Architecture for Economic, Secure, and High Performance Government Website using OSS

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Abstract

In present time, the new era of Information and Communication Technology (abbreviated as ICT) is begin. One of phenomenon arise then is the openness in term of source and content, as implemented in Ministry of Youth and Sport of Indonesia (Kemenpora).

This paper propose an architecture to support needs of website related to government institution using OSS. By using case study in Kemenpora, the proposed arctitecture will be explained. Technical and non-technical analysis will also be conducted to evaluate the whole implementation and concluded that OSS can provide a better information services in term of high performance access, good security system, and cost effective. With the implementation of OSS, the stakeholders of Kemenpora can get all those benefits thanks to OSS.

Keywords : Development, OSS, Reliability, Security, Systems, Website

1   Introduction

The impact of ICT on system development has been recognized as a multi-dimensional, multi-stakeholder, and pervasive process. Electronic government (e-gov) involves the electronic delivery of services that can reduce the cost of internal operations of a government as well as improve interactions with their communities and citizens. World Bank defines e-gov as the use of information technologies by government agencies that have ability to transform relationship with citizens, business, and other arms of government[Bank, 2003]. Government information systems are a kind of public information system which should be analyzed from several perspectives regarding to users, usages, data contents, technical, organizational, and legal aspects[Sundgren, 2005]. e-gov is a comprehensive concept that involves any aspects of government-to-consumer, government-to-business, and government-to-government interactions that can be enhanced through the use of ICT.

The corresponding objectives of e-gov are:

- Interconnect public administrations in form of data interchange to improve efficiency;

- The creation of integrated services;

- The creation of an accessible server to everyone for the purpose of online government management.

The dominant models for e-gov found their roots in public management and e-business models. While researchers of e-gov differ on the rights, privileges, and obligations of clients, customers, and citizens [Mintzberg, 1996], [D. Osbourne, 1992], they generally concur that e-gov moves through stages to reach maturity.

One aspect which e-gov depend with is technology. With technology, government can deliver and produce information to public, ensuring the information broadly disseminated and reach more people. Generally, there are two kind of technologies: proprietary and open source. Proprietary technology is using software licensed under exclusive legal right of its owner. The purchaser, or licensee, is given the right to use the software under certain conditions, but restricted from other uses, such as modification, further distribution, or reverse engineering. On the other hand, open source technology is a kind of software which source code is published and made available to the public, enabling anyone to copy, modify and redistribute the source code without paying royalties or fees. Open source code evolves through community cooperation. These communities are composed of individual programmers as well as very large companies

Open source system has several advantages compared with proprietary system, such as:

- **Security**. There are some indications that OSS are superior to proprietary systems in this aspect:

- The Gartner Group recommends that businesses switch from Microsoft Internet Information Server (IIS) to Apache or another web server, due to IIS' poor security track record. The Gartner Group noted that by July 2001 US enterprises had spent US\$1.2 billion to fixing Code Red (IIS-related) vulnerabilities.

- "Hacker Insurance" issued by J.S. Wurzler Underwriting Managers costs 5-15 percent more if Windows is used instead of GNU/Linux or Unix systems.

- **Cost Effective**. Some success stories about the tremendous savings from OSS were reported. Intel saved US\$200 million when move to GNU/Linux from Unix, and Amazon save US\$17 million from switching their servers to GNU/Linux[Shankland, 2001]. Major financial institutions such as Credit Suisse First Boston, Morgan Stanley, Goldman Sachs and Charles Schwab are moving a significant portion of their infrastructures to OSS to minimize cost[Sisk, 2003].

- **Reliability/Stability**. Some tests were conducted to OSS regarding this aspect:

  - In 1999, Zdnet ran a 10-month reliability test between Red Hat Linux, Caldera Systems OpenLinux and Microsoft Windows NT Server 4.0 with Service Pack 3 on identical hardware systems and performed printing, web serving, and file serving functions. The result was that NT crashed every six weeks, but none of the OSS were crashed during the entire 10 months.

  - A stress were conducted in 1995 to test seven commercial systems and the GNU/Linux system. Random characters were fed to these systems to simulate garbage from bad data or users. The result was that the commercial systems had an average failure rate of 23 percent while Linux as a whole failed nine percent of the time. A follow-up study several years later found that the flaws identified by the study were all fixed in the OSS, but generally untouched in proprietary software.

2 Case Study

Internet delivers changes in how public services provide their stakeholders with information. They can not use the style of the past (banning and censoring) anymore. Any form of information should be provided anytime, without any barriers, meaningful, and transparent. This kind of communication style is always asked to public services whenever they want to establish any information systems. The expectation is, of course, people can control and watch how they work to serve public and how they can provide meaningful information to their citizens. Some evalutions then can be delivered to improve the performance of public services.

One instance in Indonesian public services which understand this situation is The Ministry of Youth and Sports (Kemenpora). They want to deliver all information related to the minisitry's activities as a form of public information system by developing an integrated portal which provide:

- Information systems to make information available to public, e.g. official statistics, maps, and directories;

- Information systems to support individual actors, companies who need to perform a certain task, which is initiated and controlled by people;

- Information systems to suppert social processing involving both citizens, public authorities, and others;

- Information systems supporting business task for public authorities and institutions;

- News, media, and system for informing the general public.

2.1 Background

On November 2009, the Minister of Youth and Sports decided to develop a unique goverment website. Usually, communication type in most government websites are one way communication in which information always transferred in only one preassigned direction. Such a conservative way means only government provides information to the website so that the website is not in collaborative environment. What the minister wants is two way communication, by use an effective communication to negotiate with publics, to resolve conflict, and to promote mutual understanding and respect between the organization and its public(s). Specifically, a portal website which has function to deliver all information in every unit of the ministry and managed by journalist will be built.

Performance, reliability, and security are main considerations when developing the website. Security is a big consideration for this website, because this website will publish all information about Kemenpora. An attack which changes the content will result big impact to the public. Sustainability of system is also the main consideration. There is also

specific security requirement, for example the content providers of the website should be able to access the system backend securely everywhere such as in Internet Cafe. Thus, the isolation and integration control are some requirements to protect the whole system from tempering.

The open standard approach is selected for developing contents. The page is designed to be compatible with any platforms, so that users can acces the website by using any devices ranging from desktop computer, mobile phone, or any gadgets. The website should contains many type of file, has a video streaming facility, and support for mobile device. The document format used in the developed system has to be free from being locked into a single vendor.

The Kemenpora website is designed with main non-technical considerations as follows:

- Public can get benefits from this project. Government can provide better services using cheaper solution;

- Cost effective (with very tight budget comparing with other similar government projects). The development team of Kemenpora intended to show a role model in providing a public information system in an efficient way;

- The project is executing short path any regulations;

- Good role model for other government projects. It will assist the government body to provide a good services to the public and decreasing the cost for providing such services;

- Good learning process as well as can be used for academic research in ICT as a foundation for future OSS implementation model in Indonesia;

- Public can get information via mobile to raise "young and trendy" impression, a Kemenpora's words to describe their concern on sports and youths in Indonesia.

2.2 Development Process

The development in this project has several focuses:

- Focus on communication between users, stakeholder, visitors, and developers. Agile method still focus on the communication between developers.

- Focus on threat and risk including the non technical ones. The considered threat is also the semantic threats.
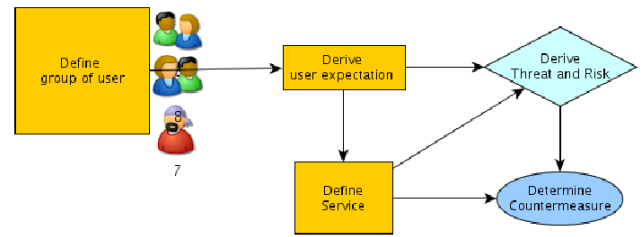

Figure 1: Development Process

Basically the design of Kemenpora site follows the participatory approach by considering end users as the main actors (as shown in Fig.1). The first step is the user groups definition. For each user group we derive the user expectations since every user group expect different functions or information delivered by the website. Here, the attackers also considered as user group since they also have expectation to the system, the intention to violate the security policy. After this step, the services can be defined based on most expected services. Each user group has different threat in the system. Understanding this threat can be used to consider the countermeasures that can appear.
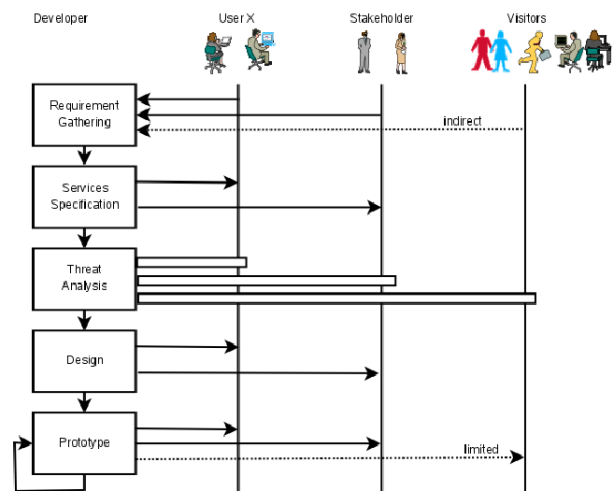

Figure 2: Communication Path

Each phase has different communication path with the users which is shown in Fig.2. The detail of development steps are :

1. Defining the users groups and stakeholders;

2. Gather the functional and non-functional as well as technical and non-technical requirements by sitting closely with the users and stakeholders;

3. Define services that will be provided by system, based on the user groups. These services are also search engines, podcast, streaming services, etc;

4. Analyze threat for each services and each user groups. After that, necessary countermeasure will be applied;

5. Design system implementation scenarios including solve conflict of requirements;

6. Develop prototype to gather any feedbacks from users. The system were developed into the final application based on this prototype, therefore it was not one-throw prototype. One of unique case in this development is Minsitry of Youth and Sportd, Andi Alfian Mallarangeng, involves in design like layouting web page, colour selection. This phase is very important somte times in this development we found problem like icon selection in this website so with this phase development can get feedback from stackholder and user.

7. Test and refine the prototype. The test was performed directly with the users, and also stakeholders.

2.3 System Architecture

The website of Kemenpora was developed by using several OSS technologies. Several Linux distributions were used and many Open Source programs were utilized. The flexibility and freedom of choose of OSS make it easier to deliver the solution. Those technologies can be described as follows:

1. **Web Server.** To create lightweight and reliable web server, the development team choose Apache web server. Apache HTTP Server is based on a further development of NCSA HTTPd in 1995. It was made available as free open source software by the Apache Software Foundation under the Apache License.

2. **Database**. To create a reliable and high performance database, the team decided to use MySQL database server. The manufacturer estimates the number of active MySQL installations world wide at more than 11 million.

3. **Monitoring System.** The good system must have monitoring system to manage and monitor every task in server. To solve this requirement, this website using OSSEC.

4. **Security System**. This website must have a good security to prevent any intruders who want to destroy the system. To do that, the website utilize some tools for provide good security. First is mod security, mod security is a web application firewall that can work either embedded or as a reverse proxy. The
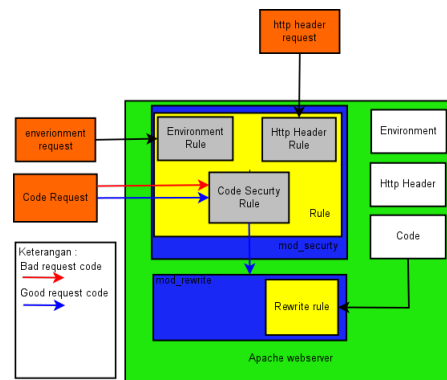

Figure 3: Mechanism of Mod Security

mechanism of mod sec is shown in Fig.3. Second is mod rewrite, this module uses a rule-based rewriting engine (based on a regular-expression parser) to rewrite requested URLs on the fly. Third is GreenSQL, GreenSQL is an Open Source database firewall used to protect databases from SQL injection attacks. GreenSQL works as a proxy and support for MySQL and PostgreSQL. Fourth is HTML Purifier, HTML Purifier is a standards-compliant HTML filter library written in PHP.

5. **Virtualization.** This website using XEN for virtualization technology. The type of XEN is *para-virtualization*, independent to hardware so every hardware can be implement this technology.

3 Conclusion

This paper has shown impacts and advantages of OSS implementation, especially in Kemenpora. Kemenpora system was launching in February 2010 and based on Apache log analysis in February, some information about this system can be gathered. First, the sum of hits in February was 115,115 (4,000/day) and total transfer 66.17 Gbyte (2.36 GB/day). Second, total unique visitor reach approximately 11,620/day. The data and its implementation has shown that OSS is very reliable because it can handle large data and ensure high performance access of the system.

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