation services | Greater ease of use; lowers payment-related delays at the beginning or end of trips and seamless transfers from one mode to another; reduces payment evasion. | Greater ease of use; offers users complete information; eliminates need to carry cash | Range of credit options that can be paid via mobile app; access concerns for "non-banked" populations |

## CLASSIC RIDESHARING

"Ridesharing" has long referred to informal and formal carpooling and vanpooling. Carpooling is a grouping of two or more individuals into one privately owned vehicle, often for commuting to work, while vanpooling is typically a group of three to 12 individuals sharing a ride to or from a job center in a van. Carpool vehicles are generally owned privately by the driver while vanpool vans are most often owned or leased by the employer or third party, and driven by an employee commuter (who may be permitted to use the vehicle for personal travel in between vanpool trips to work). Passengers and drivers in traditional carpooling typically share in the vehicle operating costs but the driver is not paid a wage for his or her time in providing the services. Carpools are covered by personal lines of auto liability insurance, and drivers are generally not separately vetted apart from their employment or, in the case of carpools) licensed beyond a personal driver's license. With vanpooling, the vans are generally leased through a third-party company to private individuals. The vanpool company or employer owns the van and is responsible for maintenance; they also provide the insurance. Costs are covered by the group participating in the vanpool, the employer, or a mix of the two, sometimes with different people driving the van on different days. Some public agencies provide eligible vanpools monthly subsidies to help cover the cost of vehicle leases and other expenses, and vanpool participants are often eligible for tax benefits (511 SF Bay 2015).

Carpooling and vanpooling services are evolving with the waxing availability of both information technology and mobile devices that ease matching passengers. In 2011, there were 612 firms around the U.S. offering carpooling services, 153 firms offering vanpool services, and 127 firms offering both (Chan and Shaheen 2012). Most of these firms are regional ridesharing programs or programs operated by very large employers. However, the vast majority of carpools are informally organized. First, most carpools are among family members. Setting "fampools" aside, among carpools by those who do not live together, informal arrangements still vastly outnumber formally organized services. According to the 2009 American Community Survey, 10 percent of all journeys to and from work were in carpools; this compares with 5 percent who

travel by traditional public transit, and the 13,917,000 daily commutes in carpools is far greater than what could be arranged by 612 ridesharing organizations (U.S. Census Bureau 2011).

## CARSHARING

Carsharing services are growing quickly and rapidly evolving. In general, carsharing is the short-term provision of individual vehicles to individuals who drive themselves and return the cars to set locations. It differs from traditional car rental in that most carsharing rentals are for minutes or hours instead of days or weeks, although there are some variations. By providing members with access to vehicles on an on-demand basis, carsharing organizations can reduce the need for personal vehicle ownership. The general concept has existed for decades, originating in Europe, and with experiments in the United States that have included the setting up of vehicle-share cooperatives (Doherty, Sparrow, and Sinha 1987), but it has grown dramatically and seen significant expansion in recent years (Shaheen and Cohen 2014). There are three main types of carsharing: (1) roundtrip, (2) peer-to-peer, and (3) one-way or point-to-point, each of which is described below.

There were 45 carsharing operators in the Americas in 2014—ranging from for-profit, non-profit, and cooperative business models—with over 1.6 million members and 24,000 vehicles (Shaheen and Cohen 2015). As of early 2015, Zipcar and car2go were the largest carsharing organizations in the world (PR Newswire 2014).

The public role in carsharing mainly involves issues of parking. Many carsharing programs have agreements with municipalities to allow for free on-street parking. The companies also have agreements with cities that provide a number of dedicated spaces, indicated by city signs, paint, or other markings, for which the carsharing company pays the city a fee which can generate significant revenues. Depending on the agreement the car company may also pay for other costs to operate that include insurance, pilot evaluation, car removal in cases of parking restriction violations.

For example, when car2go first began in Austin in 2011, the company agreed to pay the city $24,155 per month for dedicated and non-dedicated spaces (Contract Between the City of Austin and car2go 2011). The contract also specifies requirements for commercial general liability insurance, business automobile liability insurance, workers' compensation insurance, and employers' liability insurance.

In Washington DC, Zipcar originally had all 86 dedicated parking spaces in the city at no charge. Car2go entered Washington DC in 2012, paying the city $578,000 for a parking agreement for the first year of operations and with a fleet of 200 cars (Austermuhle 2012a). DC then switched to auctioning off curbside spaces to a variety of carsharing companies. In 2012, car2go increased its DC fleet size from 200 cars to 300 cars, for which it paid the District an additional $215,300 for parking (Austermuhle 2012b). Zipcar, displeased with the change from free parking to paid spaces and an auction process, pointed to the $3.5 million generated in sales, use and income tax revenue it said it had provided to the city (TBD.com 2011).

In June 2015, Car2Go received permission from Arlington Virginia's Department of Environmental Services and from Arlington County to pilot its service for one year (Arlington County Board Agenda). Car2Go pays fees in advance ($1,645 per vehicle per year) for the ability to park at metered spaces and for pilot program administration and evaluation costs (Mañon 2015) and Car2Go will share data with the county board (County Board Approves

Carsharing Test Drive 2015). Car2Go also agreed to move cars that have remained parked for 24 hours in areas zoned for residential permit parking and parked for 36 hours elsewhere.

Car2Go initially paid the city of Portland Oregon $1009 per vehicle per year. The permit (which can be viewed at http://portlandtransport.com/documents/Car2Go_permit.pdf) is up for renewal every six months (Smith 2012). The current fee is $674,810 per year for street parking for the fleet of 518 cars (Rose 2015). Car2Go also will share data on its services with the county board.

Los Angeles awarded a five-year exclusive competitive contract to Hertz on Demand in April 2013 (City of Los Angeles 2013). The vehicles can be used for one-way travel and Hertz redistributes the vehicles as needed. Other carsharing services can operate in the city but without parking benefits or the ability to advertise their services as endorsed by the City of LA. Hertz's gross revenue recovery to the city was estimated to range from $450,000 in the first year of service to $29.2M in year five, with an increase in fleet size of 300 vehicles in year 1 to 1000 vehicles in year 5. However, in June 2014, the City Council rescinded the exclusive contract to allow for competitive operations among providers due partly to Hertz on Demand's lack of responsiveness to LADOT (Transportation Committee Report 2014).

In 2013, San Francisco began charging set fees by area. For each space, the city had expected to earn $600 to $2700 annually (Miller 2013). In the summer of 2014, the city set aside 900 spaces for carsharing for Zipcar, City CarShare (a local nonprofit), and Getaround (peer to peer carsharing). At least 30% of the spaces must be in the outer 2/3 of the city, and prices range from $50 in the outermost third of the city to $150 in the middle ring to $225 downtown. The total number of reserved spaces (for all three companies) is limited to two per block (Cabanatuan 2014).

Minneapolis entered into a two-year pilot program with Car2Go in May 2013. During the first year, the service pays the city $1689.29 per vehicle for the first 250 vehicles and $1614.29 for each additional vehicle. Those fees are a combination of an administrative cost, meter revenue recovery, event revenue recovery, and residential permits. At the end of the first year, the City has the right to adjust the two recovery fees based on usage. Car2Go provides the city with quarterly reports about all transactions (Carsharing Pilot Contract 2013). While the original plan was to provide on-street spaces exclusively to Car2Go, protests by others (including the city nonprofit HourCar) led council members to amend the pilot program to include multiple vendors (Meland 2013).

Many car-sharing companies report financial support from the public sector. According to one study, 73% of car-sharing programs reported receiving parking subsidies—60% from public entities, 33% from private companies, and 20% from both public and private sources (Shaheen et al. 2004; TCRP 2005).

New regulations have been necessary to control access to residential parking in some cases. In Calgary, like in other cities where it operates, Car2Go has been able to park in on-street spaces without time limits, except for street sweeping and a few other event restrictions. After Calgary business associations and some residents became frustrated with vehicles clustered on blocks, the city implemented a new policy that required carshare companies to move the clustered vehicles, which was defined as taking up more than one-quarter of the available space in a single pay-parking zone, averaged over a month. In a residential block with permit restrictions, the limit is 20%. Failure to comply would result in higher parking rates or loss of access to residential zones (Markusoff 2015).

## Roundtrip Carsharing

Initial carsharing models required roundtrip carsharing. Here, a fleet of vehicles is available for access by the hour, mile, or both. There were 45 carsharing operators in the Americas in 2014—ranging from for-profit, non-profit, and cooperative business models—with over 1.6 million members and 24,000 vehicles (Shaheen and Cohen 2015). As of early 2015, Zipcar was among the largest carsharing organizations in the world, and it generally followed the round trip model (although it was testing one-way carsharing in 2014). This was one of many round trip carsharing operators, but it was generally the most recognizable name in the industry. Zipcar charged its members an annual fee (on the order of $25-60, depending on the market and level of membership) and an hourly rate for vehicle rentals. The hourly rate varied depending on the market, the day of the week, and the type of car, but it generally ranged from about $6 to $15 and covered vehicle use, fuel, parking fees, insurance, and maintenance. The more than 800,000 members had access to approximately 10,000 cars parked throughout the United States, Canada, the UK, Spain, and Austria. Members had automated access to the fleet of Zipcars with access cards, which they waved over a reader in the car's dash. Keys were kept inside the vehicle. Members reserved cars in advance on the internet or using a mobile app, drove the vehicle as needed, and returned the vehicle to its assigned parking spot at the end of the rental. Cars were stored in off-street garages under arrangements between the carsharing operator and the garage, or on-street under arrangements with the carsharing operator and the local government. At the time, Zipcar's fleet, as one example of a carsharing fleet, consisted of a more than 30 vehicle models, ranging from subcompacts to cargo vans to luxury vehicles. In keeping with the company's playful spirit, each vehicle in the fleet was given a name—indeed, many operators name their vehicles. Zipcar was founded in 2000 in Cambridge, Massachusetts (Eha 2013). In 2007, Zipcar merged with Flexcar, its principal competitor (Heath 2007), and in 2011, the company went public with an initial public offering (IPO) (Fontevecchia 2011). In 2013, Zipcar was purchased by the rental car giant Avis for $500 million (Kell 2013).

The annual membership fee and hourly rate cover insurance for all carsharing members in good standing. For Zipcar, this insurance included comprehensive collision coverage and liability coverage of $300,000 per accident (combined single limit) for members aged 21 and over. For members under 21, liability coverage was provided at the level mandated by law for the jurisdiction in which the collision occurs. Zipcar also provided Personal Injury Protection (PIP) at the level mandated by law of the jurisdiction in which the accident occurred; however, any personal insurance coverage that the member may have would apply on a primary basis, and the company's "no fault" coverage would be secondary. Members were responsible for a $750 damage fee per incident, although they could reduce or eliminate this by choosing to pay for an optional damage fee waiver. The damage fee did not apply if the other party in an accident was found to be 100% at fault (Zipcar 2015).

Many traditional car rental companies have also entered the carsharing market. They are well suited to do so, as they already own large fleets of vehicles and have reasonably sophisticated systems to arrange to rent them. To become a carsharing operator, they expand their business model to allow them to rent the vehicles on a shorter-term basis with automatic smartcard access. Hertz has created Hertz on Demand, Enterprise is Enterprise CarShare, and UHaul has Uhaul Car Share. By moving into this new market, these long-established companies now all serve as direct competitors to Zipcar, as do many smaller carsharing operators.

Zipcar and other traditional car rental companies are for-profit and receive no direct public subsidy. Some cities give up metered street spaces to designate these spaces as reserved for the carsharing company, but the companies pay the city for the value of the spaces, effectively leasing the parking. Other carsharing services have been developed as nonprofits based in particular metropolitan areas. One of the first large nonprofit systems was San Francisco's City CarShare, and there are many others, including eGo (Denver and Boulder), Buffalo Carshare, and CarShare Vermont.

**One-Way Carsharing**

One-way carsharing is developing as both an alternative and complement to traditional roundtrip carsharing. In the roundtrip model, vehicles must be returned to their "home" parking space, making the vehicles unsuitable for one-way trips. The first large-scale carsharing operation to introduce one-way rentals was Car2Go, a subsidiary of Daimler. Car2Go uses a fleet of all Smart ForTwos (which are manufactured by Daimler) and allows a user to access the vehicle by the minute, beginning the rental wherever the vehicle is located and ending the rental when the vehicle is parked in any legal space within a large geographic or "geo-fenced" area. Renters can drive the vehicle outside of the geo-fence, but the vehicles must be parked within the fence to end the rental. Otherwise, the vehicles can be parked anywhere, resulting in a much more free-floating fleet than traditional systems with assigned home locations for the vehicles. The tradeoff to providing travelers with the flexibility of one-way travel is that the spatial distribution of the vehicles in the geo-fenced service area must periodically be "re-balanced," or moved to bring the supply of vehicles in line with consumer demand.

Car2Go provides liability insurance of $100,000 bodily injury per person/$300,000 bodily injury per accident per accident and $50,000 physical damage per accident. Coverage for the car2go vehicle is provided with a deductible of $1000 per occurrence (car2go 2015).

Similar to roundtrip carsharing systems, members have an access card that they wave over a windshield reader in order to unlock the car, and the keys are kept inside the vehicle. One-way carsharing rentals tend to be more spontaneous than roundtrip rentals, as a user can walk up to a vehicle on the street and rent it on the spot as opposed to having to make a reservation in advance. Members can determine vehicle locations either online or using an app, and they can also reserve the vehicle through the app. One-way systems are made possible through coordination between cities and carsharing operators over parking agreements.

Other companies are also providing one-way carsharing services. Similar to Daimler, BMW has created the DriveNow program, which uses all BMW and Mini ActiveE all-electric cars. DriveNow charges an annual fee and a per-minute fee, allowing users to drop the cars off anywhere within an approved drop-off zone. It is currently (January 2015) only available one U.S. city (San Francisco), although it operates in several cities in Germany, Austria, and the UK. In 2015, BlueIndy will begin operating in Indianapolis with a planned eventual fleet size of 500 vehicles (BlueIndy 2015); the cars can be picked up and dropped off at any station around the city, resulting in a more limited version of one-way carsharing. SHIFT planned to begin operating a fleet of shared vehicles (both cars and bicycles) in Las Vegas using the one-way approach, but it shut down in spring 2015 (Schmidt 2015).

Zipcar has also begun offering one-way carsharing, with a beta test that began in Boston in late 2014 (Zipcar 2014). Zipcar has not yet announced plans to expand this test beyond Boston. Vehicles can be booked up to 30 minutes in advance, picked up at designated locations,

and dropped off at other designated locations in a guaranteed parking space. If a parking space is not available at the destination, Zipcar does not permit the trip to be booked, thereby preventing too many vehicles from accumulating in a single location (Reidy 2014). Zipcar reports that one of the most popular one-way trips is between Logan Airport and downtown Boston (Five Takeaways 2015). Such systems do not provide the same level of flexibility as Car2Go or DriveNow's European operations, which allow vehicles to be parked in nearly any legal parking space within a large zone, but they do expand the usability of Zipcar's existing roundtrip carsharing service.

### Peer-to-Peer Carsharing

Peer-to-peer (or p2p) carsharing has, to date, remained a niche market. Premised on the idea that the average vehicle is used for only one hour per day, peer-to-peer carsharing allows individual vehicle owners to make their cars available for short-term rentals managed by a third party. A p2p organization member thus has access to many individually-owned vehicles that would otherwise remain parked and unused by the owner. The vehicle owners set the hourly rate for their own cars. There are several companies that provide p2p carsharing services, including Getaround, RelayRides, eGo CarShare, Buzzcar, and JustShareIt. At the time of this report, insurance issues around this type of carsharing are still generally in flux. Personal auto insurance policies generally do not protect owners who rent out their cars for money; commercial policies are required for liability coverage in these cases (McQueen 2013).

Another airport-specific form of p2p carsharing allows arriving passengers to rent the cars of local residents parked at the airports when the owners travel out of town. An example of this service is FlightCar, which, as of December 2014, operates in eight U.S. cities (Theis 2014). The vehicle owner receives free airport parking, a car wash, and income from the rental, and incoming travelers can rent these cars for lower rates than are generally available from traditional car rental companies. Rentals are insured up to $1 million in primary liability protection, with no deductible required of the owner. For renters, the $1 million coverage included with the rental is secondary, excess coverage, with add-on primary coverage available for purchase (FlightCar 2015).

## BIKESHARING

Bikesharing, like carsharing, consists of members who pay daily, weekly or annual fees in order to have access to a fleet of bicycles for their use. Members can pick up bikes from any station and return to that station or any other. Bikeshare is thus more analogous to one-way carsharing than to roundtrip carsharing. Most bikesharing systems allow dues-paying members to use bikes for no additional charge for up to 30 minutes, with hourly rates applying beyond that.

There are generally three forms of bikesharing. The first is public bikesharing, which is open to anyone who joins and pays membership dues (whether for a day, week, or year). The second is a closed community bikeshare, in which only members of some organization (such as a corporate or college campus) may participate. The third type, and least common, is peer-to-peer bikeshare of privately owned bicycles, which is somewhat analogous to peer-to-peer carsharing as described above.

As of May 2015, 835 cities and communities worldwide had some sort of a technology-enabled bikesharing system, providing nearly one million bikes at over 37,000 stations (Stein 2015). In the United States, 68 cities provide 22,000 bikes, and there are more than 880,000 members of bikeshare systems. In 2014, 150 new programs began operating in the world; 70 of these were in China and 14 were in the U.S.[1]

Another similar part of the shared travel economy is scooter sharing, which fills the space, albeit a relatively niche one, between carsharing and bikesharing. There is one program operating in the U.S. in the city of San Francisco, called Scoot Networks (Scoot 2015).

The first bikesharing program in the San Francisco Bay Area was led by the Bay Area Air Quality Management District in partnership with the San Francisco Municipal Transportation Agency (Shaheen et al. 2012). While other bike-sharing programs have been solely public sector ventures, most are public-private partnerships. Golden BC had a short-lived publicly-owned and publicly-operated bikesharing program in 2011 and 2012 before funds were reallocated in the city budget. The operations cost for the 15-bike system was $5400 and the annual revenues were about $1700 (Tansey 2015).

DecoBike in Miami Beach has an agreement with the city of Miami to give the city 25% of advertising revenue, 12% of revenue up to $3M, and 15% of all revenue beyond $3M. However, during the first year, DecoBike only paid a $100,000 down payment for parking spots and because of contractual changes the city received less revenue than expected (Miller 2014).

Many bikesharing systems are now publicly owned and operated by a contractor. The most common contractor is Motivate. Motivate is a private company, formerly Alta Bicycle Share, that designs, deploys, and manages bike sharing. Motivate operates Pronto (Seattle), Bike Share Toronto, CoGo (Columbus OH), Bay Area Bike Share, Divvy (Chicago), CitiBike (New York), Chattanooga Bicycle Transit System, Hubway (Boston), Capital Bikeshare (DC), and Melbourne Bike Share (Australia) (Ongoing Projects 2015). Many of the systems they operate are public-private partnerships, although Citi Bike in New York is not.

Citi Bike intends to survive without public money. It is the first system that will not be a public-private partnership (other than small private programs, such as at universities) (Shaheen et al. 2012).

CaBi serves Washington DC with original bikes and docking stations funded with federal grants earmarked for local programs that mitigate congestion and improve air quality through the federal Congestion Mitigation and Air Quality Improvement Program (CMAQ). User fees cover most operating costs. Local governments cover the difference. In 2013, the Arlington County, Virginia portion of CaBi recovered 74% of its operating expenses with user fees. It appears from news reports and data on bikesharing in Washington DC and New York that bikeshare acts as both a complement to and substitute for transit. (Badger 2014)

Boston has a program called “Prescribe-A-Bike” at Boston Medical Center that subsidizes bikesharing memberships for residents with low-income. The City of Boston provides the subsidy that allows a doctor to prescribe a yearlong membership to Hubway for $5 (Gaitan 2014). Annual memberships are usually $85 (Pricing 2015).

[1] Source: Susan Shaheen, UC Berkeley.

## EMPLOYEE SHUTTLE SYSTEMS

Another service that has expanded greatly in recent years is the employee bus, which operates in many regions, including the San Francisco Bay area, Washington DC, Seattle, and Los Angeles. Major firms that draw workers from a geographically extant regional labor pool operate buses to transport clusters of workers relatively long distances to and from work. Companies such as Google, Facebook, and Apple, etc. operating in the "Silicon Valley" of the San Francisco Bay area run private bus lines through the central city of San Francisco picking up employees at both marked city transit stops and unmarked bus stops before transporting them to suburban employment sites in Santa Clara County to the south. Many of these buses have generated considerable controversy among some San Francisco residents, in part because the shuttles are viewed by many as a symbol of the technology-fueled gentrification that is pricing some out of the city. The buses effectively enable mass carpooling, thereby reducing congestion and pollution relatively to private vehicle commuting. While these buses are not enabled by technology applications in the same way that others listed here are, they are frequently employed by large information technology firms. These particular shuttles are not open to the general public, and recently Facebook's bus drivers have begun to work with Teamsters in an effort to unionize (McCormick 2014). The San Francisco Municipal Transportation Agency (SFMTA) enacted an 18 month test fee of $1 per day per shuttle for each public transit stop used by a private company, expected to yield an average of $80,000 to $100,000 per operator per year; SFMTA also requires that the buses yield to public transit vehicles (Cabanatuan and Alexander 2014). There are other employee shuttle services that are open to multiple companies for service, such as RidePal, which are less controversial.

## TRANSPORTATION NETWORK COMPANIES

Transportation Network Companies (TNCs) are on-demand ride services that have grown considerably in recent years. While some have termed the function of these firms "ride-sourcing," they are increasingly known as simply as TNCs. Rides are arranged through mobile apps that connect a traveler with a driver operating his or her personal vehicle. Drivers may be either licensed vehicle-for-hire drivers or private individuals who do are not licensed as drivers beyond normal state driver licensing processes. Fares are based on both distance and time and paid from the traveler's credit or debit card account registered with the TNC. Fares are charged automatically at the end of the trip to the TNC; the driver does not engage the passenger regarding payment.

Because they do not own the vehicles, contract with the employees, or directly provide a dispatch service, TNCs have at times claimed not to be in the transportation business (Reindl 2014; Velotta 2014). The two leading companies, Uber and Lyft, have rolled out services in various cities, sometimes without complying with local vehicle-for-hire licensing laws and have been subject to cease-and-desist and temporary restraining orders as a result. Since they provide ride services (albeit indirectly) in exchange for a fare, state and local governments have generally viewed them as subject to licensing requirements. As the companies have rapidly expanded, they have at times waged contentious battles not only with existing regulatory agencies and regulated taxi companies (Graham 2015), but with one another as well.

TNCs have become popular with the public due to convenience and availability, particularly where these are lacking from traditional taxi companies. TNCs are also unpopular among classic ridesharing services, as TNC have frequently claimed that they are facilitating carpooling with their services and were not; they also called their services "ridesharing" and co-opted the term. Interestingly, in August 2014, Lyft, Sidecar, and Uber began to facilitate "ridesplitting" services, which enable customers to share and split rides among individuals traveling in the same direction—moving their services closer to ridesharing (Said 2014).

One of the concerns about these services involves the drivers' interactions with their smartphones. Drivers who make a living behind the wheel must respond nearly instantly to requests through their smartphones in order to make money, no matter the driving conditions. This concern is not specific to any one TNC, nor is it limited to TNCs, as other transportation services, including taxis, use similar systems (Richtel 2014).

The public sector role in TNCs is almost exclusively regulatory, although attention to regulation until recently has been minimal (see Chapter 3). Private-public collaborations also are being explored. For example, Uber is collaborating with public sector entities such as the Dallas Area Rapid Transit system (DART), which services Dallas and 12 surrounding cities, to enable customers to reach Uber's app through DART's mobile ticketing platform (Lyons and Ball 2015). San Francisco is considering privatizing its paratransit fleet and has explored Uber providing services for the city's paratransit system, but, at the moment, Uber does not meet the city's insurance requirements (Rodriguez 2015). For Earth Day 2015, Uber partnered in Seattle with King County Metro Buses and private companies to promote transportation alternatives to individual personal car use. Teams of individuals logged their commute miles using alternative transportation, defined as bus, rail, carpool, Uber, or biking/walking, and at the end of a month, the team with the most alternative trips won transit passes and free rides from Pronto (bikeshare) and Uber (Cohen 2015).

**Uber**

The largest TNC is Uber, which launched in March 2009. Uber is currently in hundreds of cities in dozens of countries and is rapidly expanding. The company was valued at $40B in December 2014, which is equal to the combined values of traditional car rental companies Avis and Hertz. (Ortutay 2014). (Similarly, Airbnb was valued at $10 billion in April 2014, greater than that of Hyatt Hotels [Rusli and MacMillan 2014].) Uber has become the target of numerous lawsuits from taxi companies (Cox 2014; Seward 2014), advocacy groups for the disabled (Sullivan 2014; Ramos et al. vs. Uber Technologies 2014), cities (Lien and Mitchell 2014; Rushe 2014), the family of a girl struck and killed by an Uber driver (Streitfeld 2014), and its own drivers (Farrell 2014) and customers (Reuters 2015; Rodriguez 2014).

Uber provides a variety of service options. The first service, what is now called Uber Black, enables a customer to use an app to summon a black car and licensed driver. They have since developed a number of other services, including UberX, which allows private individuals (or community drivers) to use their private vehicles to drive the traveler around. This service has expanded fastest and has been the focus of much of the taxi and regulator concern. Other services include Uber SUV, which calls SUVs that seat six or more people; Uber Lux, which uses premium vehicles ("the finest cars with prices to match" according to Uber); and Uber Taxi, in which Uber partners with local taxi fleets to provide standard taxis through their app. As noted above, in August 2014, Uber also unveiled UberPool, which allows a user to share a ride and

split the cost with another person "who just happens to be requesting a ride along a similar route" (Uber.com 2014). As of June 2015, UberPool is available in four cities: the third of three cities: San Francisco, Paris, New York, and Los Angeles (Uber.com 2015).

Uber has until recently strongly resisted regulatory demands that it comply with state and local licensing requirements that apply to limousine and sedan services, such as having commercial auto liability policies, conducting fingerprint-based background checks on drivers and tracking drivers' licensing status. These issues have been a central focus of disputes between regulatory authorities and the company.

One of the notable features of the Uber app are fares that vary with consumer demand and vehicle supply. While such pricing is a staple of the hotel and rental car industries, it is very limited and highly regulated in the traditional taxi industry. When demand for rides is very high, such as in times of foul weather or surrounding a stadium after a sports event, Uber implements what it calls "surge pricing," which multiplies standard rate by some factor. Under basic economic theory, this both tempers demand and encourages an increase in supply; if drivers can earn additional income during surge pricing periods, more are likely to come out and drive.

For each fare, Uber takes a 20 percent cut and provides 80 percent to the driver. The company has reduced its fares several times in 2014 and has in many cases both obtained a price advantage over taxis and its competitors, and increased its customer base.

### Lyft

The largest competitor to Uber is Lyft, which is also headquartered in San Francisco. Lyft touts a corporate culture that emphasizes community over profit, and their cars can often be identified by pink mustaches that drivers place on their front grills or as a sticker on one of their windows, a tradition of passengers riding up front with the driver, and friendly "fist bumps" between drivers and passengers. Lyft was valued at $700M in March 2014 (MacMillan and Rusli 2014). Like UberX, it pairs riders with community drivers using their private vehicles, the substantial majority of whom it claims are part-time (Saitto 2014). The firm launched LyftLine as a ridesharing option, similar to UberPool[2] and Sidecar's Shared Rides, which (currently) guarantee substantially reduced fares whether or not additional passengers are picked up en route (Lyft 2014).

### Sidecar

A third major player in the TNC arena was Sidecar. Launched in 2012, Sidecar operated in eight major U.S. metropolitan areas and never obtained the market penetration of Lyft or, especially, Uber, but it offered many similar options, including a shared ride option beginning in August 2014 (Sidecar.com 2014). One distinction is that drivers were permitted to set their own rates in advance of the ride. Whereas Uber and Lyft can only provide an estimate of the total cost (which is dependent on time and distance), Sidecar allowed the driver to set an exact amount before the ride begins. In August 2015, Sidecar changed its business model to focus on package deliveries instead of passenger travel (Soper 2015).

[2] The two companies announced their ridesharing services within 24 hours of one another.

## TAXI APPS

The taxi industry has developed a number of apps of its own to eliminate the convenience advantage currently held by Uber and other TNCs. These services also offer cashless payment and app-based dispatching with no surge pricing; they work with existing taxi and limousine companies, ensuring that all of the vehicles ordered by an app user are locally licensed and regulated taxis. One of the first taxi apps was Hailo, which originated in London. The app charged a $1.50 fee per trip on top of the taxi fare, paid by the rider, and passes fares collected along to the taxi company within 24 hours (Overly 2013). The app was aimed at customers who like the convenience of securing rides through a mobile device but who prefer traditional taxis to TNCs (Aratani 2014). By October 2014, Hailo was available in seven North American cities: New York, Chicago, Boston, Washington DC, Toronto, Montreal, and Atlanta. But that month, Hailo shut down its North American operations citing "astronomical" marketing costs and intense competition from other applications, particularly the TNCs (Weber 2014). It continues to operate in Britain, Ireland, Spain, Singapore, and Japan (CTV News 2014).

Other taxi apps currently on the market include myTaxi, Flywheel, and Curb (rebranded from Taxi Magic in 2014). These companies contract with individual cab companies/fleets in each city. The contracting process and need to integrate business processes and computer systems with many small fleet operators (in contrast to a national business model, such as that offered by TNCs, like Uber and Lyft) have slowed their expansion rate, although this is changing.

See Chapter 3 for a discussion of the public sector role in the taxi industry.

## AGGREGATOR INFORMATION APPS

Aggregator apps aim to show a user all available forms of ground transportation at a particular location and time. When a user enters an origin (often "my location" as determined by the device's GPS) and a destination, the app searches bus, rail, bikesharing, carsharing, taxi, carpool, walking, biking, and driving options and provides the entire list to the user. By providing all of these results in one place, the app simplifies the process of determining which transportation mode (or combination of modes) is most optimal, such as by allowing a user to prioritize time over cost for an urgent trip. As of this writing, the largest of these apps is RideScout, which launched at the South by Southwest technology festival in 2013. By 2014, the company expanded into sixty cities. In September 2014, RideScout was acquired by Daimler and is known as the "Kayak of ground transportation" (Petru 2014), after the popular aggregator website for long-distance travel options. Because these app simply aggregate information on travel options across modes, they have to date avoided the intense media and regulatory scrutiny of the TNCs. Increasingly, aggregator apps will include fare payment across all modes.

## MOBILE PAYMENT OPTIONS

Many transportation systems and services have begun to provide mobile payment options to travelers. This is particularly prevalent in the parking industry, where pay-by-cell services are becoming a common option in major urban areas and at universities. Some cities are providing

their own services, while the ParkMobile app allows any user to pay for a participating parking meter via Paypal, the Visa Checkout service, or a Parkmobile wallet (Parkmobile 2015). Not only can the initial payment be made with a mobile phone, but the time on the meter can be extended via text or other phone-based alternative.

## PARKING/NAVIGATION APPS

The application world has also seen tremendous growth in services geared to improving the parking experience. These apps generally provide real-time maps of available parking and sometimes also provide the means to pay for the parking through the app with a credit card, eliminating the need to pay a parking meter or garage attendant. Some of the larger players include ParkMe, Parkmobile, and Parking Panda. These apps can also provide text reminders at specified times before the parking meter runs out and have developed partnerships with airports, stadiums, and cities. The apps have been hailed as a tool to reduce the congestion and emissions associated with "cruising" for open parking spaces in congested districts. Some have estimated that drivers who are cruising city streets in search of a parking space can account for 30 percent of urban traffic (Shoup 2007); providing a means for drivers to know where parking is available instead of driving around looking for it can produce a measurable effect on urban traffic. When San Francisco implemented its SF*park*, a variable-rate parking program with information provided to drivers, cruising for parking was reduced by half (Millard-Ball et al. 2014). On the other hand, the apps concern some safety advocates, who worry that they require drivers to interact excessively with a mobile device while driving.

## MICROTRANSIT SERVICES

A few families of microtransit services include Bridj, which bills itself as the world's "first pop-up mass transit system." Bridj uses (1) data provided by member riders, (2) tweets, (3) Facebook updates, (4) Foursquare check-ins, (5) census and municipal records, (6) and Google Earth to analyze typical travel patterns as well as those during major events. It launched in Boston in the fall of 2014, outsourcing driving to local partners who are licensed to provide operators and drivers (Bacon 2015). Bridj creates express transit routes that take people directly between concentrated origin-destination pairs. The fares range from $3 to $5 (Bacon 2015) and the 14-passenger buses provide Wi-Fi and leather seats (Nanos 2015). Using real-time data, the system can predict areas of peak demand and adjust schedules as needed. The company uses licensed buses from other companies and presents itself as a "relief valve" for the MBTA (the metropolitan Boston transit operator) instead of a direct competitor (Johnston 2014). As more people sign up for the service, the service dynamically adjusts routes to optimize travel times and routes for the passengers.

Bridj's six-month pilot program with Boston, which began on November 10, 2014 (City of Cambridge, Massachusetts 2014b), was contingent upon Bridj not using certain drop-off locations and streets (City of Cambridge, Massachusetts 2014a; Vaccaro 2014). In February 2015, Bridj announced that its second city would be Washington, DC (McFarland 2015). Based on the company's experience in Boston, about 20-30% of riders are new to public transportation, with the remainder coming from the city's transit system (Bacon 2015).

Chariot is another service based in San Francisco. It uses crowd-sourcing to develop a series of commuter routes driven by 15-passenger vans, charges $4 per ride, and is integrated with “virtually every commuter benefits provider” to allow travelers to pay for their commutes with pre-tax dollars (Chariot Transit Inc. 2015). Leap began in San Francisco, starting with one route available 6:30-10am and 4:30-7:30pm on weekdays, with single rides beginning at $2 and food and non-alcoholic drinks available for purchase onboard (Leap 2015). Loup, with the tagline “redefining local transportation,” is a third service based out of San Francisco, which uses a black car to run specific routes with pick-up and drop-off stops that are similar to bus routes (Loup 2015).

Public sector involvement in micotransit services has included disputes about licenses and violations, who has the authority to regulate and service definition. For example, Bridj, the data-driven pop-up bus service, began by partnering with insured and licensed limo companies that provide vans and small buses (Cambridge License Commission Hearing 2014). Rather than traveling fixed bus routes, routes are tailored to meet the travel patterns needs of its customers. Bridj received a jitney license to operate first in Boston and then in Cambridge, MA. Bridj’s terms have a DC-specific disclosure that reads as follows: “Bridj does not operate as a transportation carrier in Washington, DC. Bridj provides a platform to connect users with transportation carriers that are independently owned and operated by third parties.” (Bridj 2015)

In May 2015, the California Public Utilities Commission (CPUC) issued the luxury bus start-up Leap a cease-and-desist order for not having a permit to operate. Leap applied for a state permit in 2013, but the city of San Francisco said it should be the entity to regulate the service. While the debate was ongoing, Leap began operating under a CPUC “authority to operate” (the precursor to an actual permit). The cease-and-desist order states that Leap failed to meet several requirements that included failure to provide evidence of property damage insurance, workers’ compensation insurance, and testing for alcohol and controlled substances. A complained filed against Leap with the U.S. Department of Justice says Leap had illegally removed disabled ramps in violation of Americans with Disabilities Act (Geuss 2015; Musil 2015). Leap filed for bankruptcy in summer 2015.

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