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Empty Seats Traveling

Next-generation ridesharing and its potential to mitigate traffic- and emission problems in the 21st century

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Abstract:

There are 500+ Million privately owned passenger cars worldwide, thereof 236 Million in the US. These cars travel in the magnitude of 5 Trillion km per year. Let's assume 2 empty seats per car and a small hypothetical value of only 5 cent per km and seat, the potential value of empty traveling seats amounts to 500 billion €. This memo explores how mobile communication services can cross-link supply and demand of these empty seats. (Executive Summary at the end of this paper)

Index Terms:

dynamic ridesharing, instant ridesharing, ad-hoc ridesharing, carpool, peak-oil, fleet management, CO2 emissions, climate change

1 INTRODUCTION

As member of the mobile information society you commonly struggle with two problems: Traveling and communication. These technologies had and have significant impact on each other. People's desire to communicate while traveling (especially driving) created the mobile phone business. Since recently, off-board navigation services assists travel. There is also competition between communication- and transport industries, as you make calls to avoid traveling or you travel to avoid making calls. But imagine, you could use your phone as a means of transport. Ok, your phone does not have wings or wheels, but please consider two simple use cases:

1. call a Taxi,

2. call somebody to share a ride that is done anyhow.

Both use cases look similar, as you use your phone to arrange a trip. The important difference between 1. and 2. is that in the second example, communication does not just trigger a service, but it creates a value in terms of a transport opportunity without the typical expenses for fuel, road usage, car, environment, etc. See it like this: in 1. it is the Taxi which gets you somewhere, in 2. it is communication. This is a very simplistic example, but let's assume, a mobile service would broker empty seats between drivers and customers, you even may be tempted to credit your phone for the transport as others credit their car. A company making money on mobile communication should become interested in use cases of type 2, called ride sharing.

Using a private car is the most convenient way for door to door transport. Private transport was one of the key drivers of postwar economical growth, but at the same time it caused major problems for environment, society and, yes, economy. Some facts[1]:

As of 2005 there were about 500+ million cars worldwide (0.074 per capita), of which 236 million are located in the United States (0.75 per capita) /1//2/. The US average yearly passenger car mileage is 11.250km/year /4/ and in Germany 13.600km/year (1,7Bio Km/day, 45Mio cars) /35/.

The paved street- and highway mileage in the US increased since 1980 only by 3% while highway traffic increased by 48% /8/. Total street traffic increase for the last two decades was even reported 76% /5/. The average period people got stuck in traffic jams in the US increased from 11h to 36 hours per year from 1980 to 1999. In that year, the cumulative cost due to congestions was estimated over $78 billion in the largest 68 urban areas /5/. Statistics for 2005 /5/ indicate 1038$ (per capita) average annual cost for congestion in the very large urban US areas (>3Mio population). These costs include only gas and time, but no environmental costs. Even though fuel efficiency improved, the total consumption constantly increased by about 2% each year /7/.

Passenger cars are by far the biggest single consumer of petroleum and thus producer of CO2. Private transport in the US consumes about 43% (passenger cars and light trucks, like SUVs and pickups) and transport as a whole consumes 65% of total US crude oil consumption /9/.

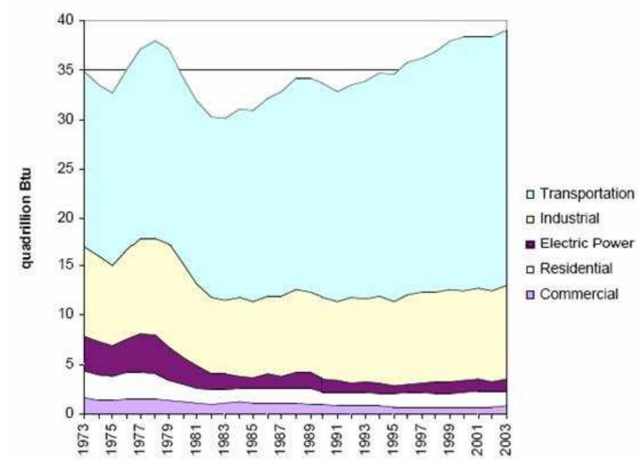

Figure 1. Oil consumption by sector in the US, 1973-2003 /9/

Personal transport is extremely wasteful compared to almost all other transport means. One reason for this is that most cars are occupied by just one or two people. Average car occupancy in the UK is reported to be 1.59 persons/car; 1.2 for commuters and 2.1 for holiday trips /3/. For Germany the commuter occupancy is even only 1.05 /33/. The empty seats of those cars constitute a potential value. These seats do travel and are already paid for.

There are quite many profit and non-profit organizations /34/ which support car pooling, but without any significant impact on overall car occupancy. The existing services allow convenient trip arrangements over the internet, support trust building between registered users, and they implement billing systems to charge passengers and compensate drivers. There are a few factors limiting the success of these organizations. Firstly, trip arrangements are not really ad-hoc. People got used to flexible working hours and instant availability of transport means in terms of their own car. With existing ridesharing services it is just impossible to spontaneously arrange trips to head home from work or to drive shopping. Secondly, people are not widely encouraged to practice car pooling, e.g. by local governments or employers.

Both problems can be solved. Making trip arrangements more flexible and ad-hoc is "just" a communication problem. There are also good reasons to believe, that the second problem can be solved once a technical solution for instant ridesharing is found. In fact, there are a few isolated but good examples where carpooling has increased significantly after local governments and large employers introduced commuter financial incentives, tax laws and traffic regulations favoring carpools /15//16//17/. Just to mention a few

- In San Francisco there are several carpool pick-up zones close to transit bus stops, where drivers pick up passengers. This entitles them to use the toll free HOV (High Occupancy Vehicle) bypass lanes. Drivers save time and passengers save money. 8000-10.000 people use this opportunity on a casual basis. HOV lanes are popular in many US cities.

[1] It is difficult to get global figures on transport statistics, but there is a lot information available on national transport mainly from government pages.

- parking cash out: Employees who commute by car typically use a free parking spot provided by their employer. Some Employers cash out the equivalent value of this free parking to employees which do carpooling or use public transport. Same or similar commute trip reduction (CTR) programs are even mandatory, for example, in Oregon and Washington State for all companies with more than 50 or100 employees, respectively. Companies failing to implement CTR may be fined.
- The UK company car tax reform of 2002 based the car tax on the CO2 emissions of the particular car type. The previous tax law decreased tax with increasing mileage, thus subsidizing people who drive more.
- Some cities introduced a city tax to encourage people to use public transport or share rides (e.g. London, Stockholm). Similarly, cities could decide to enforce car pooling, as recently happened in NY because of strike in public transport.

There is a good reason to consider car-pooling as a good complement to public transport:

- Innovative transport concepts are worldwide considered a indicator of a countries´ economic development and progressiveness. Instant ride sharing is an innovative transport concept.
- Seats in public transport vehicles are much more expensive and fares have to be subsidized by 70% and more /36/ to keep up service. Cities must constantly invest in maintenance and renewal of their public transport facilities, which are partly in disastrous condition. Unfortunately, many communities failed to create financial reserves for these expenses this in the past years.
- Even during rush-hour traffic, passenger occupancy is low in commuter cars but high in public transport.
- Finally, there are several emission laws in effect that may finally force governments to reduce traffic. In Germany and supposedly also other countries, some streets have been entirely closed to fulfill the new EU regulation on the emission of soot particles. After the ratification of Russia, the Kyoto Protocol is now in effect since the 16-feb-2005, but most signatory states will not be able to achieve the committed reductions in CO2 emissions until 2012. Governments are now forced to find options with minimal impact on national economy. Ride sharing is such an option. In fact, it may have a positive impact to economy due to the fact that the savings are fed back into the economy.

But lets stick to the communication problem first. The following chapter sketches a user scenario, how a future ride sharing experience may look like.

2 Honey, you may take the car, I take the phone

The following user narrative sketches one morning in a life of several commuters, using modern communication to arrange trips.

"Do you take the car or the mobile this morning", Jenny called from the kitchen. "I´ll take the phone, and don't forget to fill up", Tom replied. "Why do you always leave the car for me when its empty", Jenny complained, but Tom already left. He didn't feel guilty, his phone's battery also needed charging from time to time. He walked a few meters and reached the main road. While walking, he selected "transport services / select start and destination" from the main menu of the ride-sharing Java application. After authentication, he selected starting point and destination from his address book. "I should get a phone with GPS, then I only have to enter destination", came into his mind, but for now his old, java enabled phone, did the job.

At the very same moment Hermann, on his way to an appointment, heard a notification from his smartphone: "Passenger pickup, in two hundred meters ... hundred meters ... stop on the right". Herman stopped and Tom approached the car. When Tom was about 3 meters close, the navi application displayed "... connecting ... authenticate passenger..." and subsequently played a short tune to notify successful entry-authorization of the passenger. Tom's Name and picture appeared on the display of Hermann's phone, which was connected to a Bluetooth GPS mouse stuck on the dashboard behind the windscreen. His next phone would have an inbuilt GPS, but his old smartphone still did its job.

Tom entered the car.

"Hey, I bet, I´ve been in this car before".

"Well, could be that my wife drove you last time, I hope you are not disappointed". Both laughed. In fact, this ride sharing service has become very popular and it just rarely happened that the same car stopped twice.

"This is a very nice one", Tom said, and indeed, Hermann's car seemed to be everything but inexpensive. "Well, usually, I could not afford such a car", Hermann remarked, "but most of the time my phone finds me one or two passengers on my way to work. That covers most of the costs. And on the carpool lane, I´m even faster". After 5 minutes – Hermann and Tom were absorbed in a chat – the navigation application asked to pick up another passenger and after another 8 minutes it instructed Tom to change cars for his final destination.

Tom waited for less than 1 minute and another car stopped and took him to work.

When stepping out of the car the cost summary was displayed on his phone. His telephone number was charged 2,76 € including service fee. This year the government decided to make ridesharing income and expenses tax deductible, since the saving in road maintenance, congestion costs, etc already *had a measurable, positive impact on national economy and environment.*

On his work to the main entrance, his colleague Tina approached.

"Hi Tina, new haircut?"

"No, but a nice young man in a convertible picked me up this morning", Tina remarked.

"nice? How nice?"

"well, very, very nice", she said with a sigh.

"sounds serious. Name, address, …?"

"no, but I beamed my business card to his phone"

"well done"

Some observations:

Both Tom and Hermann are subscribed and connect to a ride-sharing mobile service. They access the service with today's phones, but Hermann's navigation software seamlessly integrates the client for the ride sharing service. Tom even only has a simple phone with java API and runs the passenger client as a java application. Both phones use short range connectivity (e.g. Bluetooth) to manage entry-authentication.

Herman does not do any detour when picking up passengers. These passengers just share a fraction of Hermann's default route, which earns him money. His navigation SW is operated exactly like a regular navigation client. It just had an option to switch ride sharing on or off. Tom pays Hermann and the service provider. In this particular example, Tom had to change cars to reach his final destination.

Finally, ride sharing appears to be a positive social experience, at least to Tina.

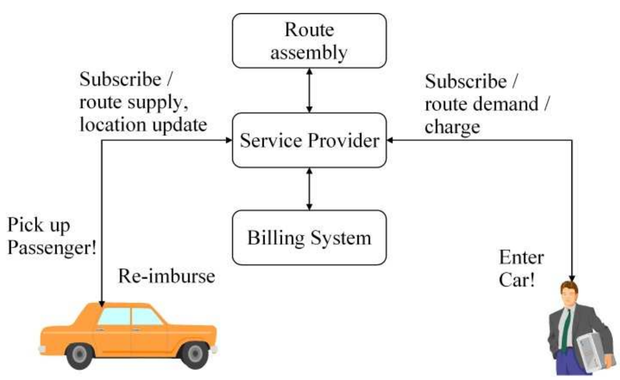

Figure 2. Outline of an instant ride sharing service

Please regard this story as an appetizing vision that has not emerged from any sound requirement- and usability study. You could tell other, equivalent user narratives, requiring a different technical implementation. Regarding the value chain, there are also many equivalent options. Operators could run both the service and billing platform. Alternatively, brokering of empty seats could be accomplished by micro-auctions in eBay while the dynamic navigation platform is run by Via-Michelin. One interesting conclusion from this particular scenario is that it admittedly constitutes an engineering challenge, but we don't talk about rocket science. The system just smartly combines existing, well understood technologies around real-time communication and navigation.

In order to derive meaningful requirements, it is an interesting exercise to identify the obstacles and success factors of such kind of services and compare it to the state of the art.

3 Obstacles and success factors collected

The idea of ride sharing is not new and, as already mentioned, you find plenty commercial as non profit services. Many people have an immediate idea of why ride sharing – also in the above scenario – will stay a niche type of transport. While some arguments are hard to disprove, some can be. Collecting these arguments helps to identify the requirements for a successful ride sharing service.

„I don´t like strangers in my car"

Security and trust are among the most important success factors for ride sharing services. Such service should only be available to subscribed customers and there should be a trustworthy, yet non-obtrusive system for passenger and driver authentication. And, as already common in Internet sales, there should be a driver and passenger rating system. Besides trust and security aspects, many people feel uncomfortable to sacrifice their privacy. This concern is difficult to address and may only be overruled by other advantages, as extra income, usage of carpool lanes, etc.

„I dont like hitchhiking. You never know whether somebody picks you up and you can´t trust people. I can afford my own car"

These arguments are the most popular from passenger perspective. It is partly addressed by the subscription and authentication means addressed above. The additional challenge is to get rid of the bad hitchhiking image, where poor and young people apply for a free ride. A ride sharing service will have to proclaim a business relationship between peers rather than solicitation. Ride sharing shall no longer be a question of whether or not you can afford your own car, but rather a cost-benefit consideration.

Moreover, the system has to guarantee and measure a quality of service, which will be difficult to keep at reasonable levels across space and time without complementary transport, like public transport and taxis.

Arranging shared rides is too complicated. I have flexible work hours, I never know when I leave home or work.

With existing ride sharing services, trips usually have to be arranged at least one day in advance and are thus not suited for commuters. Special matchfinding services for communters treat trip arrangements as fixed, recurrent appointments not taking into account flexible working hours. This is what instant ride sharing can and must overcome.

„People don't change their habits for the benefit of the environment"

Interestingly, this statement was heard many times, but is rather irrelevant, because if the service is a business case, the benefit for the environment comes a side effect and not as a service enabler. If ride sharing is no business case, environmental benefits will not help either. Smartly communicating the environmental benefits may not hurt, though.

It is a different story when public administration enforces restrictions on traffic, like the introduction of car pool lanes, or driving bans enforced by law due to emission laws or to avoid congestions. From an environmental viewpoint, ride sharing will rather arise from public incentives and regulations, than by peoples´ will to change their lifestyle for a better world. As mentioned before: where such regulations are in effect, ride sharing is already commonly practiced.

Finally, innovative transport concepts are worldwide considered an indicator of a countries´ economic development and progressiveness and contribute to a positive identification of people with their region. Dynamic ride sharing service is an innovative mobility concept, same as subways and sky trains.

„Real seamless, instant ride sharing is a tricky, difficult technology"

Until we don't prove the opposite, there is no evidence that such real-time network service would be overly complex, since most of its components, like navigation, tracking, billing, authentication, etc. exist in other frameworks and "only" need to be combined. Surely, it is an engineering challenge, but the complexity is in the software to be developed and not in the end user hardware.

Moreover, there are less complex yet useful instant ride sharing pilot projects already rolled out today /34/. More about this later.

„You´ll never make it, because the infrastructure and sufficient device population has to be in place from the beginning"

That's a serious argument, since there is a minimal subscriber population necessary to make this service happen. That's why above user narrative can hardly be a blueprint for a ride sharing service being created from scratch, even though feasible from technology point of view. Such system will rather evolve from a thread of backwards compatible services that incrementally grow from existing implementations to more complex and seamless solutions. The integration of public transport and taxis may play an important role, same as subsidies of suitable smart phones for ride-sharing subscribers.

The most important success factor here is that the service shall not mandate new devices on the consumer end. It shall rather be built on widely deployed mobile computing platforms. Today's smartphones already run off-board navigation clients. These software applications could be modified to contain a ride sharing option. For passengers, Java enabled low-end phones will do.

"Gas is just too cheap"

This may have been true 3 years ago. Ever since, the oil price went up from about 20$/barrel to a peak of 70$/barrel in 2005. There is no reason to believe that the price will stay at this level or decrease. Instead, large investment houses like Goldman and Sachs predict prices around 105$ within a few years /12/. There are more and more studies published indicating that world production of crude oil is likely to peak within the next two decades /9//11/, thus opening a gap between predicted 2-3% consumption yearly increase and a 2% yearly decrease in post-peak production[2]. This will cause a permanent energy crisis with exploding prices for petroleum, since supply will no longer meet demand. Since the early 80s, less new oil reserves are discovered than oil is consumed (figure 3). Private transport consumes about 40% of total oil production, so it even could happen that ride sharing is one of few options to keep up private transport until a transition to alternative fuels could be accomplished. Please note, that a short term transition to new, non-compatible fuels is difficult and painful not only because of technical reasons. Currently, the 50% replacement period of cars is between 10-15 years and the corresponding deprecation value only for the US amounts to 1,3Trillion$. Shortening the deprecation period means large-scale destruction of national property /9/. And don't expect alternative and compatible fuels to be cheaper than gas. If this would be the case, more cars would already run on those.

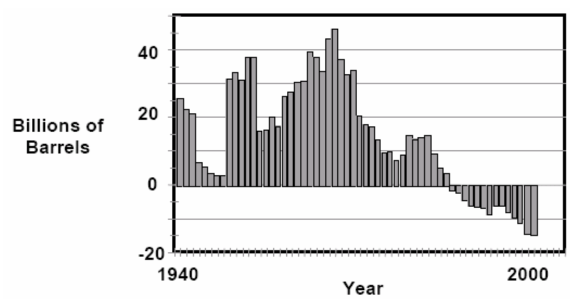

Figure 3. Net difference between annual world oil reserves additions and annual consumption/9/

"public transport, car manufacturers and their suppliers, will suffer from this, and they are too powerful to let this scenario happen"

[2] This topic is very controversial because reliable data is missing. The EIA (Energy Information Administration) of the US department of energy claims that Peakoil is more likely to occur at the end of the 21st century /10/, while other recent studies (one meta-study funded by the same department) expect peakoil to happen between 2008 and 2025 /9//11/

Disruptive technologies always create winners and losers. At first glance, car manufacturers could be affected by fewer car sales, but the savings could instead be invested in more expensive cars which drive fewer miles. Moreover, an energy crisis may be the worst disruption for car makers and this is mitigated by any technology that reduces petroleum demand, like ride sharing does.

In fact, ride sharing services could endanger the existence of public transport agencies. These are typically owned (at least partly) by community- or state governments. Governments could impose severe limitations on instant ride sharing, since picking up and dropping off passengers at arbitrary places could require adaptations in road traffic regulations and even structural measures. Moreover, passenger transport may be considered a trade and thus require special permissions. On the other hand, governments could actively support the introduction of such system through taxation, emission control, car pooling regulations, etc. In fact, they do support car-pooling already today (see examples listed in chapter 1).

Obviously, communities are enablers, loosers and winners at same time. A ride-sharing business will clearly benefit from their support. But they have to be confident that this is a big opportunity for economy, environment, welfare and common identity, and that these benefits outweigh disadvantages for public transport profitability.

Let's draw some conclusions:

Any ride-sharing service must avoid the biased image of hitchhiking and take security concerns serious. It may be a tricky technology, but the challenge is not in the technical implementation, but more in the definition of a path leading from existing ride sharing services to a fully automated systems as the one sketched in the user narrative. Finally, communities and governments should be involved in planning and implementation from the beginning.

4 The Instant ride sharing Ride-sharing Business case

Sometimes it is useful to make a simple model calculation, just playing with assumptions and parameters of such future service. Even if this is not based on any solid data, one can at least try to sketch best and worst case scenarios.

Let's say the service shall be introduced in a large urban area with roughly 20Mio People, like Los Angeles or New York. Moreover it is assumed that only 2% of all cars share every 5th ride and charge the passenger 0.15$ per km. The service providers turnover would amount 16,8 Mio$/year. Once the service gets more popular and finally every 5th car is using this service, the service turnover would grow proportional. However, the shared mileage may possible decrease as fewer drivers find passengers. Likewise, if people share rides they drive less, reducing the yearly mileage. If we assume that every 10th ride will be shared, we still get a service turnover of 135 Mio$. We can safely assume that there is an economy of scale in this type of services and that revenues increase better than proportional with the number of arranged trips.

	Symbol	Scenario 1	Scenario 2
Mio People living in service area		20	20
Mio Cars (0.75 per capita)	C	15	15
yearly mileage driver	Y	11250	9000
Subscribers	S	0.01	0.20
shared Mileage per subscriber	M	0.20	0.10
Average passenger fee / km	P	0.25	0.25
Service fee in % passenger fee	F	0.20	0.20
total yearly turnover / Mio $	C*Y*S*M*P	84,375	675
Service provider's turnover / Mio $	C*Y*S*M*P*F	16,875	135
Yearly turnover per subscriber/$		113	45

Table 1: parameters affecting the ridesharing business case

5 State of the art

As the concept of ride sharing is rather old, you find many commercial and non-profit services on the internet and there is a lot IPR. Finally, there are systems unrelated to ride sharing but implementing key technologies needed in such ride sharing application.

5.1 Publications

In an old patent from 1982 /13/ we already find many key aspects of the instant ride sharing user narrative above. The main difference between this patent and the above user narrative is that the inventor had fixed private and public terminals in mind while Tom and Herman are using mobile phones. Moreover, integrating passenger pick-up and drop-off with the navigation UI has not been mentioned.

The publication which closest anticipates Toms and Herman's story is found in a patent application, 2001 /14/, where the idea of navigation assisted, multi-hop passenger trips is disclosed. In between those two many more or less related patents and patent applications are found. The earliest publication I found mentioning instant ridesharing using mobile phones is found in a conference paper from 1995 /20/. Using GPS for tracking and dispatching in context of fleet management is disclosed in this US patent filed 1996 /27/. More potentially relevant patents are found here /15/-/32/.

Making a comprehensive list of relevant publications and implementations is a research project of its own and outside the scope of this study. Instant ride-sharing looks like an IPR minefield on first glance, but the good news is that some relevant patents are already rather old, some even older than 20 years.

5.2 Existing ridesharing implementations

Commercial ride sharing services exist at least since the 70s, where you made appointments through a human operator. Today, you find many internet assisted services on the web/34/ including instant ride sharing systems.

An interesting project on instant ride sharing is a trial on the Frankfurt Airport in Germany, planned by eNotions /33/ end of 2006. The service works like this (see figure 4):

- When signing up for this service on the web, passengers and drivers specify their personal information, general preferences and up to 8 locations, where most of their trips begin or end. These locations are identified by the numbers 1,2,..,8. Every pair of two numbers will specify one trip and up to 56 different trips can be coded this way.
- When starting a trip, users call a service number, enter the two digits of the envisaged trip and hang up again. There are two different service numbers to distinguish drivers and passengers.
- An operator service will immediately match suitable trips and automatically establish a voice call between matching passengers and drivers. These agree on a pick-up location.
- Users confirm the completion of the trip. Drivers will be compensated with 0.075€/km, passengers will be charged with 0.1€/km.

The beauty of this service is in its simplicity and robustness. Surely, it is not optimal since it does not employ location tracking and multi-hop trip assignments. But it looks like a very good option to start with. eNotions intends to license this system to ride sharing clubs after successful completion of the Frankfurt trial.

A similar system is run by Ecolane, a finnish company residing in the Helsinki area. Instead of using voice calls, the appointments are arranged by Java applications, connecting to the ridematching server over cellular data connections /37/.

Ecolane, a Finnish company, also implemented a dynamic carpooling system /37/ which was used in the Easy-Rider service in the Netherlands. This service started off in 2004 in the Schiphol Airport region The service was discontinued after a while, because of low acceptance. One reason was the lack public "incentives" like, for example, carpool lanes.

Ecolane also implemented a demand responsive transit service (DRTS) in the Helsinki area /38/. Unlike public transport with fixed schedules and bus stops, DRT systems dynamically manage fleets of mini busses to pick-up and drop of passengers at any time at any place. Similar to instant ride sharing, these mini-busses are dynamically scheduled accordingly to (voice- or web based) passenger requests with the aim to efficiently combine as many rides as possible. Most commercial DRTS services are managed by human operators. Ecolane, however, implemented a fully automated network service for this purpose. In a first phase the service will arrange transport for elder persons and handicapped. However, the system can be extended to include private cars, thus growing into a real dynamic ride sharing service. Today, Ecolanes system is operating more than 1500 trips/day in the Helsinki area.

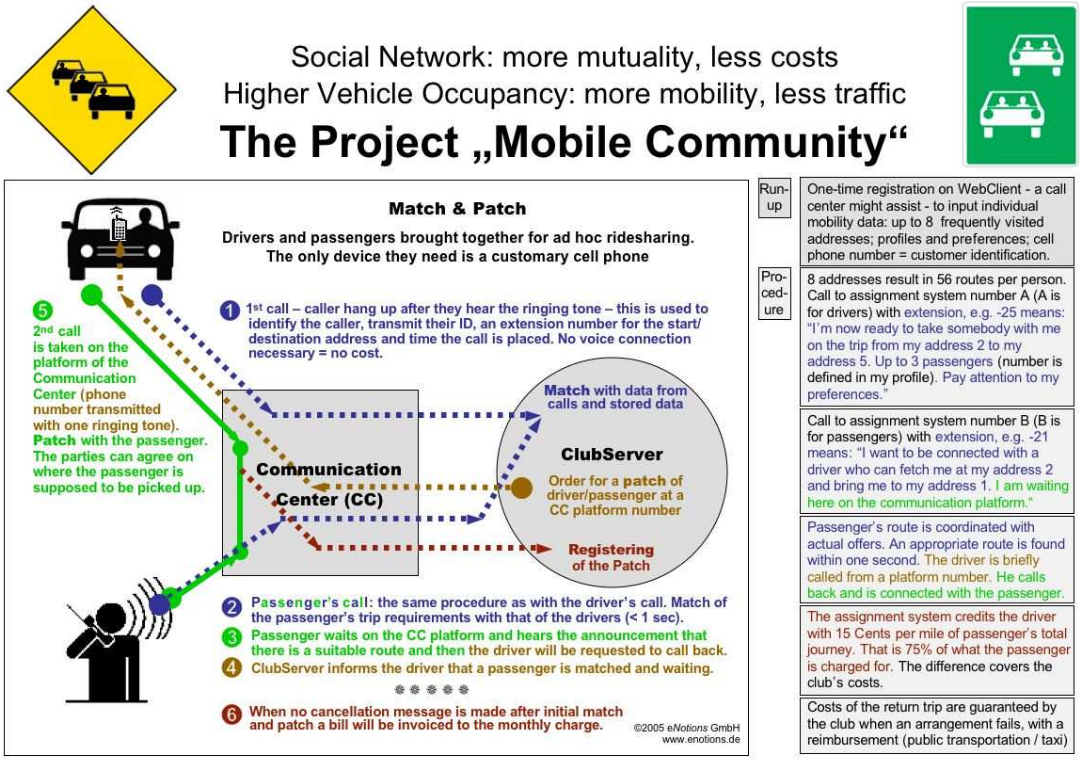

Figure 4. eNotions system outline

5.3 service ramp-up

As dynamic ride sharing does not make any sense unless the number of users exceeds a critical mass, service ramp-up is the toughest part of the project. There is no dynamic ride sharing service existing today so there is no experience on success factors and difficulties. But it is a good exercise to construct some possible introduction scenarios and discuss the pros, cons and potential pitfalls.

A few obvious points:

- Users shall not be entirely dependent on the service but should be able to rely on a backup service, like public transport or taxi.
- The initial and technical burden to subscribe and use the service should be as low as possible.
- public incentives which favour carpools will help significantly.

Extension of a DRT service

DRT systems are existing today, especially to provide transit services to urban areas spreading out into sparsely populated, rural peripheries. In these areas the operation of public transport with fixed stops and schedules is rather uneconomical, resulting in unattractive timetables. DRT overcomes this gap already today, and could be used as an enabler. In fact, the technology to run an automated DRT service is very similar to what is required for an instant ride sharing service. The main difference is that in dynamic ride sharing the driver is "his own customer" in that he himself is heading towards a destination, while a DRT vehicle is only servicing its passengers.

The service ramp in an area with existing DRT would allow private people to sign-up as DRT vehicles whenever a private trip is done. If the envisaged trip of a private car is matching DRT request, this car is selected instead of a commercial DRT vehicle.

This approach may work for cities which have a DRT system in place. However, for most urban areas this is not the case.

Extension of an existing taxi service

Taxis are the simplest, but most inefficient flavor of DRT, because with usually just one passenger it is more inefficient than private transport, taking into account unoccupied trips.

The main reason for this is that taxis cannot invoice shared rides. This is just a technical limitation that could be settled with an appropriate service infrastructure. Since communities should have an interest in more efficient and cost effective taxi services, they could favor shared taxi´s by issuing appropriate licensees and supporting the installation of suitable fleet management systems.

After this first step, the system installed is made available to the public, thus allowing anybody to provide such service with his own car.

extension of public transport

Communities could decide to run an instant ride sharing service being backed-up by their own public transport system. The quality of service (QoS) should not be lower than the QoS of the public transport itself, since people can always decide to go by public transport if no shared ride is available in due time. Public transport infrastructure is designed to manage demand at rush-hour, thus large capacities are unused outside these periods. Instant ride sharing during rush hours could improve average utilization.

In a few years, passenger billing will be implemented by electronic ticketing using RFID or NFC, as already practiced in ski-resorts for ski lifts. As future mobile phones and PDAs will more and more include NFC or RFID readers, the ticketing and authentication infrastructure could be extended to private vehicles.

free service introduced together with carpool incentives with no guaranteed quality of service (QoS)

To lower the burden as much as possible, communities could decide to install a free and simple ride sharing service without any guaranteed QoS and without any billing system. The only incentive for drivers to provide empty seats would be that they would be allowed to use car pool lanes, etc.

On first glance this looks attractive, since this system is much less complex. However, it will only work with significant incentives through traffic regulations.

The above approaches are not entirely contradictive but could complement each other or constitute different periods in a stepwise introduction. The right approach surely depends on the local realities and intentions.

6 Conclusion

Instant ridesharing shares the same destiny as many other products and services that have been envisaged for decades but were lacking key elements in technology to become successful. Like video telephony: Terminals have been commercially available for more then 15 years, but were only selling in homeopathic quantities. Today, most 3G phones are videophones, now that digital cameras and color graphics displays are common to most phones. Or HDTV: Large scale development efforts were done in Europe 25 years ago in context of HD-MAC and the US tried again in the early 90s with the Digicipher system. Even though HDTV broadcast was feasible in the 80s we had to wait another 20 years until HDTV display technology became available for consumers.

"Nothing is stronger than an idea whose time has come", is a famous quote from Victor Hugo. If technology was a bottleneck for establishing instant ride matching services, we should reconsider it today, because mobile computing and navigation platforms as key technology enablers become commodities. But it's not only technology but also the ever increasing environmental and economical costs, not to mention the insecure supply of cheap oil that make us rethink individual transport. It is far fetched to believe that instant ride sharing is the answer to all these problems, we just started to investigate what it takes to make it successful. But it is one of these rare occasions where the industry could help to solve a burning environmental issue with running a profitable business.

7 References

/1/ Automobile, keyword in Wikipedia , http://en.wikipedia.org/wiki/Automobile , same numbers found in many places. Some estimations were higher, up to 800Mio cars.

/2/ Number of U.S. Aircraft, Vehicles, Vessels, and Other Conveyances, http://www.bts.gov/publications/national_transportation_statistics/2005/html/table_01_11.html

/3/ "Other factors affecting travel", UK department of transport, http://www.dft.gov.uk/stellent/groups/dft_transstats/documents/page/dft_transstats_039335.pdf

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Executive Summary

There are 500+ Million privately owned passenger cars worldwide, thereof 236 Million in the US. These cars travel in the magnitude of 5 Trillion km per year. The average car occupancy is only about 1.5 (one passenger in every second car) making individual transport extremely wasteful regarding fuel consumption, road usage, spent capital, etc. At same time, the unused transport capacity constitutes a huge unused resource and business opportunity for those who manage to create a demand and supply network around those traveling empty seats.

Many profit and non-profit organizations provide car pooling services today. These allow convenient trip arrangements over the internet, support trust building between registered users, and they implement billing systems to charge passengers and compensate drivers. Yet, these services have not become popular and did not significantly increase the average car occupancy. The main technical reason for this is that existing ride sharing services do not allow truly ad-hoc trip arrangements. This memo points out that low popularity of car pooling results from technical constraints rather than lack of attractiveness of ride-sharing as such. Today's mobile computing and navigation platforms overcome this limitation and enable for the first time truly ad-hoc ride sharing services.

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