

Preface

This SpringerBrief is a spin-off from the EDA (European Defence Agency) research project RACUN (Robust Acoustic Communications in Underwater Networks), which started in August 2010. RACUN has partners from the five countries Germany, Italy, Netherlands, Norway, and Sweden. The overall goal is to develop and demonstrate the capability to establish an underwater ad hoc robust acoustic network for multiple purposes with moving and stationary nodes.

One of the first research tasks in RACUN was a literature survey of state-of-the-art in underwater acoustic communication networks. When this work was done, it was decided that it would be a pity to keep a thorough literature survey on this rapidly emerging topic internal to the project. Therefore, we are glad to publish a slightly edited version of the RACUN literature survey as a SpringerBrief.

This literature survey presents an overview of underwater acoustic networking. It provides a background and describes the state of the art of various networking facets that are relevant for underwater applications. This report serves both as an introduction to the subject and as a summary of existing protocols, providing support and inspiration for the development of underwater network architectures. In recent years, other overview and survey papers have been published on the subject [1–6]. These papers can be consulted in addition to the present survey, which is however more comprehensive. Developments in the field of underwater sensor and communication networks are rapid, and new papers and protocols appear continuously.

The focus of this report is OSI layer 2 “Data Link Layer” and OSI layer 3 “Network layer”. Several definitions can be found on the term “Link layer”. In the OSI model, layer 2 “Data link layer” is split into two sublayers, MAC (medium access control) and LLC (logical link control). LLC is the upper of these sublayers.

After an introduction in [Chap. 1](#), topics bordering the physical layer (time synchronization, full-duplex links, and adaptive data rate) are discussed in [Chap. 2](#). MAC is discussed in [Chap. 3](#), where considerations on frequency-division and code-division multiple access are followed by a detailed study on time-based multiple access technologies. [Chapter 4](#) discusses logical link layer topics, including relatively new techniques such as fountain codes and network coding.

Chapter 5 gives an overview of routing (OSI “network layer”), including considerations on delay-tolerant networks.

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Chapter 1 was written by Paul van Walree. **Chapter 2** was written by Thor Husøy (Sects. 2.1–2.2) and Knut Rimstad (Sect. 2.3). **Chapter 3** was written by Paul van Walree (Sects. 3.1–3.2), Michael Goetz (Sect. 3.3), Ivor Nissen (Sect. 3.3), and Roald Otnes (Sect. 3.4). **Chapter 4** was written by Roald Otnes and Alfred Asterjadhi (Sect. 4.4.5). **Chapter 5** was written by Paolo Casari, Alfred Asterjadhi, and Michele Zorzi.

In addition to the authors, the following helped in reviewing the original RACUN report: Jeroen Bergmans, Henry Dol, and Zijian Tang (TNO, Netherlands), and Svein Haavik and Jan Erik Voldhaug (FFI, Norway).

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