A light-weight secure protocol for small data dissemination in WSNs

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Abstract. This paper argues for a security scheme for security of data dissemination discovery and dissemination in WSNs, Wireless sensor networks. Our scheme is designed to be simple as well as has little impact on memory consumption and network traffic. The scheme is designed in light of issues derived from many different kinds of attacks.

Key words: Data discovery and dissemination, Security, Wireless sensor networks, Efficiency

1 Introduction

[1] WSN consists of a lot of space-distributed sensors. To function a specific application,such as health-care, or obtain valuable information about physical world, Network manager needs every node work together though wireless channel.

As shown in Fig.1. Normally, WSNs collect data to a prime location named a base station. Base station could be your computer which allows network manager to store and analyse collected data later. On the other hand, each powerful sensor node has several parts, a circuit which is able to be interfaced with other devices, a battery for supplying electrical power, a radio transceiver.Actually, WSNs are usually deployed in hostile or remote area with many kinds of topology, such as ring, star.

Obviously, it is very important that a message should be protected from vicious attackers. And broadcast authentication is a very common security mechanism in WSNs, since broadcast authentication is able to provide message with confidentiality and authentication.

WSN is one of the major milestones in the field of communication. These networked collection of nodes take us a step closer to obtaining valuable about the physical world. WSN are used popularly in many applications like remote control and monitoring, construction safety systems, environmental monitoring, health care management, disaster management, srveilance operations, smart homes, habitat monitoring, indoor sensor networks, seismic monitoring of buildings etc[1].

However, we argue every WSN, running any application, should be able to present hunman manager the ability to determine whether the WSN is functioning or not.

Why drip is reliable? Drip provides a transport-layer interface to multiple channels of reliable message dissemination. Each component wishing to use Drip registers a specific identifier, which represents a reliable dissemination channel. Message received on that channel will be delivered directly to the component.

But it does introduce extra complexity for a component that has several indepedetn variables which must be reliably synchronized among all nodes in the networks. Wireless sensor networks is usually deployed in outdoor environment, especially hostile environment to collect sensitive information. In battlefield. an adversary is able to inject vicious code images and take control of the entire WSNs.

Since an administrator of a Wireless Sensor networks often reconfigures, queries and reprograms a WSNs, The above functions can be provided by dissemination protocol, which is used to deliver some small data, such as two-byte configuration parameters, to every node in networks.

The small dissemination protocols add, delete, and modify these data by requesting each node exchange their stored data and eventually reach consistency over the networks.

Consistency is the unique property of small dissemination protocol, making a whole WSN be immune to packet loss. A disconnected one also can get latest data image from neighbor nodes.

Although reliability is necessary for dissemination protocol, it makes networks robust to temporary disconnection and high packet loss, but We cannot lay too much emphasis on the importance of security.However, to the best of our knowledge, all existing data discovery and dissemination protocols only address reliable data transmission, but provide no security mechanism.

Among existing dissemination protocols, Drip, Dip, and DHV are the most well known and widely used. These three protocols are all included in TinyOS distributions.

We first investigate the requirements for a secure broadcast mechanism in smart grids, and then show some security weakness and efficiency problems of existing broadcast authentication mechanisms. 1)We firstly investigate the security problem in data discovery and dissemination protocol of WSNs and indicate the lack of authentication of disseminated data refers to a vulnerability. The energy in each sensor node is supplied by limited battery power or its energy harvesting capacity, thus it is significant to maintain energy to lengthen the operational lifetime of a sensor node.

2 Network, Trust And Threat Models

As shown in Fig. 1(b), Wsns consists of a lot of distrubited sensor nodes, manys network users and only a owner. This is a very simple and easy structure. The network uses use mobile devices such as PDAs and mobile phone to control

the whole WSNs. The Network owner may be off-line, who has bootstrapped the keying materials for the mobile devices to enforce reprogramming privilege policy. It is assumed that the owner cannot be compromised by enemy or attacker and still has some capability of doing some computation and judgement, such as hash operation and a lot of other cryptography techniques. We assume Deluge as the underlying code dissemination protocol. We also assume sensor nodes, for example using the scheme of [19]. To enable each node to check whether the subscription period of each authorize user has expired, we assume there is a loose time synchronization among the nodes with the help of some existing secure time synchronization scheme. We assume there is a loose time synchronization among the nodes with the help of some existing secure time synchronization scheme.

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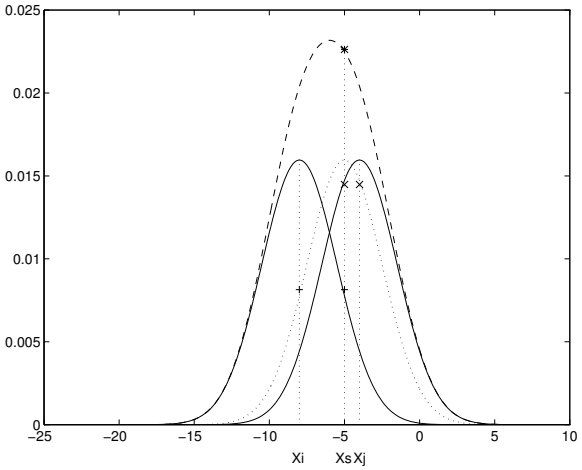

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Example of a Computer Program

```
program Inflation (Output)
  {Assuming annual inflation rates of 7%, 8%, and 10%,...
   years};
   const
     MaxYears = 10;
```

[1] The footnote numeral is set flush left and the text follows with the usual word spacing.

```
    var
      Year: 0..MaxYears;
      Factor1, Factor2, Factor3: Real;
    begin
      Year := 0;
      Factor1 := 1.0; Factor2 := 1.0; Factor3 := 1.0;
      WriteLn('Year  7% 8% 10%'); WriteLn;
      repeat
        Year := Year + 1;
        Factor1 := Factor1 * 1.07;
        Factor2 := Factor2 * 1.08;
        Factor3 := Factor3 * 1.10;
        WriteLn(Year:5,Factor1:7:3,Factor2:7:3,Factor3:7:3)
      until Year = MaxYears
end.
```

(Example from Jensen K., Wirth N. (1991) Pascal user manual and report. Springer, New York)

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References

1. Smith, T.F., Waterman, M.S.: Identification of Common Molecular Subsequences. J. Mol. Biol. 147, 195–197 (1981)
2. May, P., Ehrlich, H.C., Steinke, T.: ZIB Structure Prediction Pipeline: Composing a Complex Biological Workflow through Web Services. In: Nagel, W.E., Walter, W.V., Lehner, W. (eds.) Euro-Par 2006. LNCS, vol. 4128, pp. 1148–1158. Springer, Heidelberg (2006)
3. Foster, I., Kesselman, C.: The Grid: Blueprint for a New Computing Infrastructure. Morgan Kaufmann, San Francisco (1999)
4. Czajkowski, K., Fitzgerald, S., Foster, I., Kesselman, C.: Grid Information Services for Distributed Resource Sharing. In: 10th IEEE International Symposium on High Performance Distributed Computing, pp. 181–184. IEEE Press, New York (2001)
5. Foster, I., Kesselman, C., Nick, J., Tuecke, S.: The Physiology of the Grid: an Open Grid Services Architecture for Distributed Systems Integration. Technical report, Global Grid Forum (2002)
6. National Center for Biotechnology Information, http://www.ncbi.nlm.nih.gov

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