<table>
<thead>
<tr>
<th>Data field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module number</td>
<td>WP08</td>
</tr>
<tr>
<td>German title / English title</td>
<td>Verteilte Systeme und Dienste / Distributed Systems and Services</td>
</tr>
<tr>
<td>Credits</td>
<td>5 ECTS</td>
</tr>
<tr>
<td>Workload</td>
<td>68 Contact hours (4 SWS Ü), 82 Hours of independent study</td>
</tr>
<tr>
<td>Subject coverage</td>
<td>Subject-specific specialization</td>
</tr>
<tr>
<td>Learning outcomes</td>
<td>Students understand fundamental properties of distributed systems relevant to the design and implementation of communication systems. They know standard design patterns for distributed systems and can design and build software that makes optimal use of features offered by operating systems and network protocols. The students understand current trends in distributed systems research and standardisation.</td>
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<tr>
<td>Requirements</td>
<td>none</td>
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<tr>
<td>Level</td>
<td>1./2. Semester</td>
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<tr>
<td>Type of module</td>
<td>Seminar, Laboratory Training</td>
</tr>
<tr>
<td>Status</td>
<td>Required-elective module</td>
</tr>
<tr>
<td>Semesters when offered</td>
<td>Every semester</td>
</tr>
<tr>
<td>Method of assessment / Type of examination</td>
<td>The method of assessment / type of examination must be defined by the lecturer within the deadline determined in §19 (2) RSPO. Should the deadline pass without determination of the form of assessment in the module, the following method of assessment / type of examination applies: 50% Written examination, 50% Written laboratory report of the laboratory group with consultation</td>
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<tr>
<td>Grade assessment</td>
<td>See study and examination regulations</td>
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<tr>
<td>Equivalent modules</td>
<td>Modules with similar content</td>
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<tr>
<td>Content</td>
<td>• Foundation of operating systems: resource-management, process abstraction and life-cycle, scheduling mechanisms</td>
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<td></td>
<td>• Foundation of communication systems: Two-Army-Problem, principal properties of communication channels, network transport protocols</td>
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<td>• Inter-process communication: signals, shared memory, pipes, sockets</td>
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<td></td>
<td>• Understand typical issues in distributed systems: error-cases, synchronisation, distributed time-base and event mechanisms</td>
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<td>• Socket-programming in Java and C</td>
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<td>• Properties of low-power wireless networks such as 802.15.4</td>
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<td>• Communication Architectures: Client/Server, Publish/Subscribe, P2P</td>
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<td></td>
<td>• Middleware-Architectures: Remote Procedure Calls (RPC) and application protocols: (HTTP, HTML, XML, JSON)</td>
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<td>• Exemplary distributed architectures: DNS &amp; Web</td>
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<td>• Designing RESTful services with AJAX and JSON</td>
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<td></td>
<td>• Design of application scenarios for wireless sensor networks</td>
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<td></td>
<td>• Using the Contiki-OS for 8/16/32-bit microcontrollers</td>
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<td>• Analysis of use cases for communication protocols (real-time communication, management of limited resources, energy efficiency, excessive packet drop, secure deployment and operation)</td>
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<tr>
<td>Reading list</td>
<td>A. Tanenbaum, M. van Steen: Distributed Systems, Prentice-Hall</td>
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<tr>
<td></td>
<td>G. Bengel: Grundkurs Verteilte Systeme, Springer Vieweg</td>
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<tr>
<td></td>
<td>R. Stevens, S. Rago: Advanced Programming in the UNIX Environment, Addison-Wesley</td>
</tr>
<tr>
<td>Further information</td>
<td>Language employed in the module: English</td>
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<tr>
<td>Required Room type</td>
<td>U-Sem, U-Lab</td>
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