

Locating, Tracking and Tracing: From Geographic Space to Cyberspace and Back

Lorenz M. Hilty

Department of Informatics, University of Zurich and
Technology and Society Lab, Empa, Swiss Federal Laboratories for Materials Science and Technology
Switzerland

Britta Oertel, Michaela Evers-Wölk

Institute for Futures Studies and Technology Assessment (IZT), Berlin
Germany

Kurt Pärli

Kurt Pärli, Zurich University of Applied Sciences, Winterthur, Switzerland

Abstract

Technologies for tracking and tracing objects and people are becoming ubiquitous. The possibility to determine the location of a person (either in real-time or ex-post) often emerges as a side-effect of other activities the person is performing, such as making a phone call, using the Internet or taking a picture. It is the combination of two factors which creates considerable societal risks in addition to the obvious advantages and opportunities afforded by the positioning technologies: a drop in the voluntary nature of our use of these technologies and the increasing amount of personal data in circulation. By using a qualitative risk-assessment approach developed in an earlier TA-SWISS study, the project team identified the need for political action in several areas (from surveillance and child protection to critical infrastructures) and formulated recommendations for legislative bodies and stakeholders for minimizing the societal risks of these technologies.

Introduction: Technologies for Tracking and Tracing

An increasing amount of technologies are being used that involve information about the location of objects or persons. In addition to the widely known geolocation by satellites via GPS, at least 12 other technologies are in use today that make it possible to determine the location of devices and indirectly that of their users, such as GSM/UMTS/LTE, WLAN, RFID, optical and even acoustical technologies (for details, see Hilty et al. 2012). This may be happening in real time (tracking) or following a delay, depending on the technology (tracing); it may happen with a degree of precision ranging from a few kilometers to a few centimeters and either with or without the knowledge of the persons affected. The mix of technologies in use today bears much greater privacy risks than passive RFID technology used to tag objects with smart labels, which stirred a public debate almost a decade ago (Oertel et al. 2005).

Because tracking and tracing can be technically implemented with increasing convenience and decreasing cost, more and more location data are being generated and stored. When the results of many positioning processes are combined, movement profiles or even relationship profiles can be prepared for individual persons. In addition to navigation, there are numerous other application areas of localization technologies: location-based services, micromarketing, calculation of fees and insurance premiums, surveillance of individuals (for health reasons or in law enforcement), emergency missions, documentation and forensic evidence.

From the standpoint of the person being located, this happens often as a side-effect of another function the person wants to use:

- All mobile devices with integrated GPS receivers (such as smartphones) can determine their position with a high degree of precision; many apps build upon this; the user is not always aware whether their localization data are visible to third parties when they use an app or a service.
- Mobile phones that do not even feature GPS receivers can also be localized by mobile providers. Just knowing in which cell the device is operating provides for a rough localization. A more precise localization of mobile phones without GPS is also possible by triangulation.
- When a user is accessing information on the Internet, servers can roughly estimate the location of the user. Whenever Internet access is via a WiFi hotspot, an even more precise localization is possible.

- When buildings or fee-based zones are accessed using electronic identification or when electronic payments are made, data are also generated that document the location and movement of persons.
- Images showing persons or vehicles may document locations. More and more digital cameras are equipped with GPS receivers and mark digital image data with geotags that specify time and location; video surveillance cameras are becoming more powerful and less conspicuous. Parallel to this development, image processing algorithms are being improved so as to enable authorities to mine collections of images automatically for faces or license-plate numbers.

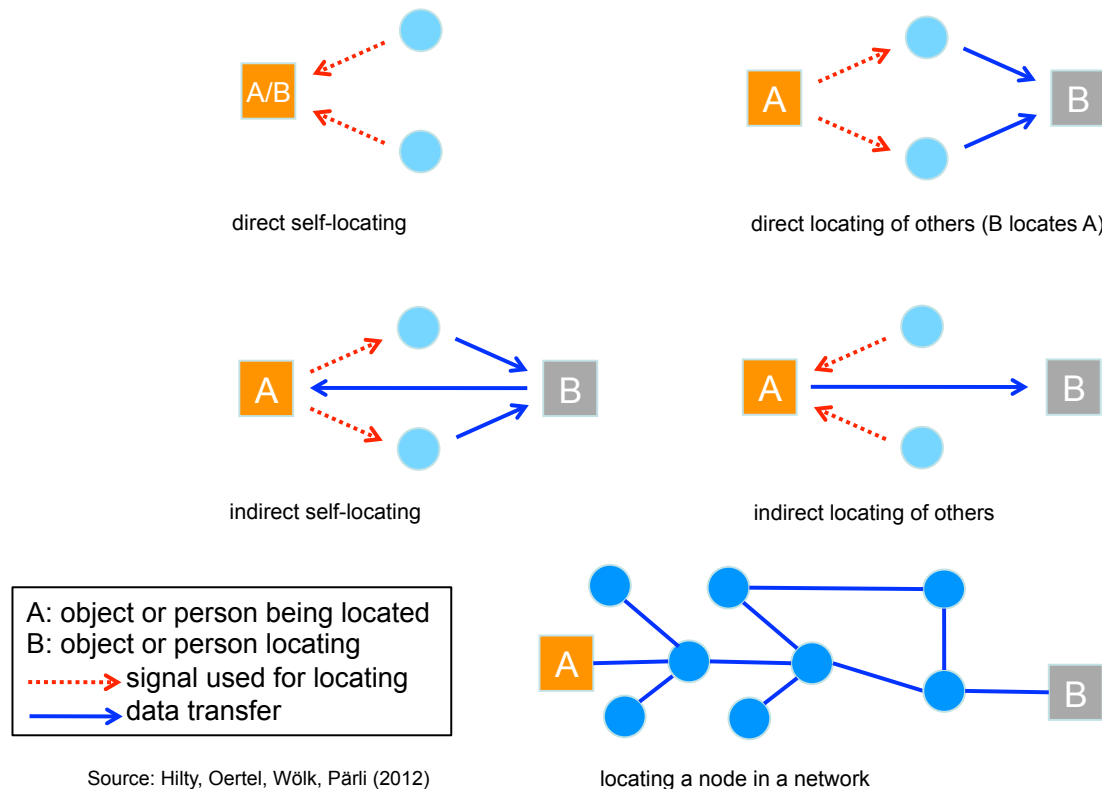


Figure 1: Basic types of determining the location of objects or people (Hilty et al. 2012)

Identifying Potential Areas of Societal Conflict

Localization technologies are in the process of assuming a dominant position in our lives and just as well-accepted as the telephone or the Internet. These devices are becoming an “external location memory” that stores an ever-increasing amount of records about our acts and when and where we performed them.

In the future, it will become difficult to imagine everyday mobility – both individual and in public transport – without localization systems. Likewise, acting in social networks on Internet platforms will be increasingly associated with the physical location of the user. New location-based business models will result from that. Advertising focussed on location, time and the individual will become normal.

Localization technologies offer many societal opportunities, e.g. for promoting public transportation (easier to find connections and to pay for them), for emergency and rescue operations, for personal security and orientation at unfamiliar locations, for meeting friends and perhaps even for making friends among strangers. They may even provide a technological basis for the vision of a sustainable information society that has been around for a decade (Dompke et al. 2004; Hilty et al. 2005; Som et al. 2009; Berleur et al. 2010; Hilty et al. 2013).

However, as localization technologies become more readily accepted, society will become more dependent on them. The technologies are becoming new critical infrastructures whose malfunction or collapse can have far-reaching consequences comparable to a breakdown of the telephone network. Manipulated localization

information may have even more serious consequences than a lack of information because it can misguide vehicles, persons and freight.

It is mainly the combination of the following two factors, which creates considerable societal risks in addition to the obvious advantages and opportunities afforded by localization technologies. The factors are:

1. *A drop in the voluntary nature of our use of localization technologies*: If a person does not wish to be located even today, he or she has to do without a mobile phone and many Internet functions, in extreme cases, even without electronic access and payment systems – thus becoming excluded from many aspects of personal and professional life.
2. *The increasing amount of personal data in circulation* due to the increasing generation, transmission, storage and processing of localization data: the public or private-sector organizations that process such data can combine them into tracking and relationship profiles. Far-reaching profiles of persons and groups can be assembled by combining that with other data, in particular geographic data.

The combination of these two aspects – the drop in the voluntary nature and the increasing amount of data – holds a potential for societal conflict because the difficulties of the individual that exist today in getting his or her right to informational self-determination respected might later intensify to a critical mass. The lack of transparency in the processing steps used, which are frequently not associated with a person until after the fact, is increasing the risk of personal and data protection violations.

Need for Political Action in Switzerland

The TA-SWISS study “Localized and Identified – How Localization Technologies Are Changing Our Lives” (Hilty et al. 2012) examined the technologies, applications and Swiss legal-framework conditions of localization technologies, including the situation in the European Union whenever relevant. In keeping with the themes of *Mobility* and *Social networks*, the possible impacts (both the opportunities and the risks) are discussed and evaluated as regards their societal relevance. By using a qualitative risk-assessment approach developed in an earlier TA-SWISS study (Hilty et al. 2004, 2005; Som et al. 2004), the project team identified the need for political action in the following areas:

- For the technical surveillance of people in dependency relationships, especially employees, persons needing protection and children;
- In Child Protection Measures pertaining to the participation of adolescents in social networks with localization functions;
- In defending the informational self-determination of the individual vis-à-vis the state and private-sector enterprises; this is a matter of maintaining control over one’s own data and avoiding the thoughtless surrendering of basic rights;
- In limiting the retention of localization data, because in many cases it can be associated with persons after the fact, possibly jeopardizing their rights to privacy (“right to be forgotten”);
- As regards the permissibility of the Terms of Service used by the providers of software packages and services with localization functions, some of which violate current law;
- Taking seriously the model function of government offices in implementing data-protection principles, whenever they use localization technologies to perform their own duties more efficiently;
- To recognize the security of localization systems as a new critical infrastructure and to protect the populace against those forms of cyber-criminality that are facilitated by localization technologies.

From this list, a set of recommendations was derived.

The *general recommendations* aim to further develop the legal framework:

- There is an urgent need for introducing more efficient ways to sanction violations in the data-protection rules intended to effectively prevent the misuse of personally identifiable data (the localization data of persons in particular).
- Measures are needed to improve the enforcement of data-protection principles in the international context.
- Because localization systems are developing into critical infrastructures for the Swiss population, they must be protected from malfunctions, breakdown or destruction.
- Many people have difficulty understanding the operation of software products and services processing localization data; this makes a certification necessary, so that software products become more reliable and transparent.
- The widely discussed “right to be forgotten” for personal data is of special importance in the case of localization data; therefore, a legal anchoring of this right should be investigated thoroughly.

- Empirical social-science research is needed, so that the real handling of localization technologies in everyday life and the social-development dynamics of sharing relations and dependencies can be better understood. Such an understanding is the basis for effective regulation.

In addition to the general recommendations that aim to establish legal guideposts for the on-going development and use of localization technologies in compliance with basic law, the study articulates *special recommendations* for specific areas:

- improving the public's understanding of the Terms of Service of social networks;
- directions and a clearer regulation of the permissibility of localization in the workplace;
- integration of the topic of localization in measures for the promotion of media literacy of adolescents;
- introduction of effective ways of establishing the legal age of users of Internet services with localization functions;
- the accession of Switzerland to the Council of Europe Convention on the Protection of Children from Sexual Exploitation and Abuse;
- exercising the model function that governments have in the application of localization technologies;
- bringing the use of crowd sourcing (cooperation of many volunteers) in road traffic into a compliance with data protection principles;
- a uniform regulation of video surveillance;
- an extension of the principle of the so-called Robinson List ("don't send me any advertising") to digital media, especially location-based marketing.

The recommendations of this TA study are not intended to hinder the use of localization technologies or to underplay their many advantages; instead, they are intended to help recognize and minimize the risks of these technologies at an early stage – only then will society succeed in exploiting the opportunities of localization technologies and in deriving sustainable benefit from them. The detailed study published in German (Hilty et al. 2012) can be accessed at <http://e-collection.library.ethz.ch/view/eth:5555>.

Acknowledgements

The authors would like to thank Sergio Bellucci and his team at TA-Swiss, the Swiss Centre for Technology Assessment, for supporting this study and Bruno Baeriswyl, the head of the advisory group of the project, for his valuable advice and feedback throughout the whole project.

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