



# A commit to crowd simulation research

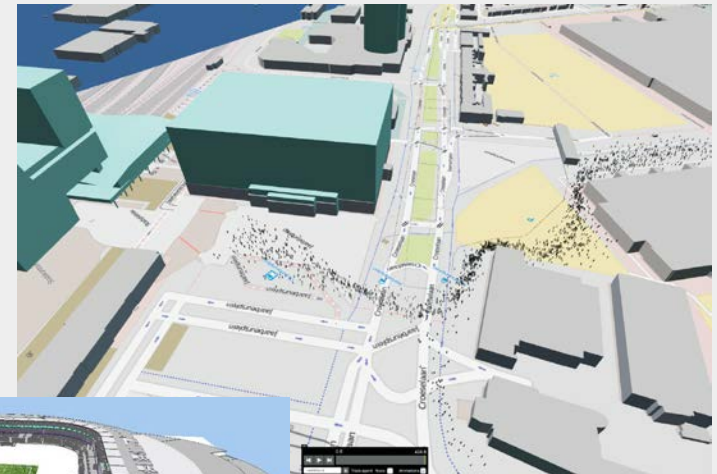
Dr. Roland Geraerts  
COMMIT/ ROYALE: Final event  
9 November 2016



# Crowd simulation in smart cities

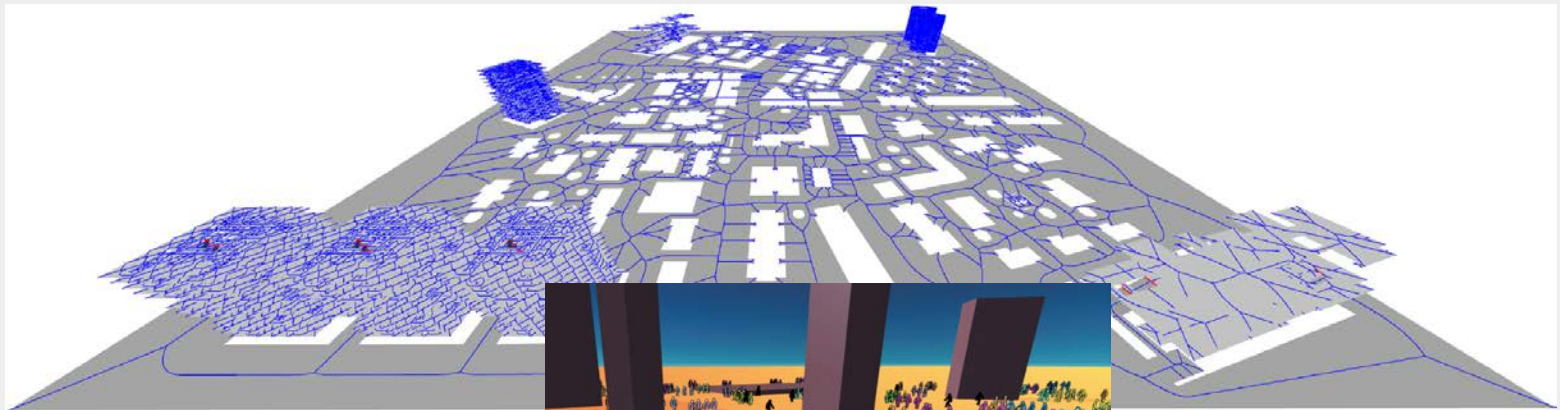
## ■ Challenges

- Determining evacuation times in complex buildings
- Avoiding overcrowded areas during mass events
- Improving the crowd flow in cities



# Our contributions

- Our research and simulation engine
  - simulates >50.000 individuals in real-time;
  - simulates more than one million people on 1 PC;
  - deals with huge 3D multi-layered environments;
  - deals with changes in the environment in real-time; and
  - delivers realistic simulation (including social groups).
- We are investigating crowd prediction



# More information

■ We welcome researchers and companies to collaborate!

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## UU Crowd Simulation Research & Development Towards making a city smarter

The increasing urbanisation of the world population presents new challenges for decision makers. Real-time crowd simulation is crucial in addressing these challenges, including determining evacuation times in complex buildings, avoiding overcrowded areas during mass events, and improving the crowd flow in cities. Based on our research, we have developed a simulation framework with unique features that aim at realism, speed and accuracy. Our software is available for research and commercial use. We welcome researchers and companies to collaborate, e.g. to write joint project proposals or to integrate our framework into their products.



### Our contributions

Our crowd simulation framework can deal with huge 3D multi-layered virtual environments. A filter pipeline extracts an efficient and flexible representation of the walkable areas which are then converted to a navigation mesh. This mesh is used by our framework through a generic five-level planning hierarchy. This enables the simulation of at least 15.000 autonomous and social pedestrians in real-time. The framework can be easily extended with new features, such as bicycles and density-based planning, thus allowing us to address current and future challenges in crowded cities.

Planning Hierarchy	Pipeline	Features
1. High-level planning 	1. Input environment 	Arbitrary agent sizes 
2. Global route planning 	2. Simplification filter 	Dynamic updates 
3. Route following 	3. Slope filter 	Visibility queries 
4. Local movement 	4. Layer filter 	Weighted regions 
5. Animation 	5. Navigation mesh 	Social groups and coordination 
	6. Simulation 	

Recent projects	
Tour de France 2011, Grand Départ, Utrecht (collaboration with Movares)	RoerigZuidSpa 2011, Amsterdam (collaboration with Movares)

Vision & current research
Crowd prediction 
Crowd validation 
Model improvements 

