

Mobile Apps for bus users in Edinburgh



Smart Cities Brief No.19

1. Introduction

Edinburgh and its surrounding area are well served by an efficient bus network. The City of Edinburgh Council (CEC) have worked with the locally owned bus company (Lothian Buses) and a system supplier (INEO Systrans) to deliver real-time information to meet passengers' needs, initially through bus-stop displays and then a website. This case study described how it was later extended to smartphone users through a cooperative and flexible approach with two individuals who had developed Apps for iPhone and Android phones.

This service is currently being upgraded in the light of experience over the first three years' operation to include a better user interface, with more consideration for accessibility issues, better capacity and a more efficient and controlled route for accessing the data through smartphones.

This is one of two case studies showing the different approaches taken by the City of Edinburgh Council (CEC) in developing content and services aimed at users of smartphones and other mobile devices. The second case study describes the approach taken by the Library and Information Services department of the City of Edinburgh Council to work with commercial App developers to reach the users of mobile devices as part of a wide-ranging social media and digital communication strategy.



2 Smart Cities and the mobile citizen

The Smart Cities project is an innovation network made up of thirteen governments and academic partners from six countries that is working to improve the development and take-up of e-services and e-government across Europe's North Sea region.

The Smart Cities project recognises that mobile is the future. Smart Cities' partners have been developing a range of new and innovative services for mobile platforms, while testing and evaluating new forms of urban wireless networks. The wide use of mobile phones and the emergence of municipal wifi-networks allows local governments to deliver new services, or to adapt existing e-services to bring them closer to citizens or workers on the move. Research shows that e-services enabled for mobile phone manage to reach social groups who currently make limited use of public e-services.

3 The bustracker system

The City of Edinburgh is almost unique in the UK where the city council is the majority owner of the local bus company, Lothian Buses. One result of this has been that it has been possible for the council, as majority shareholder, to encourage the reinvestment of profits, rather than their extraction in the form of dividends. Another has been that it is easier to maintain a relatively open and constructive relationship between the council and its bus company. This forms the background to the case study presented here.

The Bustracker project was started by City of Edinburgh Council in 2002 with the aim of providing accurate and reliable real-time passenger information for bus services across the City. Initially working closely with Lothian Buses¹ and First Edinburgh² (a division of a large private sector company), the City Council developed and agreed a detailed system specification. After an exhaustive tender process, the City Council awarded the project to INEO Systrans³, an established supplier of real-time passenger information and fleet management systems. First Edinburgh dropped out before the system could be implemented, leaving Lothian Buses as the only public transport provider involved in the project.

The system includes the installation of tracking devices across Lothian Buses' entire fleet of around 600 vehicles. It features real-time tracking of bus locations, allowing gaps between buses to be monitored and maintained, and communication with drivers in case of problems. This has meant that there is an operational motivation for the data to be maintained as it is being used for management decisions and monitoring.

¹ <http://lothianbuses.com/>

² http://www.firstgroup.com/ukbus/scotland_east/

³ http://www.INEO_Systrans.com/ and http://www.INEO_Systrans.com/action-init-en.html

The City Council has overall responsibility for the Bustracker Project but it maintains a close working partnership with INEO and Lothian Buses (see 'The bus tracker partners' below).



Figure 1 – mybustracker branding

The project has been a considerable success for INEO Systrans as well as the City of Edinburgh Council and Lothian Buses. It is now one of their key reference sites when advertising their products to other potential clients. Lothian Buses had a direct business motivation to ensuring that bus location data is accurate and up to date, whether or not there was a public-facing bus tracking system.

The first electronic display signs were installed in 2004 with the service being launched later that year. CEC has now installed displays at 400 of the approximately 2 400 bus stops served by Lothian Buses. The displays are costly to buy, install and maintain, and it has become clear that it is not realistic to expect all the bus stops to be fitted with them. As a result, the www.mybustracker.co.uk⁴ website was launched in February 2008. The site's content was originally formatted for web browsers and WAP-enabled mobile devices. INEO provide the website as a service, including hosting and support. The website was an immediate success, and some support for current mobile technology was present from the beginning through the formatting of pages for display on mobile devices.

Other cities are also working with models for web based and mobile tracking of buses. For instance, Helsinki provides live tracking of bus locations⁵. Edinburgh is relatively advanced in the UK – London introduced live bus tracking in September 2011⁶ (albeit the size and complexity if the bus network is an order of magnitude greater than in Edinburgh).

⁴ <http://www.mybustracker.co.uk/doc/partners.htm> and <http://www.mybustracker.co.uk/doc/help.htm> are good sources of background information

⁵ <http://transport.wspgroup.fi/hklkartta/defaultEn.aspx>

⁶ http://www.theregister.co.uk/2011/09/05/transport_for_london_live_bus_data_hits_mobile/



4 The bus tracker partners

City Of Edinburgh Council

The City Council is directly responsible for the delivery of real-time bus information through the Bustracker displays at bus stops, via the web-site and mobile services, and through large information displays in key locations like the Royal Infirmary of Edinburgh and shopping centres such as Ocean Terminal and Cameron Toll.

CEC is also responsible for the expansion and support of the system to increase the benefits to the travelling public, both directly by delivering bus priority at traffic signals but also by integrating with other information systems such as rail, airports and Traveline Scotland⁷. Indirect support comes through the encouragement of businesses to provide information in the workplace, encouragement of other bus operators to join Bustracker and spreading support for the system to neighbouring authorities.

Lothian Buses

Lothian Buses have played a significant role in the development of the system specification. They recognised that Bustracker's advanced fleet management tools could help improve the real-time management of their fleet and the service delivered to their customers. The fleet management system also includes security features to enhance the safety of both the driver and passengers.



Lothian Buses is directly responsible for:

- funding the installation of Bustracker and subsequent expansion across their bus fleet
- loading and updating the Lothian Buses service details on the Bustracker system database
- ensuring that the Bustracker systems (on buses and in bus depots) are monitored and maintained to deliver high quality real-time information and fleet management services

INEO Systrans

INEO Systrans is one of the European leaders in public transport fleet management and real-time passenger information systems. They have equipped over 14 000 buses spread out over 65 transport networks, 1 300 trams spread out over 35 transport networks and 5 000 on-street signs spread over 40 transport networks. In addition to Edinburgh, major clients include⁸ over 20 cities across France (including Paris), as well as Lincolnshire, Milton Keynes in the UK and major European cities like Geneva, Lausanne, Brussels and Barcelona.



⁷ <http://www.travelinescotland.com/>

⁸ <http://www.INEO-gdfsuez.com/en/solutions/transport/urban-transport/our-bus-references/our-bus-references/>

5 Development of the mobile Apps

Terminology

Smartphone describes phones with more advanced computing ability and connectivity than a contemporary feature phone, although the distinction can be vague and there is no official definition for what constitutes the difference between them. The technology has recently been extended to tablet format, notably the Apple iPad. Mobile device is the term used here to include smartphones and tablets.

App refers to application software for specific purposes written for mobile devices. The functionality provided is generally richer than would be found by simply visiting the web page using a smartphone's built-in web browser. Apps are available for devices which use advanced operating systems like iOS (Apple iPhones and iPads) or Google's Android (used by many manufacturers prominently HTC, Samsung and Sony-Ericsson). Apps are now becoming available for Blackberry and Windows mobile devices.

API Short for Application Programming interface: a mechanism through which separate web applications can share data and exploit each other's functionality.

API Key is a code generated by websites that allow users to access their API. Used to track how the API is being used in order to prevent malicious use or abuse of the terms of service.

Some of the definitions given here are derived from their Wikipedia entries.



Figure 2 - Finding bus stops near the user - screenshot from iPhone App

Mobile technology developed significantly since the original decision to create a bus information website: iOS (iPhone) and Android powered mobile devices in particular have had a large impact, and have raised user expectations of what is possible.

Gordon Christie, an independent iOS software developer based in Edinburgh developed an iPhone App (EdinBus) to make the information on the mybustracker website available to iPhone users. He wanted official clearance for the functionality before launching, so he approached the transport department. They saw this as an opportunity to make the service more useful to the travelling public so worked with Christie as he finalised the application.

A similar Android App (My Bus Edinburgh) was created by Niall Scott – an undergraduate student at Heriot-Watt University – for his final year project in 2010. Over time, other Apps with similar functionality have been developed, but Christie and Scott remain the two with a working relationship with CEC.

Neither application was designed as revenue generators for the developers – rather in both cases they were used as demonstrations of the programmers’ skills, helping them develop their careers. At the same time CEC was able to benefit from a significant amount of specialist consultancy and development at no direct cost.

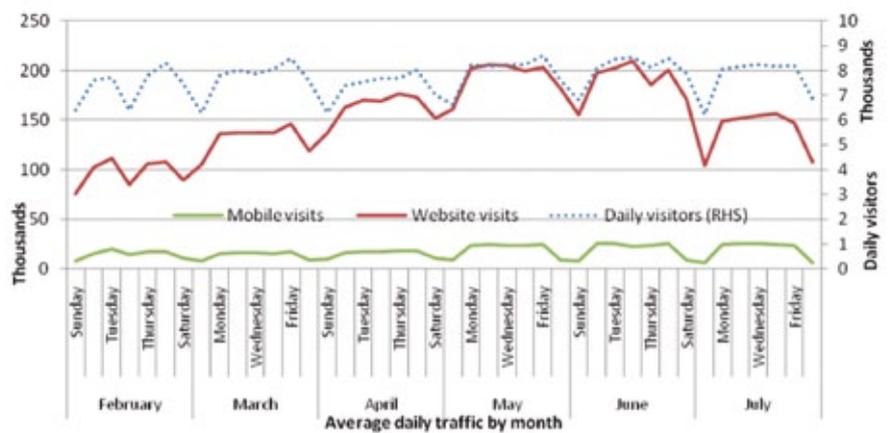


Figure 3 – website statistics for mybustracker

Analysis of website statistics shows that the service is most used during the working week, with usage tailing off during the holiday season in July. The original system, which generated this data, cannot differentiate between the website visits (in red) by internet browsers and activity by mobile apps visiting the site to scrape the data. The new version resolves this issue.

How the Apps work

The existing mybustracker website was not designed with access for new devices in mind, so the Apps have to read ('scrape') content directly from the HTML of the existing site. This involves the extraction and reprocessing of a considerable volume of data: for instance, bus stop IDs, names and locations, their associate routes, bus timetables and actual locations. A carelessly written application could overwhelm the website with data requests.

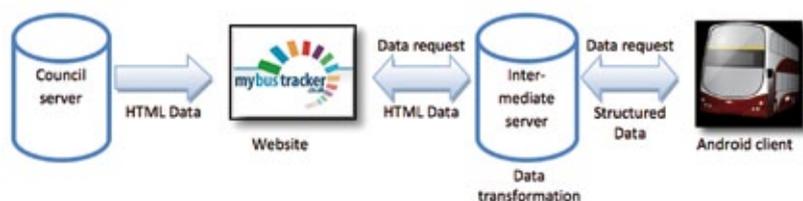


Figure 4 - Data flow from website to the Android App

The Android App mitigates this problem through the use of an intermediate server controlled by the developer (see Figure 4). It is used to store bus stop data, with a weekly update from the live website of the list of 2 400 bus and 8 400 service mappings. The Android devices then just needs to check with the server for changes, using only 8 bytes if no there is no change.

Development of both Apps has to take into account the evolution of their target platform. The iOS App is targeted at iOS3+. The Android App only requires version 1.5 (the latest version is 3.3), so is largely backwards compatible; the challenge with Android development rather is the extremely wide range of devices that it has to work with, with different screen resolutions, densities and methods of interaction.

“(The iPhone App is) Easily the best public transport App in the UK. The data provided is accurate and up to date. A must if you live or are visiting Edinburgh.”

Review of the EdinBus App from a satisfied user



Figure 5 – Searching for buses to a given destination on the Android app

As a result of the relationship both developers have built up with the Council, their Apps have been supported by providing publicity – for instance through bus stop displays or back-of-ticket adverts.



Figure 6 - Summary figures for the Android App.

The Android market statistics show a steadily rising number of installs, with over twelve thousand in active use (see Figure 6). Note the high rating, the steadily increasing number of active installs, and their high proportion in relation to total downloads. Figures for the iPhone App follow a similar pattern. The latest version of the iOS App now includes usage tracking, showing over 90% of activity comes from repeat usage. Both Apps have very high rating in their respective stores; in Christie’s words:

“People have been very very generous with their praise for the system... it’s this type of comment that keep you going”

Bug reporting and support is generally over email, with 2-3 support emails a month. Both the Android and iOS Apps make use of twitter accounts but interaction is very low volume.

7 Bustracker Version 2: Responding to lessons learned

Since its launch in 2008, the bustracker web service has become increasingly popular, receiving over 200,000 requests a day. This number confirms not only the popularity of the website but also the expansion of smartphone ownership and the use of their associated Apps.

The increasing popularity of the website has occasionally caused overloads – for instance, during the bad weather in the winter 2010/11, when bus services were being severely disrupted. Ironically, the success of mobile access to the site makes it much more likely the system will be queried when there are delays as waiting passengers can directly access the service. As a result, sometimes the web based real-time information has not been available when it could have been most useful.

Recognising this problem, the City of Edinburgh Council's Public Transport team worked on a number of solutions in the first half of 2011. Some solutions were quick and simple, like adding more system memory and improving server speed. The most significant improvement was a redesign of the system architecture; this has significantly improved capacity and now allows a far greater number of simultaneous requests for information to be managed.

At the same time, the administration functionality of the system has been extended to allow monitoring of the levels and sources of usage so that it can be clearer how much activity is generated by the Apps and mobile users.

Finally, as this system architecture was being worked on and improved, the Public Transport team have taken the opportunity to refresh the look of the website. Much of the original functionality remains unchanged but the site is now brighter, fresher and easier to access.

Given the amount of data processing involved required by the mobile Apps, it is becoming clear that a middleware server is necessary to support efficient functioning by caching data from the main server. Although the costs are relatively modest, they do need to be covered, so it might become appropriate to charge for providing the service. The challenge is that these Apps need to remain free-to-download if they are to be widely used.

“The city council has invested a lot of money into the bus tracker system which you can use from your home or office desktop, but the ability for someone to capture the information and transfer that into mobile information is fantastic. We even use it ourselves.”

Iain Coupar, marketing director of Lothian Buses (Edinburgh Evening News, 2 December 2009)

8 Changes to the Smartphone Apps

Managing access to the data

The popularity of the Apps has led to the development of an **API** for the service. This will mean that development is more straightforward in future and benefits the Council by being less demanding on their server. By making App development simpler the Council hopes to see interested parties begin to develop apps for different types of mobile device and also some more innovative projects where the information is integrated with other web based solutions.

It is hoped that the API will be extended to provide route information as connected bus stops and shapes to make an overlay for maps but also to allow logical (diagrammatic) display of routes. Subject to CEC funding, it may be possible to include unique bus-identifiers in the data. With a unique id, it will be possible to calculate buses' progress along their routes by tracking visits to bus stops. On the other hand, detailed information on bus timings and location can be commercially sensitive (e.g. by allowing rivals to overtake), so access needs to be controlled to prevent misuse.

In order to access the system, apps will have to have a valid **API key** and CEC will put a page on their website to tell developers how to apply. The keys will be prioritised: so that in times of system stress, low-priority keys will be given a system unavailable message first. Risks from system load can then be managed through prioritising the keys, allowing times of system stress to be managed and misbehaving apps to be controlled and shut out if necessary.

Development community

Since the initial releases, there had been requests to allow the development of Apps for Blackberries and Windows Mobile phones. These were deferred until the new site and its API could be in place, though a Windows Phone 7 app has now been released: “Bus Tracker Edinburgh for Windows Phone 7” which uses the HTML-scraping approach.

As the developer base increases, putting the use of the API a clear footing has become more important. To this end, the Council is working with the App developers to define terms of use for the data. Chicago, Seattle and Oslo have similar systems in place and are being used as models for IPR/terms of use for App developers. The challenge is to create a model that does not prevent legitimate use of the system while preventing abuse.

There are a number of alternative bus tracking Apps available for Edinburgh, including the App offered by the Library Service and the national timetable site offered by Traveline Scotland (which is based on scheduled – not real-time – services). The majority of the other developers have not been in dialogue with CEC. However, CEC recognises that it is important to contact them as any service failure from changes to the system could reflect badly on the city, not the developer.

Work is continuing to create a developer community around the data – for instance by making the documentation available online in wiki format so that it can be updated and maintained by the community.



The system supplier's perspective

From the perspective of INEO Systrans, Edinburgh has been an exceptional city to work with in the UK, as it has a single dominant public transport company, guaranteeing a longer-term perspective and a large proportion of the available bus passengers. At the same time, because of its long term relationship with the stakeholders, INEO was willing to initially invest in creating a website, and then work with the Council, Lothian Buses to support the App developers' needs. This has paid off by demonstrating the potential for providing data directly to passengers over the internet – through browsers or mobile devices: the 200 000 daily visits is much higher than had been anticipated.

Accessibility

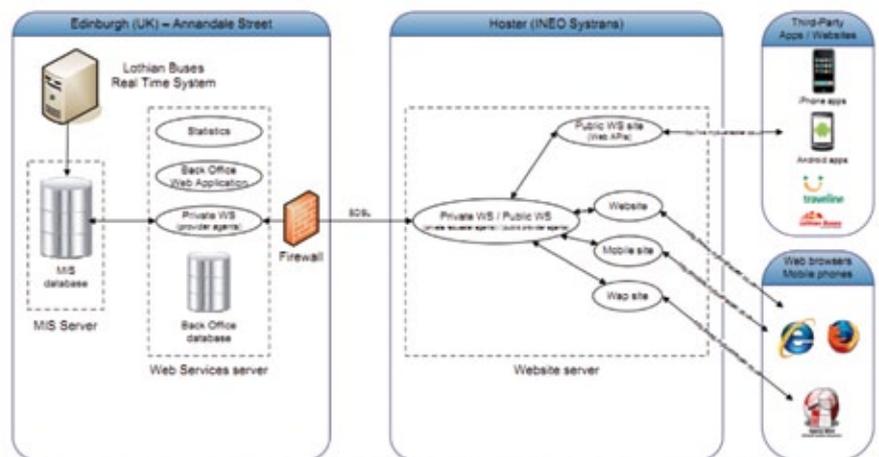
As part of CEC's responsibility for delivering audio based services for visually impaired passengers, some signs are now being upgraded to make audio announcements using the RNIB React system

This theme is inspiring thoughts on how the service could be developed – for instance, through an alert noise when the bus is approaching the passenger's destination.

Developments in Edinburgh and now across Europe have convinced the company that provision of a quality data service should be a core part of their offering to customers – for instance, ensuring the system is able to accurately and immediately report disruptions to bus services due to diversions or delays.

Although Mobile Apps will be provided by INEO Systrans to their customers, they appreciate that by providing a quality data feed, local developers will be able to develop customised Apps – supporting the business model by embedding the system in a wider ecology.

The company has been aware of the need to comply with data standards, and has explored the Service Interface for Real Time Information (SIRI)⁹. However, SIRI does not provide useful support for features like mapping of bus routes or responding to real-time diversions. This has led to the development of their own, richer, API. At the same time, the company is a partner in the European Bus System of the Future (EBSF)¹⁰ project. This project will provide a platform for bus companies and systems suppliers to agree a common standard.



System overview. Note that the real time system is hosted by CEC and Lothian Buses. INEO Systrans hosts the web service.

Figure 7 – System overview

⁹ www.siri.org.uk

¹⁰ www.ebsf.eu

9 Discussion, conclusion and future developments

The UK is one of the first European markets where smart phone penetration has now reached the point that make them an effective route to reach passengers. This, combined with the structure of the public transport sector in Edinburgh, has created an environment ripe for innovation.

The positive and flexible working relationship between the three core parties – CEC, Lothian Buses and INEO, meant that they have been able to take opportunities as they arise – starting with the original decision to develop the website. In turn this meant that when the city was contacted by App developers, there was the flexibility to be able to work constructively with them. This resulted in a stable development context within which the Apps could be developed and the chance for developers to engage with plans to develop an API for structured access to the data by mobile Apps.

This flexible approach has meant that risks associated with this informal approach to project management and development strategy have been avoided. For instance, issues such as data ownership and access to the system can be addressed in an environment when all parties involved understand the issues and trust each other.

This approach shows interesting parallels with the co design processes described in a separate Smart Cities report¹¹. At the heart of this concept is a move towards user-led design as part of a broader context of where municipalities move towards a situation where citizens and professional staff co-produce services together. There may be some interesting lessons learned from the success of this cooperative approach to App development that the Council could learn from and then apply elsewhere.

¹¹ Co-design in Smart Cities - A guide for municipalities from Smart Cities - <http://www.smartcities.info/co-design>





Although exact figures are commercially confidential, it is reasonable to estimate that 25 000 Apps have been downloaded and are being actively used by the approximately 500 000 bus travellers in Edinburgh – a penetration rate of at least 5% and perhaps 10%, which can only increase through the combination of word-of-mouth and increasing penetration of smartphones. This is approaching the level where it will make significant impact on aggregate passenger behaviour.

Turning back to App development, the challenges the stakeholders now face are ones of success: how to bring in the other developers to use the new API to create novel applications, to create Apps for other platforms, and (if they wish) to extend their Apps to be usable in other cities. At the same time the positive relationship between the core stakeholders of the Council, INEO SYSTRANS and Lothian Buses needs to be nurtured.

There is potential for INEO Systrans as bus management system provider to act as a data broker between a city's bus management system and the front-end user interface, provided by Apps or conventional websites. This would allow Apps to be developed for different cities, bringing together data from different transport companies. But there are also challenges associated with sharing of commercially sensitive data, and agreeing on cross-industry data-sharing standards.

Finally, it is clear that the creation and success of mobile Apps cannot be considered in isolation. The separate Library case study shows that other drivers can be a digital engagement strategy that includes delivery of information to mobile devices. This case study has shown the benefits of building in an information infrastructure that is already in place and has operational reasons to be maintained – as Lothian Buses now INEO Systrans system for managing its assets – and the benefit of a cooperative approach to development with external stakeholders.

10 Annexes

Smart Cities reports

- Case Study: Support for mobile devices by the Library and Information Services department of the City of Edinburgh Council
- Output on workshop on the business models for Wireless services held in March 2011, focussing on the drivers and pitfalls for a successful and sustainable wireless city. The report can be downloaded via:

<http://smartcities.info/workshop-business-models-wireless-services-report>

- The Smart Cities Co-design report (in publication) gives an overview to an approach that engages all stakeholders in a constructive approach to problem solving, as has been demonstrated in this case study

Contacts and information

Mobile App developers

iPhone/iOS App (Free to use, closed source)

<http://gordonchristie.com/edinbus/>

Twitter: @EdinBus

Android App (Free to use, open source)

<http://www.rivernile.org.uk/bustracker/>

Twitter @MyBusEdinburgh

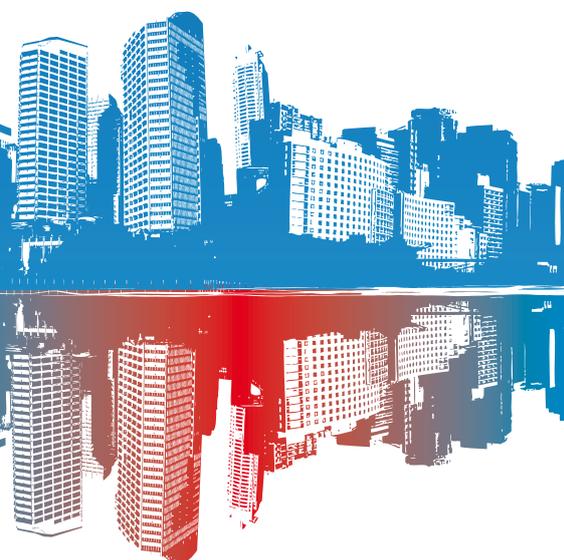
My Bus Tracker

- Main web page <http://www.mybustracker.co.uk/mobile/>
- Contact the Transport team via mybustracker@edinburgh.gov.uk
- Lothian Busses annual report (the source for passenger journey numbers) can be obtained from: <http://lothianbuses.com/more-info/corporate.html>

INEO Systrans

- Thomas Huentz, Key Account Manager thomas.huentz@ineo-gdfsuez.com





www.smartcities.info

www.epractice.eu/community/smartcities

The Smart Cities project is creating an innovation network between cities and academic partners to develop and deliver better e-services to citizens and businesses in the North Sea Region. Smart Cities is funded by the Interreg IVB North Sea Region Programme of the European Union.

Smart Cities is PARTLY funded by the Interreg IVB North Sea Region Programme of the European Union. The North Sea Region Programme 2007-2013 works with regional development projects around the North Sea. Promoting transnational cooperation, the Programme aims to make the region a better place to live, work and invest in.

