Mdsclone: Multidimensional Scaling Aided Clone Detection in Internet of Things

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ABSTRACT Cloning is a very serious threat to the Internet object (IoT) because of the simplicity of an attacker collecting configuration and authentication credentials from a non-tamperable node and replicating the network. In this research, we suggest MDSClone, a new method of discovery based on multidimensional measurement (MDS). MDSClone seems perfectly appropriate for Internet objects scenarios, since (i) it detects clones without having to know the geographical positions of the nodes, (2) unlike the previous methods, it can be applied to hybrid networks consisting of both fixed and mobile nodes, Navigate in advance. In addition, another advantage of MDSClone is that (iii) the basic part of the detection algorithm can be parallel, leading to a full acceleration of the detection mechanism. Our comprehensive analytical and experimental assessments demonstrate that MDSClone can achieve the probability of 100% clone detection. In addition, we propose several modifications to the original MDS account, resulting in more than 75% acceleration in large-scale scenarios. The demonstrated competence of MDSClone proves to be a promising way to design a practical clone detection in Internet objects.

The Internet of Things (IoT) is an emerging network model in which a large number of interconnected devices are connected to facilitate communication between people and things [1]. For example, the smart city consists of smart sectors, such as smart homes, smart hospitals, and smart cars, which are important applications for Internet things. In the Smart Home scenario, each Internet tool is equipped with integrated sensors and wireless communication capabilities. The sensors are able to gather environmental information and communicate with each other, as well as the home owner and central monitoring system. In the intelligent hospital scenario, which can be performed using BSN, patients wear implantable sensors that collect body signals and send data to a local or remote database for further analysis. For example, in a smart traffic scenario, sensors embedded in cars can detect accidents and traffic information, and share this information collaboratively. In calculating their limited features and capabilities, Internet devices are vulnerable to many security threats. For example, Internet devices can easily capture objects, leading to clone attack (also known as node replication attack). In such a scenario, the captured device is reprogrammed, duplicated, and put back into the network. Moreover, in special cases (eg, wrong configuration or production by unreliable manufacturers with antagonistic intentions), reliable devices can cause clone attacks [4]. The cloning attack is extremely damaging, because cloning with legitimate credentials will be considered legitimate organs. Therefore, these versions can easily perform various malicious activities in the network [5], [6] such as launching an attack from within (eg, a black hat attack) and injecting erroneous data that leads to risks in the Internet scenario.

View the problem.

While there is fairly extensive literature on the methods of detecting replication attack in WSN networks [8], [8] this is still an open problem when it comes to Internet scenarios. In particular, compared to traditional WSNs, the two unique characteristics of the Internet environment things make the creation of cloning detection schemes in the Internet things a more challenging issue. First, there is a lack of accurate geographic location information for the devices. For example, embedded devices in smart cars are more likely to derive information from a vehicle's navigation system, ie GPS, while appliances in a smart home or BSN are unlikely to have built-in GPS capability, High and additional hardware requirements [9]. Secondly, IoT networks are hybrid networks consisting of fixed and mobile devices without a predetermined mobility pattern (which can be fixed or move at high or low speeds) [10], for example, a patient with wearable sensors living in a smart home. Wearable devices can be considered as mobile nodes, because the patient may move, while most devices in the smart home are immobile. In fact, Internet objects can be redefined, without a preset navigation pattern (can be fixed, move at high speed, or move slowly) [10]. Although some methods of detecting current cloning of mobile networks (for example, [11] - [13]) can be applied to hybrid networks (consisting of both fixed and mobile devices), these methods suffer from a reduced probability of discovery a certain. Here, we show how to deal with these challenges and provide modern solutions in detecting cloning attacks.We propose a clone detection method that does not rely on geographic positions of nodes. Instead, by adopting the MDS algorithm, we generate the network map based on the relative neighbor-distance information of the nodes. While most of the state-of-the-art clone detection methods assume that each node is always aware of its geographical position, this assumption does not hold for all the IoT devices [9]. Therefore, by removing such an assumption in MDSClone, we significantly advance the existing clone detection solutions for IoT.

RELATED WORK

In recent years, due to increased interest in adopting WSNs in many applications, there has been an increased interest in providing WSN security solutions, among which the discovery of the polarization attack has attracted considerable attention. In this section, we review ways to discover the most relevant copies of our work, and clarify the difference between our proposal and the current work associated. The researchers [7], [8] suggested several classifications of the cloning detection approach based on the information required (for example, site-dependent or stand-alone), detection methods (ie, centralized, distributed or partially distributed) (Ie mobile or fixed networks). The proposed MDSClone approach is in the category of independent central roads that support hybrid (fixed and mobile) networks. We believe that the central nature of MDSClone is not flawed, taking into account IoT's municipal-level technologies such as NarrowBand-Internet of Things (NB-IoT) [16] and LoRaWAN [17]. Indeed, the central security control solution is fully in line with the hierarchical structure supported by such technologies, which is currently supported by key players, including Cisco and Orange. For example, the current deployment of LoRWWAN, which is being developed in the city of Rome, focuses on all the movement of Internet sensors. Things collected by several dozen radio stations spread throughout the municipality of Rome and the relevant neighbors in one central network server (logically) The natural candidate to host an approach to detect anomalies such as MDSClone.

In the case of fixed networks, the common method of detecting copies is the detection of witnesses. In essence, the idea behind the discovery of witnesses is that the presence of cloned animals should lead to conflicts in situ. More specifically, each node u collects the location information, L (v), from adjacent nodes, for example v, and sends the aggregated site claims hv; L (v) i to some specified nodes. The contract, which receives two site requests with the same identifier v, but with two different sites, will act as a witness contract, and will witness a conflict of position. The strategy for finding witnesses reveals not only the existence of the clone, but also the identity of the publication. Network-wide broadcasts are the simplest way to find a witness, but this causes expensive communication costs. In [18], the authors proposed two approaches, namely, Random Multicast (RM) and Multicast Selector (LSM), in order to reduce the cost of communications for network-wide broadcasting. There are two other proposed methods in [19], namely a single deterministic cell (SDC) and multiple parallel-probability cells (P-MPC), sharing the same spirit as RM and LSM. However, the SDC and P-MPC are effective only when the network is split into cells. Compared with the above methods, the protocol proposed in [20], namely the Random, efficient and distributed protocol (RED), provides an almost perfect assurance of detection of transcription. RED uses a special central radio device, such as a satellite and drones, to periodically broadcast contract identifiers responsible for detecting certain conflicting site claims. In another study, Zhang et al. [21] Four methods were suggested for the detection of cloning that benefits from double-rule and Platter-Plum. Recently, Dong et al. [22] The method of detecting low-volume cloning (LSCD) was suggested, taking into account the memory requirements and residual energies of the contract. The inherent weakness of all approaches based on witness detection is the presumption of knowledge of the location information available to each node. There are two approaches that take alternative approaches to detecting cloning, such as the social footprint [23], the keys that have been distributed [24], and random methods [25].

SYSTEM MODEL

Network model

We regard the Internet as a hybrid network consisting of two main entities: 1) n Fixed and mobile nodes with unique identifiers [29]: ID 2 f1; :::; ng. And 2) base station (BS). Each Internet device periodically measures the distance with neighboring nodes, and sends information to the base station. In our system model, BS is responsible for implementing our proposed MDSClone algorithm and selecting "clones" (for definition, refer to section III-B) in the grid. In particular, the terminal periodically receives information adjacent to each node in the network, and builds a site map (based only on information received from the nodes) to detect the copies (we will explain the details of the MDSClone algorithm in the VA section). BS performs MDSClone offline, and each site map is created for a specific network segment at the time t. The main idea in our proposed method is that at time t, node x can not contain two different sets of neighbors, which means that x can not be in two different network locations at time t. In our network model, we make the following assumptions:

We assume that the contract is not necessarily "aware" of its precise geographic location. This assumption is based on the following factors described in the current literature: 1) As described in [9], the use of the GPS system is important in terms of energy and additional hardware requirements, and 2) researchers believe that [30] Menu sites are not effective in internal scenarios. Therefore, assume that some nodes (for example, smartphones) may be enabled by GPS, and may not be enabled (for example, home appliances). Therefore, our proposed method does not depend on the geographical locations of the contract. This assumption is to address the first challenge we mentioned in the "Problem Statement" section, ie, lack of accurate location information for devices.

conclusion

In this research, we proposed a copy discovery solution, called MDSClone, based on the multidimensional scaling algorithm (MDS) for the heterogeneous Internet environment. We have taken into account the features of Internet devices in the design of MDSClone, ie lack of knowledge of geographical locations, the possibility of being fixed and mobile alike, and the lack of a specific navigation pattern. (In Table 1) compared with existing cloning detection methods, MDSClone provides a distinct method, because it is the first method that supports hybrid networks, while the cost of their own memory is in order O (1), the cost of their connection is reasonable, About the site. Furthermore, we have shown that the probability of detecting MDSClone cloning is approximately 100%, and that the MDS account algorithm can be parallel, resulting in a shorter detection delay. Therefore, given all its advantages, we believe that MDSClone can be considered as a superior candidate for detecting transcription in Internet scenarios of things in the real world. However, in the case of dense network topology, our proposal may impose a network connection expense. So, in future work, we aim to provide a distributed version of MDSClone for Internet stuff scenarios.

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