THE PROCESS OF DEPLOYMENT OF CLOUD ENVIRONMENT OF AN EDUCATIONAL INSTITUTION: NETWORK SECURITY

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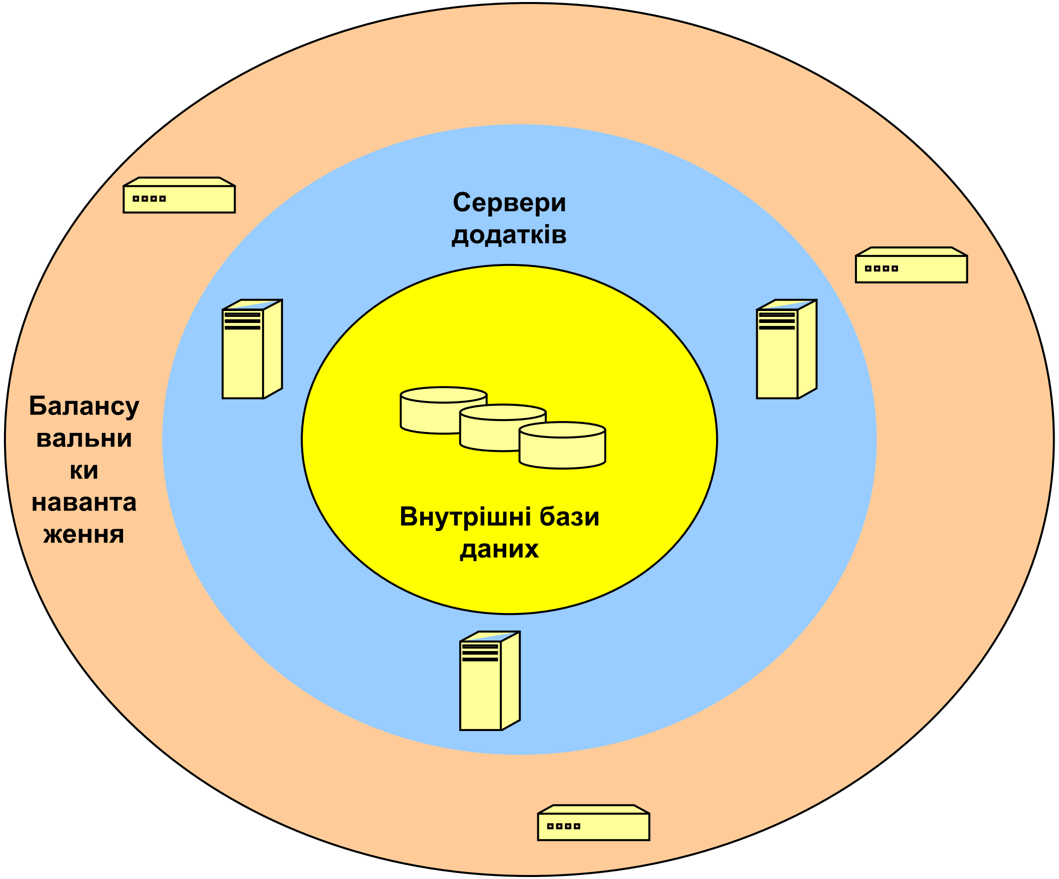
The process of deployment of cloud environment of an educational institution: problems...

- ❑ Problems that arise between physical infrastructure of information and communication technologies and cloud environment can be partly solved by **using outsourcing services and services of SRM provider.**
- ❑ While using / working with cloud services, a user can experience an emotional challenge that is connected with **inability to visually scan the server which contains data**.
- ❑ An essential problem is limited access to **educational materials (data)**, for instance, **when a chosen cloud provider fails to protect its infrastructure components**.
- ❑ The measures to be taken: **data encryption and remote backup execution** (including backup encryption and network communications on another cloud service, encryption of network traffic together with web traffic).

The following is recommended:

- ❑ Connect to an **additional cloud provider for executing automated backup procedures,** which guarantees recovery of all data and their history, even with the main cloud provider being physically destroyed.
- ❑ Settings of the level of control on using own data in **cloud environment and data processing centre.**
- ❑ While bundling data for backup, to encrypt using strong **cryptography**, for example **Pretty Good Privacy**, which enables us to store messages (data) even in insecure environment.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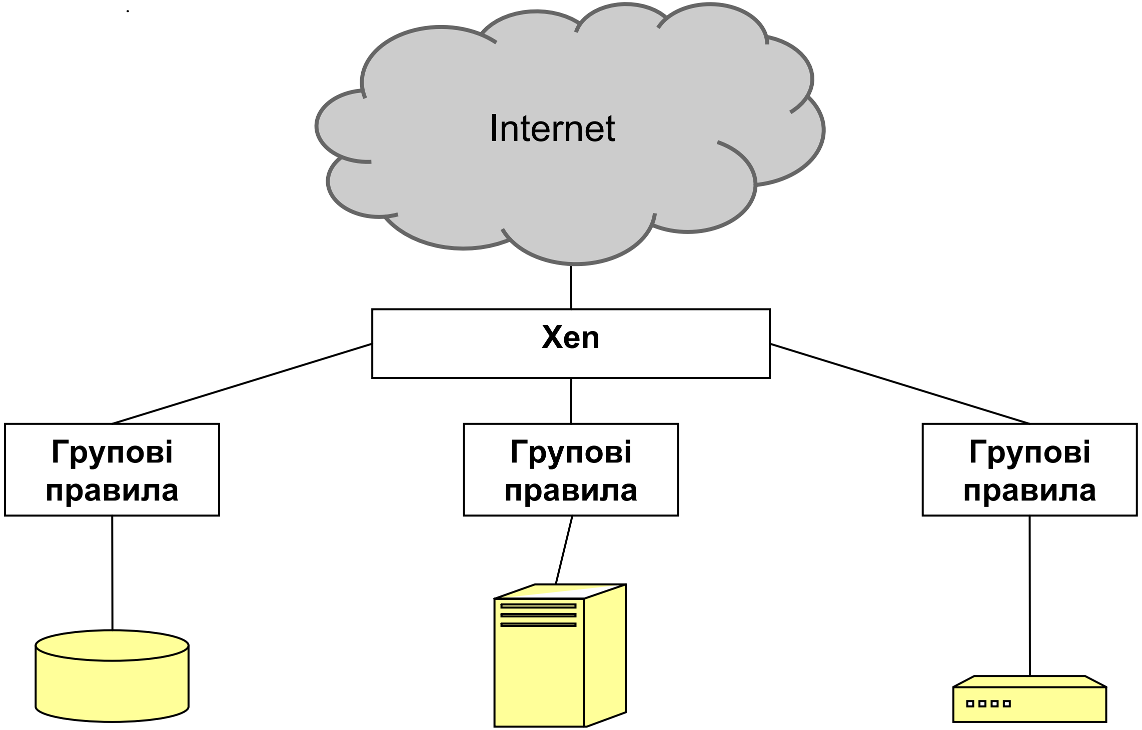
Network security support:

- ❑ While developing cloud environment it is essential to have a possibility to mount **ephemeral storage devices** when **virtual server** is used, although in **EC2** environment the failure to encrypt ephemeral storage devices poses a risk because the **system zeros** the storage out when your instance terminates.

- ❑ **Encrypting filesystems** with caution helps to avoid conflicts regarding requirements to the performance level of **certain applications and data security.**

- ❑ **Security of using data in cloud environment** is provided by mounting block storage devices and ephemeral storage devices with using encrypted filesystems.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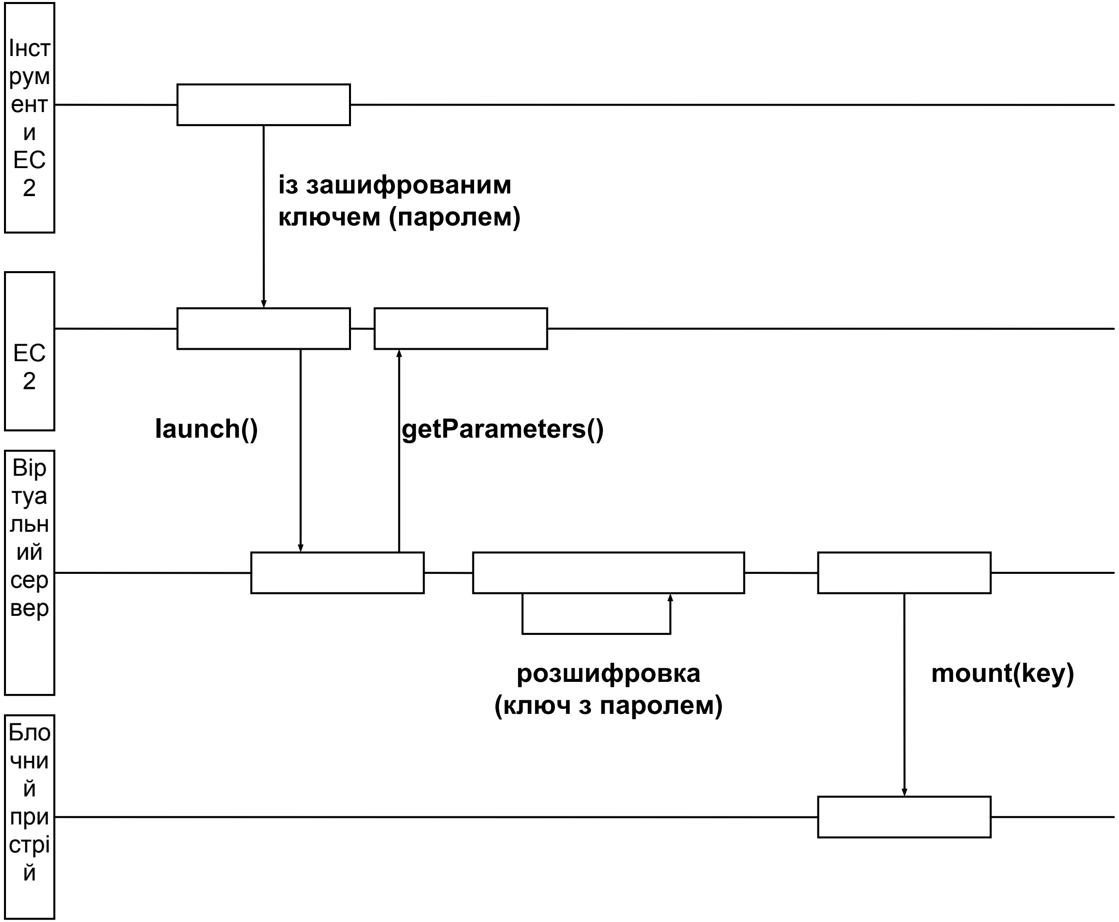
The process of deployment of cloud environment of an educational institution: network security support...

- ❑ Managing the start up a cloud server with using **encrypted filesystems in cloud environment is simplified** and requires advanced security level.
- ❑ It is more reasonable to store **system security passwords** in an unencrypted root filesystem than in a cloud environment.
- ❑ Such password storing is problematic, because the objective of filesystem encryption is to **protect against physical access to disk image.**
- ❑ The process of starting up a **virtual server** with using access **passwords** is shown here.



Інструменти EC2

із зашифрованим ключем (паролем)

EC2

launch()

getParameters()

Віртуальний сервер

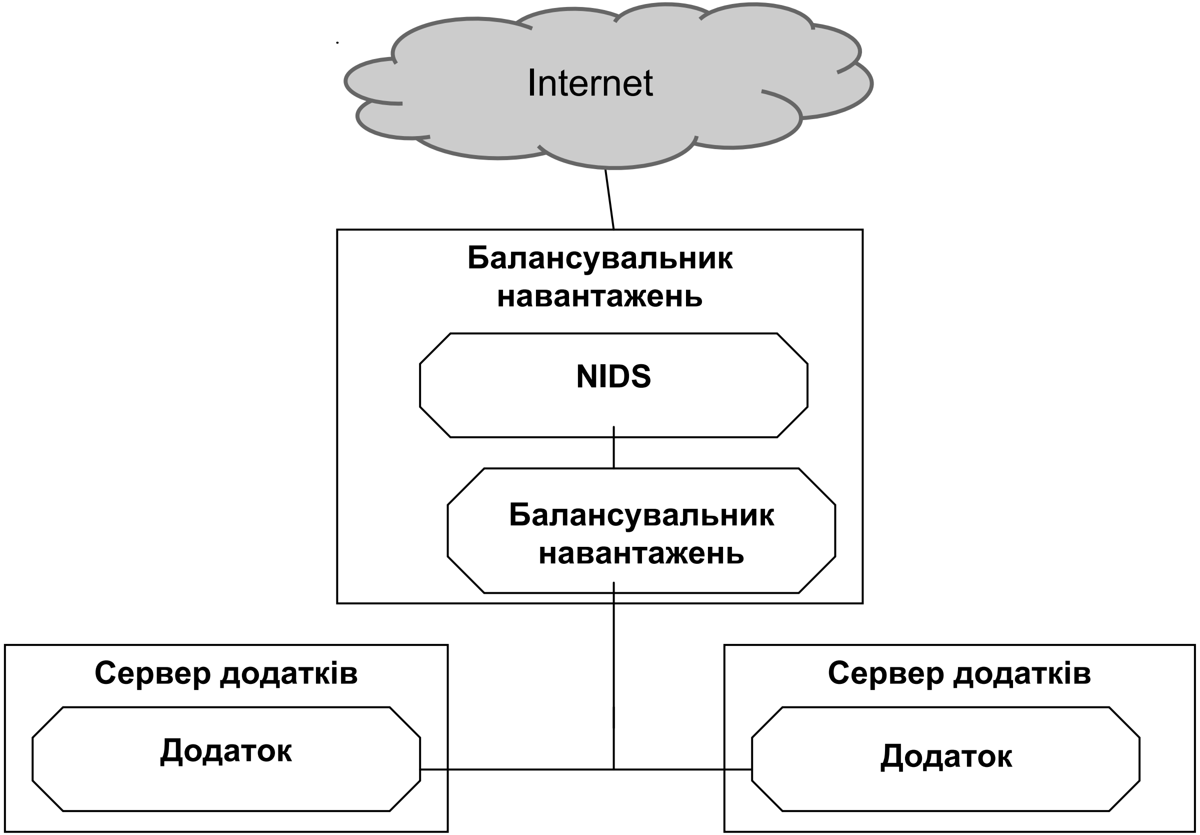
розшифровка (ключ з паролем)

mount(key)

Блочний пристрій

The process of deployment of cloud environment of an educational institution:

- **Specification of developing the system** in cloud environment is possible with implementing mixed architecture, which consists of **physical elements and some virtual elements.**
- **Cloud infrastructure, specializing in hybrid solutions, is the optimal option.**
- In a mixed environment, no sensitive data are hosted in the **cloud infrastructure**, because they are processed on servers of physical data centre which is under a user’s control.
- **The perimeter of one or more network segments** is protected by a firewall. A firewall protects the outermost perimeter, allowing in only **http, https, ftp**.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Сервер додатків
Додаток

The process of development of cloud environment of educational establishment:

- **Between the protected network segment and outermost perimeter there are border systems**, such as load balancer, that route traffic into a special area, where there are application servers.
- They make requests to the database across another firewall into internal protected network with **internal sensitive database**.
- The proposed structure is used for **gaining access to increasingly sensitive data**, and there are several layers of network protection **in the form of firewalls**.

- The disadvantage of this infrastructure is that once any internal server is compromised inside any **given segment**, full access is provided to other servers in **this segment**.

It is essential!

❑ In cloud environment there are no **perimeters and segments.**

❑ **All virtual servers** are on the same level in the network, and the traffic is managed through security groups.

There are many factors which define how **effective the network security system** in a cloud environment can be:

1. It is reasonable to run only one **network service** and **services, aimed for administration on each virtual server**.

2. **Sticking several services** on one server can lead to attack vectors for accessing the data on that server or using the server as a buffer zone to receive network's access rights.

The process of deployment of cloud environment of an educational institution:

- ❑ It is not reasonable **to open direct access to most sensitive data,** and attackers will need to exploit three different attack vectors before they can get to that data.
- ❑ Obviously, protection of each server requires using a certain port for the support of a service given.**It is appropriate to limit access of third parties to servers.**
- ❑ It is recommended to use a reverse proxy even when **load balancer using** is limited.
- ❑ A **reverse proxy forwards** a user's requests from external environment to one or several servers, logically located in internal network.

Thank you

for your attention!

Good luck!