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Tracing the Invisible: A Privacy-Centric Labeling System for IoT Data Flows

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The growing use of Internet of Things (IoT) devices in homes and workplaces has presented significant security issues, particularly due to the opacity with which devices function and handle personal data, especially when cloud services get introduced. Increasingly, IoT platforms rely on external cloud infrastructure to mediate even basic device operations, using remote servers as middle-men to issue commands rather than enabling direct local communication. This architecture not only increases latency but also facilitates continuous data extraction and cross-border transmission, often without user awareness, despite increasing consumer concern and heightened regulatory scrutiny. The majority of end-users remain unaware of the cyber risk they are exposed to, the pathways that their data traverses, the extent of its sharing, and the associated hazards. This study introduces an innovative, privacy-focused labeling system intended to monitor, measure, and classify the data streams of IoT devices. Devices are categorized based on criteria including data transmission volume, destination, tracker usage, and frequency of routing packets through external servers. The aim of the proposed framework is to improve transparency and enable customers to make privacy-conscious decisions. It will also create a basis for regulatory benchmarking, tackling the visibility and accountability shortcomings in IoT ecosystems.

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