

Tutorial Proposal - DBKDA 2026-

Title: A Web-Component Primer for Database Developers

Organizers:

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Abstract:

The W3C web standard “Web Components” contains a collection of different technologies that allow you to create reusable, user-defined HTML elements and integrate them into any web application. This allows the semantics of HTML to be extended with new, user-defined components whose semantics and visual appearance can be freely defined. This approach has a number of advantages:

- A component has a clearly defined functionality and a simple, declarative interface, which supports reuse. Through the use of html attributes and subelements, the components are highly configurable.
- The declarative nature also allows non-programmers to develop more complex applications based on available powerful web components. For example, web components can be used to integrate existing domain-specific markup languages within HTML.
- The ability of web components to communicate with backend processes enables the development of powerful and highly specialized components.

Keywords:

Web development, Declarative Web, W3C composite standard

Aims and Learning Objectives:

The aim of this tutorial is to introduce the technologies underlying web components and to demonstrate step by step how to develop and use your own web components. A continuous example is constantly expanded and also serves as the basis for the tasks in the practical exercises. In detail, the following topics will be covered: Custom elements, Shadow DOM, slots/templates, asynchronous access to remote resources. In addition, the aspect of linking between components is addressed. In our experience, this is essential for the successful implementation of a domain-specific extension of HTML that is easy to use and at the same time allows sufficient flexibility.

The tutorial includes a series of practical exercises that participants can complete on their laptops. The exercises are designed to reinforce the theoretical concepts using practical examples. Participants will be provided with a simple Docker-based environment and code snippets from web components, which they can expand and adapt. In addition, participants will be provided with a GitHub repository containing a series of examples for specific use cases, which can serve as a starting point for further development.

Provided materials:

- Slideset
- Practical exercises
- Docker container containing a Web-Server and a bunch of example files

Target Audience:

Web developers and backend developers who are interested in declarative interfaces for the services they develop.

Prerequisite Knowledge of Audience:

Participants should be familiar with Javascript and HTML. At least knowledge of an object-oriented language would be helpful.

Detailed Outline:

- Introduction/Motivation
- Custom elements
- Shadow DOM
- Hands-on Part I
- Interaction with other elements of the application
- Communication with a backend service
- Templates and slots
- Hands-on Part II
- Summary & Outlook

(several short breaks as needed)

Further relevant information:

The authors have been working with web components for a long time and have already published a number of articles in this field. They also have extensive experience in giving tutorials at international conferences (see the following bibliography).

Relevant Publications concerning Web-Components:

Andreas Schmidt, Tobias Münch. “Low-Code Web Database Integration: Enhancing Workflow Efficiency and Collaboration with Web Components and Generic Web Services”. Lecture Notes in Business Information Processing, Springer [to appear: 30/8/2025]

Tizian Berger. “Entwicklung einer komponentenbasierten Web-Mapping-Plattform auf Basis von Leaflet und Web Components”. Bachelor Thesis, Karlsruhe University of Applied Sciences [to appear 9/2025].

Andreas Schmidt, Tobias Münch: “A Lightweight Web Component Toolbox for Database-Driven Web Applications”. International Journal on Advances in Software ISSN: 1942-2628, 2025

Tobias Münch, Andreas Schmidt, Sebastian Heil, Martin Gaedke. “MoralWeb: Reimagining the Web with Solid, Low-Code Tools, and Moral Codes for an Democratic and Equitable Future”. 25th International Conference on Web Engineering (ICWE 2025), Delft, Netherlands, 2025.

Andreas Schmidt, Tobias Münch: “A Low-Code Approach for Creating Dynamic Map-Based Web Applications Using W3C Web Components”. Proceedings of the 17th International Conference on Advances in Databases, Knowledge, and Data Applications (DBKDA 2025), 2025.

Andreas Schmidt, Tobias Münch. “Enable Business Users to Embed Dynamic Database Content in Existing Web-Based Systems Using Web Components and Generic Web Services.” In Proceedings of the 20th International Conference on Web Information Systems and Technologies (WEBIST 2024), 2024.

Andreas Schmidt, Tobias Münch. “Web Components for Database Developers”. Proceedings of the 16th International Conference on Advances in Databases, Knowledge, and Data Applications (DBKDA 2024), Athens, Greece, 2024 [Best Paper Award].

Previous given Tutorials:

Tobias Münch. Tutorial: “Vanilla JS – Design and Implementation of a Progressive Web Application from Scratch”. 24th International Conference on Web Engineering (ICWE 2024). Tampere, Finland, 2024

Andreas Schmidt, Anis Koubaa. Tutorial: “Practical Data Science Using the Shell”. 20th International Conference Applied Computing (AC 2023), Funchal (Madeira), Portugal, 2023

Andreas Schmidt, Tutorial: “Knowledge Discovery and Information Retrieval using the Shell”. 14th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management (KDIR), Valetta/Malta, 2022

Andreas Schmidt, Steffen Scholz, Tutorial: “How to build a Search-Engine with Common Unix-Tools”. The Tenth International Conference on Advances in Databases, Knowledge, and Data Applications, DBKDA 2018, Nice, France, 2018

Andreas Schmidt. Tutorial: “A Practical Approach for Teaching Model Driven Software Development – A plea for the ‘from scratch’ Approach”. Workshop at the EDUCON 2018 – IEEE Global Engineering Education Conference, Santa Cruz de Tenerife, Spain, 2018.

Andreas Schmidt, Steffen Scholz; Tutorial: “Data Science using the Shell”, 20th International Conference on Enterprise Information Systems (ICEIS), Funchal, Madeira, 2018

Andreas Schmidt, Steffen Scholz: Tutorial: “An Introduction into statistical computing with R”. Seventh International Conference on Internet Technologies & Applications, Wrexham/Nord Wales, 2017.

Andreas Schmidt, Steffen Scholz: Tutorial: “Data Manipulation and Data Transformation using the Shell”. Ninth International Conference on Advances in Databases, Knowledge, and Data Applications (DBKDA-2017), Barcelona/Spain, 2017

Andreas Schmidt, Steffen Scholz; Tutorial: "An Introduction into statistical computing and natural language processing with R". Tutorial at the 8th International Conference on Advances in Databases, Knowledge, and Data Applications, Lisbon, Portugal, 2016.

Kimmig, D., Schmidt, A.: Tutorial: "The Hadoop Core – Understanding Map Reduce and the Hadoop Distributed File System". Tutorial, DataSys 2013, November 17 - 22, Lisbon, Portugal, 2013

Schmidt, A.: Tutorial: "Overview of the Hadoop Ecosystem". Fifth International Conference on Internet Technologies & Applications (ITA-13), Wrexham, Wales, 2013.

Schmidt, A.: Tutorial: "The power of regular expressions in the software development process", International Conference on Software Engineering and Applications (SEA 2010), Marina del Rey, USA, 2010

Schmidt, A.; Tutorial: "Building a Multi-Purpose Generator Engine"; 11th International Conference on Internet and Multimedia Systems and Applications (IMSA 2007, Honolulu, Hawaii, USA), 2007

Schmidt, A.; Tutorial: "Programming Patterns and Architecture of Web-based Database Applications". 8th International Conference on Internet and Multimedia Systems and Applications 2004, Kauai/USA, 2004

Tutorial example slides or repositories:

- ICWE 2024: https://github.com/tomuench/icwe2024_tutorial
- KDIR 2022: <https://www.smiffy.de/KDIR-2022/>
- DBKDA 2021: <https://www.smiffy.de/dbkda-2021/>

Instructor Details:

Prof. Dr. Andreas Schmidt is a professor at the Department of Computer Science and Business Information Systems of the Karlsruhe University of Applied Sciences (Germany). He is lecturing in the fields of database information systems, data analytics and model-driven software development. Additionally, he is a senior research fellow in computer science at the Institute for Applied Computer Science of the Karlsruhe Institute of Technology (KIT). He regularly gives tutorials on international conferences in the field of Big Data related topics and model driven software development. Prof. Schmidt followed sabbatical invitations from renowned institutions like the Systems-Group at ETH-Zurich in Switzerland, the Database Group at the Max-Planck-Institute for Informatics in Saarbrücken/Germany, and the Database Group at the University of Darmstadt/Germany.

Tobias Münch is the CTO of Münch Gesellschaft für IT-Solutions and a Ph.D. student at Chemnitz University of Technology. For ten years, he has implemented various PWA solutions in the finance, veterinary medicine, and logistics sectors. In his past research, he has focused on the maintainability of the World Wide Web and the use of standards.

Tizian Berger has just completed his bachelor's degree. In his thesis, under the supervision of Prof. Andreas Schmidt, he developed a series of web components that enable the declarative definition of web-mapping applications based on the Leaflet library. He is currently doing his master's degree in business information systems at Karlsruhe University of Applied Sciences. He also teaches an elective course in web mapping at Karlsruhe University of Applied Sciences.