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Covert Channels: Attack Models and Research Challenges

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Abstract: The increasing complexity of networks and computing platforms jointly with the unbounded growth of data volumes lead to an attack surface difficult to control. A recent offensive trend takes advantage of covert channels, i.e., abusive communication paths hidden within legitimate network traffic and data. Covert channels demonstrated their effectiveness to exfiltrate sensitive information, avoid detection, retrieve malicious payloads, or bypass execution enclaves. Unfortunately, their mitigation is difficult and poorly generalizable since it strictly depends on the used hiding mechanism or the targeted digital object. Being able to model the behavior of network traffic, workload or software components is then a mandatory step, especially to reveal the presence of hidden communications. This talk presents the main attack scenarios, functional ambiguities and imperfect isolation features exploited by malware to create covert communication mechanisms. Then, it discusses some countermeasures and the main research challenges to be faced for mitigating and detecting modern advanced threats.

Bio: Luca Caviglione (male) is a Senior Research Scientist at the Institute for Applied Mathematics and Information Technologies of the National Research Council of Italy. He holds a Ph.D. in Electronic and Computer Engineering from the University of Genoa, Italy. His research interests include optimization of large-scale computing frameworks, traffic analysis, wireless and heterogeneous communication architectures, and network security. He is the author or co-author of more than 190 academic publications, and several patents in the field of p2p and energy-aware computing. He has been involved in Research Projects and Network of Excellences funded by the ESA, the EU and the MIUR. He is also a contract professor in the field of networking/security and a board member for the PhD program in Security, Risk and Vulnerability of the University of Genoa (Cybersecurity and Reliable AI). He is the head of the IMATI Research Unit of the National Inter-University Consortium for Telecommunications, part of the Steering Committee of the Criminal Use of Information Hiding initiative within the European Cybercrime Center, and a Work Group Leader of the Italian IPv6 Task Force.

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