SCIENCES & BIOENGINEERING SCIENCES

The Web & Information Systems Engineering Lab

has the honor to invite you to the public defence of the PhD thesis of

Maxim Van de Wynckel

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:

Interoperable and Discoverable Indoor Positioning Systems

Supervisor:
Prof. Dr. Beat Signer (VUB)

The defence will take place on

Monday, June 30, 2025 at 3 p.m.

VUB Etterbeek campus, Pleinlaan 2, Elsene, LIC.0.04

The defence can be followed through a live stream: https://phd.maximvdw.be/live

Members of the jury

Em. Prof. Dr. Olga De Troyer (VUB, chair)
Prof. Dr. Elisa Gonzalez Boix (VUB, secretary)
Prof. Dr. Bart Jansen (VUB)
Prof. Dr. Pieter Colpaert (UGent)
Prof. Dr. Kris Luyten (UHasselt)

Curriculum vitae

Maxim Van de Wynckel obtained his Master's in Applied Informatics from the VUB in 2019. He then started his doctoral research at the WISE lab. During his PhD, Maxim presented his work at several international conferences. His research resulted in eight peer-reviewed publications, including seven as first author. Additionally, Maxim has also contributed to several open-source projects such as *OpenHPS* and *SemBeacon*. Further, Maxim was responsible for teaching various exercise sessions in the Bachelor and Master programmes. He supervised four Bachelor and six Master thesis students.

Abstract of the PhD research

Satellite positioning systems such as GPS have made outdoor navigation highly accessible. They enable us to find destinations, locate services, and support technologies like autonomous vehicles and delivery tracking. However, once indoors, these systems no longer function reliably. Determining one's position inside a building is a different challenge altogether. Indoor positioning systems aim to address this need and have found applications in environments such as airports, hospitals, shopping centres and warehouses. They support tasks like navigation, asset tracking, smart building management and robotic automation.

Despite their growing relevance, most indoor positioning systems are isolated solutions that rely on different technologies and proprietary software. As a result, they are often limited to a single building or use case and cannot easily be reused elsewhere. Users frequently have to install separate applications or accept new conditions to access these systems, leading to a fragmented experience and raising privacy concerns. For building managers and developers, the high cost and complexity of deploying such systems can be a barrier to adoption. Moreover, the lack of standardisation makes it difficult for systems to share data or work together effectively.

This dissertation investigates how to improve the *interoperability* of indoor and outdoor positioning systems. It proposes a framework for enabling consistent and seamless exchange of location data across different platforms and technologies. The research introduces new machine-readable vocabularies that make it easier for systems to interpret and share information about locations. It also explores methods for systems to discover each other and exchange data without requiring prior coordination, increasing flexibility and reducing dependence on tightly integrated setups.

An important aspect of the proposed solution is the emphasis on user control. By supporting privacy-aware data management and reducing reliance on closed, vendor-specific applications, the framework aims to offer a more open and user-centric alternative. The ultimate goal of this research is to support the development of a unified ecosystem for positioning systems, where location data can be managed and shared efficiently across various contexts while preserving trust and interoperability.