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Low-Earth orbit satellite constellations for global communication network connectivity

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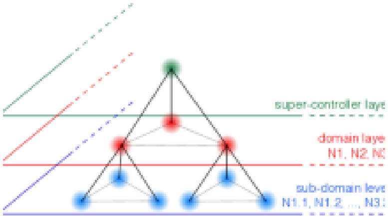
Abstract

The satellite communications sector is experiencing a revolution pushed by the unprecedented deployment of satellites in low-Earth orbit (LEO) constellations for connectivity solutions. Innovative technologies have led to cost-effective manufacturing. Lower launch costs have encouraged private ventures to deploy broadband LEO networks targeting market opportunities such as internet services for remote or under-served areas, mobile connectivity, governmental services and communication services for emergency response and disaster relief. Ubiquitous coverage and resilience are key characteristics of space-based communications. However, LEO satellite operators face several technical challenges, which need to be addressed to unleash the full potential of this promising technology. Here, we describe the developments in the field of LEO broadband constellations and discuss the challenges to establish a LEO-based extension to current 5G and coming 6G cellular networks. We also present the advancements that are, from the beginning of the 2020s, empowering LEO constellations to become a fundamental complement to, and be integrated with, terrestrial-based communication networks. Finally, we introduce the activities related to standardization, experimental validations and demonstrations and present our own vision on the potential of the technology to transform the space-based connectivity.



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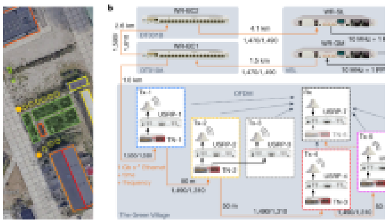

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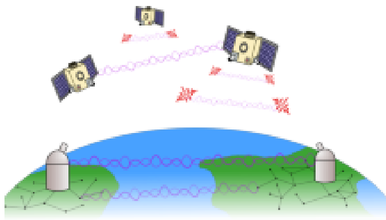

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Contributions

B.O. conceived the original idea. E.L. led to the contribution and writing of the manuscript. B.O. and S.C. provided contribution, advice and supervision. All authors reviewed and agreed on the manuscript before submission.

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Ethics declarations

Competing interests

The authors declare no competing interests.

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