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Arup

Chris Luebkeman
Arup Fellow and Director,
Global Foresight + Research + Innovation
chris.luebkeman@arup.com

William Baumgardner
Associate Principal, Transport Planning
william.baumgardner@arup.com

Jordan O'Brien
Associate, Sustainability & Real Estate
jordan.o'brien@arup.com

Radha Mistry
Consultant, Foresight + Research + Innovation
radha.mistry@arup.com

Qualcomm Technologies, Inc

Kiva Allgood
Global Strategic Market Development
kallgood@qti.qualcomm.com

Aidoo Osei
Strategic Market Development
aosei@qti.qualcomm.com

Qualcomm Smart Cities
qualcomm.com/smart-cities

ARUP

560 Mission Street Suite 700
San Francisco, Ca
arup.com
driversofchange.com

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Cover Image: Arman Thanvir

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Neil Kramer

The Foundation: Intelligent Connectivity

"Cities are a network of interdependent systems, not unlike the human body; each one depends on the next to function properly. But unlike our bodies, whose integrated systems work together when faced with injury or illness, ...our cities' systems are often developed in silos."

—JULIA HAVENS, INSIDE THE BODY OF A RESILIENT CITY (2014)

Our cities are so much more than where we live and work; they are where we create, where we build, where we exchange goods and information, where we encounter one another. Our cities are alive, and we wish to see them flourish. Vital as they are, our cities are facing unprecedented challenges; as they expand, as they become denser, as they confront new threats to their very being from resource constraints and an increasingly volatile climate.

As these challenges to the city mount, so too does our power of innovation. We have never had a better understanding of the complex systems that comprise our cities, of the subtle interactions between physical infrastructure and human desire that animate urban life. We have never had access to such rich data about the patterns of daily life, nor such ability to shape this data towards a more convenient, efficient, and accessible urban existence. Our cities are indeed alive; it is finally within our means to make them intelligent.

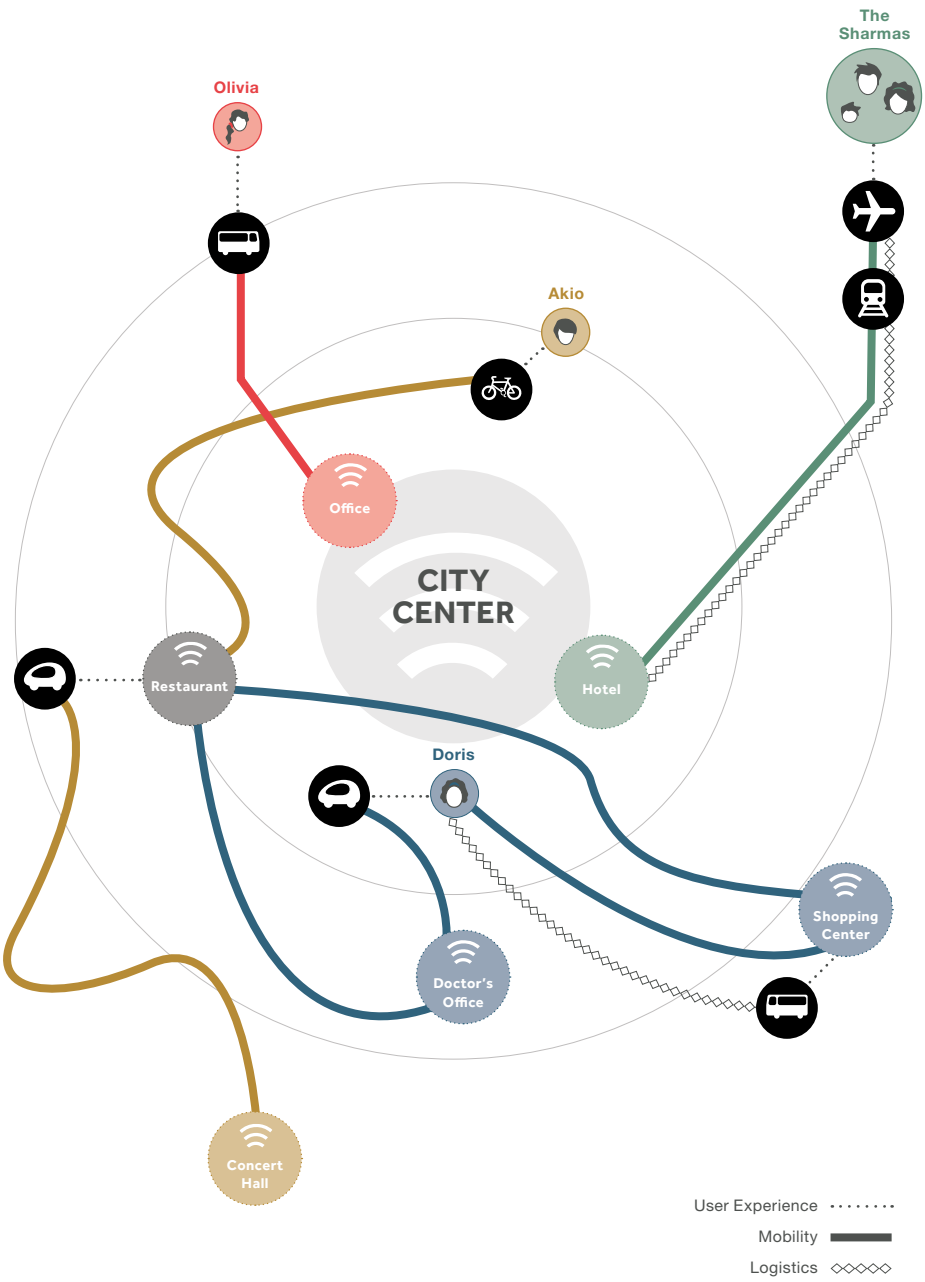
The key to this quickening is Intelligent Connectivity: the sum of the systems, services and technologies connecting people, data and infrastructure. Intelligent Connectivity unites a broad range of emerging technologies to enable smarter, healthier, more resilient and economically vibrant urban life. Intelligent Connectivity requires a shift in thinking, towards integration across systems and scales. Data and communications innovations are the mortar with which we will build smart, integrated cities, merging technology and policy to revitalize legacy systems and develop new solutions.

Qualcomm's expertise in information and communication innovation and Arup's long experience as a leader in planning and designing the built environment are a natural fit for collaboration towards enhancing the future of smart cities worldwide.

The signal characteristic of our cities is movement, the flow of people and goods throughout the urban fabric. Mobility enables economic activity, consumes resources, and influences quality of place, environment and life. The planning and operation of mobility profoundly impacts the beauty, resiliency, and sustainability of cities. This document considers smarter cities in terms of urban mobility, outlining current challenges, suggesting technological, infrastructure and policy solutions and distilling explorations of the future into a series of 'user journeys'. These visionary examples detail citizens' experiences of an Intelligently Connected city of the 2030s, projecting possible pathways into a mobility future likely to differ in significant ways from today's systems. Key implications and stakeholder considerations are highlighted along the way to start conversations and assist continued development.

Let's take a look at the future of intelligently connected urban mobility.

Urban Mobility 2030 Ecosystem



Executive Summary

Intelligent connectivity, converging trends, and technological innovations are paving the way for a complete re-imagining of urban mobility.

The Future is Fiction. It is the story which each of us writes every day. Arup and Qualcomm have joined forces to explore the potential of urban mobility in the coming decades. We foresee a world in which our mobility is not only safer, but comes with infinitely better experiences, enhanced safety and a near zero environmental impact. To achieve these by 2030, a diverse range of stakeholders need to expand how they think about integrated mobility as well as how data is generated, secured and used, while ensuring that infrastructure and policy are continuously upgraded.

Four key themes emerged from our research, which we've used to explore needs and desires during four typical user journeys: **Usership vs Ownership**, **Realtime Data Ecosystem**, **Bridging the Digital Divide,** and **Safe Travels.** A traveler experience was crafted for for each theme, engaging a range of issues: enabling better choices and smarter decisions; predictable, dependable and productive mobility; mobility opportunities for everyone; and public safety & cyber-security.

Our research recognizes that there are three distinct stakeholder groups who have vested interests in these user journeys: **Citizens/Users**, **Cities and Municipalities**, and **Owners and Operators**, each with a critical role to play in creating the seamless urban mobility experience to which we aspire.

The user journey research revealed a suite of outcomes, all worthy of working towards. They can be summarized in three words: **Safer, Better** and **Healthier**. Intelligent connectivity for seamless urban mobility will help accomplish these outcomes. We envision a Safer System that will eliminate accidental road deaths; a system that is robustly multimodal, providing increased resiliency and radically improved response rates. We envision a Better Experience that is personalized and on-demand; an experience with better service and lower cost, enabling confident travel and productivity in motion.

To realize this future, we will need to engageand unite stakeholders across domains, promoting interaction and mutual understanding of imperatives.We will need ubiquitous, secure data generation and collection, while supporting data codependency. We will need a commitment to getting more out of existing hard infrastructure, including an accelerated upgrade pace. And we will need to incentivize good behavior, through policies that acknowledge both the rapid evolution of technology and urban citizens' habits and expectations.

The considered context, user journeys and case studies that helped us identify these opportunities are included in these pages. We hope you will be as inspired by this vision of the future as we are; we look forward to working together to make that vision a reality.

Jiuguang Wang

Introduction: Cities and Urban Systems

"Urban Mobility will be one of the toughest challenges for cities around the globe."

—CHARBEL AOUN, "URBAN MOBILITY IN THE SMART CITY AGE", ARUP (2014)

Cities present us with a paradox: they are beset by an increasing number of 21st century challenges, and yet represent a key arena in which we find opportunities to shape the future.

Across the globe, cities and their systems are confronting a similar set of issues. Already home to over half the world's population, cities will only become more densely populated. Climate change impacts pose significant challenges to the urban environment and infrastructure, while resource depletion places ever-greater strain on urban systems. Therefore, fundamental changes in the way we develop, interact with and conceive of cities are needed, if they are to nurture livable communities that encourage sustainable economic vitality into the future.

The Focus: Urban Mobility

This report will examine intelligent connectivity as it applies to urban mobility: how people and things move through cities. Enabling effective transport of citizens and goods is critical to a city's economic and social vitality, the wellbeing of its inhabitants, and its consumption and emissions footprint. When urban mobility systems work — cleanly, collaboratively, efficiently — the entire city benefits as a result. A variety of urban challenges are deeply linked with transport issues: air quality and safety issues, congestion management, pressure on energy systems and quality of life concerns are just some examples.

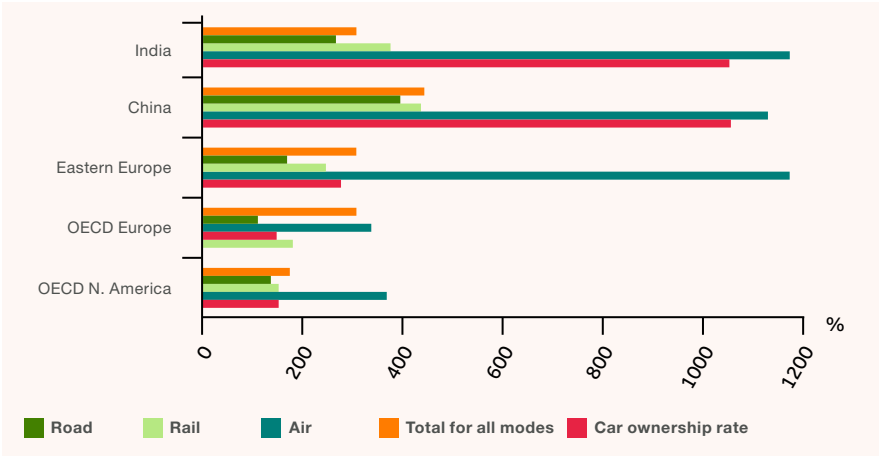
Urban mobility is a hugely complex issue, even when considered against the scale of other urban systems. Multiple layers of public and private assets, services and systems are all competing for limited resources. Adding to the internal complexity of this array of transport systems are a series of external complicating factors, such as the demand for land use derived from transportation, considerations of built form, energy and fuel prices, and the inevitable discussions over who pays for vital investments in new infrastructure. The number of stakeholders involved in renovation or new development at any level can be overwhelming; balancing the often competing interests of human scale, practical operation and throughput against increasingly critical issues of energy efficiency, environmental responsibility and sustainable development is a Herculean task.

"In addition to spending an average of 42 hours a year in traffic, drivers in congested cities face peak hour [congestion] that can increase travel time during rush hour by 15% or more."[1]

"Smart mobility's ambition cannot come down to simply healing the wounds of the current situation. If mobility aims at being "smart" it has first to differentiate between desired and undesired mobility, and find alternatives to the latter because they both harm people's everyday lives and stifle cities."

—BRUNO MARZLOFF, "BEYOND FLYING CARS, DRONES, AND CONGESTIONS", NEW CITIES FOUNDATION (2014)

Additionally, for the majority of the 20th century, cities were built for the needs and convenience of cars and trucks rather than human beings. Market demand, public sentiment, and environmental awareness all favor the productivity, social and health benefits of smarter approaches to development. We face a tremendous challenge to design flexible, sustainable, human-scale urban mobility solutions that integrate with existing infrastructure; enormous opportunities exist for organizations with the political, operational, and technological abilities to bridge the gap.



Projected percentage change in passenger transport by mode and car ownership rate from 2000 to 2050. Source: European Environment Agency (2007)

Megatrends Impacting Urban Mobility

"City systems are typically built for normality, not adaptability"

—MARK A. EHLEN, "HOW CITIES CAN LEARN FROM THE HUMAN BODY'S SYSTEMS", ROCKEFELLER FOUNDATION 100 RESILIENTCITIES

Urban mobility systems are facing an array of challenges worldwide. Rapidly increasing urbanization, accelerating resource depletion, shifting balances of equity and ownership, and evolving expectations for livability and resilience must all be considered in the planning and development of efficient, resilient and scalable mobility systems.

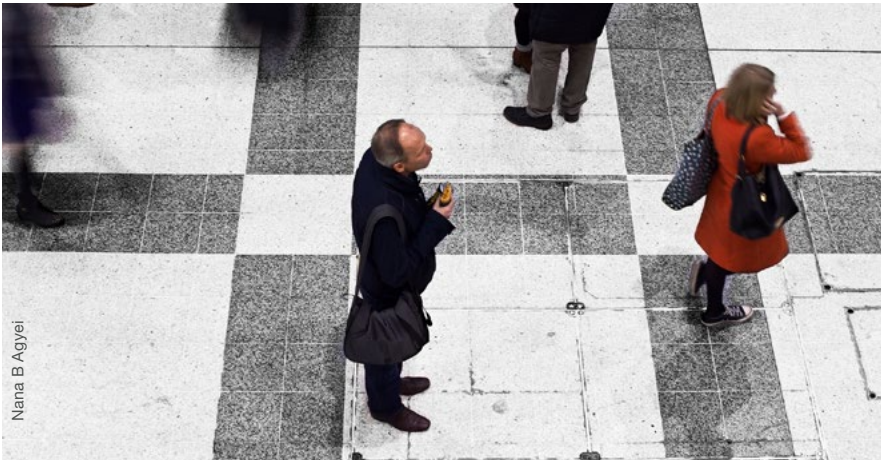
Urbanization

At present, about half of the world's population is living in urban areas. It is estimated that by 2050, 66% of the global population will be urbanized, with 6.4 billion people living in urban centers; a sharp increase from the 3.9 billion people who inhabit cities today.[2] Increasing rates of urbanization threaten to exacerbate economic, environmental and social

Shibuya Crossing in Tokyo: Tokyo exhibits the highest percentage of transit usage globally. Mass transit accounted for 65% of all trips in 2007 within a radius of 50 miles.[3]

impacts on an already stressed infrastructure; for instance, the economic cost of congestion in and around urban areas in the US is projected to reach $186 billion annually by 2030, a 50% increase from 2013.[4,5] This trend is amplified not only by the creation of new cities globally, but also an expansion of existing urban areas, leading to drastic changes in land-use patterns and potentially extending commuting distances. However, despite the global trend towards an increase in megacities (urban centers with more than 10m inhabitants), urbanization in North America will be distributed more evenly. In addition to this, urban concentrations are often located in areas at high risk from climate change and severe environmental incidents; in 2011, 60% of the global urban population in areas with 1 million or more inhabitants lived under threat of severe natural disasters.[6] The rate of urbanization, its impending impact on traffic volumes as well as an increasing pressure on infrastructure capacity and resilience pose unprecedented challenges to urban mobility systems. Over the next 15 years, it is estimated that global urban mobility demand will increase by 68%, by 2050, that rate is projected to go up by an additional 50%.[7]

By 2050, North America is expected to have only 3 megacities compared to 37 worldwide, 21 of which will exist in Asia alone.[6]



The global population will undergo dramatic demographic changes in the next few decades. What do we need to do differently to meet the changing needs of citizens?

Changing Demographics

According to the United Nations, the number of persons 60 years of age or above will more than triple by the year 2100.[8] This aging population, along with changing household structures and ownership patterns, are three of the key factors that will impact users' mobility needs and expectations, and drive changes to urban mobility systems in the near future. An increase in life expectancy and declining birth rates will continue to skew the population towards an older demographic, introducing new demands on mobility systems to ensure convenience. The United Nations expects 21% of the global population, more than 2 billion people, to be 60 years old or over by 2050; in comparison to 12% in 2013. This trend will inevitably shape the landscape of developed regions, as the number of people age 60 or over will reach 32% by midcentury.[8] Along with an aging population, declining household sizes and changing living arrangements will highly influence customer expectations on mobility services. The average household size in OECD countries (Organization for Economic Co-operation and Development: members include countries the United States, Europe and the Asia-Pacific) decreased from 2.8 to 2.6 people per household from 1985 to 2005 and over half of all households in these countries were

Life expectancy is forecast to rise from 69 to 76 years globally by 2050, while fertility rates are expected to decline from 2.53 children per woman to 2.24 children per woman.[8]

without children in 2011.[9] Usage patterns are shifting along with populations and households, with a new generation of citizens tilting the balance between "ownership" and "usership." A paradigm shift towards sharing services rather than owning products is taking place in many Western societies, with critical implications for how urban mobility systems are designed, implemented and delivered.[10]

Climate Change

As the effects of climate change will continue to pose unprecedented challenges to urban areas, cities must take responsibility for a large proportion of global greenhouse gas (GHG) emissions. One of the primary consequences of climate change facing cities in the future will be rising temperatures. Sea level rise poses another challenge, as a large number of cities are located along coastal areas. By 2100 global sea levels are expected to be on average 0.26–0.81 meters higher than today.[13] Furthermore, global greenhouse gas emissions are expected to increase by 50% from 2012 to 2050; an 80% reduction in global emissions would be needed by midcentury if global warming is to be halted at an increase of 2°C.[11,14] A recent MIT study on air pollution and health suggests that in 2005, 200,000

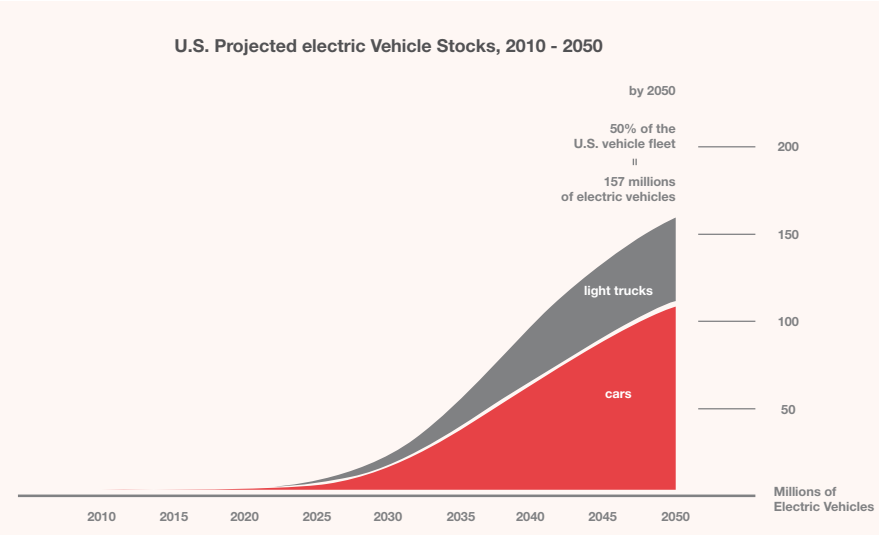
The global temperature is expected to be 3°–6°C warmer by 2100 when compared to current measures, while from 1901 to 2012 the global temperature increased by only 0.89°C.[11,12]

US citizens died prematurely; health conditions related to air pollution from the road transport sector alone accounted for 53,000 of these deaths.[15] Additionally, global biodiversity has decreased by 30% since 1970 and is expected to decline by another 10% by 2050.[11,14] These factors highlight the necessity of reducing GHG emissions, and go hand-in-hand with the challenge of developing energy distribution methods capable of cleanly and efficiently powering new urban mobility systems.

In the US, total transport emissions account for 27% of total GHG emissions and 32% of CO_2 emissions.[16]

Energy and Resources

Energy and resource constraints are a fundamental focus of current challenges facing our global ecosystem. While environmental consequences of climate change and resource depletion highlight the need for the deployment of cleaner energy and reduced resource usage, estimations predict the global resource use will triple by 2050 to 140 billion tons per year.[17] A significant contribution to increased resource utilization comes from the mobility sector. While emissions must be drastically reduced, with urban transport already accounting for 25% of total passenger transport emissions in the EU, global passenger mobility is expected to increase 2.5 times from 2010 to 2050 with 10 to 50%



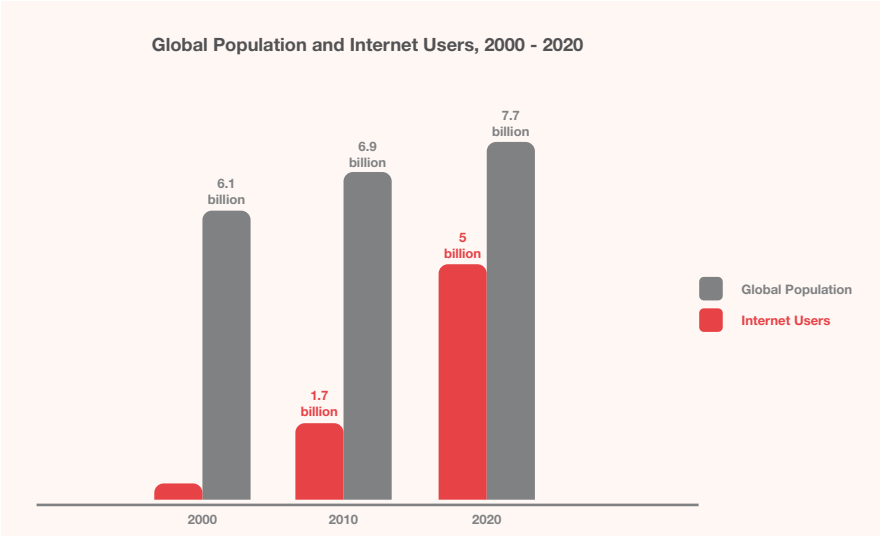
Source: Rocky Mountain Institute

increase in passenger mobility in OECD countries.[18,19] The dual necessities of reducing resource consumption while providing increased levels of clean energy in order to reduce emissions may fundamentally transform how urban mobility systems will operate in the future. In light of the predicted rise in electric vehicles, cities will need to consider the electrification of their mobility infrastructure and the cleanliness of its power supply. The integration of electric charging infrastructures could have profound effects upon urban transport systems, unlocking mobility potential while reducing air pollution.

The amount of liquid fuels used in transportation are expected to increase by 1.1% per year until 2040, representing 63% of the net increase in global liquid fuel demand.[20]

Technological Convergence

Ubiquitous data capture, robustly interconnected systems and the increasing availability and importance of Big Data will play a significant role in enabling urban mobility systems in the years ahead. These technological developments will allow transformative advancements in transit system resilience and responsiveness, while simultaneously raising critical questions around security and privacy. As of 2013, 3.4 billion people, or 50% of the global population, were active users of mobile data services; by 2020 this number is projected to reach 4.3 billion. The acceleration of mobile



Source: futuretimeline.net / http://www.futuretimeline.net/21stcentury/2020.htm#.VJNIICvF9rJ

service usage aligns with projected annual mobile data traffic growth rates of 61% through 2018.[21, 22] The use of social networks is also increasing at a rapid pace. The rise of the Internet of Everything is likely to continue at an exponentially increasing rate. Around 99.4% of objects that will one day be part of the Internet of Everything are still unconnected.[23] Furthermore, 50 billion things are expected to be connected to the Internet by 2020 with major growth to occur in the field of machine-to-machine communication.[24] Internet-connected vehicles are projected to experience an annual growth rate of 30%, reaching a total population of 20% internet-connected vehicles by 2020.[25] Additionally, autonomous and driverless vehicles are likely to become an integrated component of city systems, posing complex new technological, liability and regulatory challenges.

By 2017, 2.55 billion users are forecast to have online profiles, compared to 1.73 billion in 2013.[26]

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User Journeys

The following journeys reflect the urban mobility experiences of a cross-section of example users in the year 2030, outlining an inspiring vision for intelligently connected systems in cities.

Featured case studies highlight emerging trends and indicate possible directions for future development. These case studies include technical examples to support the vision expressed in future user journeys.

1. Usership versus Ownership
2. The Realtime Data Ecosystem
3. Bridging the Digital Divide
4. Safe Travels

2030: Usership vs. Ownership

Olivia, 28

Olivia works in Public Relations, and commutes daily to the downtown business district. She lives alone, and tends to opt for lifestyle choices that are fast and convenient, to cope with her demanding work schedule. The weather in Olivia's city has always been unpredictable, but in the last few years it seems that the winters are getting distinctly longer and colder. While Olivia would like adopt a healthier lifestyle by walking to work, she often ends up taking the bus, using a monthly subscription based ride-share service. Sensitive to time, and moderately sensitive to price, Olivia is keen on keeping up with the latest connected personal devices on the market. When not on a conference call via mobile web-based services, Olivia uses her commute to network with other professionals on the bus.

EMERGING TREND

Disaggregated Assets

The Internet has made it easier for people to connect with one another as well as for products, services, and experiences to be shared among consumers. Technology has reduced the cost of transactions and created a more accessible marketplace, making the sharing of assets more convenient and economically viable than ever before. The availability of and access to ever-increasing amounts of data about people and things, is enabling a transformation of the way we consume, moving away from products and towards services.

EMERGING TREND

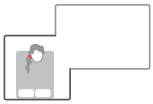
Quantified Consumption

While sharing resources is on the rise, consumption patterns remain critical. The Quantified Self movement includes monitoring a myriad of daily actions, and highlights increased health and sustainability considerations as a response to behavior. Climate change impacts, energy and resource constraints and urbanization will make sustainable lifestyles increasingly important. Access to information and data will not only drive conscious energy and resource reductions, but cultivate a generation of users better able to make informed decisions about everything from eating habits and social participation to transportation choices.

EMERGING TREND

Socio-economic Shift

Changing attitudes across generations are causing once sacred notions and assumptions to fade away. In a more mobile and more connected world, an upgrade of experiences is required. These experiences will need to be individually curated in real-time, responding to diverse individual and collective needs and expectations. As people live longer, have fewer children later in life, own less, and share more, convenience becomes a key decision-maker. Car ownership will continue to be less important to younger people, while an ageing population must continue to navigate the digital divide. Bridging these societal and economic divides will be imperative in rethinking mobility solutions.

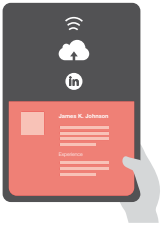


1 BEDROOM > APARTMENT

Alerted by her footsteps across the bathroom threshold, Olivia's shower turns on, triggering her personal mobility network to enter active mode. Algorithmic processing of weather, traffic conditions, and other learned and input-based personal preferences, calculates estimated time of arrival coordinating between Olivia and the shared mobility vehicle.

MOBILITY NETWORK:

As predictive technologies become more readily and ubiquitously embedded in our environment, the Internet of Everything connects and delivers the right information at the right time. This means that Olivia's mobility network learns from and anticipates her needs even before she does, allowing for a safe and efficient, seamless user experience.

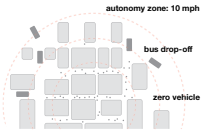


2 APARTMENT > BUS

Olivia is notified via voice interface that her bus is arriving. Seat suggestions are based on the journey route and registered passenger information, so Olivia can optimize her commute for networking. Proximity based sensors automatically lock her apartment and power down any devices that aren't needed while Olivia is away.

MOBILITY NETWORK:

As emerging technologies provide users with mobility services through state-of-the-art computing platforms, vehicles in the mobility ecosystem also receive an upgrade, such as automated transport systems built around integrated low-power solutions. Olivia's transit meet-point features a road-embedded wireless static electric charging pad.

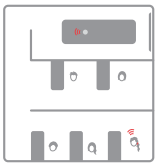


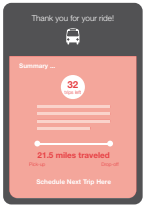
3 BUS > DOWNTOWN

On the autonomous bus, Olivia's presence is authenticated via secure wearable ID. Olivia rides an electric vehicle, which operates along a wireless charging route within the city center. She pays a premium for the service, but in exchange for reducing her carbon footprint, she receives credits transferable towards other services.

MOBILITY NETWORK:

Intelligent connectivity will allow Olivia be securely identified via biometrics, enabling her to make seamless payment transactions. Olivia also receives just-in-time information, based on predictive patterns and anticipated needs. Thanks to this increased access to data, Olivia is empowered to make environmentally conscious decisions, incentivized through road and environmental impact fees based on usage. Her device tracks opportunities to improve health by substituting more active modes along her commute. Such activities will link to health-based incentives and related products.





4 DOWNTOWN > ARRIVAL AT OFFICE

As the bus approaches her stop, a visual notification appears on Olivia's device. As Olivia crosses the bus door threshold, her personal connected device makes a seamless payment transaction, and alerts Olivia to the number of rides she has remaining for the month.

MOBILITY NETWORK:

The shift towards usership of services versus ownership of products is marked by convenience and sustainability. In the future, wearable technology capable of communicating with infrastructure, vehicles, and pedestrians will allow users like Olivia to make seamless payments for transit services through a single system, ensure her safety while commuting, and help her make more informed transport decisions that optimize her individual experience. At a higher level, municipalities and operators will be able to deliver more efficient services as a result of citizens' information.

Akio, 15

Akio is a high school student travelling to meet up with some friends at a concert. He often travels by bicycle or skateboard. Akio doesn't want a driver's license and prefers to get around the city without having to depend on his parents, who work full-time; seamlessly integrated mobility allows for Akio's parents to be aware of their son's whereabouts. Akio is sensitive to price, and sometimes sensitive to time, especially if he is attempting to meet up with friends. If Akio is not cycling or skateboarding, he often uses his commute to watch a movie or play one of his favorite online games on a tablet. Having access to social networks, a cloud-based music library, and being able to message his friends while en route is incredibly important to Akio.

EMERGING TREND

Intelligent Systems

New platforms require new infrastructure; manufacturers are reluctant to market vehicles without necessary intelligent systems in place, and federally-funded infrastructure development requires demand to justify investment. With the availability of advanced broadband communications and data sharing, citizen buy-in will be needed to close the gap. Devices may enable multi-directional communication, while vehicle data could be shared in real-time, employing learning algorithms to optimize user experience and mediate infrastructure performance within the city. Intelligent systems will succeed in direct proportion to their ability to seamlessly, securely and profitably integrate with existing urban environments.

EMERGING TREND

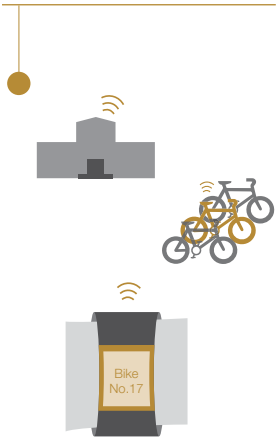
Digital Society

As open-source infrastructure makes city operations increasingly transparent and citizens become more vocal in communicating their needs, governing bodies are increasingly held accountable to remedy citizen-alerted deficiencies. Technology integration into mobility infrastructure already provides more seamless user experiences, with citizens and organizations increasingly becoming heavily influenced by crowd-sensed data streams. As demand for transport increases, and connected, autonomous transit modes become more viable, we must consider data ownership issues and the influence of data access on real-time decision-making.

EMERGING TREND

Data Interaction

Intelligent infrastructure is already technically viable. Changes to policy and an evolving relationship with data impacts the interaction between citizen and city. In a future where cooperative systems allow vehicles to communicate, traffic signals interact with vehicles, and bi-directional data provides predictive updates and hazard warnings, people are not the only cargo being transported through cities. Systems must also meet the demands of moving goods, as convenience-driven retail models shift to online transactions, and automated delivery systems become commonplace.

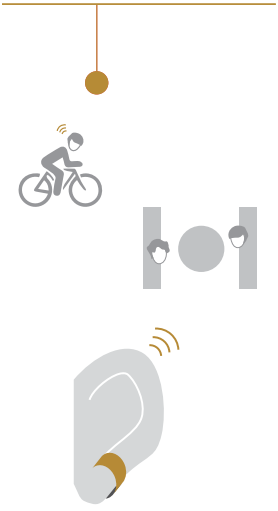


1 SCHOOL/ BIKE-SHARE > ON BICYCLE

Akio receives a notification on this wearable device for a concert he's attending that evening. His e-bike reservation comes on screen. Akio scans his social network for friends to meet for food before the show. Proximity based networking calls out a restaurant, with a suggested dining time based on flow control.

MOBILITY NETWORK:

As an increasing number of devices and objects become part of the Internet of Everything, teens like Akio will have more freedom to explore their world, while providing relatives and guardians the transparency to ensure that their journey will be a safe and secure one. Here static charging can also be used for micro-mobility units such as an electric bicycle, allowing for low-powered solutions within a complex mobility ecosystem. Device to device proximity technology drives personalization, facilitating the notion of local and private clouds."

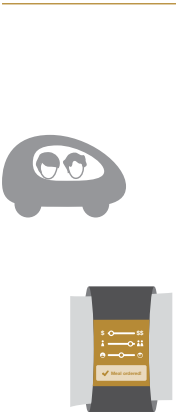


2 ON BICYCLE > RESTAURANT

At the bike-share area, Akio's device shows available bikes, based on charge and travel distance. Upon selecting an e-bike, Akio's personal device taps into the e-bike network, receiving weather notifications, restaurant location, and proximity to friends. The restaurant inquires about meal order and provides approximate preparation time, based on route.

MOBILITY NETWORK:

For a teenager obsessed with his virtual social network, public safety may not always be an inherent priority. Integrating technology such as dedicated short-range communication (DSRC) and wearables that notify infrastructure and vehicles of pedestrian on foot, bike or other modes of transportation ensures that Akio will remain safe and be provided with a steady stream of data for his journey, all the while remaining connected to his friends.



3 RESTAURANT > EN ROUTE TO CONCERT

Akio chose a meal, via voice interface. Recommendations were made based on preferences and health monitor. Now, en route to the concert, the price of Akio's ride-service is partially subsidized in the cost of his meal; the restaurant, ride-share and concert have all partnered to provide an integrated user experience.

MOBILITY NETWORK:

Akio's mobility network expands to include auxiliary services, that impact his journey. Decisions become automated as predictive capabilities become more readily embedded within our environment. Amenities such as just-in-time commerce and seamless payments for everything from transit to entertainment become a part of the intelligently connected mobility service offering.

4 EN ROUTE TO CONCERT > CONCERT

Akio's ride is partially subsidized in the concert ticket cost. Along the way, he re-routes to pick up his friend, to go to the concert together. A preview of the concert plays in the vehicle. Predictive routing ensures an on-time arrival. The venue is geo-fenced, to maintain traffic flow control.

MOBILITY NETWORK:

Akio wants to stay connected to his social network, while getting to his destination easily. For this user, an integrated smart city system that runs in the background and anticipates his needs becomes key. En-route, dynamic charging for the autonomous vehicle with integrated, low-power solutions and state-of-the-art networked platforms ensure an efficient journey. A geo-fenced venue that taps into a seamless payment system means that Akio can go from journey to destination quickly and safely.

2030: Bridging the Digital Divide

Doris, 82

Doris lives alone, and has recently moved into an assisted living community just east of the city center. Prior to moving to her new home, Doris lived in the same residence for almost 30 years. When Doris worked full-time she drove to work every day; in the last few years, however, she feels her eyesight and hearing are not as sharp as they used to be when she was younger. Doris has increasing anxiety about finding parking in the city as well as navigating through traffic congestion in the city center. Doris works at a local shop for two days a week to fill some time and earn a bit of discretionary income. Most days she uses a mobile on-demand ride-share service provided by her assisted living community. This service provides Doris with the opportunity to continue to enjoy independent mobility.

EMERGING TREND

Generational Changes

By 2030, 25% of licensed drivers in the U.S. will be over the age of 65.[27] This older population will have more time to spend, but will also have significant safety and security concerns. For a generation who has been accustomed to owning vehicles, emerging services in the sharing economy may seem foreign or offputting, despite their ability to provide access to transportation meeting their needs. While designing and operating systems capable of enabling user-friendly senior mobility has its challenges, the sheer force and influence of this generation could turn it into a tremendous opportunity area.

EMERGING TREND

Digital Gap

Technology and services that meet the mobility demands of an aging population require a more integrated approach across social service, transit agencies, and private sector players. Subsidized mobility schemes, economically viable personal devices, improved quality of public transportation, and point-to-point mobility services can remedy many challenges associated with older people adopting emerging practices. Ultimately, the focus is not simply providing access to technology, but rather enabling access to information and products by providing the hard and soft infrastructure to optimize efficiency and cost.

EMERGING TREND

Ambient Intelligence

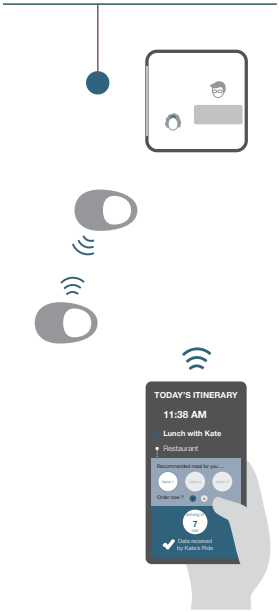
Algorithmic optimizations are converging with automotive technologies to revolutionize urban mobility. More viable integrated mobility options and sharable infrastructure will link mobility systems closer together. For systems to be fully adopted, citizens must be comfortable using them, creating demand to implement solutions; intuituve and seamless user experiences become key. Ambient intelligence may aid in providing on-board driver assistance to enhance human decision-making, while off the road, connected devices can remind users of upcoming appointments and seamlessly present related mobility options.

1 HOME > DOCTOR'S OFFICE

With the help of telepresence concierge services, Doris opts for an in-person visit with her doctor. A driverless vehicle, operated by her health insurance provider, is automatically scheduled for Doris. The responsive on-board system passively collects health data, securely transmitting it to Doris' doctor's office in preparation for her visit.

MOBILITY NETWORK:

For Doris, Intelligent Connectivity allows for a reduction in stress and anxiety. The technology works to reassure her and guide her during her journey, correcting incorrect inputs, and even explaining the purposes behind commands. Here the technology facilitates human support, allowing Doris to retain a healthy quality of life while aging. Autonomous vehicles connected to an ambient assistive living network can aid in delivering wireless healthcare services as part of the mobility offering.

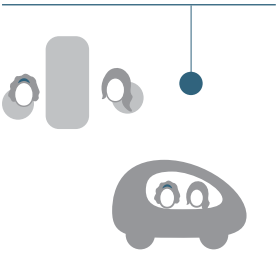


2 DOCTOR'S OFFICE > RESTAURANT

As her doctor's visit comes to an end, Doris receives an audio notification on her connected device that she is scheduled to meet a friend for lunch. She is asked to choose between a public transport option or shared driverless vehicle, pre-selected to fit into her allocated monthly transportation budget.

MOBILITY NETWORK:

Public safety, accessibility and efficiency are the key determining factors for Doris' mobility journey. Applications that are able to monitor and anticipate her needs, while providing her with secure data and real-time guidance make Doris' mobility experience virtually anxiety-free. While seamless transactions make for one less element that Doris must remember or respond to, biometrics-based identification may also make Doris less susceptible to security threats such as fraud or theft.

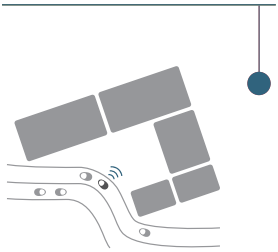


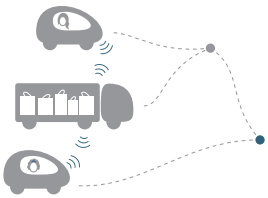
3 RESTAURANT > SHOPPING CENTER

Unsure of how to get to the shopping center — an unplanned trip — Doris is nervous about having to order an autonomous vehicle. Via voice interface, she is assisted through the process. The shopping center is for browsing only; purchases are scanned, and then products are delivered to residences.

MOBILITY NETWORK:

Self-parking of vehicles not only allows for up to 100% utilization of static charging pads and parking spaces, but also means that Doris receives door-to-door service as part of her mobility experience, which is critical to meet her accessibility needs. Wearable sensors that interact with infrastructure and vehicles ensure Doris' public safety, notifying her if there is an obstruction in her path or a vehicle approaching.





4 SHOPPING CENTER > HOME

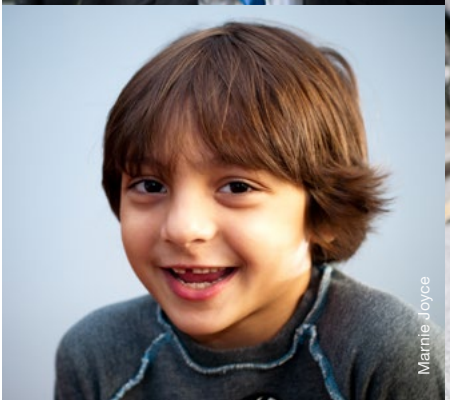
Doris returns to her assisted living campus via public transportation. The vehicle drops her at the geo-fenced perimeter, sending a voice notification via personal device, so she doesn't forget to alight. Doris' shopping items are delivered to her home via drones, as the logistics system has been seamlessly integrated with building infrastructure.

MOBILITY NETWORK:

The automated transport of goods means that Doris does not have to worry about carrying her purchases home with her. A aerial drone-based delivery system that taps into the logistics and supply chain also functions as a part of the seamless mobility network. Doris' purchase transactions, the journey of her goods, and her own transportation mode are coordinated through an integrated computing platform where vehicles, devices and infrastructure are connected and more readily capable of predicting Doris' needs before she even is aware of them.

2030: Safe Travels


Peter McConnochie


Marnie Joyce


Peter McConnochie

The Sharmas Akshay, 45 / Marcella, 39, / Jay, 6

The Sharmas are international tourists, visiting San Francisco for the first time from Italy. Their ultimate destination is the Union Square apartment they are renting through a peer-to-peer hospitality platform. The Sharmas deliberately chose their accommodation because of its central location and proximity to restaurants and shopping. They are not sensitive to time or price, but are traveling with a young child, and so require a relatively hassle-free journey with minimal interchanges. The Sharmas have limited connectivity due to international roaming networks. Thanks to the information provided on their tablets upon landing at the San Francisco International Airport, they are aware that a train can take them into the city, but will also need to check up on their apartment reservation and look up directions to their accommodation during the commute.

EMERGING TREND

Cyber Threats

Data is increasingly integral to the development of urban infrastructure where data-driven people-vehicle interactions, for example, are able to minimize accidents and ensure road safety. However, the challenges surrounding the use and sharing of data should be considered. Real-time machine learning algorithms are becoming a ubiquitous part of urban decision-making processes. While users can change devices' privacy settings, anonymity has its limits. It will be crucial to fill the gap between aging infrastructures and intelligent networks to prevent compromised cyber-security systems.

EMERGING TREND

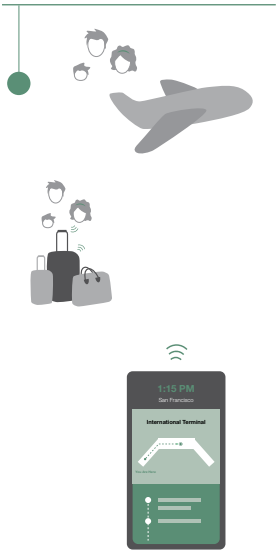
Logistics Processing

As citizens become more aware of the detrimental impact of carbon fuel-powered deliveries in saturated city centers while expectations for fast shipments increase, it will be crucial to rethink urban logistics. Urban logistics encompasses multiple layers of complexity; the diversity of goods to be transported, transportation methods employed, and key stakeholders involved all raise challenges for implementing intelligent logistics systems. Considerable opportunities lie in the development and deployment of fully integrated operational platforms and governance structures with automated processing of supply chain data and automated intermodal transfers.

EMERGING TREND

Targeted Experience

Enhancing the quality of public transit offerings while improving customer experience is one way to move towards future integrated mobility systems. As information about city and transportation systems operation becomes readily available, cities may see an increase in public transport usage. While users leverage technology to seek out personalized experiences, municipalities and operators may benefit by taking a more customer-centric approach, providing bundles of services targeting customer groups at varied prices and third-party services through their public transport assets.

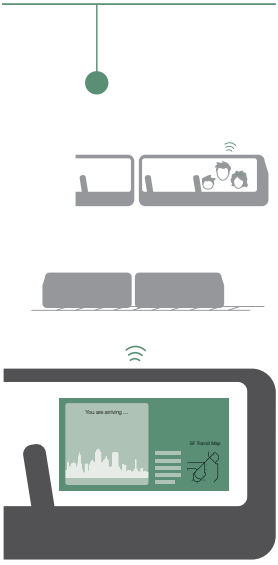


1 AIRPLANE > AIRPORT

The Sharmas opt to pack their items from home to be more environmentally conscious. Trip-planning personalizes recommended activities, relieving the uncertainty associated with travel, while real-time instructions, updates for weather, traffic, and the family's luggage delivery confirmation are delivered in Italian.

MOBILITY NETWORK:

Environmentally conscious and information-driven, the Sharmas value safety, security and convenience. Automated transport systems that seamlessly connect with the Sharmas' itinerary means that a logistics delivery system will have their luggage waiting at their desired destination. Intelligent connected technologies that ensure the family's safety through targeted way-finding, predictive capabilities, and secure connections, providing the young family with some peace of mind on their holiday.



2 AIRPORT > TRAIN

The Sharmas go through the streamlined immigration checkpoint. Their luggage has already been processed separately; the parcels will be delivered to the Sharmas' holiday accommodation via the city's logistics fleet of electric vans and drones. Personalized way-finding provides "push info" options upon arrival, based on preferences for ease of travel.

MOBILITY NETWORK:

The Sharmas expect an individually curated experience, where the technology ensures their safety while providing them with options that accommodate their specific preferences. Here, once-onerous travel decisions are increasingly automated through ambient embedded technology with predictive capabilities. A combination of biometrics and wearable technology also works with the smart city system to provide information in an efficient and digestible manner.

3 TRAIN > CITY CENTER

For their ride into the city, the Sharmas' devices notify them of available seats, and navigation directs the family to the correct train car. Onboard, geo-tracked incentives provide family-friendly travel and "info-tainment" options on personal devices. Predictive navigation eliminates uncertainty with "just-in-time" feedback and the family's wearable devices translate signage to Italian.

MOBILITY NETWORK:

Trust in the system and the data it provides is crucial for the Sharmas to receive the best mobility service offerings. Convenience, access and safety are greatly valued by the family, and the data received during transactions allows mobility system operators to provide better services, while giving citizens the safe, personalized options they have come to expect of service providers. Targeted incentives are also considered as part of the expanding mobility service network.

4 CITY CENTER > HOLIDAY ACCOMMODATION (PEER-TO-PEER APARTMENT-SHARE)

The Sharma family's personal devices recognize they are within city center perimeters. The family is given the option of requesting an autonomous electric ride-share vehicle, or walking to their destination. At the apartment, luggage is delivered in advance of the family's arrival, minimizing the stress of traveling with a child.

MOBILITY NETWORK:

As predictive technologies become more extensively embedded in our environment, the Internet of Everything connects and delivers targeted information as it is needed. This means that the Sharma family's mobility network learns from their habits and anticipates their needs even before they do, regardless of their location, ultimately guaranteeing a safe, efficient, seamless user experience. mode are coordinated through an integrated computing platform where vehicles, devices and infrastructure are connected and more readily capable of predicting the Sharmas' needs before they are even aware of them."

2030: Usership versus Ownership

The last decade has seen major shifts from car ownership based-models towards the usership of a range of mobility services. An exponential increase in urban populations globally brings a greater severity to already existing challenges such as poor air quality, traffic congestion, and inefficient parking systems. These challenges, coupled with trends towards technological convergence, have had a profound impact on personal mobility. Looking forward, concepts like bike and car sharing, integrated door-to-door transport solutions and intermodality, activated through intelligently connected devices, will become commonplace. As principles of the sharing economy become a ubiquitous part of our lives beyond mobility, and a generation of net-natives enter the workforce, users who share everything from social activity to food allergies will help to fuel an immersion into this new economic mode. Transportation may become largely propelled by local, community-owned assets; easily reconfigured as a singular vehicle or as a collective system supporting the ebb and flow of user needs. Demand may change due to individual preference, or from environmental conditions altering the moment-to-moment desirability of certain routes and systems. This shape-shifting, demand sensitive system adapts and reorganizes based on the multitude of sensors, leveraging excess capacity made available by time and space. Peripatetic lifestyles and preferences that change as quickly as the technology around us make the prospect of using products, services and experiences rather than owning them increasingly appealing.

2030: The Realtime Data Ecosystem

We are developing a dependence on technological advancements that serve to unify billions of people. In our evolving relationship with data and shifting attitudes towards privacy, the invisible systems that accompany us become an extension of our decision-making processes, in essence a “digital sixth sense”. Ubiquitous technology provides the right information at the right time to get things done with greater convenience than ever before; decisions become automated, as predictive capabilities become extensively embedded into our environment. As our lives become heavily immersed in data streams, it is imperative to consider who owns our collective data, and how key stakeholders can leverage this growing affinity for information. For an emerging generation of net-native users, dependency on data is commonplace, instant gratification is the norm, and decision-making is highly influenced by real-time inputs heavily based on peer activity via social networks. Cities will increasingly deliver services that utilize smart technologies, which can embed intelligence in a city’s infrastructure, extending the effectiveness of services at a lower cost to meet the needs of users and provide solutions to challenges facing urban mobility. Ultimately, cities and service providers will become just as dependent on data to meet the demands on infrastructure and be alerted to (and accountable for) deficiencies in the system, as are individual users dependent on data to make decisions about everything from clothing to morning commute routes.

2030: Bridging the Digital Divide

The Digital Divide is no longer an issue of access from a socio-economic perspective. Advances in mobile technology mean that a growing constituency are using personal devices to access the Internet. While a significant proportion of citizens have become connected to the digital world, an increasing aging population may have greater difficulty navigating the digital infrastructure intended to make their lives more convenient. This lack of awareness of the true power of assistive technologies for purposes beyond entertainment (such as assisting with health and socialization) coupled with initial socio-economic constraints may prove debilitating in urban mobility futures where shifts towards convenience result in the digitization of critical services. Ensuring access to the technology used to bridge vehicles, infrastructure and people may require a fundamental design shift, where personal devices and wearable technologies are manufactured at a lower cost, providing basic services to a wider demographic, with an emphasis on seamlessly connected experiences. New business ecosystems can be leveraged, offsetting the implicit cost of mobility services for those unable to afford them. In the future, mobility may even be considered a free service, where value becomes subsidized in the price of other targeted services to which users subscribe. Furthermore, in an effort to span the generational divide, solutions such as telepresence concierge services may have to be implemented as an integral part of the urban mobility system.

2030: Safe Travels

The Federal Aviation Administration predicts that air travel in the United States alone will double over the next 20 years.[25] Delivering sustainable mobility solutions requires us to think about Intelligent Connectivity within the context of networks of cities, however ensuring safety, (cyber)security and privacy while maintaining a seamless user experience becomes a critical challenge when implementing networked systems. Major improvements will have to be made in the quality of static and real-time information; punctuality and regularity of services; and security as well as the perception of security. Geo-fenced perimeters and long- and short-range communications networks may be used for traffic and road safety measures, with buses and emergency vehicles subsequently being offered reliable and swift access through long-range identification systems. Ultrasonic technology used to capture “3D fingerprints” as biometric data, facial recognition, and other wearable technology sensors can begin to combat identification concerns associated with fraud and privacy, as part of the Internet of Everything. The movement of people and goods across borders requires the involvement of multiple stakeholders. Achieving a balance between physical security and ease of access, between data security and appropriate transparency is crucial; doing so will require breaking open silos between the parties involved to deliver tailored solutions that pay deference to user preference. If successful, implementations of such networked, integrated systems have the potential to reduce congestion, optimize climate and health conditions, and reduce the number and severity of physical and digital threats.

Dan Hill

Stakeholder Considerations

The following key implications point the way to transforming mobility experiences in the intelligently connected city of the future. Outlined are significant technological, infrastructure and policy considerations, to assist in continued conversations between principal stakeholders.

Citizens

1. A seamless customer experience marked by convenience across transport modes, including travel planning, transfers and payments
2. Informatics and increased personalization to assist users in making smarter choices for their mobility needs, including the best choice of mode, route and departure for each trip based on real-time and predictive information
3. Increased certainty and reliability contribute to reduced stress while traveling
4. Improved public transport systems and quality of experience draws users towards an alternative to the car
5. Cost-effective, reliable and safe transport provide equitable mobility options at different price points
6. Land use decisions, improved infrastructure, incentives and information promote active mobility (walking and bicycling) and healthier lifestyles
7. Increased access to mobility for an aging population via a combination of ridesharing initiatives and autonomous vehicles
8. Reduced costs enabled by optimized networks, smarter distribution and autonomous vehicles
9. Transformative improvements in roadway safety with advancements in sensing, communications and active safety systems
10. Pay as and how you go correlates more accurately to the true cost of infrastructure use

In 2008, Vanderbilt Avenue, in Brooklyn was transformed to include landscaped medians, and bicycle lanes, where cyclists no longer have to compete with motorized vehicles on the road.

Cities & Municipalities

1. Opportunity for municipalities to act as an enabler for innovation across mobility ecosystem
2. Proactive cooperation between governments, local authorities, and both public and private mobility providers
3. Accelerated expansion of intelligent transportation systems via new infrastructure to increase safety, reduce congestion and better manage incidents
4. Address regulatory frameworks and update policy to leverage public resources to support innovation while ensuring the public's best interests
5. Provide a platform for private-sector innovation through transparent and open-source public data
6. Maximize positive behavioral shifts through pricing, real-time information and balanced infrastructure such as complete streets and improved public space
7. Craft policies to encourage cleaner and more sustainable mobility
8. Reconcile an autonomous future with traditional planning objectives via land-use policy, infrastructure design and infrastructure pricing
9. Leverage opportunities to upgrade existing infrastructure utilizing emerging technologies
10. Use new and abundant data sources, including crowd-sourced data and sensor networks to optimize operations and enhance long-term planning

Rush-hour metro traffic in Hong Kong. With a population nearing 8 million citizens,[28] the MTR in Hong Kong has built a reputation on efficiency and punctuality while ensuring public safety, to cope with increasing demand.

Owners & Operators

1. Greater focus on user-centric customer services applying offer additional personal choice; taking principles of convenience associated with e-commerce platforms to multi-modal transportation in order to better address individuals' requirements

2. Harness sensor capabilities and automation technologies to create self-learning networks of individual elements continuously communicating with each other to optimize overall system performance

3. Owners and operators contribute to the long-term health of communities they serve by embracing low-carbon and low-emissions technologies

4. Truly seamless integration of different transport modes requires a variety of systems and services; integration of payment systems, parking and storage, electric power provision as well as end-to-end journey information

5. Increasing deployment of communication networks introduces privacy and security concerns; the institutional protection of collected data requires safety and security protocols to be implemented in parallel with technological development

6. Integrating connected systems, infrastructure and vehicles to create new mobility products, services and platforms

7. Greater consideration needs to be given to the integration of electric vehicles into existing infrastructure

8. Widespread adoption of a connected urban mobility system requires the true integration of human behavior with physical infrastructure; analytics and intelligence can equip systems with the ability to learn from user interaction and crowd-sensing technologies

9. Focus on broader implementation of digital infrastructure including data analytics in order to predict and adapt to fluctuating conditions


Bradley Schroeder

Conclusion

"…Connecting the physical world around us to the virtual world of the Internet can result in huge gains"

—DANIEL KELLMEREIT AND DANIEL OBODOVSKI, THE SILENT INTELLIGENCE (2013)

Intelligent connectivity is the catalyst for a surge of innovation in urban mobility. It unlocks the potential for transformative change in how we move through cities and between networks of cities. Our vision for urban mobility in 2030 includes new choices for individual trip-making, better information for smarter decision-making, and system optimization to utilize infrastructure efficiently; all in service of fostering a seamless, safe and sustainable travel experience.

Intelligent connectivity enables the symbiotic exchange of data between individuals and smart systems. It facilitates new models of on-demand mobility services. It supports electrification of transport and the rapid development of improved safety systems.

Achieving this vision requires creativity, trust in our technology and a fearless re-imagining of our current solutions. Providing new mobility offerings will mean developing proactive cooperation between the public and private sectors, agile responses to shifting customer needs and expectations, and a relentless commitment to both security and sustainability. Enabling technology from private-sector leaders like Qualcomm is helping to make this vision for the future a reality. The technologies exist to support all of these mandates. Robust economic vitality, healthier communities, more resilient and sustainable spaces, and vastly improved quality of life await the transformation of our urban mobility systems.

Immense opportunities exist for a positive future, and this requires a collective re-imagining of our current solutions.

	Usership versus Ownership	The Realtime Data Ecosystem
	Better Choices, Smarter Decisions	**Predictable, Productive Mobility**
CITIZENS	New choices and increased flexibility for personal accessibility and mobility, opportunity to seamlessly choose the right tool for the right trip, minimizing wasted resources	Provision of real-time data reduces uncertainty and enables decision-making; traffic-aware data collection supports system optimization
CITIES & MUNICIPALITIES	Updated policies address regulatory frameworks and leverage public resources to enable innovation, while ensuring best interests of the public	Increased digitization of systems allows for greater transparency; focus on expansion of intelligent and adaptive transport systems to manage changing conditions, incidents and events
OWNERS & OPERATORS	Focus on user-centric services offering greater personal choice through principles of convenience and community associated with e-commerce, the sharing economy and social networking	Analytics enable systems to learn from changes in user behavior and analyze great volumes of data, improving system performance; this creates competitive advantages and better aligns profitability with consumer desires.

Bridging the Digital Divide

Mobility for Everyone

Safe Travels

Public Safety and Cyber-security

Integration of mobility services and autonomous vehicles, with a focus on an ageing society; supporting citizens' independence and access to goods, employment and services	Fresh technology-enabled solutions to legacy challenges: air quality, road safety, personal safety; data privacy and security concerns in an increasingly automated and connected world	**CITIZENS**
Reconsideration and revision of policy objectives to provide and improve mobility accessibility for all user groups, minimizing subsidization and leveraging new technologies such as autonomous vehicles	Upgrades and improvements to existing systems; digitzation of assets coupled with smart sensing technologies to achieve integrated infrastructures and ensure public safety	**CITIES & MUNICIPALITIES**
Provide a wide range of services at varied price points, addressing the needs of all user groups; find new solutions that empowers citizens with independence	Implement safety protocols alongside technological development to mitigate privacy, security and liability concerns associated with widespread deployment of communication networks	**OWNERS & OPERATORS**

Actions

DATA

- **Grow the data ecosystem.** Increasing dependence on technological advances creates mutually beneficial, two-way data flow.
- **Capture and share.** Connected devices and infrastructure generate rich data streams that can be tapped to better operate and plan our transportation systems.
- **Leverage public sector data.** Open source data from municipal governments and transportation agencies will fuel innovation.
- **Protect privacy and security.** Users must be confident that their systems are secure and be given the power to protect their privacy.

INFRASTRUCTURE

- **Do more with less.** Optimize performance at both the individual user and system-wide levels to get the most out of limited infrastructure.
- **Unlock value.** Create new opportunities to actively generate revenue from transportation infrastructure.
- **Upgrade faster.** Leverage value creation to speed infrastructure improvements, narrowing the gap between the pace of infrastructure and technology development.
- **Upgrade smarter.** Integrate innovations in communications & power technologies.

POLICY

- **Lay the groundwork.** Ensure positive outcomes from emerging disruptions in urban mobility with proactive and collaborate policy formation.
- **Incentivize good behavior.** New service models enable “pay AS and HOW you go” to encourage more sustainable and more efficient choices, for example by traveling off-peak and ridesharing.
- **Enable innovation in the public interest.** Foster new solutions to old problems in the public realm.

Outcomes

- **Eliminate road deaths.** Intelligent connectivity provides new tools in the battle to avoid unnecessary loss of life on our roads and highways.
- **Multimodal coexistence.** Reduced conflicts between pedestrians, bicyclists, road vehicles and trains.
- **Neutralized threats.** Prevent cyber-security and terrorist attacks to advanced transportation systems.
- **Increased resiliency & improved response.** Better prediction and planning of emergencies while enabling faster disaster relief and response.

SAFETY

- **Personalized mobility on-demand.** A wide range of transport options to meet individual needs for each trip, available when and where they're needed.
- **Productivity in motion.** Reclaiming travel time for useful purposes including work, play, learning, and rest.
- **Better service, lower cost.** More efficient public and private transportation systems.
- **Travel confidently.** Personalized travel planning and real-time information to increase certainty and reduce stress.

USER EXPERIENCE

- **Zero emission vehicles.** Electrification of transport eliminates tail pipe emissions and supports cleaner air.
- **Renewable energy.** Enabling electrification strategies to maximize the use of clean energy with smart grids and power storage.
- **Upgradable vehicles.** Shared use vehicles replace many personal vehicles and translate to a younger fleet, enabling faster upgrades to more efficient technology.
- **Minimized footprint.** Reclaiming land used for parking and streets.

ENVIRONMENT

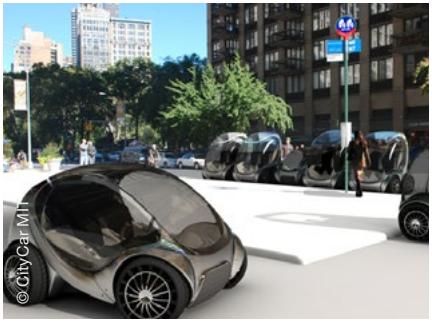
Padmanaba01

The Case for Intelligent Connectivity

Emerging innovations and ideas serve as case studies to inspire a forward-looking approach to Intelligent Connectivity in Cities. These concepts can assist various stakeholders in defining and shaping approaches to future solutions. Case studies are intended to highlight potential approaches to future challenges and inspire the development of intelligently connected urban systems.

LEFT: Saigon, Vietnam. As populations and economies around the world continue to grow, citizens will require a diverse range of mobility solutions to address the current congestion and infrastructure challenges.

Case Study: CityCar Urban Electric Vehicle Prototype



This compact electric vehicle, aimed at the urban car-sharing market, is powered by four in-wheel motors, rather than a combustion engine. The body is hinged between the two wheel sets, and can fold into an "upright" configuration to park in small spaces. In development since 2003, the CityCar is designed to address major issues in urban mobility: congestion, carbon emissions and inefficient energy use. One of the first cars designed exclusively for the sharing market, the CityCar has interchangeable body panels to allow for different visual designs.

Location / Business: Cambridge, MA. MIT Media Lab / General Motors for commercial use.

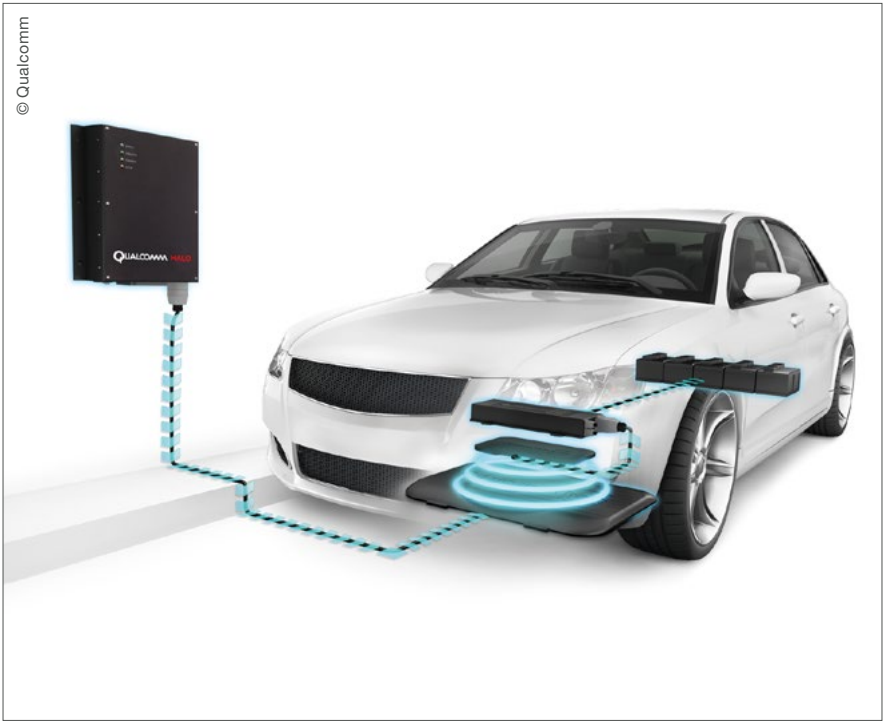
Source: http://gizmodo.com/5879489/mits-folding-city-car-is-finally-a-reality

Case Study: Autonomous Vehicles

Autonomous vehicle technology means that passengers could spend their time in a more meaningful way while traveling. As the occupants' focus will be internal to the vehicle, there will be more emphasis on the passenger experience. At the 2014 Geneva Motor Show, Rinspeed has proposed one vision of this driverless future with its Xchange concept car. Rinspeed transformed the interior of an electric Tesla Model S with seats that swivel, tilt and slide into 20 positions, a wide-screen television in the rear and an Italian espresso maker in the centre console. The advent of autonomous vehicles will increasingly include V2P demonstrations and holds the potential to make widespread use of DSRC technologies.

Location / Business: Geneva, Suisse. Rinspeed (Think Tank and Mobility Lab) Private company.

Source: http://www.rinspeed.eu/aktuelles.php?aid=15



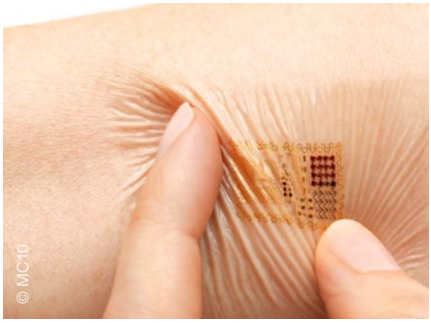
Case Study: Qualcomm Halo™ Wireless Charging

With Qualcomm Halo™ Wireless Electric Vehicle Charging (WEVC), Qualcomm has developed a highly efficient and safe technology. The platform provides an easy way for the broadest possible range of EV models to receive wireless charging. Applications span from private vehicles to shared and commercial fleets, enabling static and dynamic charging. The technology utilizes resonant magnetic induction; the vehicle battery is charged through the connection of its Vehicle Charging Unit (VCU) to a Base Charging Unit (BCU) that is installed underneath the road surface or beneath the floor of garages, car parks and public parking units.

Location / Business: Qualcomm—teams positioned globally with R&D in US, Europe & New Zealand. Partnership with the University of Auckland, an acknowledge pioneer & leader in IPT systems.

Source: https://www.qualcomm.com/#/products/halo

Case Study: Biostamp Health Monitor



These flexible electronic circuits known as Biostamps can be applied directly onto the skin to monitor the wearer's vital statistics such as temperature, hydration and strain. The temporary tattoo is designed to monitor health and fitness and could potentially be wirelessly connected to a smartphone. It allows consumers to better monitor their health. It could be directly linked to health services, sending information instantly as well as reducing necessary trips to health centres through knowing if and when visits are needed.

Location / Business: Illinois, US. MC10 for commercial use.

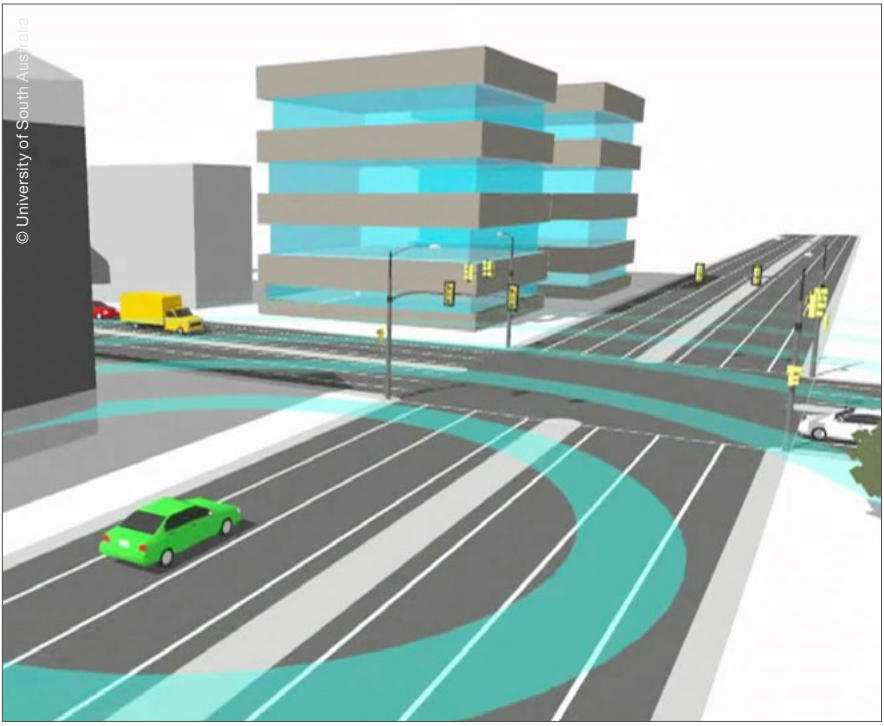
Source: http://www.mc10inc.com/

Case Study: Gimbal

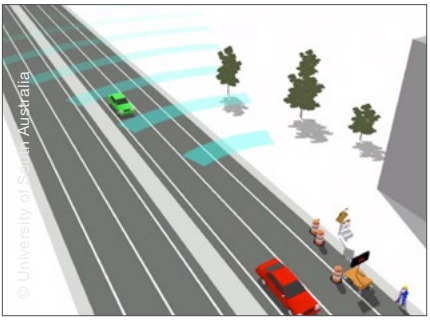
Gimbal is a context-aware proximity sensing platform. The technology relies on a network of strategically placed Bluetooth nodes. The Gimbal platform responds to unique preferences (including location and time of day) to deliver curated mobile content for the individual user in real-time, enabling organizations to share content, information and targeted offers. By tapping into the wider connectivity ecosystem, combining geofencing, location-based messaging, analytics and consumer privacy controls, the Gimbal platform delivers more seamless user engagement between digital and physical environments. Applications of Gimbal's platform include sports venues, for marketing and advertisements, and for use with brands and retail to provide more engaged shopping experiences.

Location / Business: San Diego, CA. Gimbal, Inc for commercial use.

Source: https://www.gimbal.com



Case Study: Dedicated Short Range Communication (DSRC)



DSRC uses dedicated licensed spectrum (near 5.9 GHz in the US and the EU) to provide standards-based short range broadcast communication of messages that allow vehicles, infrastructure and other road users such as pedestrians to warn and alert drivers to impending collisions. In the US, rulemaking for DSRC implementation for vehicle-to-vehicle safety is being considered. DSRC provides Fast Network Acquisition, a safety for life application, for immediate communication; low latency, interoperability and priority for safety applications to ensure undisrupted safety measures; and security and privacy settings.

Based on Qualcomm Technology

Source: http://www.its.dot.gov/dsrc/dsrc_faq.htm

Case Study: ShelfX Intelligent Vending Platform

ShelfX is an interconnected ecosystem of retail vending technologies aimed at eliminating lines, cashiers and time-consuming checkout procedures. It is based around a proprietary customer ID device associated with a ShelfX cloud-based account, working in conjunction with a weight-sensitive 'smart shelf'. This ecosystem of intelligent wireless display stands, customer ID cards and back-end software allows shoppers to pay for items as they're removed from the shelf, while instantly updating retail inventory data; if the item is returned to the shelf, the purchase is refunded. The system can be implemented in traditional stores, stand-alone kiosks, or pop-up installations.

Location / Business: Boulder, CO. ShelfX for commercial use.

Source: http://www.shelfx.com/product/retail

Case Study: Smart Highways Infrastructure Upgrade Concept

This conceptual upgrade to existing road systems would introduce a suite of intelligent, responsive, interactive technologies to improve efficiency, situational awareness and safety. With a few upgrades, today's highways could actively assist drivers, communicate information, respond to changing conditions and reward energy-efficient travel. The Smart Highways plan combines related concepts for safer and more efficient journeys: solar-charged glow-in-the-dark paint to improve nighttime visibility; weather-sensitive surface graphics capable of warning drivers about slick, frozen surfaces; and an electric vehicle priority lane with integrated on-the-go inductive charging.

Location / Business: Waddinxveen, Netherlands. Roosegaarde / Heijmans for public use.

Source: http://www.dezeen.com/2013/03/21/smart-highways-by-studio-roosegaarde/

Skybum, Wikimedia Commons

Case Study: Low-speed Urban Transport System

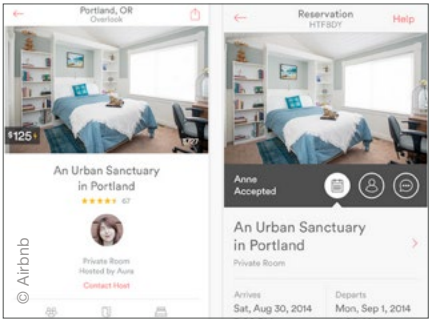

© UK Dept of Business

This program aims to field a trial fleet of 50 driverless, collision-avoiding transport pods, available to passengers through a smartphone app. In 2015 Milton Keynes will be the host city for the initial trials of three electric-powered two-seater pods that will be equipped with sensor and navigation technology initially provided by the University of Oxford's Mobile Robotics Group. The initial trial will be followed in 2017 by the deployment of 50 pods manufactured by RDM Group that will be operated as a public transport system on existing paved areas. Summoned and paid for via smartphone app, the pods will travel at up to 12mph and will be equipped with obstacle detection sensors.

Location / Business: Milton Keynes, UK. Ultra Global for Milton Keynes Transport.

Source: http://www.theengineer.co.uk/automotive/news/milton-keynes-to-trial-driverless-pod-cars/1017445.article

Case Study: Airbnb Peer-to-Peer Hospitality Platform



Airbnb is an online rental-sharing platform which offers consumers a massive variety of accommodations, with over 500,000 listings in 33,000 cities worldwide as of 2014. It allows users to rent out unused spaces (homes, apartments and event venues) to others for an agreed-upon fee. An exemplar of the "sharing economy", the service is built on a strong social community of users. Its "disruption" of the traditional hospitality market has resulted in extraordinary growth. The company employs a proprietary algorithm-driven predictive pricing model, and has acquired various neighborhood-cataloguing technology firms to support its core hospitality business.

Location / Business: San Francisco, CA. Airbnb for public use.

Source: https://www.airbnb.co.uk/

Case Study: Drone Relay Delivery Network Concept

Matternet's proposed airborne logistics system for remote areas is modelled after the Pony Express, with a relay system of drones handing off packages to one another through a network of base stations. Current drones can only fly relatively limited distances on a battery charge, reducing their utility for transportation roles. The system aims to allow rapid transport of necessities to remote or inaccessible locations, potentially revolutionizing the conduct of disaster relief, humanitarian and social support operations. Matternet sees the developing world as a natural fit for drone technology, as road networks are often either nonexistent or poorly maintained; the company believes that widespread adoption of relatively inexpensive cargo drones could potentially outpace large-scale investment in traditional infrastructure.

Location / Business: Matternet for commercial use.

Source: http://matternet.us/

© Qualcomm

Case Study: 2net™ Platform

© Qualcomm

Developed by Qualcomm Life, 2net is a novel wireless health platform. The system includes an array of wirelessly working health solutions which are able to capture and transmit data from medical devices of customers to portals designed to store the submitted data reliably. As an innovative way of connecting devices, the measured biometric data becomes ubiquitous across healthcare. 2net is a cloud-based system through which healthcare practitioners as well patients can access their data, interoperable with various medical devices and applications while enabling wireless end-to-end connectivity. The system will become even more capable and important given an aging society, the ability to share data with transportation systems for health visits, and the rise of autonomous vehicles.

Source: http://www.qualcommlife.com/wireless-health

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Authors
Radha Mistry
Stephanie Schemel
William Newton

Contributors
William Baumgardner
Francesca Birks
Josef Hargrave
Chris Luebkeman
Jordan O'Brien
Josh Treuhaft

Graphic Design
Mark Pearsall

Illustration
Alingo Loh

Editor
William Newton

Research
Stephanie Schemel

Additional Contributors

Qualcomm
Kiva Allgood
Chris Borroni-Bird
Scott Dickson
Frank Lane
Jim Misener
Aidoo Osei
Mike Roberts
Anthony Thomas

External
Jason Dietrich
Ramses Madou
Evan Samek
Robert Seidl
Aisha Sheikh
Andrew Tang
Dan Tuttle

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Cities present us with a paradox: they are beset by an increasing number of 21st century challenges, and yet represent a key arena in which we find opportunities to shape the future.

Across the globe, cities and their systems are confronting a similar set of issues. This report examines intelligent connectivity as it applies to urban mobility: how people and things move through cities. Enabling effective transport of citizens and goods is critical to a city's economic and social vitality, the wellbeing of its inhabitants, and its consumption and emissions footprint. When urban mobility systems work — cleanly, collaboratively, efficiently — the entire city benefits as a result. A variety of urban challenges are deeply linked with transport issues: air quality and safety issues, congestion management, pressure on energy systems and quality of life concerns are just some examples.

Our vision for urban mobility in 2030 includes new choices for individual trip-making, better information for smarter decision-making, and system optimization to utilize infrastructure efficiently; all in service of fostering a seamless, safe and sustainable travel experience.

ARUP

560 Mission Street Suite 700
San Francisco, Ca
arup.com
driversofchange.com