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| International School  SE-MIS Program | **Assignment 2b**  **CMU-SE 403 Software Architecture & Design**  Fall – 2023-2024  Duration: 2 hours / Date: 17-Nov, 2024 |
| **Score** | **Student Name: Phan Nhật Tuấn**  **Student ID: 26211228251** |

1. Identify 01 Scalability, 01 Performance, and 01 Security scenarios that you think would be necessary for a widely used website, such as Shopee, Lazada, and MyDTU (use a six-part scenario template) (40 points)
2. Select 01 of the 3 questions below answer that question in detail and give an example.(30 points)
   1. How does Security trade-off against Performance? How would you change a system that is required to have strong security?
   2. [How might availability trade-off against cost-effectiveness?](https://link.springer.com/article/10.1007/s11219-019-09478-x)
   3. How might usability trade-off against security?
3. Consider the student database at Duy Tan University. (30 points)  
   1. Identify two kinds of sensitive data or other resources in the system.  
   2. Determine the possible attackers, their motivations, and their resources.

Solutions:

1. I choose Facebook website.

**Performance scenario:**

“500000 users initiate 1000000 transactions per minute stochastically under normal operating conditions and each transaction is processed with an average latency of two seconds.”

Stimulus: initiate 1000000 transactions.

Source of Stimulus: 500000 users.

Environments: normal operating conditions

Artifacts: system

Responses: each transaction is processed

Response Measures: average latency of two seconds

**Scalability scenario:**

“Holidays or special days will significantly increase user interactions including posting, commenting, liking, and sharing, leading to a significant increase in server requests under operation overload. To address this, Facebook's system implements dynamic resource scaling, automatically allocating additional server capacity. Server load metrics, response time, and resource utilization are measured to ensure efficient scaling and optimal performance.”

Stimulus: The surge in user interactions.

Source of Stimulus: users in peak usage periods.

Environments: Operation Overload

Artifacts: Server Infrastructure

Responses: Facebook's system automatically scales its resources, allocating additional server capacity to handle the surge in user requests.

Response Measures: Measure the time it takes for the system to respond to user requests during peak periods.

**Security scenario:**

“"An unauthorized individual from an external source, attempts to access the Facebook system and manipulate user data. The system promptly identifies this malicious activity, retains an audit trail documenting the unauthorized actions, notifies system administrators, and initiates a shutdown procedure to safeguard the integrity of the platform.

Stimulus: tries to manipulate user data.

Source of Stimulus: unauthorized individual.

Environments: online

Artifacts: Facebook system

Responses: notifies system administration, and shuts down the system

Response Measures: probability of identifying individual responsible for the attack.

1. [How might availability trade-off against cost-effectiveness?](https://link.springer.com/article/10.1007/s11219-019-09478-x)

Availability refers to the ability of a system to remain operational and accessible, ensuring that services are consistently provided to users.

Cost-effectiveness involves optimizing resource utilization and minimizing expenses to achieve business goals efficiently.

Availability >< cost-effectiveness

The higher the availability, the higher the cost and vice versa

Example: Consider a social media platform like Facebook. High availability is critical to ensure users can access the platform consistently. This might involve redundant servers, load balancing, and failover mechanisms to handle spikes in user traffic or server failures. To meet the above factors, Facebook must invest heavily in facilities, for example deploy redundant servers and a load balancing system, which will cause prices additional costs, including hardware, maintenance, and operations costs to increase.

1. Identify two kinds of sensitive data or other resources in the system.

**Student Personal Information:**

Description: Student personal information is sensitive data that includes details such as names, addresses, contact numbers, birthdates, and sometimes even medical records.

Importance: Protecting this information is crucial for maintaining privacy and complying with data protection regulations.

**Educational Records and Grades:**

Description: Educational records and grades contain sensitive information about a student's academic performance, attendance, and disciplinary history.

Importance: Unauthorized access to this data could impact a student's privacy, academic standing, and potentially violate privacy laws.

1. Determine the possible attackers, their motivations, and their resources.

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| Attacker Type | Motivations | Resources |
| Students | - Grades or Academic Competition | - Personal Computers or Devices |
|  | - Curiosity or Challenge | - Online Resources (Tutorials, Hacking Tools) |
| Insiders (Faculty/Staff) | - Grudges or Discontent | - Administrative Access |
|  | - Financial Gain | - Knowledge of System Weaknesses |
| **Hacktivists** | - Political or Ideological Reasons | - Technical Skills |
|  | - Disapproval of School Policies | - Online Networks (Communities, Hacking Resources) |