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Multi-Tenancy Authorization System with Federated Identity for Cloud- Based Environments Using Shibboleth

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Introduction

- **Cloud computing systems:** reduced upfront investment, expected performance, high availability, infinite scalability, fault-tolerance.
- **IAM (Identity and Access Management)** plays an important role in controlling and billing user access to the shared resources in the cloud.

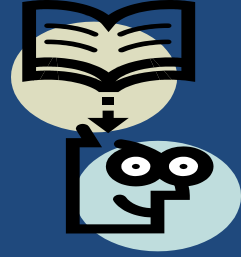
Introduction

- IAM systems need to be protected by federations.
- Some technologies implement federated identity, such as the SAML (Security Assertion Markup Language) and Shibboleth system.
- The aim of this paper is to propose a multi-tenancy authorization system using Shibboleth for cloud-based environments.

Related Work

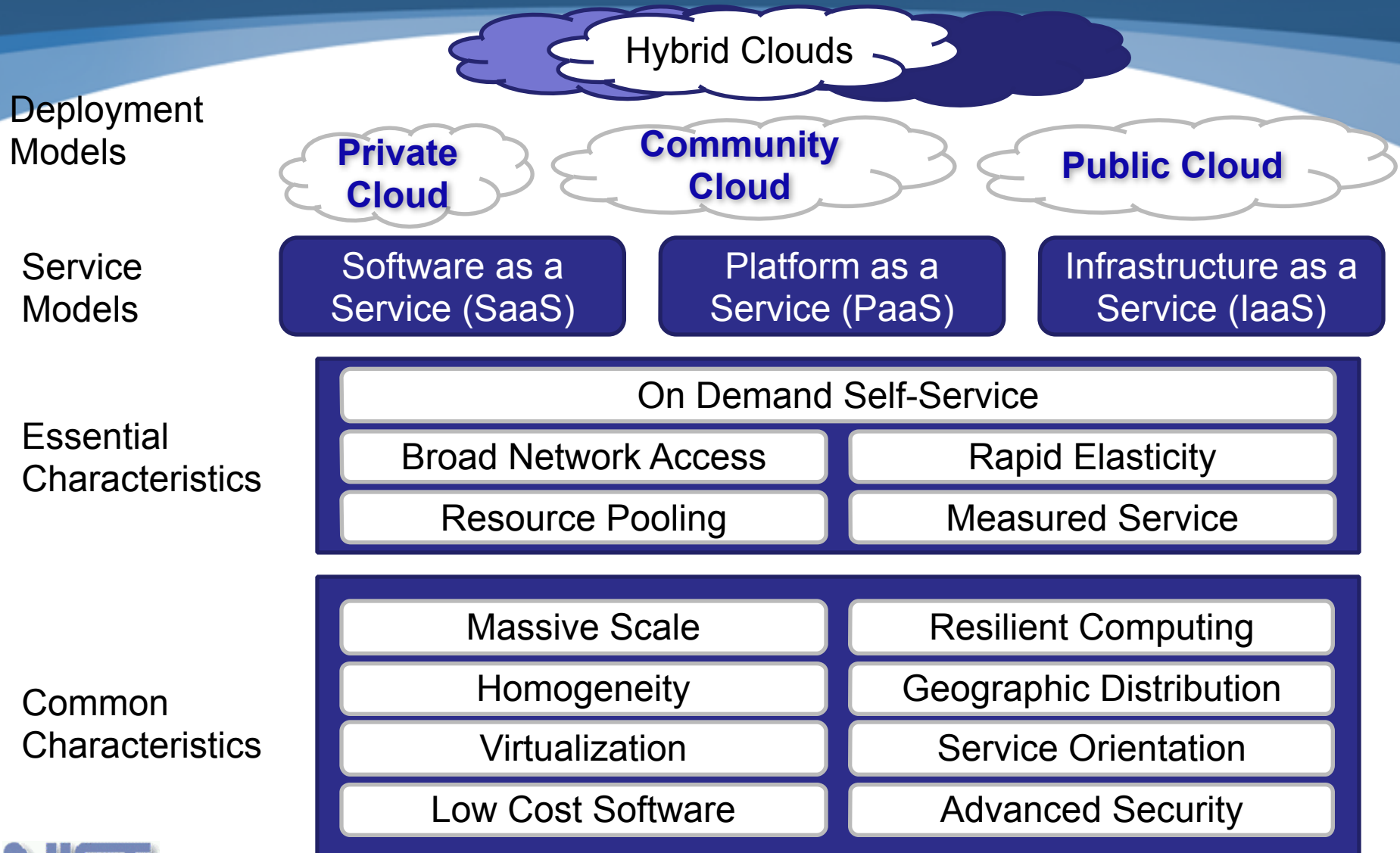
- R. Ranchal et al. 2010 - an approach for IDM is proposed, which is independent of Trusted Third Party (TTP) and has the ability to use identity data on untrusted hosts.
- P. Angin et al. 2010 - an entity-centric approach for IDM in the cloud is proposed. They proposed the cryptographic mechanisms used in R. Ranchal et al. without any kind of implementation or validation.

This Work



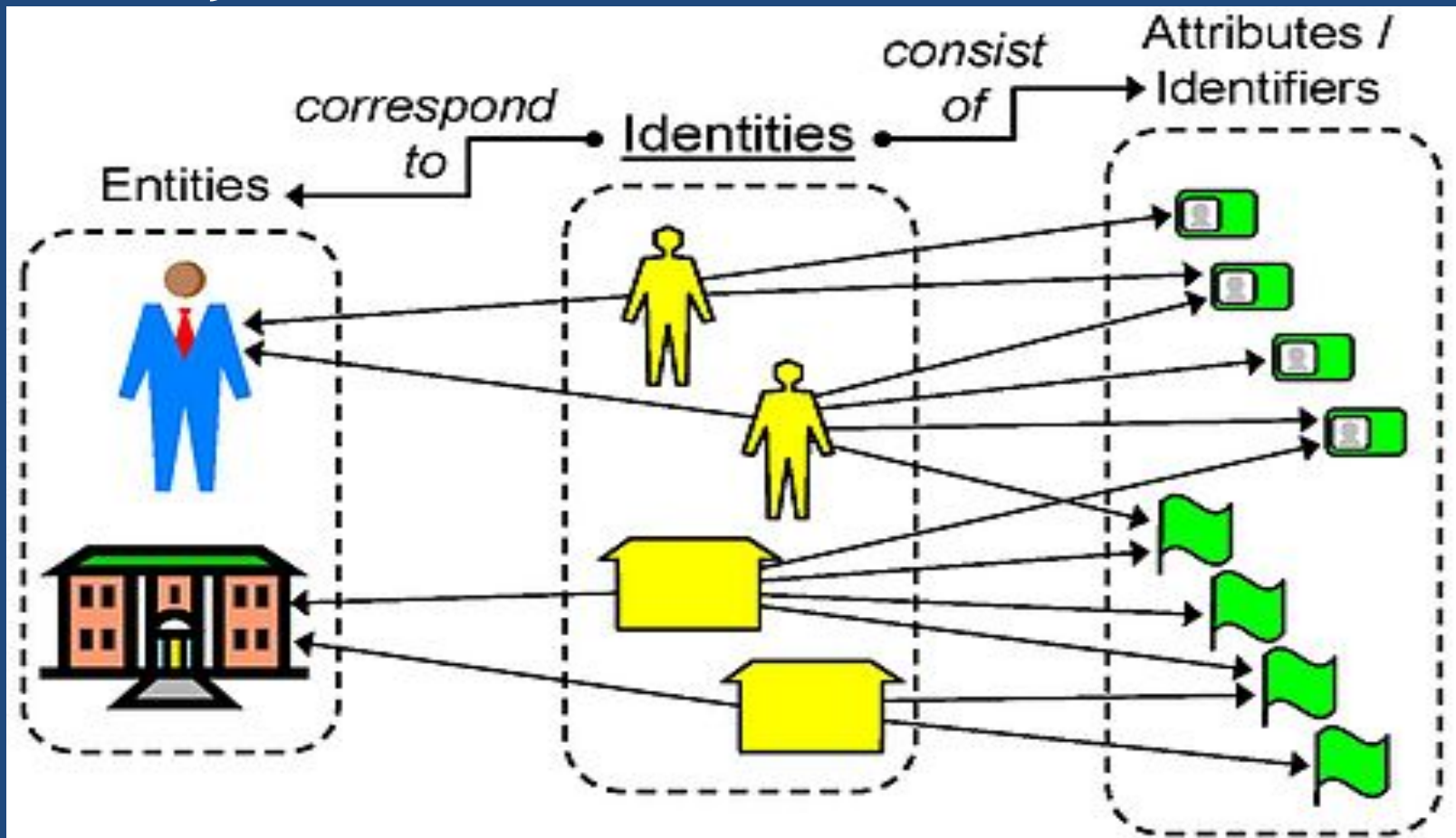
- Provide identity management and access control and aims to: (1) be an independent third party; (2) authenticate cloud services using the user's privacy policies, providing minimal information to the Service Provider (SP); (3) ensure mutual protection of both clients and providers.
- This paper highlights the use of a specific tool, Shibboleth, which provides support to the tasks of authentication, authorization and identity federation.
- The main contribution of our work is the implementation in cloud and the scenario presented.

The NIST Cloud Definition Framework



Identity Management

- Digital identity is the representation of an entity in the form of attributes.



Identity Management

- **Identity Management (IdM)** is a set of functions and capabilities used to ensure identity information, thus assuring security.
- An **identity management system (IMS)** provides tools for managing individual identities.
- An IMS involves:
 - User
 - Identity Provider (IdP)
 - Service Provider (SP)

IMS

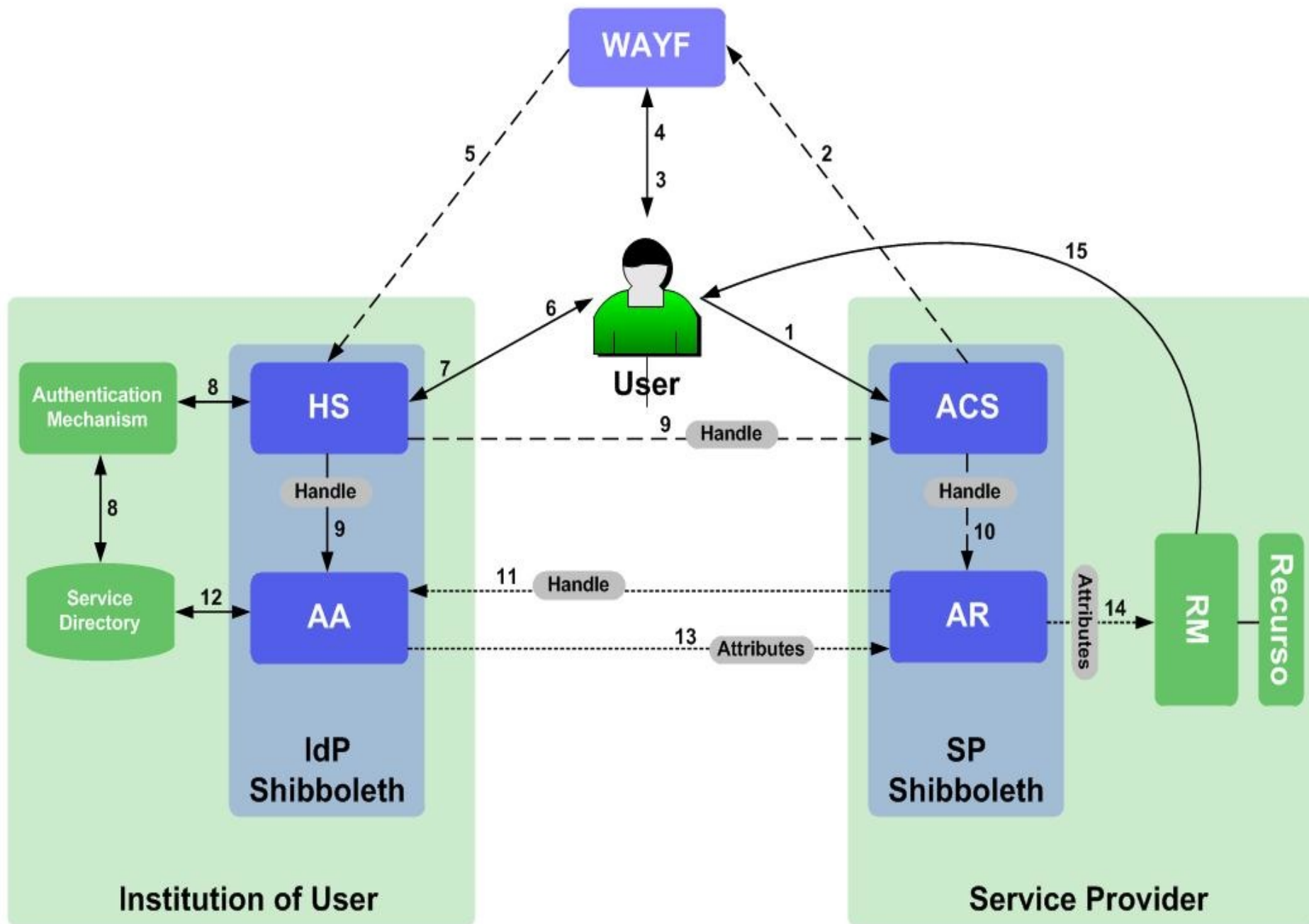
- *Provisioning*: addresses the provisioning and deprovisioning of several types of user accounts.
- *Authentication*: ensures that the individual is who he/she claims to be.
- *Authorization*: provide different access levels for different parts or operations within a computing system.
- *Federation*: it is a group of organizations or SPs that establish a circle of trust.



- The OASIS SAML standard defines precise syntax and rules for requesting, creating, communicating, and using SAML assertions.
- The Shibboleth is an authentication and authorization infrastructure based on SAML that uses the concept of federated identity. The Shibboleth system is divided into two entities: the IdP and SP.

Shibboleth

- The **IdP** is the element responsible for authenticating users: Handle Service (**HS**), Attribute Authority (**AA**), Directory Service, Authentication Mechanism.
- The **SP** Shibboleth is where the resources are stored: Assertion Consumer Service (**ACS**), Attribute Requester (**AR**), Resource Manager (**RM**).
- The **WAYF** ("Where Are You From", also called the Discovery Service) is responsible for allowing an association between a user and organization.

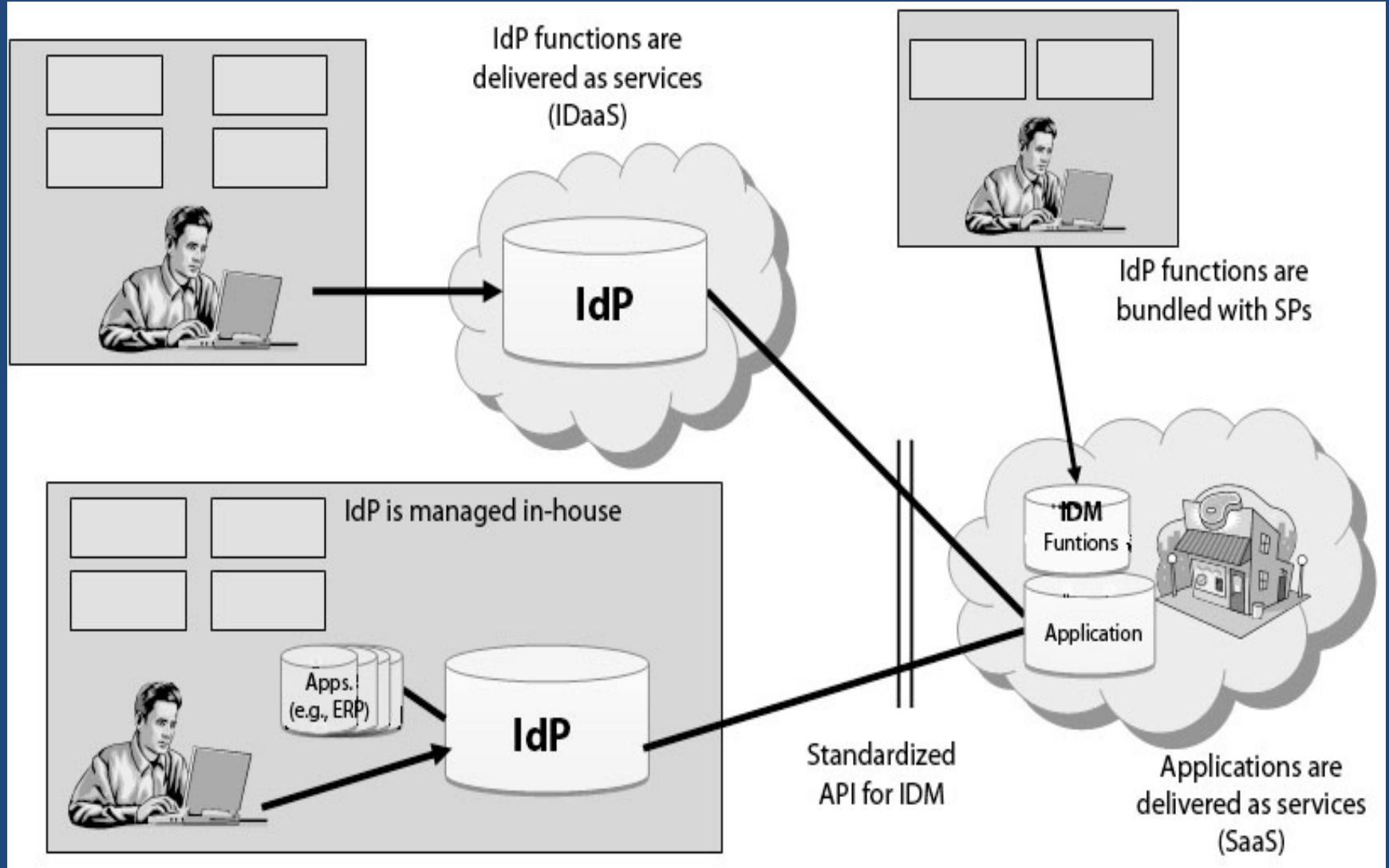


In **Step 1**, the user navigates to the SP to access a protected resource. In **Steps 2 and 3**, Shibboleth redirects the user to the WAYF page, where he should inform his IdP. In **Step 4**, the user enters his IdP, and **Step 5** redirects the user to the site, which is the component HS of the IdP. In **Steps 6 and 7**, the user enters his authentication data and in **Step 8** the HS authenticates the user. The HS creates a handle to identify the user and sends it also to the AA. **Step 9** sends that user authentication handle to AA and to ACS. The handle is checked by the ACS and transferred to the AR, and in **Step 10** a session is established. In **Step 11** the AR uses the handle to request user attributes to the IdP. **Step 12** checks whether the IdP can release the attributes and in **Step 13** the AA responds with the attribute values. In **Step 14** the SP receives the attributes and passes them to the RM, which loads the resource in **Step 15** to present to the user.

Federated Multi-Tenancy Authorization System on Cloud

- IdM can be implemented in several different types of configuration:
 - IdM can be implemented in-house;
 - IdM itself can be delivered as an outsourced service. This is called Identity as a Service (IDaaS);
 - Each cloud SP may independently implement a set of IdM functions.
- In this work, it was decided to use the first case configuration: in-house.

Configurations of IDM systems on cloud computing environments



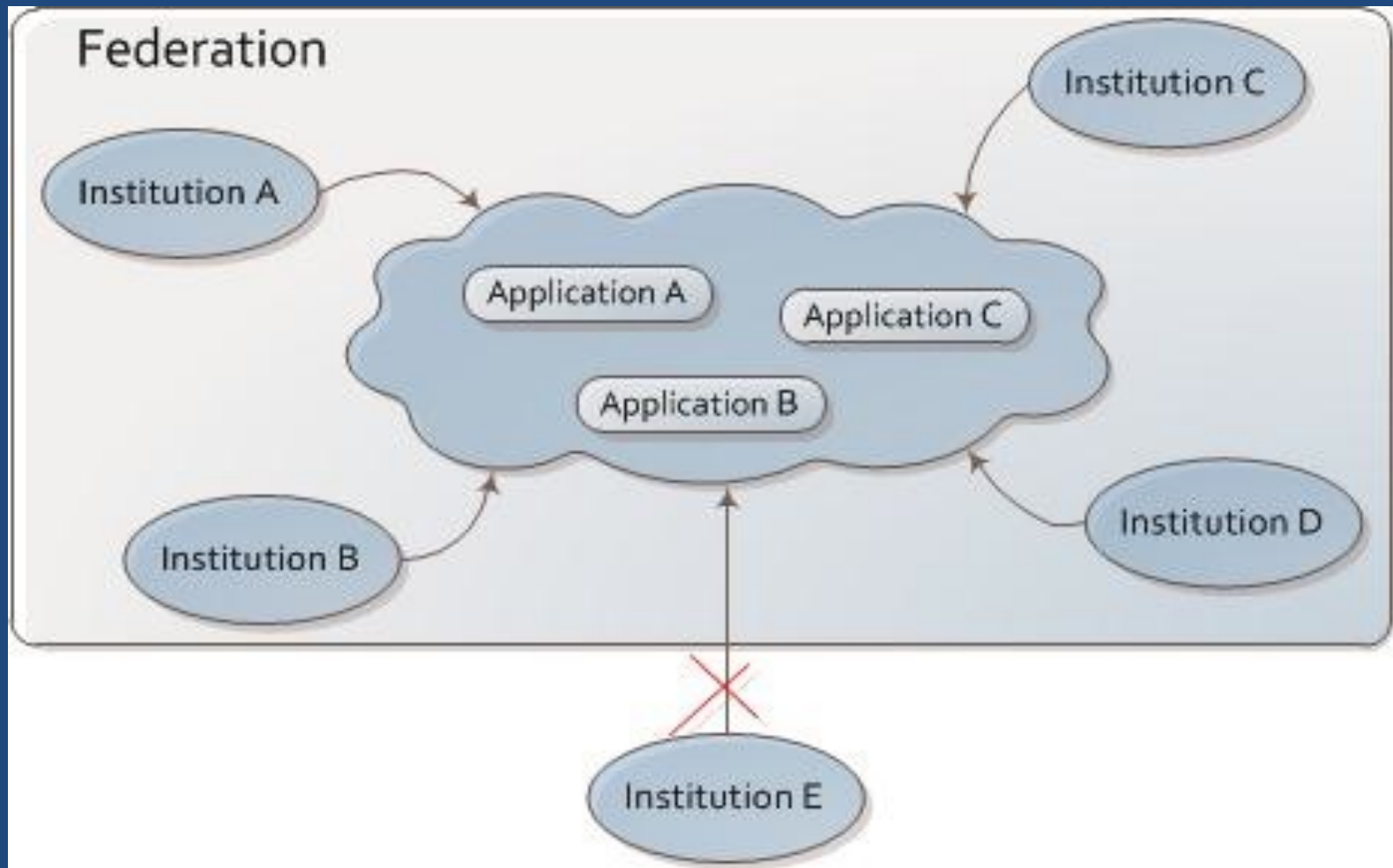
Federated Multi-Tenancy Authorization System on Cloud

- This work presents an authorization mechanism to be used by an academic institution to offer and use the services offered in the cloud.
- The part of the management system responsible for the authentication of identity will be located in the client organization.
- The communication with the SP in the cloud (Cloud Service Provider, CSP) will be made through identity federation.
- The access system performs authorization or access control in the environment.
- The institution has a responsibility to provide the user attributes for the deployed application SP in the cloud.
- The authorization system should be able to accept multiple clients, such as a multi-tenancy.

Scenario

- A service is provided by an academic institution in a CSP, and shared with other institutions. In order to share services is necessary that an institution is affiliated to the federation.
- For an institution to join the federation it must have configured an IdP that meets the requirements imposed by the federation.
- Once affiliated with the federation, the institution will be able to authenticate its own users, since authorization is the responsibility of the SP.

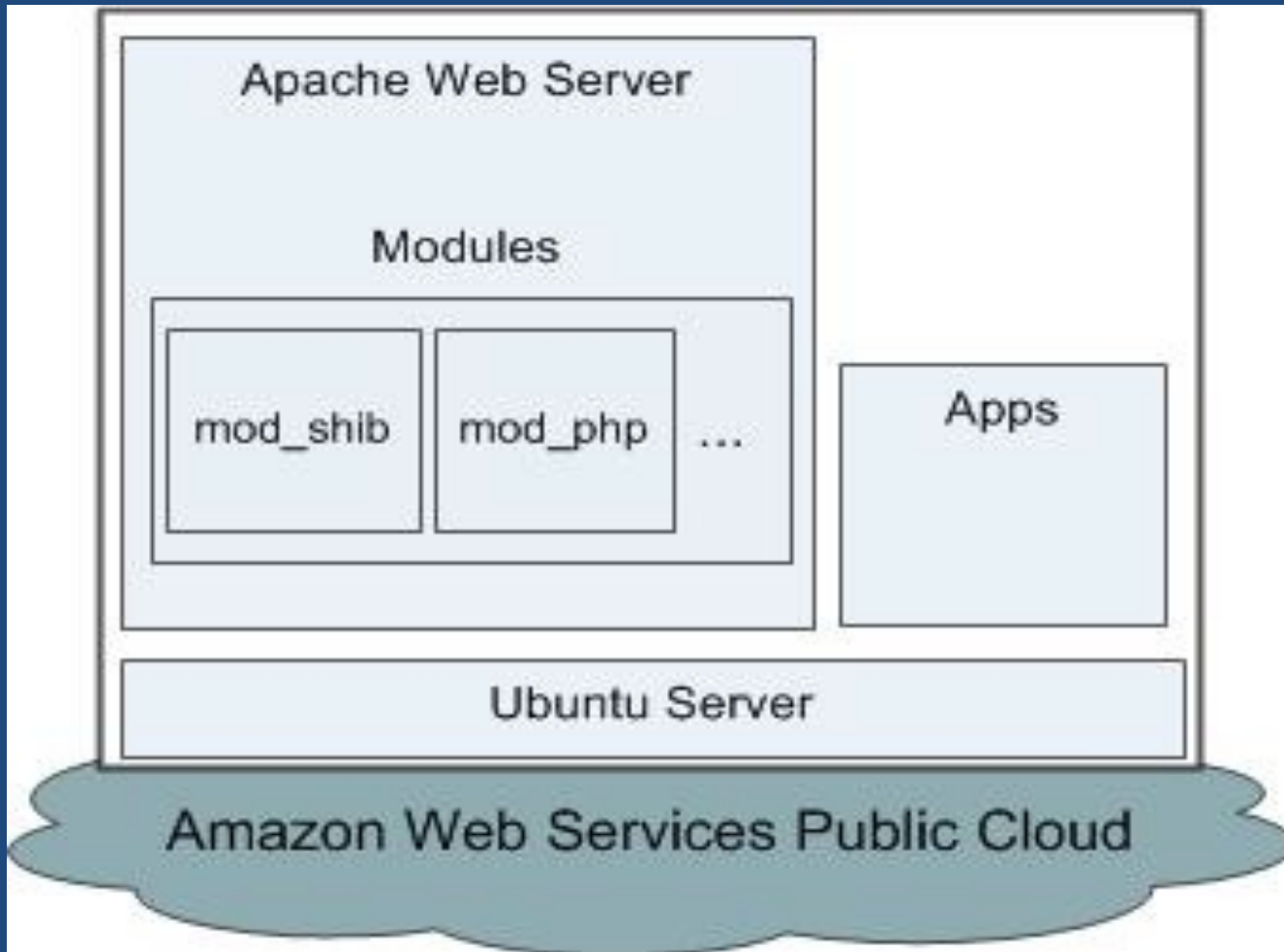
Scenario - Academic Federation sharing services in the cloud



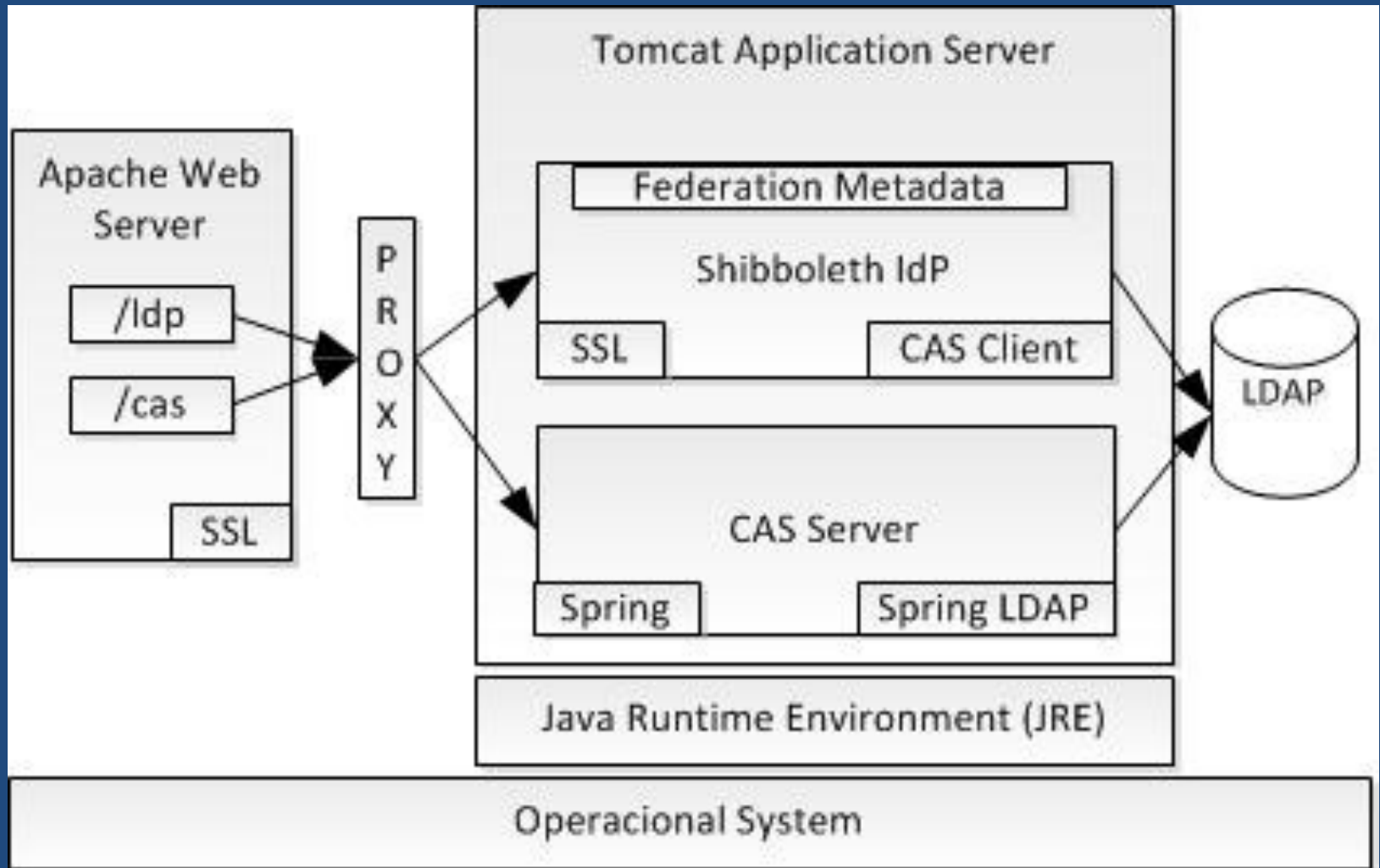
Implementation of the Proposed Scenario

- A SP was primarily implemented in the cloud:
 - an Apache server on a virtual machine hired by the Amazon Web Services cloud.
 - Installation of the Shibboleth SP.
 - Installation of DokuWiki, which is an application that allows the collaborative editing of documents.
 - The SP was configured with authorization via application, to differentiate between common users and administrators of Dokuwiki.

Implementation of the Proposed Scenario - Cloud Service Provider



Implementation of the Proposed Scenario - cloud IdP



Implementation of the Proposed Scenario

- The JASIG CAS Server was used to perform user authentication through login and password, and then passes the authenticated users to Shibboleth.
- The CAS has been configured to search for users in a Lightweight Directory Access Protocol (LDAP). To use this directory OpenLDAP was installed in another virtual machine, also running on Amazon's cloud.
- To demonstrate the use of SP for more than one client, another IdP was implemented, also in cloud, similar to the first. To support this task Shibboleth provides a WAYF component.

Analysis and Test Results within Scenario

- In this resulting structure, each IdP is represented in a private cloud, and the SP is in a public cloud.

The results highlighted two main use cases:

- *Read access to documents*
- *Access for editing documents*



Conclusions

- The use of federations in IdM plays a vital role.
- This work was aimed at an alternative solution to a IDaaS. IDaaS is controlled and maintained by a third party.
- The infrastructure obtained aims to: (1) be an independent third party, (2) authenticate cloud services using the user's privacy policies, providing minimal information to the SP, (3) ensure mutual protection of both clients and providers.

Conclusions

- This paper highlights the use of a specific tool, Shibboleth, which provides support to the tasks of authentication, authorization and identity federation.
- Shibboleth was very flexible and it is compatible with international standards.
- It was possible to offer a service allowing public access in the case of read-only access, while at the same time requiring credentials where the user must be logged in order to change documents.

Future Work

- We propose an alternative authorization method, where the user, once authenticated, carries the access policy, and the SP should be able to interpret these rules.
- The authorization process will no longer be performed at the application level.
- Expanding the scenario to represent new forms of communication
- Create new use cases for testing.
- Use pseudonyms in the CSP domain.

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Thank you!



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