What Stations Will Become: Opportunities in Future Urban Railway Infrastructure

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In the coming years, as urban population centres continue to grow and become more congested, more of the workforce will choose rail travel over cars, placing a heavier demand on the railway infrastructure. Commuters will undoubtedly spend more time in transit to and from work, while at the same time using their mobile devices to do some of the things that make us human—communicate, gather information, learn, and play.

Behavioural changes in society resulting from these trends will present both new challenges for station operators and new opportunities to support regional economic growth. In the future, railway stations will play new roles. These new roles form the foundation for new business models that can enhance the quality of life for commuters.

In order to prepare stations for the changes that will occur, the station communications infrastructure must evolve to help deliver a range of benefits for commuters and station operators.

Trends That Will Impact Urban Commuters

More than 60 percent of the population in Europe, the Middle East, and Northern Africa will live in urban areas by 2030.[1] Today, the portion of urban dwellers in Sweden, Denmark, Finland, and France exceeds 80 percent of the population. By 2030, according to the latest U.N. population study, that list will grow to include the U.K., Spain, Turkey, and five other countries.

Cities in these countries will become the same kinds of vibrant engines of economic growth that are found today in most of North and South America, and parts of Asia. These urban agglomerations host the major

[1] UN Population Division, World Urbanisation Prospects, the 2011 Revision, April 2012

portion of the GDP growth in countries. The per capita GDP of London, for example, is more than three times higher than the average GDP of the EU27 group of countries.[2]

Urban areas will become even more attractive in countries with positive population growth rates. The U.K. now records the highest birth rate in a generation: 1.9 births per woman. Eurostat estimates that by 2060, the U.K. will become the most populous country in Europe, with a population of 77 million, surpassing Germany, whose population is expected to shrink.[3]

As urban centres of population grow, so does the demand on the transportation infrastructure. In the U.K., the use of roadways is projected to grow 28 percent by 2030. The demand on rail will increase by 49 percent over 2010 levels.[4] Each kilometre of roadway in the U.K. today accommodates nearly as many passenger- vehicle kilometres as in Germany, France and the United States combined.

In addition to the trends in population growth and the demands on the rail system, it's reasonable to assume that the road congestion faced by commuters will continue to worsen, regardless of the growing acceptance of telework. For this reason as well, more and more commuters are likely to shift from using roadways to taking the train to work.

Smartphones: Making the Commute More Productive

This continued modal shift depends, of course, on the convenience of lower commute times as well as the potential additional benefits rail transport infrastructure can provide. Given the chance, and provided that the benefits outweigh the perceived costs, commuters are likely to prefer a commute that allows them to be productive, to communicate, and to collect information.[5]

A current example of this is the enormous growth in the numbers of smartphone users. Smartphones are being adopted 10 times faster than PCs in the 1980s, and are now used by more than 74 percent of the adult population in the U.K., Denmark, and Switzerland. In the United States, the smartphone penetration rate is 78 percent. In Sweden, it has reached 86 percent.[6]

Unsurprisingly, smartphones are not primarily used for telephone calls. In fact, in terms of time spent per activity, phoning ranks only fifth, behind Internet browsing, social media, games, and music, and just ahead of email.[7] Smartphones—and increasingly, tablets— help us to interact with one another, gain insights, make informed decisions, and lead richer lives.

Some Behavioural Changes Commuters Are Likely to Make

Commuters in the U.K. already spend the equivalent of five weeks annually on travelling to and from work.[8] We predict that commute times will increase significantly in the future—not only because of the trends cited above, but also because people will *want* to spend more time in stations, for several good reasons.

The Desire for High-Bandwidth Connectivity

One reason commuters are likely to spend more, not less time, in stations in the future is the pull of reliable network connectivity.

In their latest telecommunications predictions, Deloitte note that the typical smartphone generates 35 times more network traffic than a simple mobile phone; they also expect wireless traffic increase 50 fold over current

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[2] Eurostat, Regional GDP per capita in 2009: seven capital regions in the ten first places, 13 March 2012
[3] Ian Traynor, Europe of the future: Germany shrinks, France grows, but UK population booms, The Guardian, 27 August 2008
[4] McKinsey & Company, Keeping Britain Moving: The United Kingdom's transport infrastructure needs, March 2011
[5] Prof. Steve Fuller, Being Human in the Information Age, symposium lecture, University of Warwick,16 March 2012,
[6] Peter Farago, iOS and Android Adoption Explodes Internationally, Flurry, 27 August 2012
[7] Shane Richmond, Smartphones hardly used for calls, Telegraph, 29 June 2012
[8] Trades Union Congress, Commute times add up to five extra weeks work a year, 11 November 2011

levels by 2016. The laws of physics, however, limit the possibilities for radio-based communications. Deloitte predicts that the demand for mobile carrier spectrum will exceed supply in many urban areas by 2014. Projections of this shortage already take new allocations of spectrum blocks to carriers into account.

Smartphone users will feel the impact of this spectrum shortage during wireless "rush hours"—sharply reduced capability will make video streaming almost impossible and web browsing intermittent and slow. Estimates are that three to four times as many calls will be dropped.[9]

So while mobile carriers struggle to turn high theoretical throughput into reality for a majority of their users, neither Long Term Evolution (LTE) nor its successor IMT-Advanced will completely alleviate the problem of too many mobile device users with bandwidth-hungry applications in a crowded space. What's more, the root problem of spectrum scarcity —and the symptoms of poor network throughput—are only exacerbated when mobile users are travelling at speed, on a train.

The solution for mobile carriers will be to offload traffic, where possible, onto fixed Wi-Fi picocells. The interoperability of mobile devices with various radio-based technologies is one of the subjects of the IMT-Advanced set of standards. And stations, with their very high-capacity fixed networks, provide an ideal location for the offload of mobile traffic onto a Wi-Fi infrastructure. As they access more bandwidth-hungry mobile services, commuters may find the urban station to be one of the few islands of reliable, high-bandwidth connectivity, beyond their home and office environments. People will prefer to access certain applications while in the station rather than on board the train, because the station environment offers better connectivity and potentially, a more suitable environment for online interaction, learning and absorbing information.

The Desire for Very Secure Connectivity

Most of us have adapted our behaviour, at least somewhat, to take advantage of the possibilities of being connected via mobile devices. Certainly, not all of the changes in behaviour can be viewed as beneficial. Do you have a "no devices at the dinner table" rule in your home yet? At times, we'll have to readjust our behaviour as we reflect on our priorities.

One acute risk that may affect both the evolution of technology, and our use of it, is data security. In their predictions, Deloitte asserts that the era of strong passwords as a means to authenticate users will come to an end in 2013. Studies show that username and password combinations are increasingly vulnerable,[10] and it's quite likely that business and personal applications will soon require robust, multiple layers of authentication. Sufficiently strong multifactor authentication methods will probably include biometrics. Without robust authentication methods, the trust in and the benefits derived from mobile business and social networking applications will diminish.

Urban railway stations are a logical location for the trusted technology environment with which commuters, using multifactor authentication, can securely access their mobile applications. This trusted technology environment might include retina-scan terminals in those areas where ticket vending machines are found today. Certainly, expanding the station operator's brand to include stations offering a trustworthy and convenient place to connect to sensitive applications will be necessary. The good news is that this new domain of trust is a natural extension of the trust already placed in the safety of train and metro operations.

New Roles for Stations Based on Societal Needs

Secure access to good connectivity and convenience provide only a partial impetus for commuters to spend more time in stations. New roles for stations will grow from changes as people discover how to best balance quality of life with the need to commute to work. The new uses of stations will extend today's practise of making stations a place to stay, rather than a place to leave quickly. The renaissance of rail travel that began

[9] Deloitte, Technology, Media & Telecommunications Predictions 2013
[10] Deloitte

10 years ago lead to some of Europe's biggest stations becoming beautiful shopping centres with an attached transport interchange. This evolution will lead to some perhaps surprising use-cases for stations.

A hub for the elderly. One possible use of stations is as a central and conveniently accessible hub for meeting the needs of the elderly. Stations could serve, for example, as a place for face-to-face meetings with family members and as a place for the elderly to get various kinds of healthcare. The demographics in Europe and elsewhere support the increasing need for such convenient hubs.

Recycling. Urban stations could also become a place to recycle or re-purpose plastics and other materials. Consumer plastic waste collection points could be conveniently located in stations. The waste could be transported by rail to recovery facilities. Overall, station infrastructure could support a society's desire to sharply reduce waste in landfills and reduce the introduction of unrecycled raw materials into product lifecycles. In Denmark and Germany, for example, more than 85 percent of plastic waste is recovered. These countries have high recovery rates due in part to bans or restrictions on landfills.[11] Locating materials recovery facilities in stations would further reduce the carbon footprint associated with the product lifecycle.

Small-scale manufacturing. Given that stations provide ready access to an energy-efficient rail transport system, the use of stations in small-scale manufacturing cycles also seems logical. Recycled plastic could be made available to additive manufacturing facilities—for instance, for 3D printing. In addition to plastics, 3D printing shops could use metal powders in a process called direct metal deposition. Commuters could order a customized consumer product or spare part that is then manufactured onsite, during the day. The finished product would be collected on the way home, or shipped home on the train if it's too large to carry. The proximity of the materials, the manufacturing facility, the transport infrastructure, and the commuting consumer potentially make urban stations an excellent location for the micro-manufacturing facilities of the future.

Centres for community outreach and fitness. Another role for stations might build on human desires for aiding others and physical fitness. Business models that work well in the virtual world may provide even more benefits when combined with face-to-face interaction in the local community in a convenient location. "Crowd helper" kitchens, for example, would let walk-in volunteers spend an hour of their time preparing meals for the poor and help foster a sense of community belonging.

Maintaining a commitment to regularly engage in sports or fitness activities is a considerable challenge for many. Why not combine the need to interact with the good habit of personal fitness, and build small venues for team sports in urban railway stations? Registered participants could participate in a 30-minute game of volleyball, half-court basketball, or indoor football on their way home from work. The resulting expansion of a city's cultural, community outreach, and sports offerings in such visible and easily accessible venues could enhance the region's ability to attract and retain a productive workforce.

How Station Operators Can Prepare for the Future

The transformation of station infrastructure and facilities will become critical in helping to provide a higher quality of life and self-sustaining economies in tomorrow's cities. Because the daily rail journey will consume an increasing portion of the day, transportation planners should prioritise measures that will enhance both a station's attractiveness and its contribution to GDP.

Factors such as ambient air quality and climate will be important in ranking. Station operators must also assume that everything and everyone in the station environment needs to be connected to the network. Ideally, there will be a single, standards-based IP network, securely segmented as necessary, and designed to support a number of devices that exceeds the number of people in the station by several orders of magnitude. Station infrastructure components—like escalators, information kiosks, and HVAC systems—will be connected

[11] European Commission, Plastic Waste in the Environment, April 2011

to the network. Once connected, these systems can be efficiently and proactively monitored, so that faults can be detected quickly, and maintenance scheduled for off-peak hours.

The Wi-Fi infrastructure in the station offers a unique opportunity for station operators. When commuters register to access the Wi-Fi infrastructure, they could agree to let the station operator collect data on preferences and purchasing habits while in a station. Station operators can also choose to be in the information business. For example, Berlin's S-Bahn network of urban commuter trains transports 1.4 million passengers per day.[12] A majority of commuters, enticed to use a station's Wi-Fi infrastructure in exchange for the permission to collect anonymous statistics on their purchasing and travel habits, could form the basis for a data brokerage business model.

And, of course, the expansion of operations into the information business can be lucrative. Sports gear and apparel manufacturer Nike was able to attract more than 5 million users to its Nike+ community, enabling the company to enter into the information business.[13] When such a business model is centred in stations, a significant opportunity to reduce public subsidies of the transport infrastructure is created.

Conclusion

The renaissance of railway stations will continue. Stations will evolve from being a shopping and transport mall to becoming centres of human interaction. Wired and wireless IP communications networks can meet one of urban society's most urgent needs: to connect reliably and securely via a mobile device during the daily commute. When urban stations are transformed to cater to this and a range of other needs, commuting will no longer be seen as a necessary evil, but as a chance to enrich our lives.

For More Information

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[12] Deutsche Bahn, Menschen Bewegen – Welten Verbinden, 2009
[13] Anthony John Agnello, Nike's FuelBand Could Become Big Business, InvestorPlace, 25 January 2012

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