REAL-TIME POSITION ANALYSIS DURING SOCCER MATCHES

Oliver May – Lead GIS developer
DFC Software engineering

Company profile

- Belgium-based ICT company
- Independent
- Est 1994

- Located in Ghent

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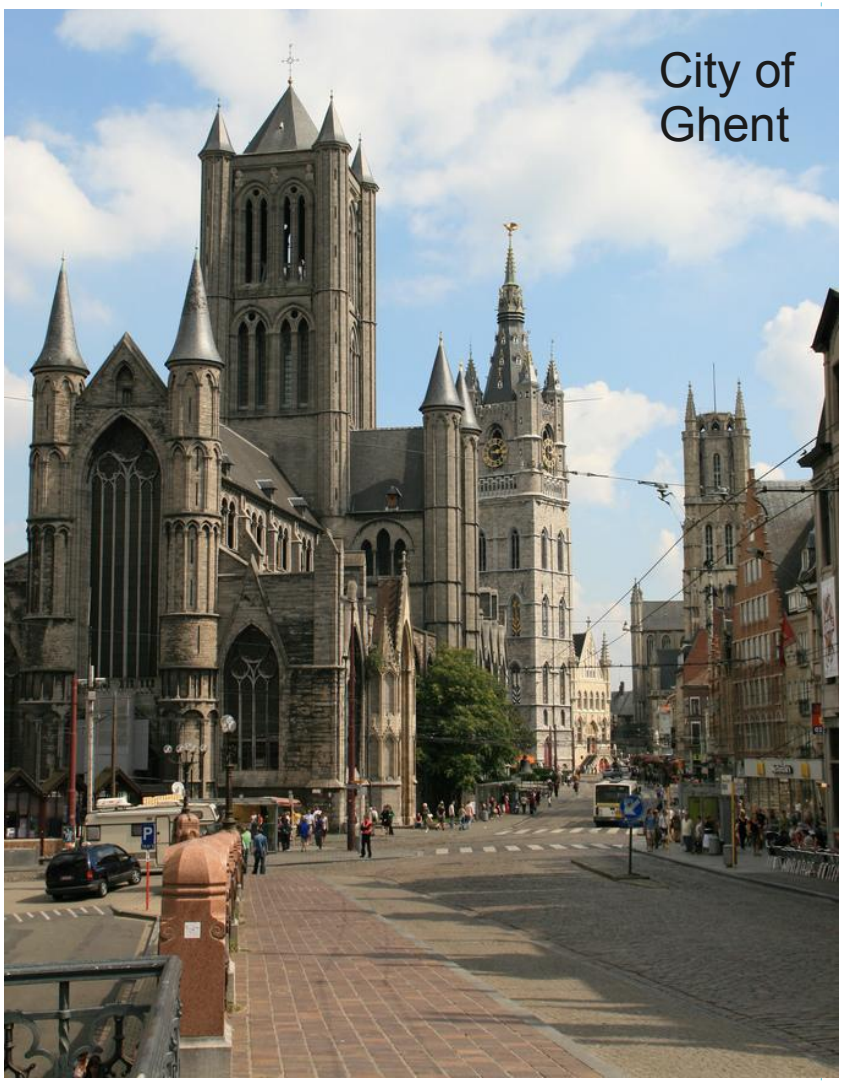


Company profile

- GIS & integration projects
  - Public sector 60%
  - Corporate market 30%
  - Innovation Studies 10%
- Open Source Minded
- Stable, cohesive team: 12 software architects
- www.dfc.be/gis/

Personal profile

- Java Developer
- Joined DFC Software engineering 3 years ago

- Professional interests
  - Open Source Software
  - Software project development techniques
  - People dynamics in project teams

Personal profile

- Accomplishments
  - Project coordination of several strategic GIS projects
  - Implementation of AGILE/Scrum in the GIS team
  - Member of the geomajas Project Steering Committee

The project: BIPS™

- HJB Systems
  - Belgian start up
  - Patented hardware for high accuracy GPS positioning
  - Ball Intelligent Positioning System™
  - GPS receivers built into heart-rate monitors
  - DFC → Build a Proof Of Concept application for Soccer Analysis

Functional requirements

What is the POC meant to do?

Functional requirements (1)

- Real-time visualisation of playing field, players and ball
- Recording and playing of the match data
- Aid the referees during a soccer match
  - Goal
  - Players Offside
  - Ball out
  - ...

Functional requirements (2)

- Training/Match analysis
  - Man marking
  - Ball possession
  - Strategy
  - Health monitoring and statistics
    - Heartbeat sensors

Business requirements

What are the goals of the customer?

Business requirements

- Low cost
  - In the price range of every team
  - No installation on site
    - No complex camera systems
    - No special RF triangulation
    - ...
  - Portable
    - Employable on external locations
  - Software as a service

Technology requirements

How did we (developers) want to build the POC?

Technology requirements

- Requirements?
  - Rendering API for rendering actors on playing field
  - Easy modelling of soccer game
  - Web based (SAAS)
  - Rapid Application Development

Technology of choice

- Choice: 
  - Able to model and display domain logic
  - Web based
  - Known technology
  - Framework allows rapid development
    - Easy extendible
    - Server oriented
    - **100% Java**
      - No time waste debugging JS
      - One project, one team, one language!

Design questions?

Problems we stumbled upon during analysis

Design questions?

- Modelling the playing field
- Aggregating the actor data
- Event system

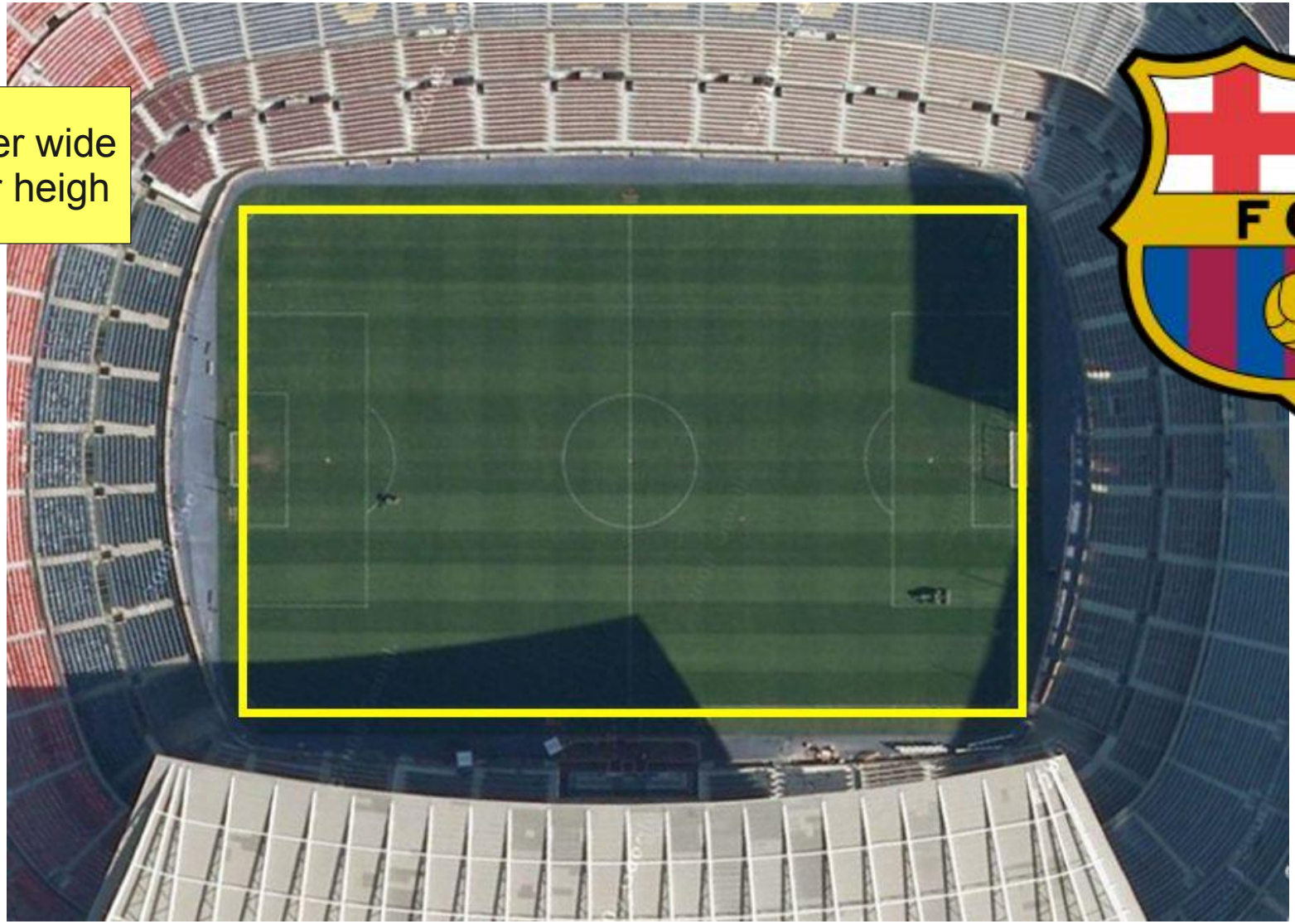
Modelling the playing field

- Lots of soccer fields don't have standard measurements
- Some examples:

(Source: Google maps)

Modelling the playing field

105 meter wide
68 meter heigh



Modelling the playing field

K.A.A. GENT

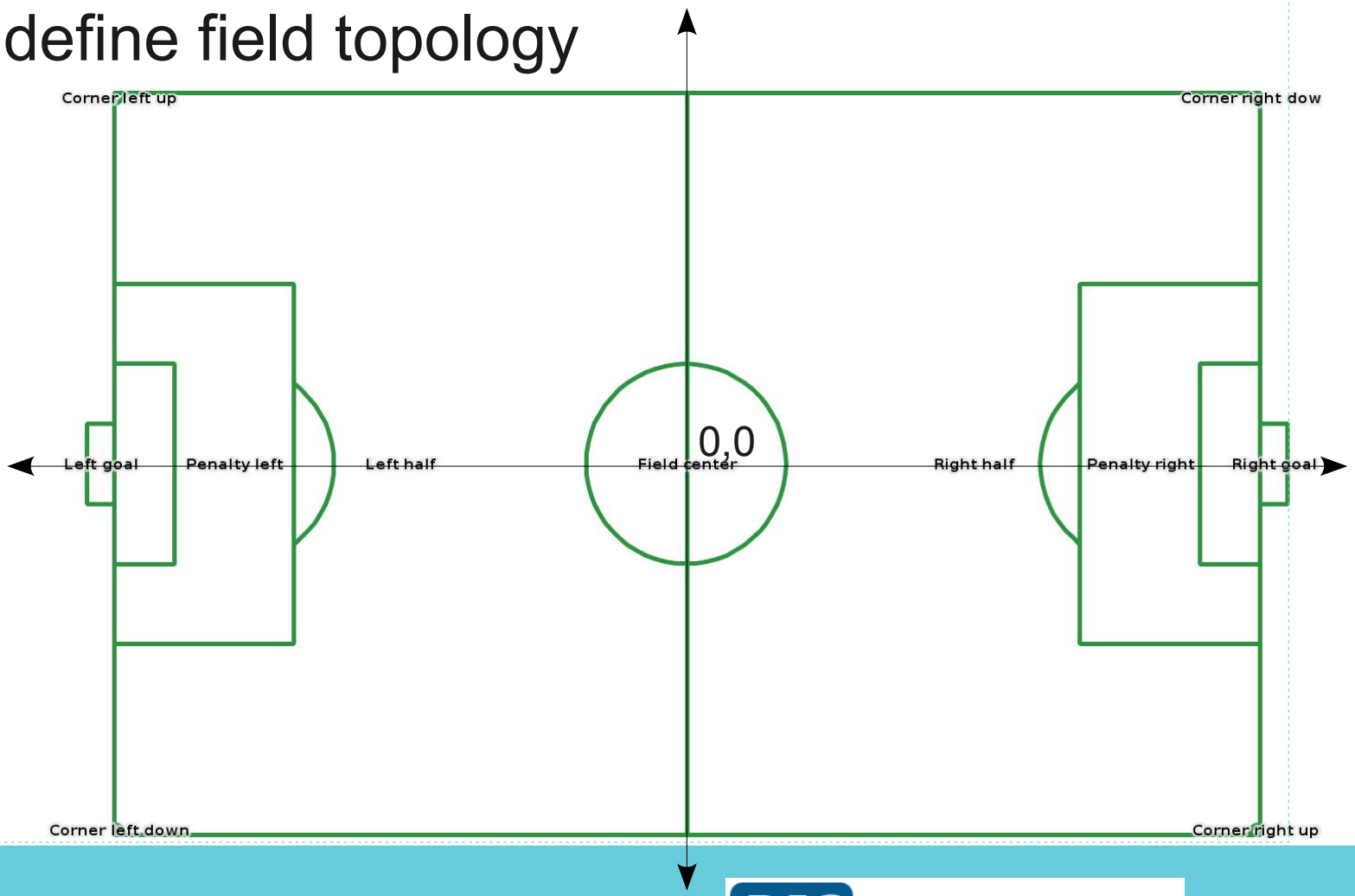
Modelling the playing field

Modelling the playing field

- Problems
  - Playing fields differ in size
    - Length: 90~120 meters (100~110 by FIFA)
    - Width: 45~90 meters (64~75 by FIFA)
  - Positions of zones may differ
    - Goal might not be in exact centre
  - GPS Coordinates differ for every location

Modelling playing field

- Cartesian plane with centre spot: x=y=0
- Polygons define field topology

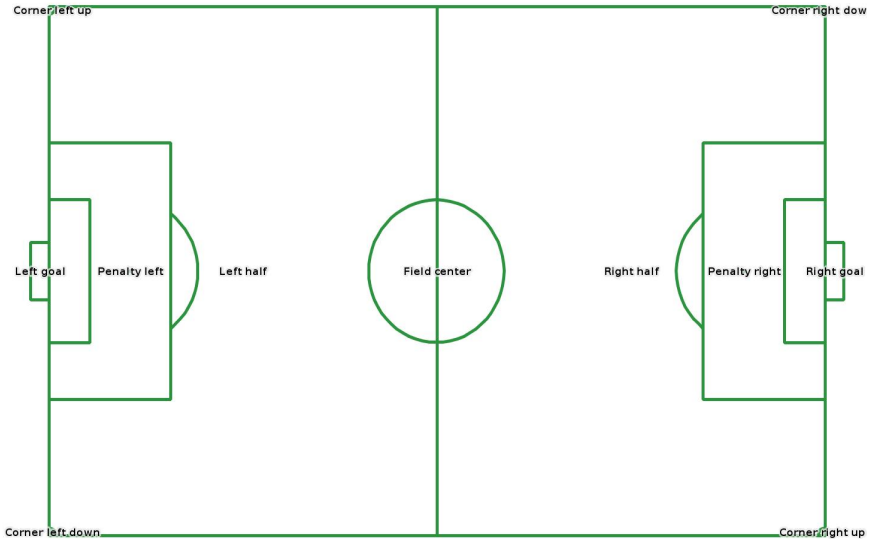


Modelling playing field

- How to cope with variances in different fields?
- Initialisation
  - Measure 4 corners
    - Transformation from GPS coordinates to Cartesian plane
  - Define position of goal and zones, if needed
    - Transform topology to fit reality

Modelling playing field

Transformation
Translation



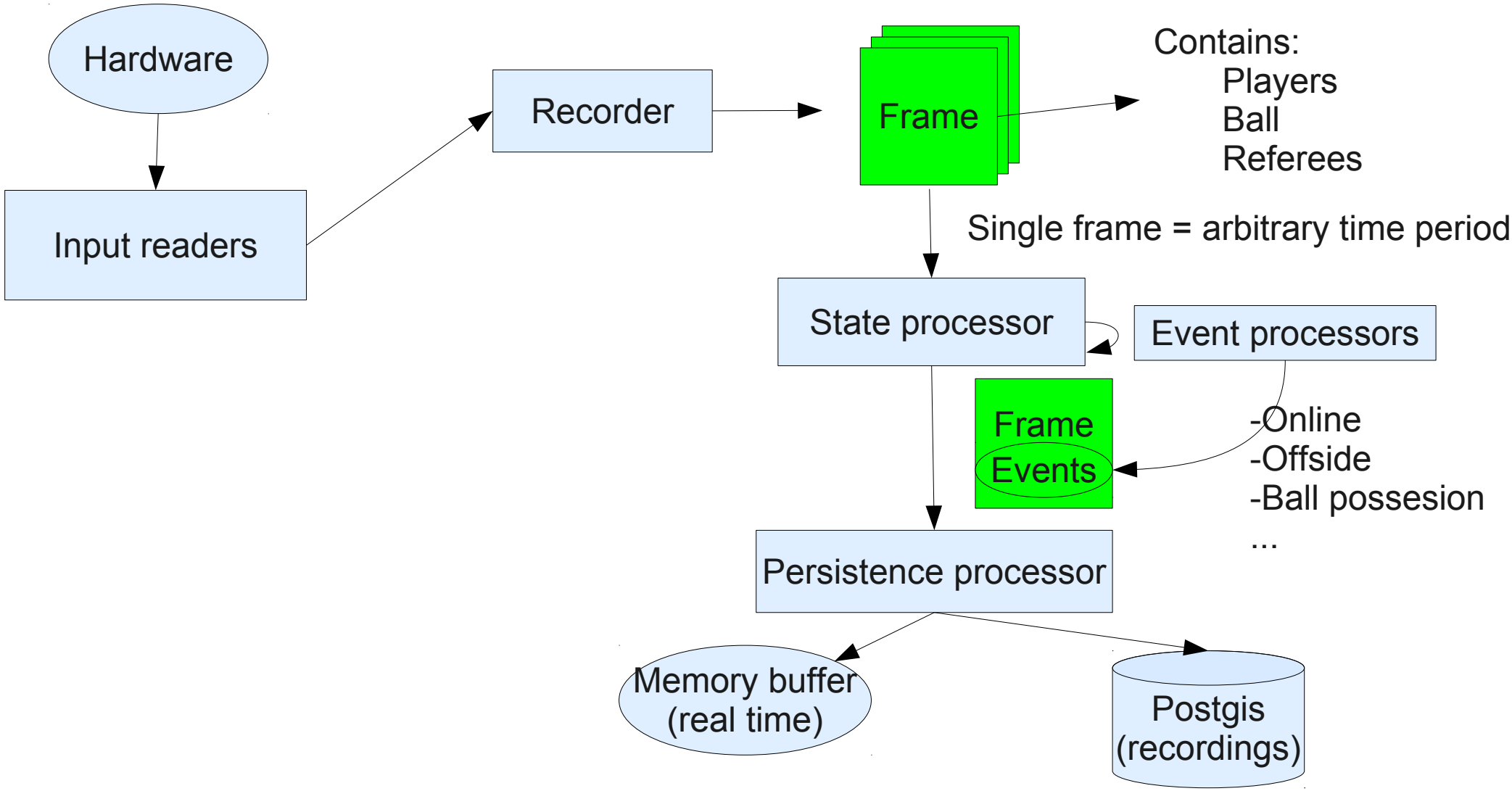
Event system

- How to capture data?
- How to handle events?

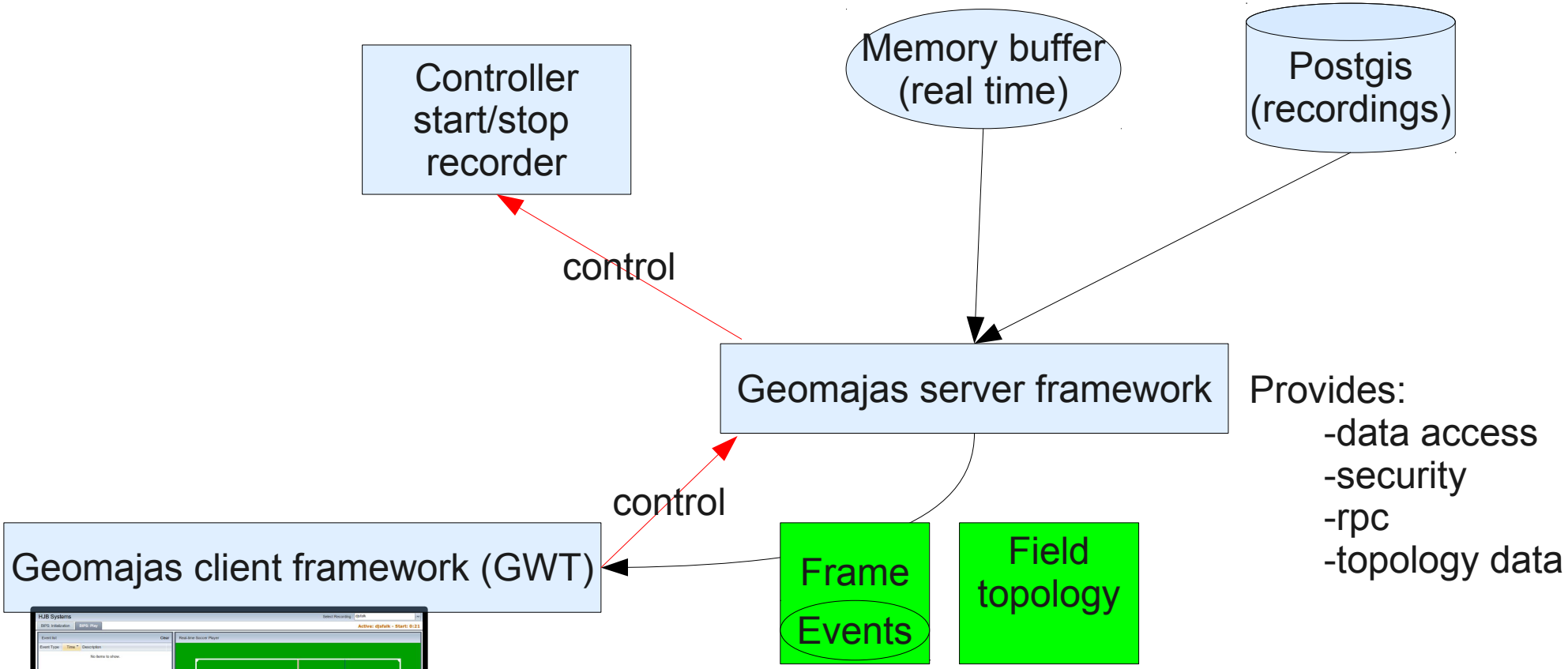
Event system

- Input
  - Actors with sensors via RF
    - 22 players
    - 1 ball
    - 3 referees
- Output
  - Frames with positions of actors
  - Events

Event system model
Server side Java process



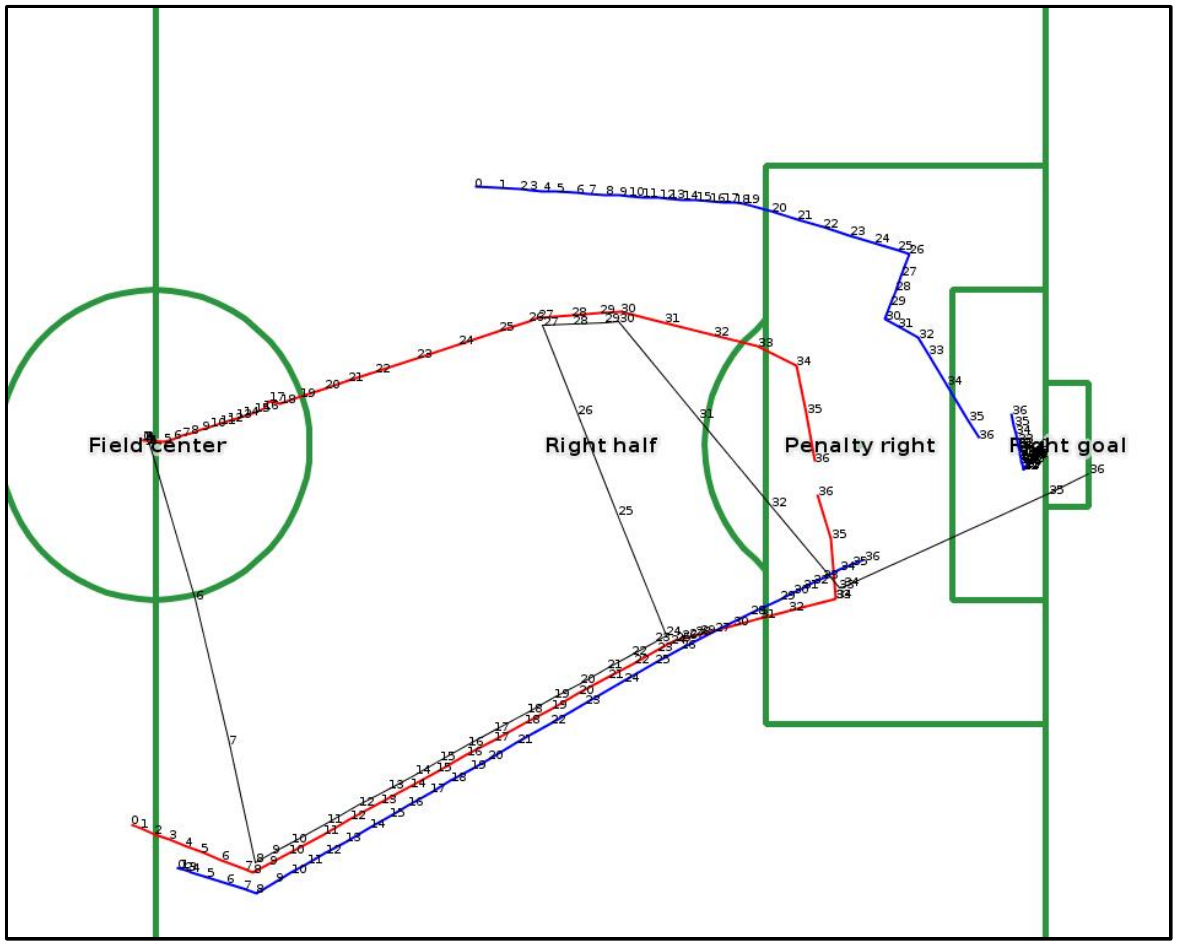
Event system model
Client side Java process



In action (goal)

- Example recording of a goal:

Input data modeled in desktop GIS:



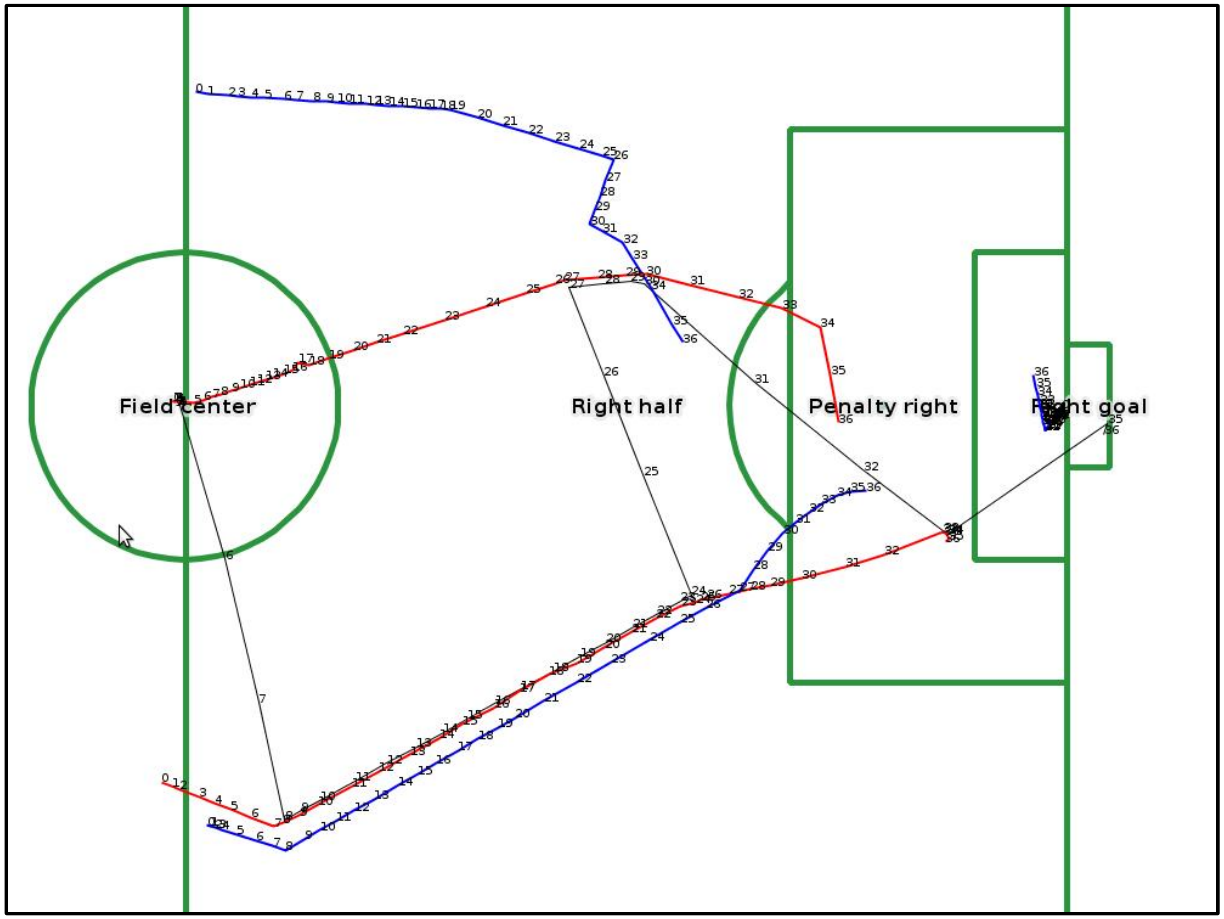
In action (goal)

- Movie

In action (offside)

- Example recording of offside:

Input data modeled in desktop GIS:



In action (offside)

- Movie

Match analysis

Time	EventType	Duration	Description	PlayerName
02:12:04	BALL	6017	Ball ownership: VT 1 (Albert)	VT 1 (Albert)
02:12:08	MANMARKING	7051	Man Marking: HT 2 (Jef) -> VT 2 (Alfred)	HT 2 (Jef)
02:12:08	MANMARKING	7051	Man Marking: VT 2 (Alfred) -> HT 2 (Jef)	VT 2 (Alfred)
02:12:12	DUEL	3018	Duel between: HT 2 (Jef), VT 2 (Alfred)	
02:12:15	BALL	14023	Ball ownership: VT 2 (Alfred)	VT 2 (Alfred)
02:12:29	MANMARKING	2998	Man Marking: HT 2 (Jef) -> VT 2 (Alfred)	HT 2 (Jef)
02:12:29	MANMARKING	2998	Man Marking: VT 2 (Alfred) -> HT 2 (Jef)	VT 2 (Alfred)
02:12:31	BALL	4007	Ball ownership: VT 1 (Albert)	VT 1 (Albert)
02:12:37	MANMARKING	3000	Man Marking: HT 2 (Jef) -> VT 2 (Alfred)	HT 2 (Jef)
02:12:37	DUEL	2001	Duel between: HT 2 (Jef), VT 2 (Alfred)	
02:12:37	MANMARKING	3000	Man Marking: VT 2 (Alfred) -> HT 2 (Jef)	VT 2 (Alfred)
02:12:39	GOAL	0	The visitorteam scored.	

Metrics of development cycle

- One week sprint
- Team of 4 developers
- 20 development days
  - Analysis and sprint planning
  - Test driven development
  - Simultaneously develop client and server thanks to single definition of DTO's
  - Daily SCRUM meetings
  - Delivered POC on time!

- Questions?
- Contact me:
  - oliver.may@dfc.be
  - During foss4g:
    - oliver4g@dfc.be
    - Between sessions at booth 12 (geosparc)
- Thank you for your time!