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Information Exposure for Consumer IoT Devices: A Multidimensional, Network-Informed Measurement Approach

ABSTRACT

The “Data Revolution” is transforming our society in an irreversible way at a pace Internet of Things (IoT) devices are increasingly found in everyday homes, providing useful functionality for devices such as TVs, smart speakers, and video doorbells. Along with their benefits come potential privacy risks, since these devices can communicate information about their users to other parties over the Internet. However, understanding these risks in depth and at scale is difficult due to heterogeneity in devices’ user interfaces, protocols, and functionality.

In this work, we conduct a multidimensional analysis of information exposure from 81 devices located in labs in the US and UK. Through a total of 34,586 rigorous automated and manual controlled experiments, we characterize information exposure in terms of destinations of Internet traffic, whether the contents of communication are protected by encryption, what are the IoT-device interactions that can be inferred from such content, and whether there are unexpected exposures of private and/or sensitive information (e.g., video surreptitiously transmitted by a recording device).

We highlight regional differences between these results, potentially due to different privacy regulations in the US and UK. Last, we compare our controlled experiments with data gathered from an in situ user study comprising 36 participants.

BIOGRAPHY

Daniel J. Dubois is a postdoctoral research associate at Northeastern University’s Khoury College of Computer Sciences, working with Professor David Choffnes on understanding the privacy implications of the Internet of Things.

His research is rooted in software engineering, specifically on decentralized and self-adaptive software architectures. As his work has matured, he has become more interested in distributed systems, in particular from a privacy perspective, which he focuses on now. Daniel earned his PhD in information engineering from Politecnico di Milano, where he interned at IBM Haifa Research Lab, working on optimizing live Virtual Machines migrations.

He then participated as a postdoctoral research fellow at the MIT Media Lab funded by the MIT-Italy Rocca Fellowship, as well as Imperial College London funded by the Marie Skłodowska-Curie program. Dubois received both his bachelor’s degree and his Master’s degree from Politecnico di Milano as well as another Master’s degree from the University of Illinois at Chicago.

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