Foundations and tools for processing tree structured data

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Summary
The course is about the foundations and tools for processing tree structured data, a prevalent model for representing semi-structured data (SSD) over distributed information networks. It aims at presenting approaches, programming languages and tools for modeling and manipulating tree-structured info.

Content
The theoretical part introduces underlying concepts sustaining the approach. The practical part illustrates the application of the concepts in a concrete context: the development of Web applications that make use of an XML native database (one category of the NoSQL databases) and associated XML languages.

Theoretical foundations
• Tree grammars
• Finite tree automata
• Type systems to describe and validate the structure of SSD
• Document Type Definition
• XML Schema
• RELAX NG and Schematron

Querying tree structured data and programming
• Navigation and extraction of information from tree structured data (XPath expressions)
• Tree data transformation (XSLT)
• Query and programming language (XQuery) incl. Static Type Checking

Application scenario
• Use of a development framework in which all these languages fit

Keywords
Tree-shaped data representation and processing, Foundation of XML types, Tree grammars, XML core technologies, Web applications

Learning Outcomes
By the end of the course, the student must be able to:
• Explain and understand the differences - strengths and weaknesses - of a tree structured model in comparison with other data models.
• Understand the fundamental principles of a strongly typed language to manipulate tree structured data.
• Use core languages for modeling, querying, repurposing and processing tree structured data.
• Identify situations where information management requirements can be more appropriately dealt with a tree structured data model approach.
• Get a flavor of research ongoing in the domain.

Teaching methods
Ex cathedra lectures and group mini-projects.

**Expected student activities**
Attend the lectures
Work on mini-project

**Assessment methods**
Written exam and mini-project evaluation.