SCIENCE AND EDUCATION IN KARAKALPAKSTAN

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TECHNICAL SCIENCES

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DEVELOPING A METHOD FOR SELECTING THE MOST OPTIMAL WAF

Reypnazarov E.N.[1], Lazarev A.P.[2]

[1] Tashkent University of Information Technologies named after Muhammad al Khwarezmi

[2]Nukus Branch of Tashkent University of Information Technologies named after Muhammad al Khwarezmi

Summary. *This article analyzes the methods and means of ensuring the protection of mobile Web services, and also gives recommendations on how to optimize the performance of information security tools.*

Key words. *Web application firewall, method, algorithm, model of selection, vulnerability.*

Introduction. The main problem of securing a public web application is that it is not possible to restrict access to it for potential intruders. Requirements for business in modern times lead to the need to create multifunctional web applications, which consequently negatively affects security, since the more complex the application, the greater the likelihood of an error in it, which could potentially become a vulnerability.

However, a modern web application is not only a collection of files located on a web server, it is a set of software necessary for the full operation of a web application.

Model of selection of the most optimal WAF. A web application firewall (or WAF) filters, monitors, and blocks HTTP traffic to and from a web application. A WAF is differentiated from a regular firewall in that a WAF is able to filter the content of specific web applications while regular firewalls serve as a safety gate between servers. By inspecting HTTP traffic, it can prevent attacks stemming from web application security flaws, such as SQL injection, cross-site scripting (XSS), file inclusion, and security misconfigurations [1, 2].

Productivity is a major factor in the work of the WAF. The WAF chosen by us should not affect the performance of the existing infrastructure, including applications and network devices. This means that even if WAF acts as a security proxy for an application, the application continues to perform data transactions without accumulating requests and does not stop working under heavy load. The application should work as if there is no WAF. And from the point of view of the end user, WAF should be absolutely transparent. Users should not suffer from noticeable

delays or interference with maintenance.

Adhering to the above, it is necessary to choose the optimal firewall, the model "Model of selection of the most optimal WAF" can help in this matter. Below is the model itself. Sets [2, 145]:

1. Set of questions $Q = \{q_1, \dots, q_N\}$, where $q_1, \dots, q_N$ – required questions to the administrator;

2. Set of answers $A_i = \{a_1, \dots, a_t\}$, where A_i – set of answers to q_N – questions of set Q;

3. Set of criteria $C = \{C_1, \dots, C_K\}$, where $C_1, \dots, C_k$ is a set of criteria.

4. Matrix of matching questions and criteria $W - AxC$, $W_{tk} = \{^{1}_{0}$ (according to table 1).

5. Set WAF – $S = \{S_1, \dots, S_k\}$.

6. Matrix of matching $R = SxC$, where $R_{km} = \{^{1}_{0}$

To develop the most rational WAF for the given requirements, it is necessary to get answers to the questions asked. Questions for selecting WAF:

1. Question relating to WAF components.
2. The web resource contains static or dynamic pages.
3. Does the web resource contain authentication fields?
4. Does the web resource contain comment fields?
5. Information on the web resource has different levels of confidentiality.
6. Is it possible to upload files to a web resource?
7. Highly loaded server.
8. Users receive mostly the same Web resources.
9. Does the server contain confidential data?
10. Is it necessary to encrypt network traffic with the client?
11. The web resource contains many dynamic pages in several thematic sections.
12. The site is built on XHTML.
13. Does the web resource introduce new functionality?
14. Does the web resource contain other network services?
15. There are groups of trusted client IP addresses.

To determine the elements from the set *C* and *S* (their combination will be the resulting set), information is needed on the results of answering questions, that is, each answer to a question is a condition for selecting an element from the set *C* and *S*.

Table 1. Compliance questions and criterias.

Criteria								
Number of Question	DLP-model	Antivirus	Proxy	IDs/IPs	Vulnerability Scanner	Firewall	Cryptographic protection	Load balancing
1	-	-	+	-	+	-	-	+
2	-	-	+	+	-	-	-	-

3	-	-	-	-	+	-	-	-
4	+	-	-	-	-	-	-	-
5	-	+	-	-	-	-	-	-
6	-	-	-	-	-	-	-	+
7	-	-	-	-	-	-	-	+
8	-	-	-	-	-	-	+	-
9	-	-	-	-	-	-	+	-
10	-	-	+	-	-	-	-	-
11	-	-	-	+	-	-	-	-
12	-	+	+	-	+	-	-	+
13	+	+	-	+	-	+	-	-
14	-	-	-	-	-	+	-	-

The WAF selection model is based on the following plan [3, 289]:

1. Build a subset of selected for comparison criteria $C' \subset C$. his set is built with the table 1 of the correspondence of questions and criteria M_{ij} where i – question, j – criteria. If the answer k to question i is affirmative $a_k(q_i) = 1$, then we take into account this criterion.

2. The best WAF is determined as the arithmetic mean of the WAF comparison table according to the selected criteria C', the best WAF is defined as $max\left(S_m = \frac{1}{z}\sum_{i=0}^{z} r_{mi}\right)$ for each WAF, where the criteria are determined from the subset R', z is the power of the set R', m is the current WAF from the set S.

Development of software architecture. The software architecture for automating the selection of the most rational WAF is presented in Figure 1 and consists of 3 modules:

– Poll module. Responsible for conducting a survey and registering user-selected answers.

– Evaluation module - analyzes the data in the form of answers, evaluates the WAF and selects the most appropriate WAF.

– User interface. Displays the matched WAF.

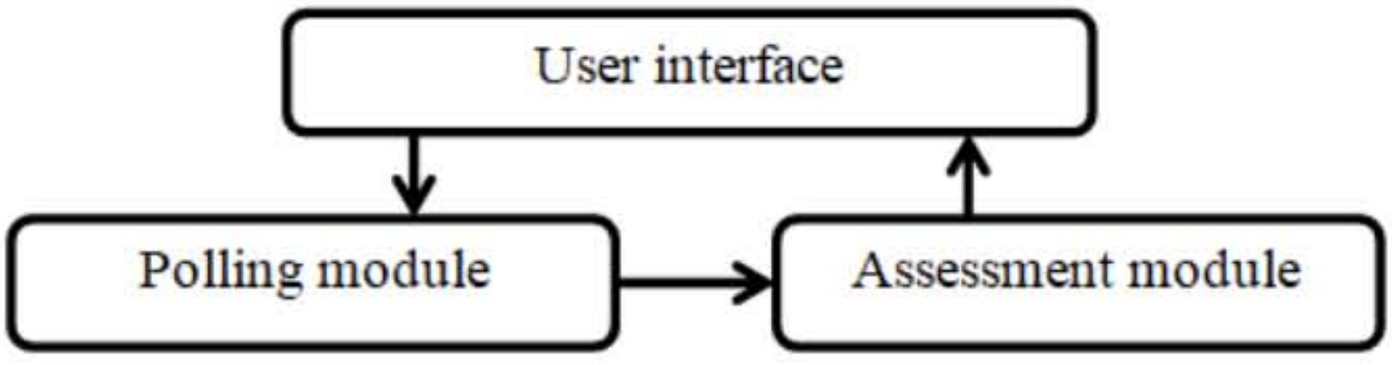

Figure 1. Program architecture.

Development of algorithms for the selection of the most rational WAF. The general algorithm of the software is a flowchart, for the construction of which such blocks as the beginning, the data, the predetermined process, the decision, the end were used. The block diagram is shown in Figure 2.

A brief description of the general algorithm of the software:

– Step 1. The questions and the list of possible criteria are loaded (block 2);

– Step 2. The user answers the questions (block 3);

– Step 3. The output of the matched WAF is performed (block 4).

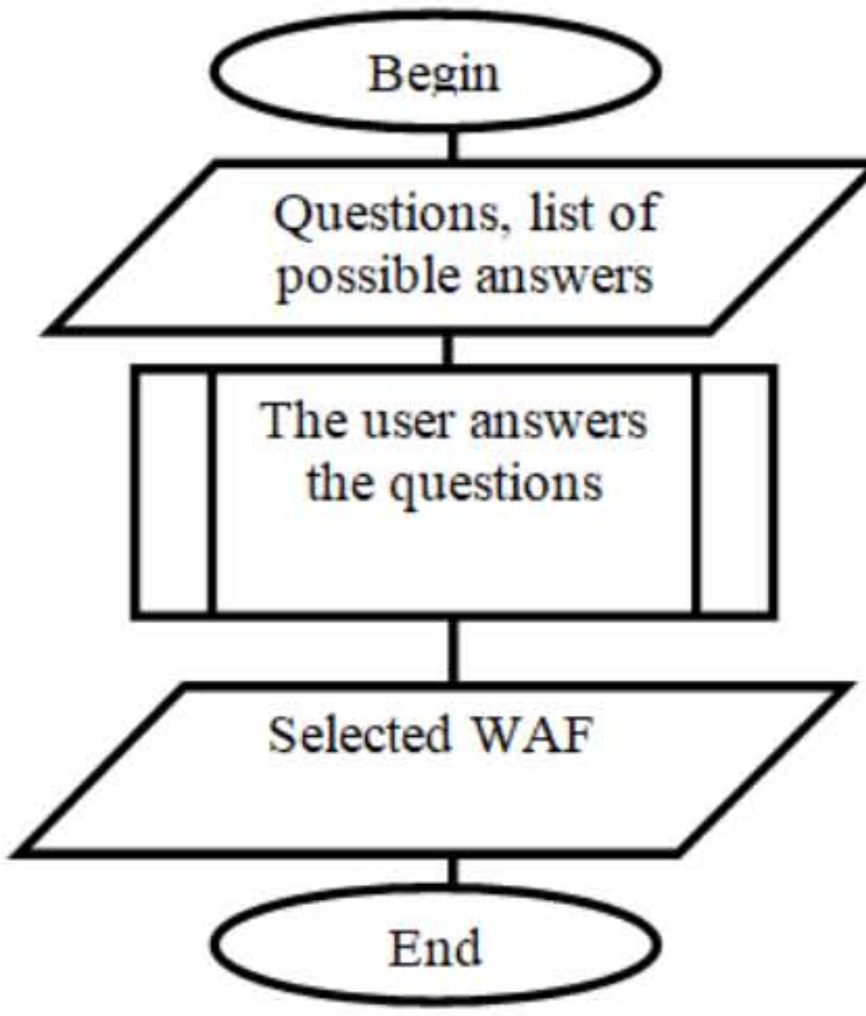

Figure 2. The general algorithm software means.

Brief description of the WAF selection algorithm (Figure 3):

– Step 1. (block 2) At the entrance are questions and a list of possible answers.

– Step 2. (block 3) Start of the cycle (block 3): for all questions.

– Step 3. (block 4) check the condition "Do I need this criterion". If the question is positive, it means that certain components must be present in the WAF.

– Step 4. (block 5) End of the cycle "number of questions".

– Step 5. (block 7) Start of the cycle (block 3-5): for all criteria.

– Step 6. (block 8) Start of the cycle, all WAF.

– Step 7. (block 9) Process, determined by how many criteria WAF will meet.

– Step 8. (block 10) End of the "number of criteria" cycle.

– Step 9. (block 11) End of the "WAF" cycle.

– Step 10. (block 12) Withdrawing the WAF that most satisfies the conditions.

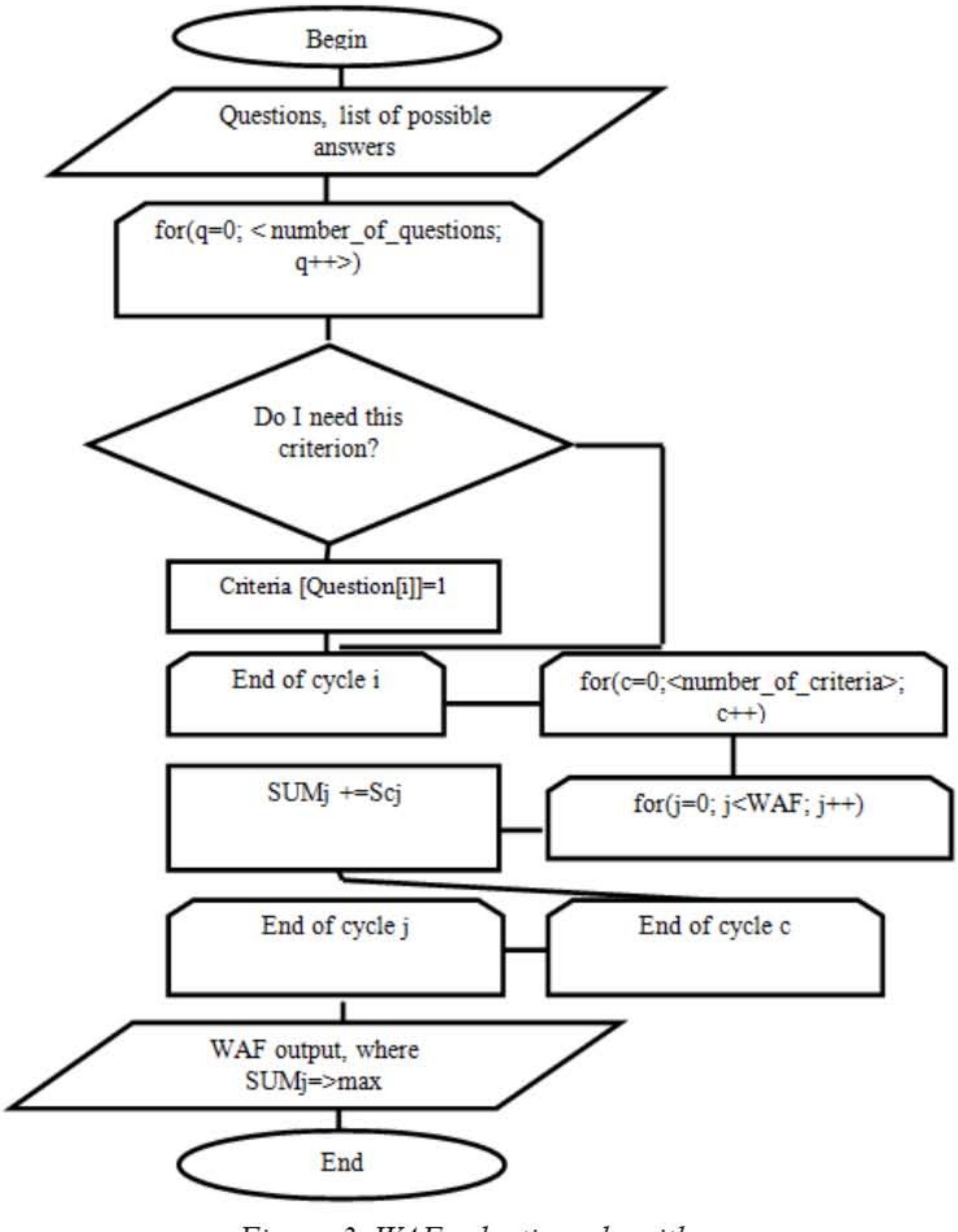

Figure 3. WAF selection algorithm.

Conclusion. This article contains questions about ensuring the information security of web services. The most potentially vulnerable element in the infrastructure of a modern web application is the web application itself. Based on the analysis of the most popular web vulnerabilities, it was found that the main cause of security breaches is insufficient or missing filtering of the transmitted data to the web application. Based on the performance, a model for selecting the most optimal WAF has been developed.

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Rezyume. *Ushbu maqolada mobil veb-xizmatlarni himoya qilish usullari va vositalari tahlil qilindi, tahlil natijasida axborot xavfsizligi vositalarining ishlashini optimallashtirish bo'yicha zarur tavsiyalar berilgan.*

Резюме. *В этой статье анализируются методы и средства обеспечения защиты мобильных веб услуг, а также приведены рекомендации по оптимизацию и производительности средств информационной безопасности.*

Kalit so'zlar. *Veb-ilova brandmaueri, metod, algoritm, selektsiya modeli, zaiflik.*

Ключевые слова. *Брандмауэр веб-приложений, метод, алгоритм, модель селекции, уязвимость.*