Cloud-Based Protocol IDS using Apache Kafka and Spark Streaming

Leon Wirz   
Sirindhorn Internatioanl Institute of Technology, Thammasat Univerity, Pathum Thani, Thailandleon.wir@dome.tu.ac.th

Rinrada Tanthanathewin   
Sirindhorn Internatioanl Institute of Technology, Thammasat Univerity, Pathum Thani, Thailandrinrada.tanth.gal@gmail.com

Asipan Ketphet   
Sirindhorn Internatioanl Institute of Technology, Thammasat Univerity, Pathum Thani, Thailand@

*Abstract*—In the Current era of technological advancements web applications are a major medium in the internet world. Many of these mentioned web applications adapt the usage of a dedicated back-end server where most of the technical processes happen. Typically the front-end sends requests to the back-end which can be done in multiple ways being, GraphQL, gRPC, REST, etc. In this particular paper the focus is on REST as it is still considered a norm in most web applications. In REST requests which are mapped to GET, POST, PUT, and DELETE have been proven to be prone to attacks and exploits that can inflict extensive amounts of damage to a system. Therefore, this paper’s main point will be the detection of such attacks and exploits, mainly being Automated Brute Forcing on web-based login, HTTP flood attacks, SQL Injections (SQLi), Cross Site Scripting (XSS). Both Apache Kafka and Spark streaming are used as main pillars in the architecture for processing the user inputs in REST HTTP header fields, which are the main vulnerabilities that are being exploited in such attacks. As HTTP requests from users of a web application come in massive amounts of volumes it is crucial to process these HTTP requests in an efficient and resourceful way. Spark streaming allows both of these critical characteristics of processing by the usage of batch processing and MapReduce. Apache Kafka allows back-end engineers to send duplicated requests to a Kafka broker and furthermore bridges the streamed data to Spark streaming using the Spark Streaming & Kafka Integration library in Scala.

Keywords—Intrusion Detection, Apache Kafka, Spark Streaming, SQL injection, Cross-site scripting, Brute Force Login, HTTP flood attacks

Introduction (Heading 1)

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*a**b* 

Note that the equation is centered using a center tab stop. Be sure that the symbols in your equation have been defined before or immediately following the equation. Use “(1)”, not “Eq. (1)” or “equation (1)”, except at the beginning of a sentence: “Equation (1) is . . .”

## Some Common Mistakes

* The word “data” is plural, not singular.
* The subscript for the permeability of vacuum **0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter “o”.
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* The abbreviation “i.e.” means “that is”, and the abbreviation “e.g.” means “for example”.

An excellent style manual for science writers is [7].

# Methodology

Figure (system diagram) illustrates how the system works. Our system works entirely on the Google Cloud Platform, starting from query requests directly from the web server by Apache Kafka. Figure 1a shows a request template that will be queried by Apache Kafka.

Figure 1a : Request Template

Apache Kafka then splits the request into four topics, GET, POST, PUT, and DELETE, depending on the header type of each request. The request string is then sent to Spark Streaming running on the Google Dataproc cluster. Google Dataproc allows users to create different cluster types and versions. This project uses a single node master on Debian 10, Hadoop 3.2, and Spark 3.1. A single node master provides a single node that acts as both a master and a worker.

Internal Spark Streaming is divided into four jobs: BruteForce job, DDOS job, SQL Injection (SQLi) job, and Cross-Site Scripting (XSS) job, which will be operated on the Debian cluster. The output of each Spark Streaming job will be stored as a log file in the bucket on Google Cloud Storage. In addition, we use the SMS API Vonage for SMS notifications.

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1. Table Type Styles

| Table Head | Table Column Head | | |
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##### Acknowledgment *(Heading 5)*

The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g”. Avoid the stilted expression “one of us (R. B. G.) thanks ...”. Instead, try “R. B. G. thanks...”. Put sponsor acknowledgments in the unnumbered footnote on the first page.

##### References

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