



openHPI – Internet Security Movement Profiles

Prof. Dr. Christoph Meinel
Hasso Plattner Institute, Potsdam, Germany

Movement Profiles (1/2)

Movement profiles aggregate user data:

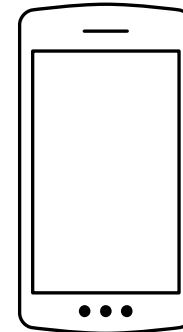
When and what was done and where did it take place?

- Typical understanding relates to location-based profiles
 - where, when, and how long were users in one place?
- Other movement profiles
 - Application profile:
 - how does a user moves around within an application?
E.g., Internet browser, or Email client
 - Internet
 - how a user surfs on the Internet?
 - which pages he/she visited, when and for how long?
- Data collection does not always have to be anonymous,
the name of a person can also be assigned

Movement Profiles (2/2)

Profiles can be created by:

- mobile phones
- RFID chips
- smart cards
- cameras
- Wi-Fi
- browsers
- third-party websites
- ...

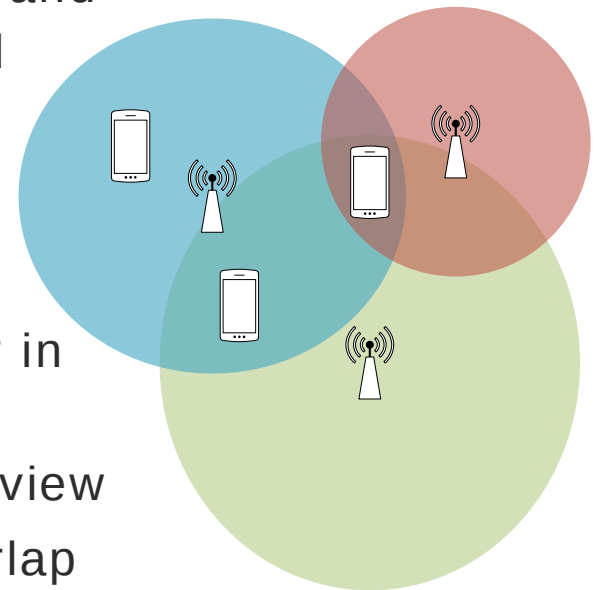


Profiles are used for e.g.,

- surveillance
- personalized advertising / analysis

Mobile Phone Tracking with GSM (1/3)

- After power on, mobile phones always connect with a mobile phone site (cell tower)
- Network operator store ID of the mobile site and time at which a mobile phone was connected
- Mobile sites have a certain range
 - few 100m in the city
 - up to 35 km in the countryside
- Makes it possible to determine the perimeter in which the mobile phones were located, but not the direction from the site's point of view
- Transmission ranges from cell sites may overlap
 - Position can then be determined more precisely → „Triangulation“
- Mobile phone tracking is being offered as a service ...



Mobile Phone Tracking with GSM (2/3)

- Germany: New data retention law passed on 18.12.2015
 - Connection data must be stored for 10 weeks
 - who was called?
 - date, time, duration of the call
 - location data must be stored for 4 weeks
 - **currently suspended due to law suits**
- With these connection data and publicly available data from the Internet such as Twitter or blogs, a very accurate movement profile of a person can be created ...
- Data published on Green Party politician Malte Spitz shows how this can look like
 - <http://www.zeit.de/datenschutz/malte-spitz-vorratsdaten>

Mobile Phone Tracking with GSM (3/3)

Tuesday, 1 September 2009



Spitz continues takes the train to Munich. At 2 pm he has a meeting in a beer garden - most likely "Das Kloster" near the Munich Ostbahnhof station. Flight back to Berlin in the evening, landing at Tegel Airport around 11 pm. (source: **Twitter**)



13 incoming calls
46 outgoing calls
total time: 1h 29min 48s

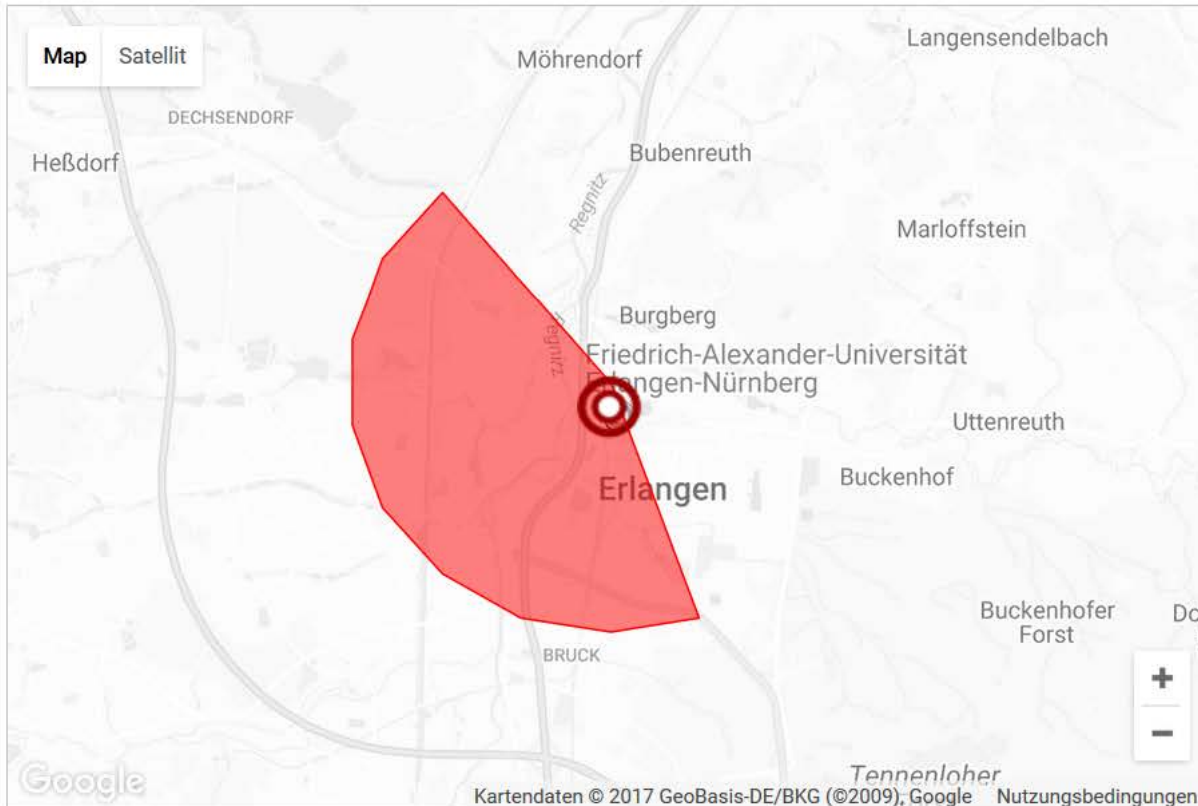


19 incoming messages
26 outgoing messages



duration of internet connection:
20h 38min 22s

Download Data



Speed

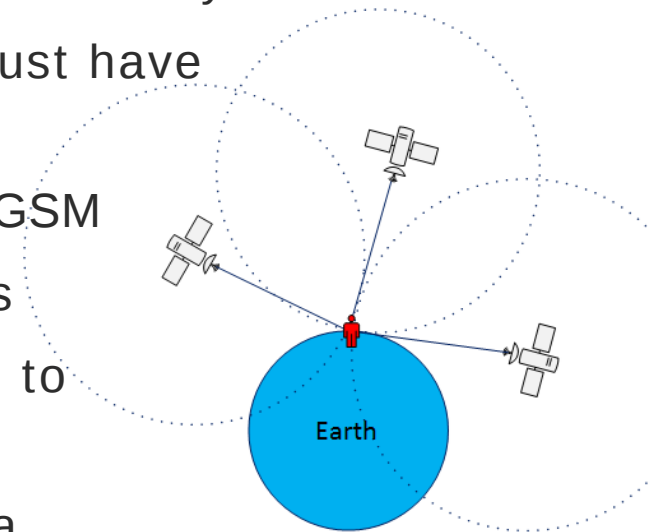
01 Sep 09 01:29

Show the points in time, Malte Spitz was in the selected map segment, too

Source: <http://www.zeit.de/datenschutz/malte-spitz-vorratsdaten>

Mobile Phone Tracking with GPS

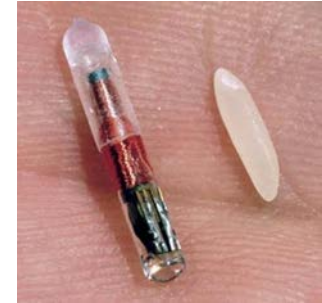
- GPS (as well as GLONASS, BeiDou, and Galileo) receiver (e.g. mobile phone) receives position data from satellites and can thus calculate its own position
 - applied for navigation systems
 - location-based information is determined in this way
- For precise position determination, receiver must have contact with at least 4 satellites
- Locating with GPS is more precise than using GSM
- Communication inside GPS itself is anonymous
 - **But:** Apps can collect GPS data and send it to application servers
 - with Android, you can view stored GPS data in the Google account: <https://www.google.com/maps/timeline>



RFID

RFID: Radio Frequency IDentification

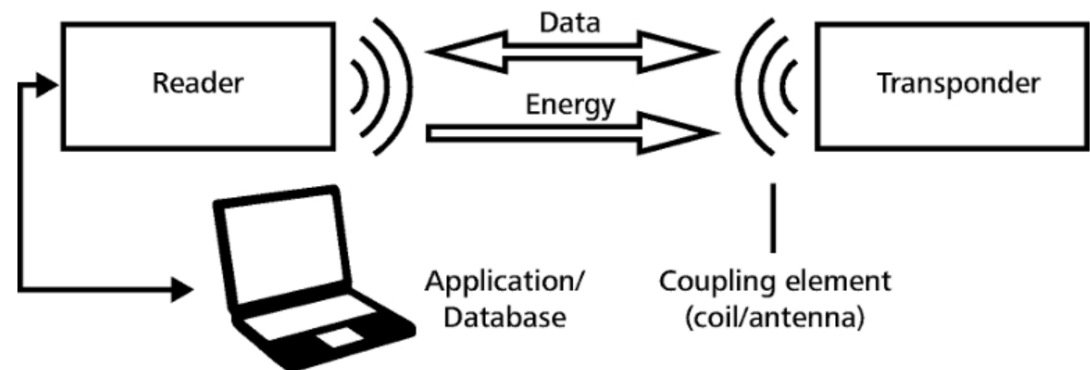
- Radio technology for transceiver systems
- RFID transponders can be very small (rice grain)
- Have a permanent memory, which contains identity (also application or user data possible)
- Transponders are read via radio waves



Quelle: Wikipedia

Use

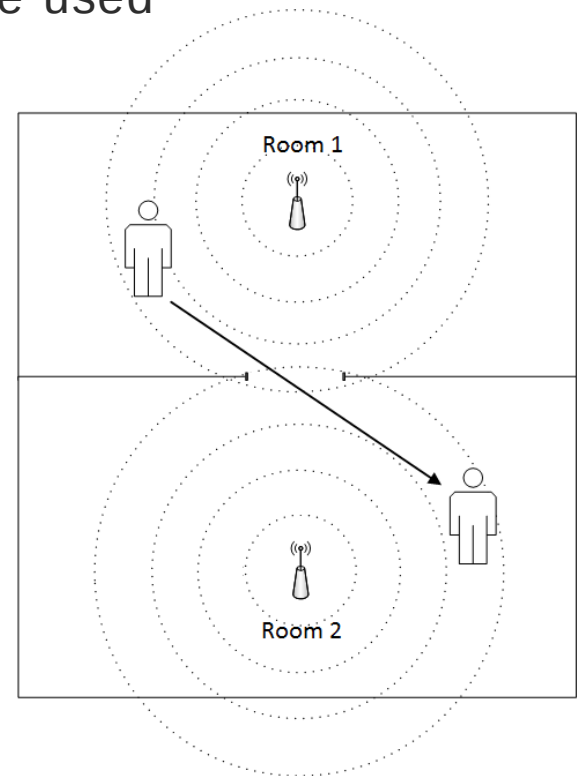
- tagging of objects, patients, ...
- anti-theft
- identification



Source: <https://www.hellermannntyton.de/kompetenzen/rfid-tracking-industrie>

RFID Motion Profiles

- RFID is used to identify and track objects, e.g., packages, clothes, ...
- RFID chips in smart cards or clothing can be used to create motion profiles
 - knowingly or unknowingly by wearer
- Movement from room to room recognizable
 - antennas in every room
 - problems with overlaying signals

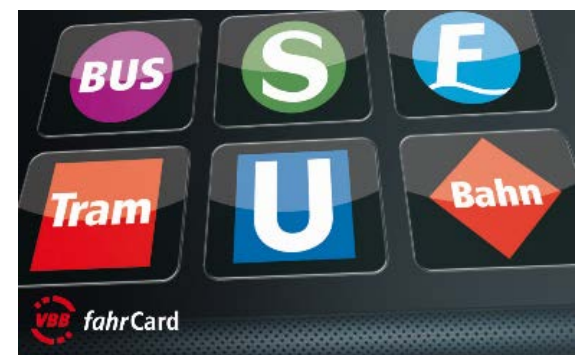


Smart Cards and Motion Profiles

Contactless smart cards are also RFID chips, which usually also have a processor

- Have known check card format
- Use as
 - ID card
 - access control cards
 - cash cards / tickets

Tickets in the form of smart cards can generate motion profiles like storing the entry and exit stations ...



Surveillance Cameras

Surveillance cameras are used to increase security at railway stations, airports, public squares, buildings, etc.

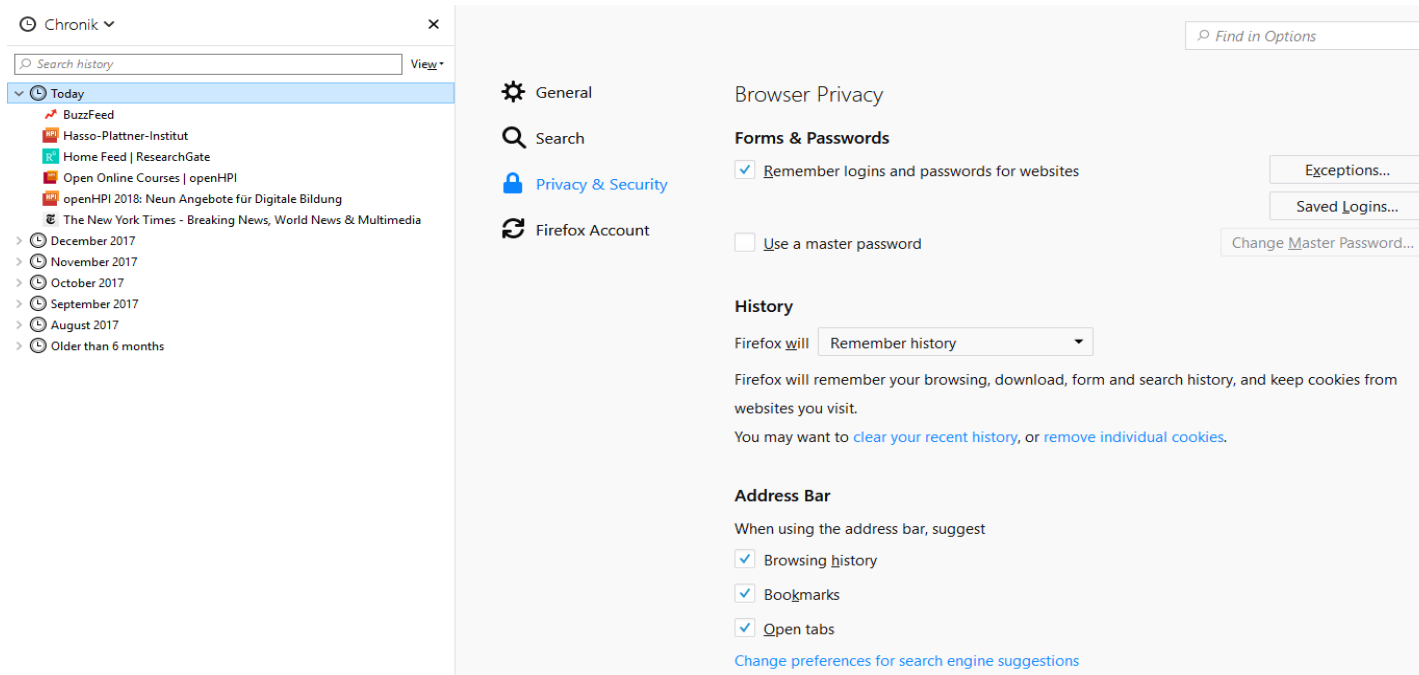
- **But:** With appropriate software, people can be differentiated by their faces, body shapes, clothes, etc.
 - it can be determined when and where a person was captured on camera
 - linking the data of many cameras produces informative movement profiles
- China's CCTV surveillance network includes 170 million cameras
 - it tooks 7 minutes to locate and catch a BBC reporter after he was added to the "suspects" database ...



Image source: University of Washington

Motion Profiles on the Internet (1/4)

- Storage of websites visited, how many, when, how often, how long, etc.
- Data differs for most people
- Internet usage profile, e.g., from the browser's history



The screenshot displays a web browser interface with a sidebar on the left and a main content area on the right. The sidebar, titled 'Chronik', shows a search bar and a list of history items under 'Today', including BuzzFeed, Hasso-Plattner-Institut, Home Feed | ResearchGate, Open Online Courses | openHPI, openHPI 2018: Neun Angebote für Digitale Bildung, and The New York Times - Breaking News, World News & Multimedia. Below these are monthly archives from December 2017 to August 2017, and an 'Older than 6 months' option. The main content area is titled 'Browser Privacy' and contains sections for 'Forms & Passwords' (with checkboxes for remembering logins and passwords, and a master password option), 'History' (with a dropdown set to 'Remember history'), and 'Address Bar' (with checkboxes for browsing history, bookmarks, and open tabs). Buttons for 'Exceptions...', 'Saved Logins...', and 'Change Master Password...' are visible on the right side of the settings panel.

Motion Profiles on the Internet (2/4)

Third-party providers can also create such profiles through their own content on different websites, e.g.,

- social networks, ...
Facebook's Like button, sharing on Twitter, ...
- advertising banner of the same service on different pages
- through third-party javascript files

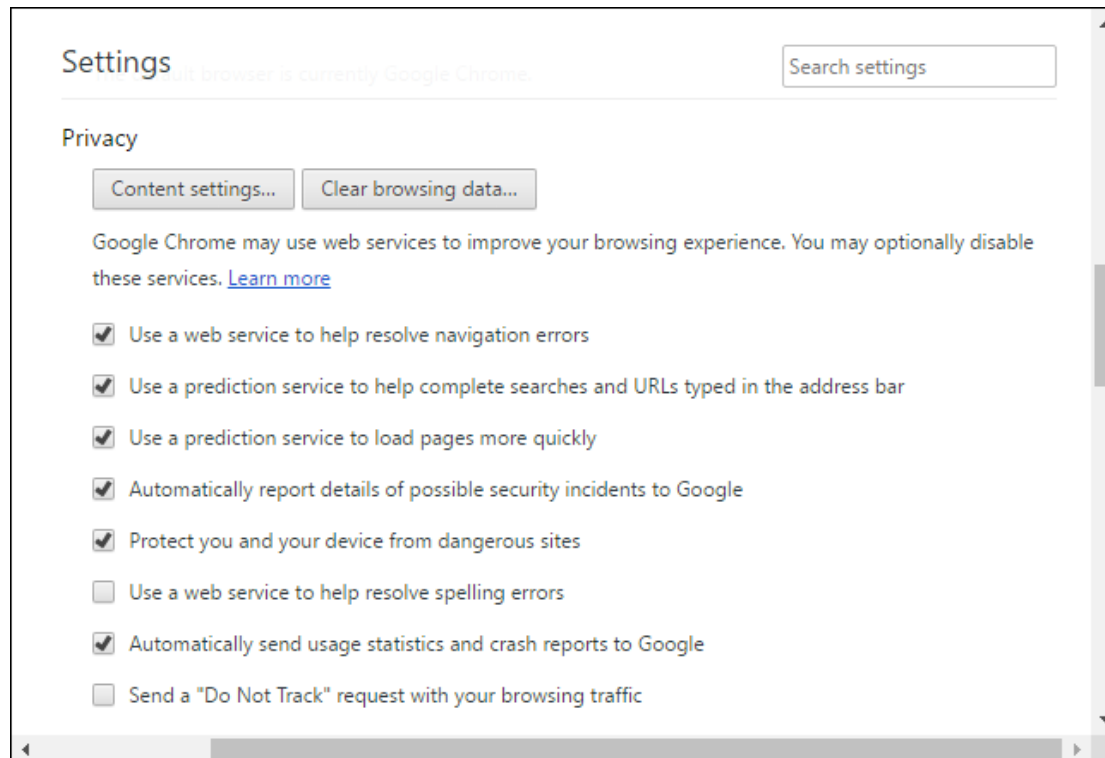
Countermeasures:

Browser plugins like (taking Firefox Web Browser as an example) NoScript, Google / Facebook / Twitter Disconnect, Adblock Plus can block tracking code and other unwanted content

■ **But:** Many modern web sites do not work without JavaScript

Motion Profiles on the Internet (3/4)

Depending on the model and configuration, **browsers send** a series of **data to central services**, allowing tracking, e.g., **Google Chrome**



Advanced settings
for Google Chrome

Motion Profiles on the Internet (4/4)

Depending on the model and configuration, **browsers send** a series of **data to central services**, allowing tracking, e.g., **Google Chrome**

- Send web services send navigation and form data with the data of the currently accessed page for correction of navigation errors, spelling check, or completion
- "Prefetch of resources" function also sends partially entered URLs to Web service
- Manufacturers have a legitimate interest in getting usage statistics, but often sent information is not transparent

Caution: If enabled, "Do Not Track" setting is sent as a request to site operators, but is not a legally binding obligation for them

Conclusion

Digital technologies and innovative features enrich our everyday life with many amenities

Downside: We leave data tracks and very sensitive personal information that is stored externally unknown to us

- If you do not want to live without new digital techniques, you can hardly avoid data traces and motion profiles ...
- However, it is possible to limit the collection of personal data, e.g.,
 - only activate GPS locating on smartphones when necessary
 - only turn on Internet on smartphone when necessary
 - block third-party cookies in browser settings
 - prohibit JavaScripts by third parties with browser plugins
 - ...