



# OSMTrack

Towards the “best iPhone app for adding roads”

Dmitri Toropov  
[dt@osm4iphone.com](mailto:dt@osm4iphone.com)  
[www.osm4iphone.com](http://www.osm4iphone.com)

# Outline

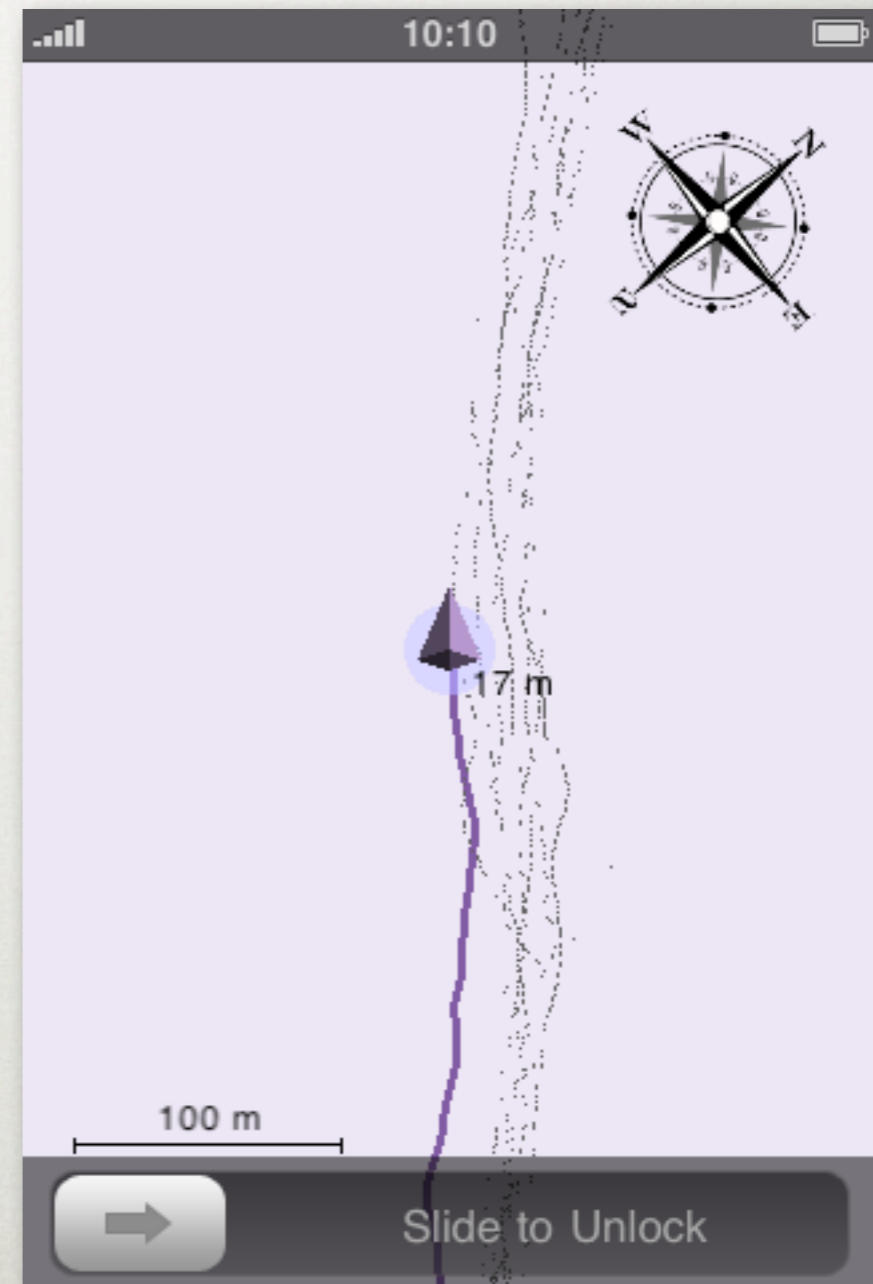
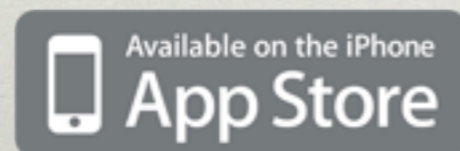
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- OSMTrack today
- Near future
  - The Map
  - Smart logging
- Distant future: automatic way creation

Today & Near future

# OSMTrack today

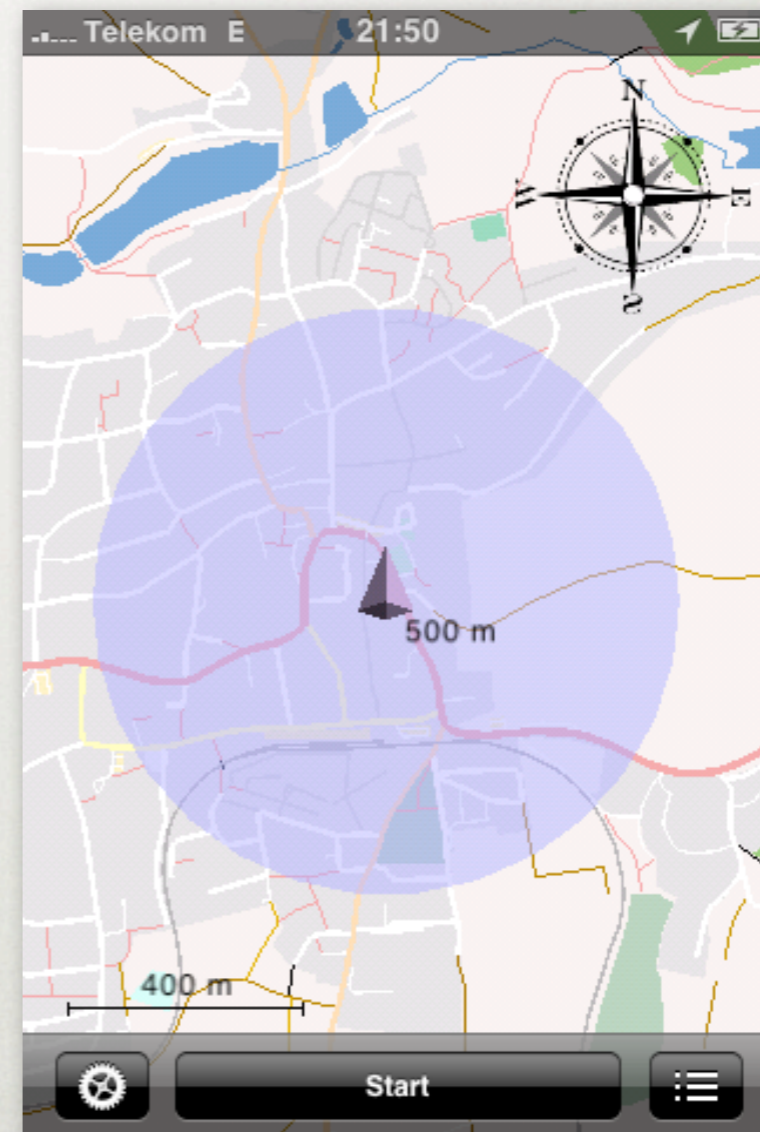
- Zoom- and pan-capable graphical track view
- Direct upload to the OpenStreetMap account as well as sending tracks per email
- Multiple tracks
- Screen lock for in-pocket use
- Preliminary support for waypoints
- Support for both landscape and portrait modes throughout the application



# Coming soon: the Map

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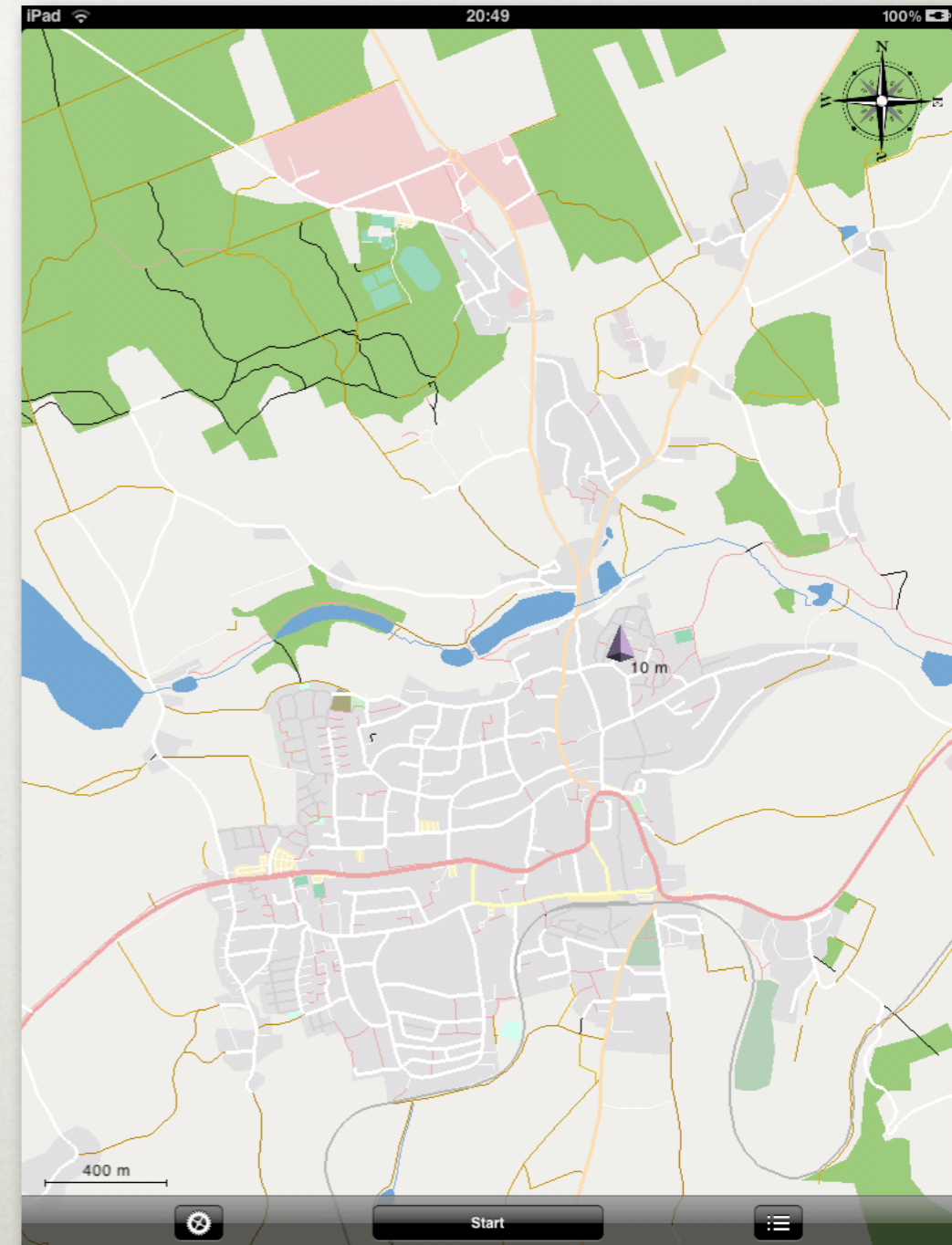
- Offline map
- Rendered on the device in real time from vector map data



# Coming soon: the Map

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- Offline map
  - Rendered on the device in real time from vector map data
- + iOS4 (multitasking), iPad, ...



# Map: the lessons...

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- It is hard to keep the database in sync with the OSM server:
  - The available API's are oriented to a web-server containing the whole world map, not to a mobile device containing a small region

Proposal: SyncML



– XML-based

– A lot of implementations, also open source

– See <http://en.wikipedia.org/wiki/SyncML>

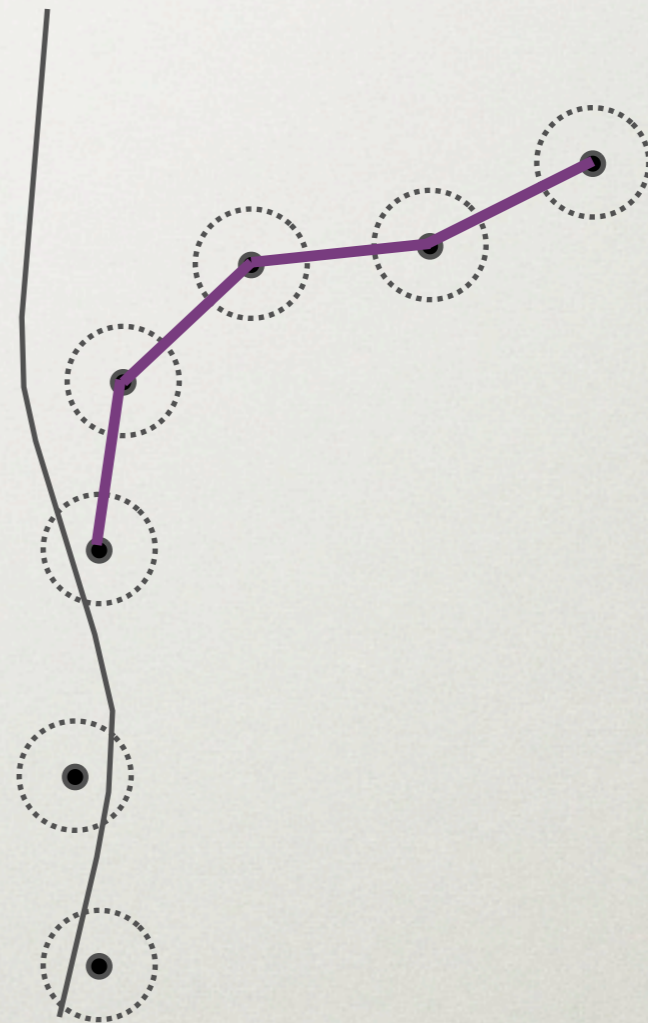
– SyncML 1.2 supports partial database synchronization

– Extensible with vendor-specific data types

# Coming next: smart logging

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- Creates tracks ONLY for the ways that are not in the map
- Especially useful if running in the background mode

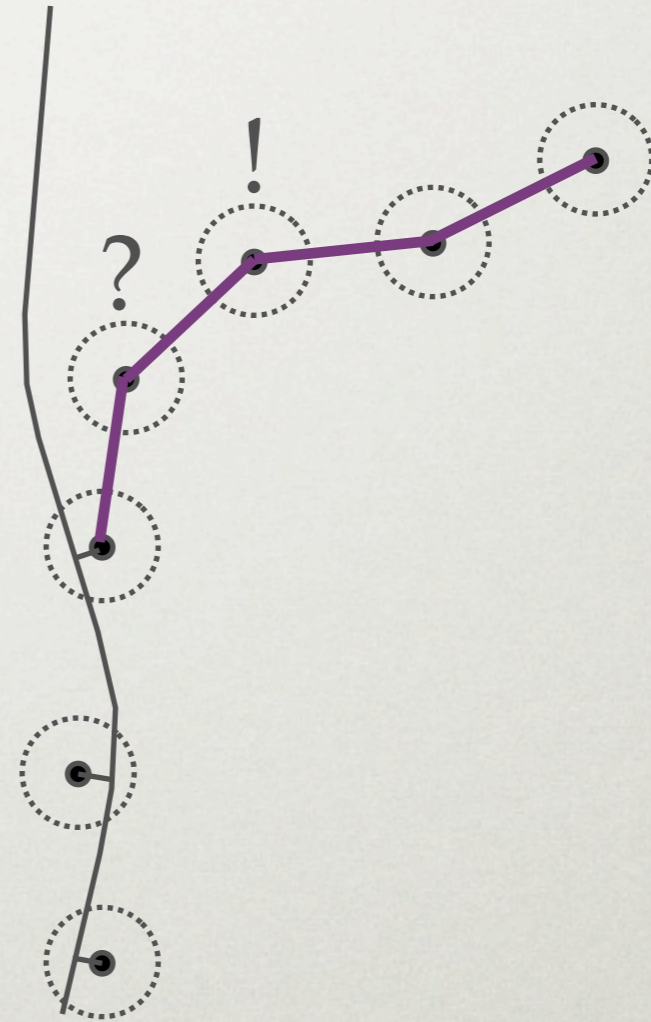




# Smart logging: how?

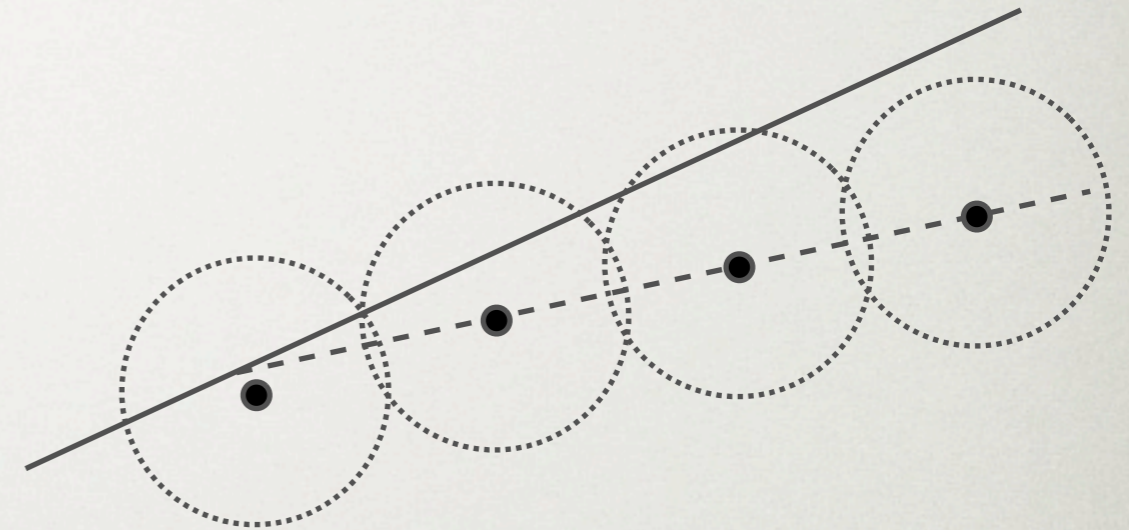
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- Map-match the current position
- If there is no match found (configurable, scale in  $n \cdot \sigma$ ) for certain number of positions - start logging
- If in logging state a match found for certain number of positions - stop



# Map matching challenges

- In some situations with low GPS accuracy a longer history of positions may be needed



- To be reliable map matching should consider:

- Location → Closest distance matching
- Direction of movement → Mahalanobis distance + direction
- Position history and map topology → Hidden Markov Models
- Position history and reasonable speed changes → 1-D Kalman filter for each match candidate

Very complex algorithm!

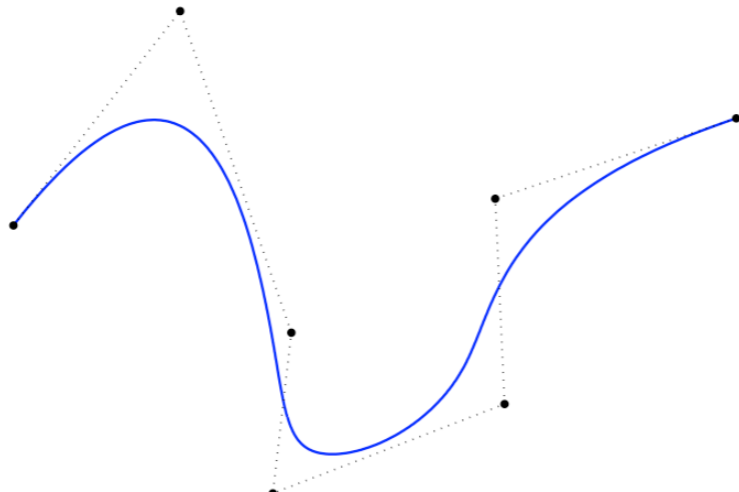
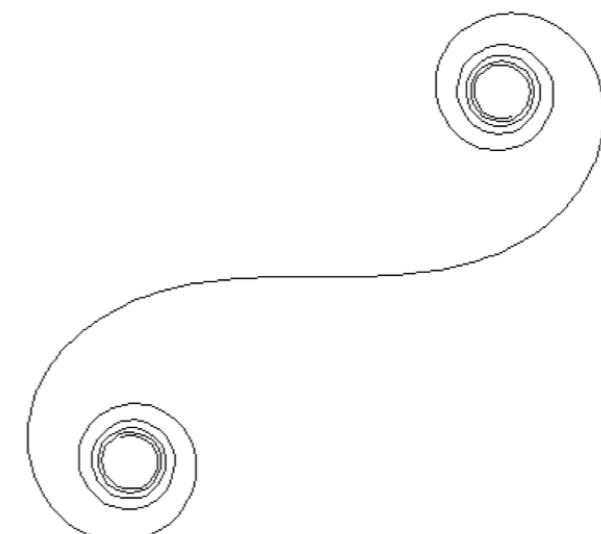
*Automatic way creation*

# Idea

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- Smart Logging will already create tracks for missing parts of the map. → Major part!
- Cut tracks into pieces lying between two consecutive junctions. → Create a way “on the fly”, all “returns” will automatically stop logging + add cutting existing ways
- Reduce the complexity: ways should be smooth with “well behaving” curvature. → Need more sophisticated road geometry model than polyline
- Tag → Cannot be automated

# Road geometry model

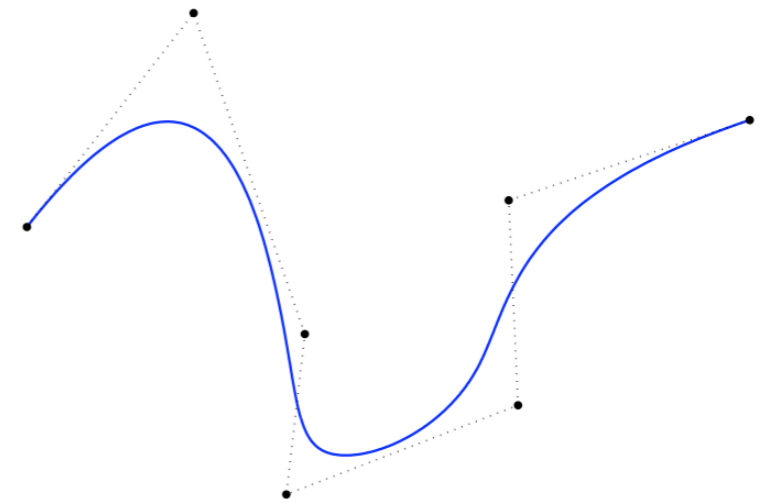
B-Splines	Clothoids
 $P(t) = \sum_{i \in \mathbb{Z}} B_{ik}(t) d_i$	 $\left( \int_0^t \cos(x^2/2) dx, \int_0^t \sin(x^2/2) dx \right)$

- Road geometry model for OSMTrack is yet to be decided

# B-Splines

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- Polynomials, easy to compute
- Used by many map companies as internal format
- Curve fitting is difficult\*
- Needs additional “regularization” to achieve smooth curvature
- Spline’s control points at the moment cannot be directly handled by the OSM server

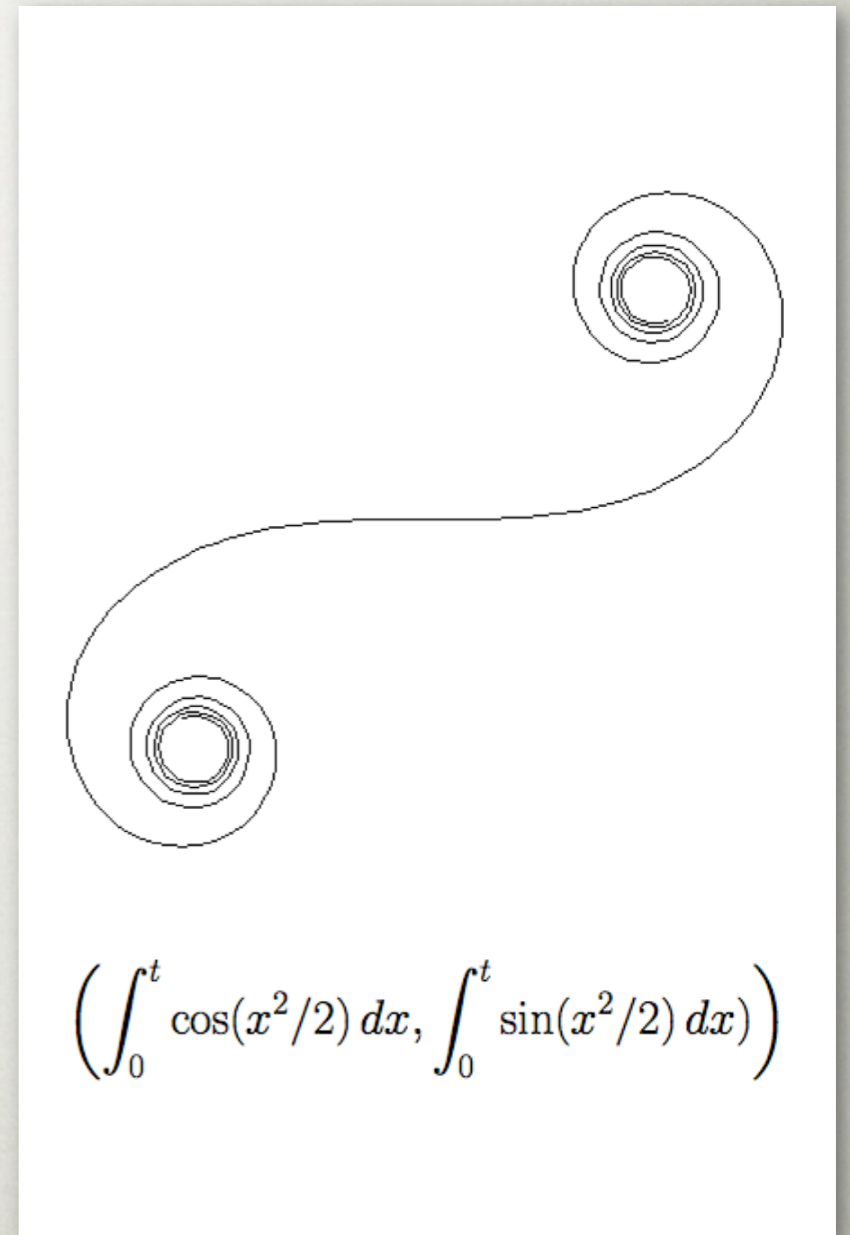


$$P(t) = \sum_{i \in \mathbb{Z}} B_{ik}(t) d_i$$

\*) For curve fitting using B-Splines see: Simon Flöry “Fitting B-Spline curves to point clouds in presence of obstacles.” Diploma thesis. TU-Wien.

# Clothoids

- Curvature changes linearly with arc length
- ‘Natural’ way to build roads
- Part of future NDS standard ([www.psf-initiative.com](http://www.psf-initiative.com))
- A simpler curve-fitting approach exists\*
- Way curvature may be attached to existing way points (way+node)
- Fresnel integrals - hard to compute (map match)



\*) For curve fitting using clothoids e.g. see: James McCrae “Sketch-based path design.” MSc thesis. University of Toronto.

Questions?