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# Detecting Provenance Forgery with Lightweight Secure using Wireless Sensor Networks

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***ABSTRACT:***

*Large-scale sensor networks are deployed in numerous application domains, and the data they collect are used in decision making for critical infrastructures. Data are streamed from multiple sources through intermediate processing nodes that aggregate information. A malicious adversary may introduce additional nodes in the network or compromise existing ones. Therefore, assuring high data trustworthiness is crucial for correct decision-making. Data provenance represents a key factor in evaluating the trustworthiness of sensor data. Provenance management for sensor networks introduces several challenging requirements, such as low energy and bandwidth consumption, efficient storage and secure transmission. In this paper, we propose a novel lightweight scheme to securely transmit provenance for sensor data. The proposed technique relies on in-packet Bloom filters to encode provenance. We introduce efficient mechanisms for provenance verification and reconstruction at the base station. In addition, we extend the secure provenance scheme with functionality to detect packet drop attacks staged by malicious data forwarding nodes. We evaluate the proposed technique both analytically and empirically, and the results prove the effectiveness and efficiency of the lightweight secure provenance scheme in detecting packet forgery and loss attacks.*

## INTRODUCTION

Sensor networks are used in numerous application domains, such as cyber physical infrastructure systems, environmental monitoring, power grids, etc. Data are produced at a large number of sensor node sources and processed in-network at intermediate hops on their way to a Base Station (BS) that performs decision-making. The diversity of data sources creates the need to assure the trustworthiness of data, such that only trustworthy information is considered in the decision process. Data provenance is an effective method to assess data trustworthiness, since it summarizes the history of ownership and the actions performed on the data. Recent research [1] highlighted the key contribution of provenance in systems where the use of untrustworthy data may lead to catastrophic failures (e.g., SCADA systems). Although provenance modeling, collection, and querying have been studied extensively for workflows and curated databases [2], [3], provenance in sensor networks has not been properly addressed. We investigate the problem of secure and efficient provenance transmission and processing for sensor networks, and we use provenance to detect packet loss attacks staged by malicious sensor nodes. In a multi-hop sensor network, *data provenance* allows

the BS to trace the source and forwarding path of an individual data packet. Provenance must be recorded for each packet, but important challenges arise due to the tight storage, energy and bandwidth constraints of sensor nodes. Therefore, it is necessary to devise a light-weight provenance solution with low overhead. Furthermore, sensors often operate in an untrusted environment, where they may be subject to attacks. Hence, it is necessary to address security requirements such as *confidentiality*, *integrity* and *freshness* of provenance. Our goal is to design a *provenance encoding and decoding mechanism* that satisfies such security

## LITERATURE SURVEY

Wireless networks are vulnerable to spoofing attacks, which allows for many other forms of attacks on the networks. Although the identity of a node can be verified through cryptographic authentication, authentication is not always possible because it requires key management and additional infrastructural overhead. In this paper we propose a method for both detecting spoofing attacks, as well as locating the positions of adversaries performing the attacks. We first propose an attack detector for wireless spoofing that utilizes K-means cluster analysis. Next, we describe how we integrated our attack detector into a real time indoor localization system, which is also capable of localizing the positions of the attackers. We then show that the positions of the attackers can be localized using either area-based or point-based localization algorithms with the same relative errors as in the normal case. We have evaluated our methods through experimentation using both an 802.11 (WiFi) network as well as an 802.15.4 (ZigBee) network. Our results show that it is possible to detect wireless spoofing with both a high detection rate and a low false positive rate, thereby providing strong evidence of the effectiveness of the K-means spoofing detector as well as the attack localizer.

## IMPLEMENTATION

### 1. Node Configuration

#### a. Link Configuration

In this module Nodes are configured based on number of nodes in need of packet requisition. We create the network group by connecting nodes to sink. Link configuration means connecting the nodes and intermediate nodes to the sink.

### 2. Sender Node

#### a. Packet Splitting

In this module, Sender selects the file which is to be sent. And then it split into the number of packets based on the size for adding some bits in it.

#### b. Send Packets to Intermediate

And then it encrypts all the splitted packets. And then sender adds some bits to each encrypted packets before sending that. Bit Addition for each packet is identification for sender. After adding of bits to each packet, it sends the packets to the nearest node or intermediate node.

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## SOFTWARE ENVIRONMENT

### Java Technology

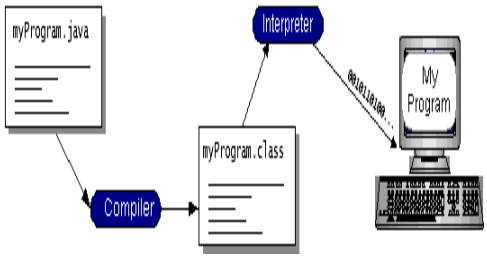
Java technology is both a programming language and a platform.

### The Java Programming Language

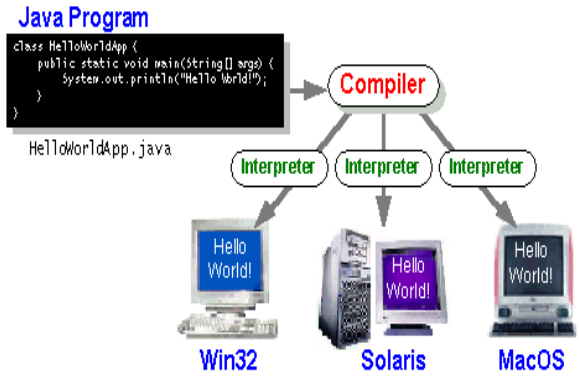
The Java programming language is a high-level language that can be characterized by all of the following buzzwords:

- Simple
- Architecture neutral
- Object oriented
- Portable
- Distributed
- High performance
- Interpreted
- Multithreaded
- Robust
- Dynamic
- Secure

With most programming languages, you either compile or interpret a program so that you can run it on your computer. The Java programming language is unusual in that a program is both compiled and interpreted. With the compiler, first you translate a program into an intermediate language called *Java byte codes* —the platform-independent codes interpreted by the interpreter on the Java platform. The interpreter parses and runs each Java byte code instruction on the computer. Compilation happens just once; interpretation occurs each time the program is executed. The following figure illustrates how this works.




You can think of Java byte codes as the machine code instructions for the *Java Virtual Machine* (Java VM). Every Java interpreter, whether it's a development tool or a Web browser that can run applets, is an implementation of the Java VM. Java byte codes help make "write once, run anywhere" possible. You can compile your program into byte codes on any platform that has a Java compiler. The byte codes can then be run on any implementation of the Java VM. That means that as long as a computer has a Java VM, the same program written in the Java programming language can run on Windows 2000, a Solaris workstation, or on an iMac.




## SYSTEM DESIGN AND DEVELOPMENT

## INPUT DESIGN

Input Design plays a vital role in the life cycle of software development, it requires very careful attention of developers. The input design is to feed data to the application as accurate as possible. So inputs are supposed to be designed effectively so that the errors occurring while feeding are minimized. According to Software Engineering Concepts, the input forms or screens are designed to provide to have a validation control over the input limit, range and other related validations.

This system has input screens in almost all the modules. Error messages are developed to alert the user whenever he commits some mistakes and guides him in the right way so that invalid entries are not made. Let us see deeply about this under module design.

Input design is the process of converting the user created input into a computer-based format. The goal of the input design is to make the data entry logical and free from errors. The error is in the input are controlled by the input design. The application has been developed in user-friendly manner. The forms have been designed in such a way during the processing the cursor is placed in the position where must be entered. The user is also provided with in an option to select an appropriate input from various alternatives related to the field in certain cases.

Validations are required for each data entered. Whenever a user enters an erroneous data, error message is displayed and the user can move on to the subsequent pages after completing all the entries in the current page.

## OUTPUT DESIGN

The Output from the computer is required to mainly create an efficient method of communication within the company primarily among the project leader and his team members, in other words, the administrator and the clients. The output of VPN is the system which allows the project leader to manage his clients in terms of creating new clients and assigning new projects to them, maintaining a record of the project validity and providing folder level access to each client on the user side depending on the projects allotted to him. After completion of a project, a new project may be assigned to the client. User authentication procedures are maintained at the initial stages itself. A new user may be created by the administrator himself or a user can himself register as a new user but the task of assigning projects and validating a new user rests with the administrator only.

The application starts running when it is executed for the first time. The server has to be started and then the internet explorer in used as the browser. The project will run on the local area network so the server machine will serve as the administrator while the other connected systems can act as the clients. The developed system is highly user friendly and can be easily understood by anyone using it even for the first time.

## SYSTEM TESTING

### TESTING METHODOLOGIES

The following are the Testing Methodologies:

- **Unit Testing.**
- **Integration Testing.**
- **User Acceptance Testing.**
- **Output Testing.**
- **Validation Testing.**

### Unit Testing

Unit testing focuses verification effort on the smallest unit of Software design that is the module. Unit testing exercises specific paths in a module's control structure to

ensure complete coverage and maximum error detection. This test focuses on each module individually, ensuring that it functions properly as a unit. Hence, the naming is Unit Testing.

During this testing, each module is tested individually and the module interfaces are verified for the consistency with design specification. All important processing path are tested for the expected results. All error handling paths are also tested.

### Integration Testing

Integration testing addresses the issues associated with the dual problems of verification and program construction. After the software has been integrated a set of high order tests are conducted. The main objective in this testing process is to take unit tested modules and builds a program structure that has been dictated by design.

**The following are the types of Integration Testing:**

#### 1. Top Down Integration

This method is an incremental approach to the construction of program structure. Modules are integrated by moving downward through the control hierarchy, beginning with the main program module. The module subordinates to the main program module are incorporated into the structure in either a depth first or breadth first manner.

In this method, the software is tested from main module and individual stubs are replaced when the test proceeds downwards.

#### 2 .Bottom-up Integration

This method begins the construction and testing with the modules at the lowest level in the program structure. Since the modules are integrated from the bottom up, processing required for modules subordinate to a given level is always available and the need for stubs is eliminated. The bottom up integration strategy may be implemented with the following steps:

- The low-level modules are combined into clusters into clusters that perform a specific Software sub-function.

- A driver (i.e.) the control program for testing is written to coordinate test case input and output.
- The cluster is tested.
- Drivers are removed and clusters are combined moving upward in the program structure

The bottom up approaches tests each module individually and then each module is module is integrated with a main module and tested for functionality.

## CONCLUSION

We addressed the problem of securely transmitting provenance for sensor networks, and proposed a light-weight provenance encoding and decoding scheme based on Bloom filters. The scheme ensures confidentiality, integrity and freshness of provenance. We extended the scheme to incorporate data-provenance binding, and to include packet sequence information that supports detection of packet loss attacks. Experimental and analytical evaluation results show that the proposed scheme is effective, light-weight and scalable. In future work, we plan to implement a real system prototype of our secure provenance scheme, and to improve the accuracy of packet loss detection, especially in the case of multiple consecutive malicious sensor nodes.

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