

All Things Considered: An Analysis of IoT Devices on Home Networks

Introduction:

The first large-scale empirical analysis of IoT devices in real-world homes is provided by leveraging data collected from user-initiated network scans of 83m devices in 16m households. More than half of households have at least one IoT device in three global regions and in North America more than 70% of homes have a network connected device. Media devices like smart televisions are most common in seven of eleven global regions, but there is significant variance otherwise. Wi-Fi inspector allows users to scan their local network for insecure IoT devices. To provide users with a human readable list of hosts on their network, Wi-Fi inspector runs a classification algorithm against the application-and transport layer data collected in the scan. a significant portion of the work is based on identifying the manufacturers and types of IoT devices in homes.

Theory:

Device Classifier Performance: The final classifier combines the supervised classifier and expert rules, and achieves 92% coverage and 96% accuracy against a manually labeled set of 1,000 devices.

Regional Distribution of Homes: The 15.5m homes and 83m devices in the dataset they are from geographically diverse regions. Because this breakdown is representative of Avast market share rather than organic density of homes and devices, our analysis is limited to within individual regions.

IOT In Homes—: The percent of households that have one or more of each type of IoT device and the percent of devices (in gray) in each region that are of a certain type is shown. For example, 42.8% of homes in North America have at least one media device and 44.9% of North American IoT devices are media devices. For the presence of any IoT device, the percent of homes with an IoT device is reported.

IOT Device Distribution By Region: IoT device type distributions vary between different geographic regions. For example, surveillance devices are most prevalent in Asia, whereas home automation devices only appear in North America and Europe.

Regional Similarities: The regional similarities are calculated by computing the Spearman's rank correlation test over each region's rank order list of most popular types of devices. Correlation coefficients presented are out of 100. North America has the highest density of IoT devices of any region. South American homes are the least similar to North America of any region. Eastern and Western Europe are both most similar to Oceania, primarily due to the three regions sharing a similar fraction of storage devices. The four regions (East, Central, South, and Southeast) of Asia are analyzed separately as they have different IoT profiles. The North Africa, Middle East (combined) region is most similar to Eastern Europe. Oceania ranks third to North America and Western Europe in terms of fraction of homes that contain an IoT device (49.2% of homes).

IoT Device Vendors: The devices from 14.3K unique vendors were found. In all regions, 100 vendors account for more than 90% of devices and 400 vendors account for 99%. In contrast, some device types are almost entirely dominated by one or two vendors. For example, Amazon and Google produce 91.9% of voice assistants and Hikvision produces 18.6% of surveillance devices. Regional differences in vendor preferences may cause the observed variance in vendor distributions across device types. To measure this, the pairwise Spearman's correlation for each vendor distribution across every pair of regions is computed.

Home Security: Beyond understanding the landscape of IoT devices, the security profile of devices in homes is investigated, including devices that allow weak authentication, the security profile of home routers, and the presence of homes that exhibit scanning behavior on a large darknet.

Conclusion:

In several regions, the majority of homes now have at least one networked IoT device. We analyzed the types and vendors of commonly purchased devices and provided a landscape of the global IoT ecosystem. We further analyzed the security profile of these devices and networks.

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