Interoperation between Identity Management Systems

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Agenda

1. Identity Management Systems
2. Current systems
3. Differences and issues
4. Interoperation
5. Privacy and security
6. Concluding remarks

Need for identity management

- Today’s user typically has many accounts with many Internet service providers.
- Each account has its own ‘name’ for the user, and also its own *credential*, i.e. a means of authenticating the user (e.g. a password).
- This presents a huge burden on the user, who typically resorts to one or both of two bad practices:
  - writing down passwords, or
  - re-using passwords.

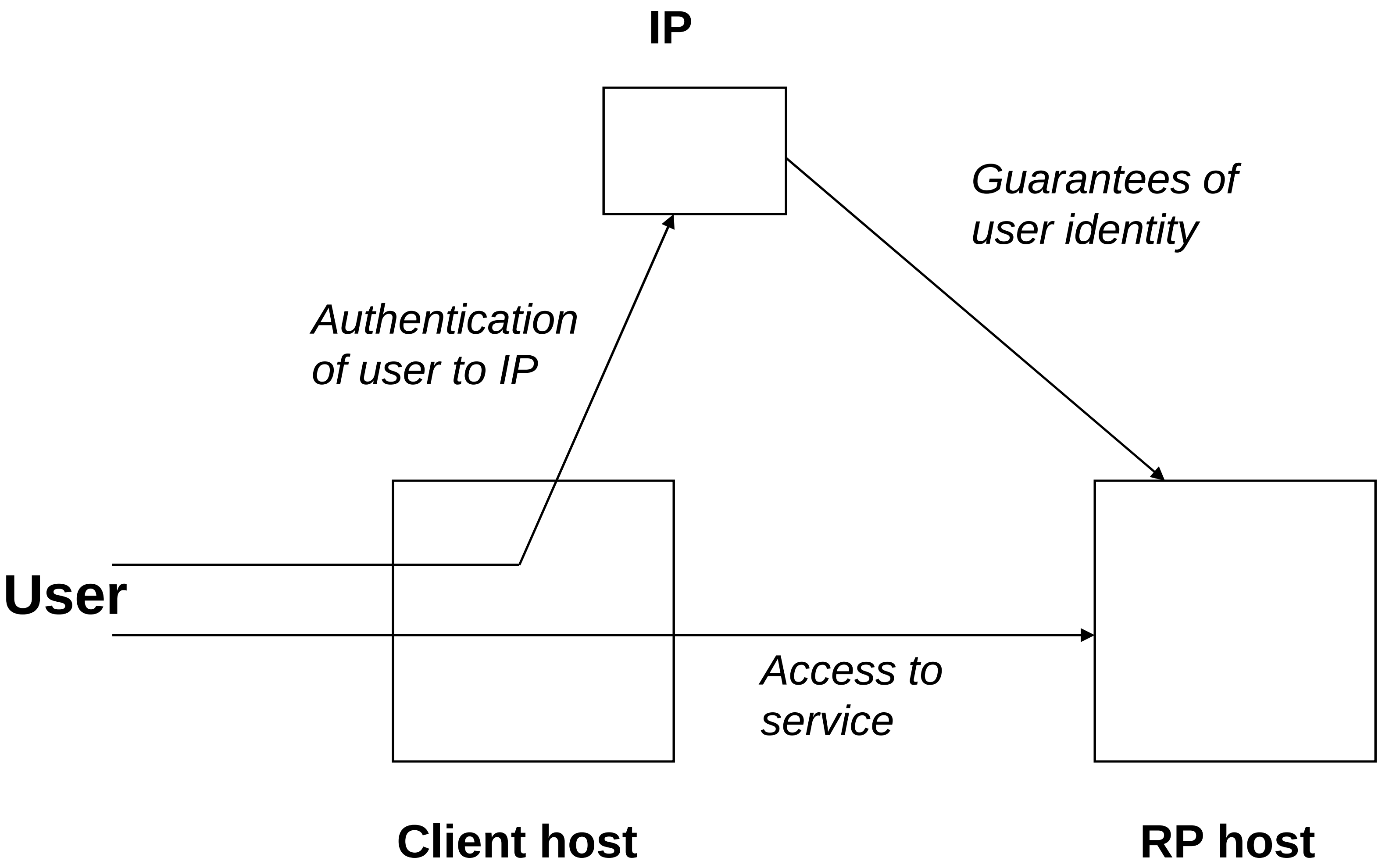
What is an ID Management System?

- Various definitions in use.
- For purposes of this talk ...
  - an Identity Management System (IDMS) is a scheme which enables a user to delegate some of the responsibility for credential management to a TTP called an *Identity Provider* (*IP*);
  - this reduces task of credential management for user (at cost of delegating trust).

Roles

- **User** – human being for whom service is ultimately provided;
- **Client** – platform (e.g. PC) employed by User;
- **Relying Party (RP)** – provider of service which wants assurance about user identity;
- **Identity Provider (IP)** – authenticates user/client and then provides assurances about user to RP.

Operation


IP
Guarantees of user identity
Authentication of user to IP
User
Access to service
Client host
RP host

Terminology

- **Single Sign-On (SSO)**: an SSO system is a special type of IDMS in which user authenticates to IP just once and then is authenticated automatically to multiple RPs.
- **User-centric**: a user-centric IDMS is simply an IDMS in the terminology used here.
- **Claim-based**: a claim-based IDMS is one in which the IP not only authenticates the user, but may store other information about the user (attributes).

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History

- An early example of a (failed) IDMS is provided by Microsoft Passport.
- Microsoft introduced Passport:
  - provided an SSO service for Passport-registered users to Passport-registered RPs;
  - no longer operates as an SSO service – used simply as a means of managing Microsoft logins.
- This seems to have acted as a spur to the industry, and there are a now a whole range of IDMSs.

SAML overview

- SAML (Security Assertion Markup Language) is an OASIS standard.
- Actually two major versions: 1.1 and 2.0 (with significant differences).
- Standards specify two (quite different) things, both designed to support IDMSs:
  - SAML assertions – XML data structures;
  - protocols to support an IDMS.
- Arguably SAML is not actually an IDMS, but certainly provides key messaging components of an IDMS.

SAML assertions

- SAML assertions are a standardised means of enabling one party (e.g. an IP) to make statements about authentication of a User.
- Three types:
  - Authentication statements;
  - Attribute statements;
  - Authorisation decision statements.
- These standardised assertions are widely used in IDMSs.

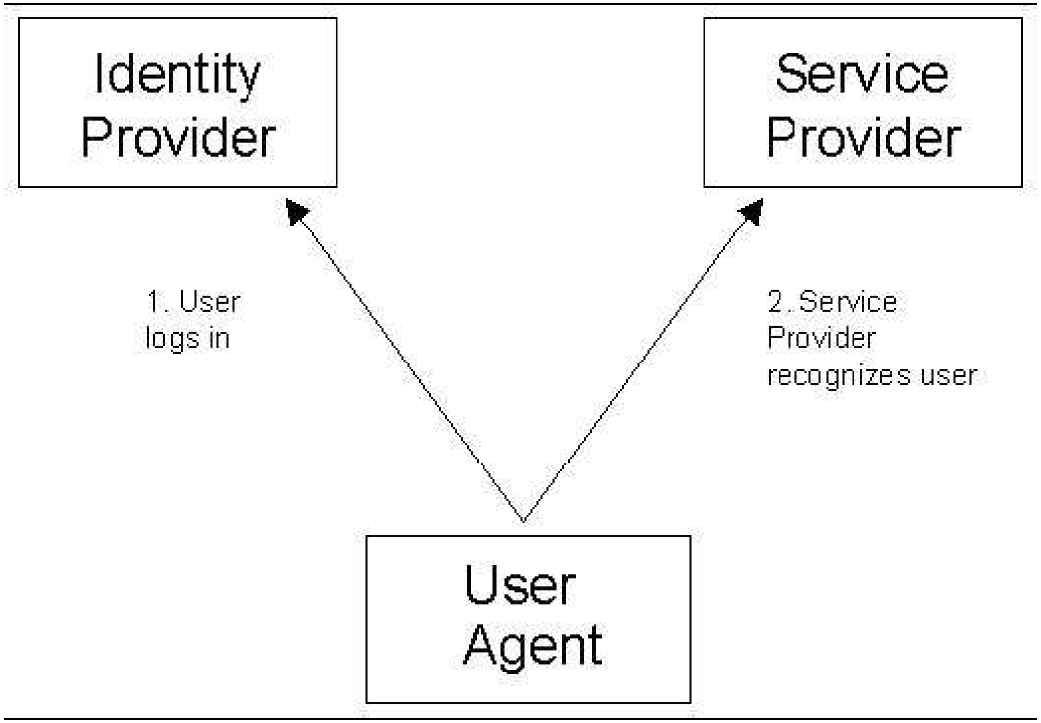
SAML protocols

- These enable SAML assertions to be transferred from an IP to an RP in response to a *query* from the RP.
- Three types of query:
  - Authentication queries;
  - Attribute queries;
  - Authorisation decision queries.
- SAML v2.0 also includes protocols for other functions necessary to support an IDMS (e.g. ‘single logout’).

Liberty Alliance

- The Liberty Alliance is a consortium of companies interested in SSO and identity management.
- It has published a series of specifications for an ‘open’ XML-based SSO system.

Liberty SSO Model



Role of Identity Provider

- In Liberty, a User authenticates to a Liberty *Identity Provider* (IP).
- The IP then automatically authenticates user to RPs.
- User then needs only one password (or other means to authenticate to IP).
- Works using http redirection.

Liberty operation I

- Typical operational scenario is as follows.
- User visits web site of RP, and SSL connection established.
- RP then redirects user web browser to Liberty IP which establishes SSL connection and then authenticates the user (if necessary).
- Liberty IP then redirects user back to RP.

Liberty operation II

- Messages need to be passed between RP and IP.
- RP sends authentication request and IP responds with authentication response (containing ‘security assertions’).
- Messages passed either embedded in URLs or in http forms (using POST method).
- Syntax of messages based on SAML.

Pseudonymity

- Liberty requires the IP to use a different pseudonym with each RP.
- Gives a level of unlinkability for users (a type of anonymity).
- However, may be compromised through network addresses.

CardSpace

- CardSpace is a Microsoft architecture for identity management.
- It has a number of component parts:
  - A distributed architecture for identity management;
  - A set of defined Web Services interfaces between entities in the architecture;
  - A set of software is available both for Windows Vista and XP which will enable users to manage their identities in a Windows environment;
  - Development support to enable applications to use CardSpace managed identities.

Identity Metasystem

- Microsoft refers to this collection of components as an Identity Metasystem.
- The idea is to provide a unified way for (Windows) users to use many different underlying identity management systems.
- Key ideas here are:
  - provide a simple user model for identity;
  - enable users to control which identity is used for what purpose through user interface notion of **InfoCards**.

Some CardSpace definitions

- *Digital identity*: a set of claims made by one digital subject about itself or another digital subject.
- *Digital subject*: a person or thing, represented or existing in the digital realm.
- *Claim*: an assertion of the truth of something.

CardSpace comments I

- The Microsoft definition of digital identity is a very general one, and does not distinguish between two concepts which are often treated separately:
  - identifiers or labels (e.g. email address, National Insurance Number, passport number, …);
  - attributes (e.g. the identity holder is an employee of company X, a silver card holder for airline Y, a season ticket holder for train route Z, …)

CardSpace comments II

- There are two main justifications for the Microsoft ‘claims’ approach:
  - it enables protocol interactions to be simplified – a single protocol can be used to transfer claims;
  - some types of claim are difficult to categorise – a credit card number may be viewed as both an identifier and an attribute.
- However, on the down side, human beings by and large understand the distinction between the two types of claim – this means that it may be a useful distinction.
- Thus CardSpace is a **claim-based** IDMS.

OpenID

- OpenID is a decentralised SSO system (with some similarities to Liberty) – it is open source.
- Users register with an OpenID identity provider (IdP).
- A service provider using OpenID displays a login form containing a space for an OpenID identifier, indicating a particular identity with a particular IdP (no password).

Using OpenID

- The RP then communicates with the appropriate IdP, either via the user’s browser or directly.
- The user’s browser is redirected to the IdP, and, if necessary the IdP then authenticates the user (OpenID does not restrict how this is done).
- The IdP then redirects the user’s browser back to the RP and provides an authentication assertion.

Adoption and issues

- Use of OpenID is growing rapidly.
- The technology is now backed by a lot of leading players (Google, Microsoft, ...).
- See www.openid.net
- As with all systems relying on redirection at the behest of the RP, the scheme is open to phishing attacks if username/password used for authentication.

OpenID and CardSpace

- Because CardSpace and its identity metasystem are token-format-agnostic, CardSpace does not compete directly with other Internet identity architectures like OpenID.
- In some ways, OpenID and CardSpace can be seen as complementary.
- Indeed, CardSpace Information Cards can be used today for signing into OpenID providers, Windows Live ID accounts, SAML identity providers, and other services.

Shibboleth

- Shibboleth is an architecture and implementation for a federated identity-based authentication and authorisation system.
- Identities are treated as attributes, as in CardSpace.
- It is open source.
- Shibboleth builds on SAML 1.1.

Higgins

- Higgins is an open source identity framework with significant similarities to CardSpace.
- Like CardSpace is uses a card-based metaphor for managing user identities.

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Common features

- **Use of SAML**: all the schemes we have discussed either mandate SAML, or, in the case of the two frameworks, support its use.
- All adhere to general IP-RP model discussed earlier in talk.

Differences in scope

- CardSpace and Higgins are frameworks, i.e. in some sense are not complete IDMSs.
- They are designed to allow a variety of token types to be used to support IDM.
- Nevertheless, they do have standardised message formats/types.
- CardSpace also does not easily support SSO.
- Liberty, OpenID and Shibboleth, however, are complete schemes, with fixed token types.

Open-ness

- Shibboleth, Higgins and OpenID are open source, in that software is freely available,
- However, the term is not so relevant to Liberty, which is just a set of specifications – there could be open source Liberty implementations out there …
- CardSpace is not open source, but nevertheless all major interfaces are public (except Windows interface).

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Need for interoperation

- Many systems are being deployed.
- If the user has a different user experience, and a different set of identity providers for almost every different service, then the whole point of IDMSs will be lost.
- Thus, ideally, either one system will win out, or some level of interoperation between systems is needed.

Who should support interoperation?

- Of course, if every RP supports every IDMS, then there will essentially be no problem.
- However, this seems unlikely (and would be a big burden on small service providers).
- If every IP supports multiple systems, then the problems will be less (but user will still have variety of UXs).
- Client-side support for interoperation would be useful.

Barriers to interoperation

- Differences in scope are a major issue for a client-side approach.
- If RP is using a claim-based IDMS, it may expect to interact with an IP that can make assertions about a range of user attributes.
- However, an IP supporting an ‘authentication only’ IDMS, e.g. Liberty, will not generate such assertions.

Concordia

- The Concordia project (www.projectconcordia.org) is a global initiative designed to drive interoperability across identity protocols in use today.
- It solicits and defines real-world use cases and requirements for use of multiple identity protocols in practical deployment scenarios.
- It supports the creation of protocol solutions.

Concordia – recent work

- Concordia demonstrated technology-provider interopation of high-priority scenarios at the RSA conference in April 08.
- This involved InfoCard – federation, and SAML v2.0 – WS-Federation chaining scenarios.

A client-based approach

- A client-based approach to interoperation between CardSpace and Liberty was presented in:

  W. Alrodhan and C. J. Mitchell, ‘A client-side CardSpace-Liberty integration architecture’, Proceedings of IDtrust 2008, 7th Symposium on Identity and Trust on the Internet, NIST, Gaithersburg, MD, March 2008.

Integrating the two schemes

- *Identity management architecture adaptor* is software installed on client which understands Liberty and CardSpace message flows/formats.
- Interposes itself between IPs and SPs adhering to different identity management architectures, to translate messages.
- In case of Liberty IP and CardSpace RP, we assume that there is a pre-established trust relationship (including pseudonyms, and an InfoCard identifier).

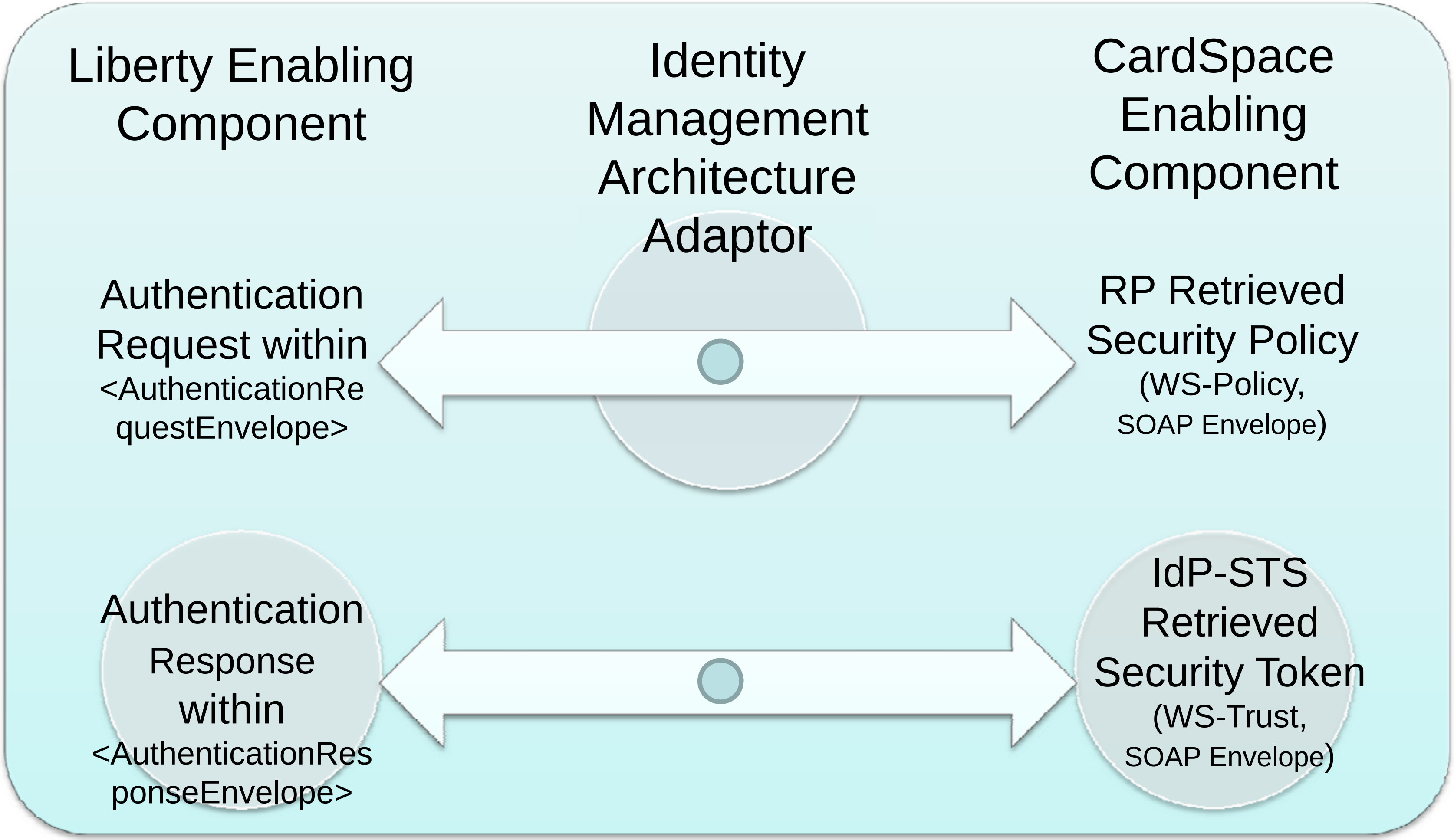
Restrictions

- The scheme has the following restrictions:
  - Only supports SAML tokens;
  - Only asymmetric proof of rightful possession of the token (holder-of-key);
  - In case of CardSpace RP & Liberty IP, token freshness requests are discarded.

Representing the claims

- Possible approaches:
  - **SAML attribute statement**: Would require some modifications to the Liberty enabling component;
  - **Authentication with no claims**: Severe impact on the usability of the integrated scheme.

Data flows



Liberty Enabling Component

Identity Management Architecture Adaptor

CardSpace Enabling Component

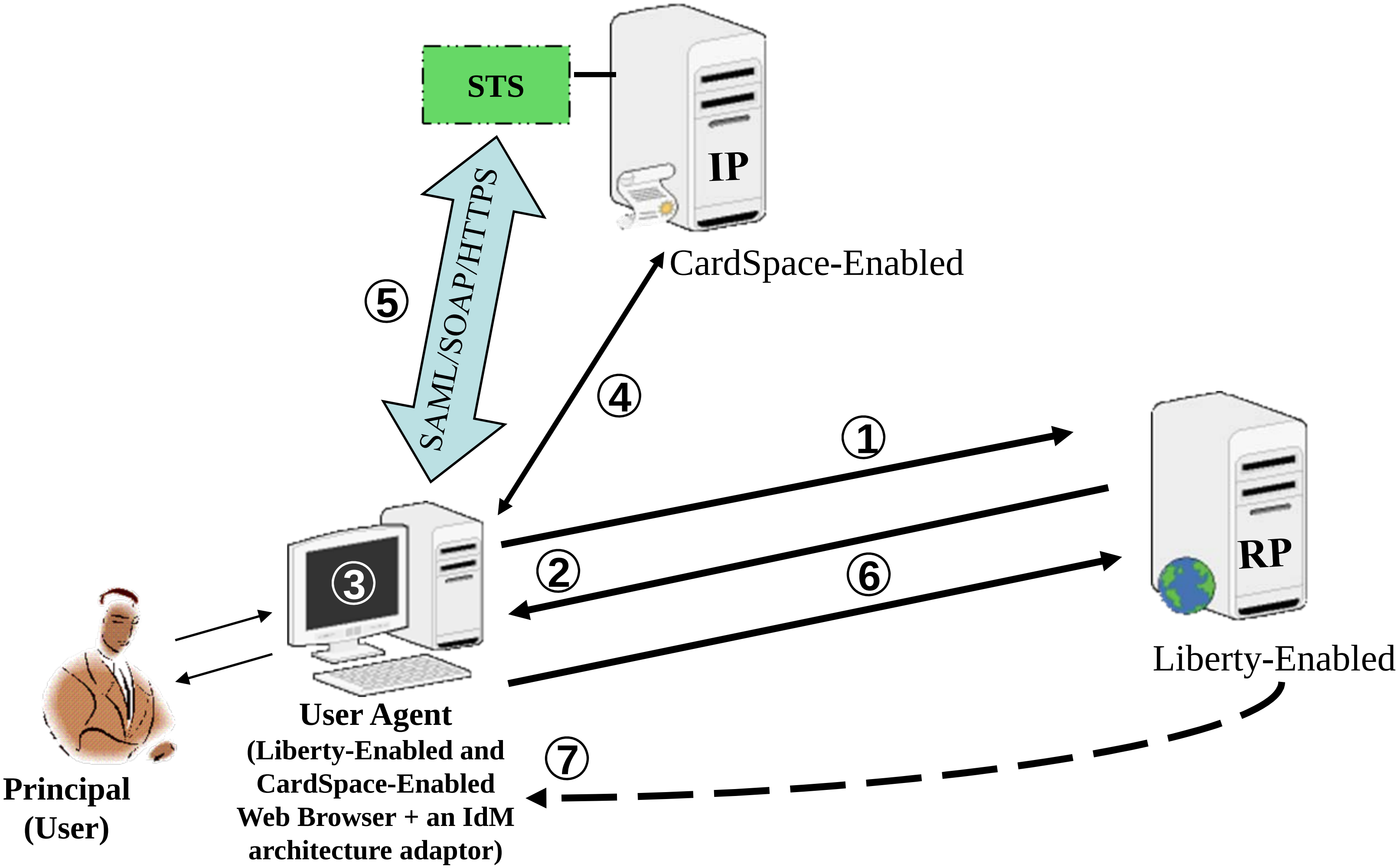
Authentication Request within <AuthenticationRequestEnvelope>

RP Retrieved Security Policy (WS-Policy, SOAP Envelope)

Authentication Response within <AuthenticationResponseEnvelope>

IdP-STS Retrieved Security Token (WS-Trust, SOAP Envelope)

A possible scenario


STS
IP
CardSpace-Enabled
SAML/SOAP/HTTPS
⑤
④
①
②
③
⑥
⑦
RP
Liberty-Enabled
Principal (User)
User Agent (Liberty-Enabled and CardSpace-Enabled Web Browser + an IdM architecture adaptor)

Analysis

- The integration model does not require Microsoft/Liberty cooperation.
- However, implementing such a model is non-trivial task.
- CardSpace and the Liberty ID-FF have somewhat different scopes.
- User-agents still need to be CardSpace and Liberty enabled.
- There is no end-to-end encryption

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Phishing attacks

- There is a major ‘phishing’ problem with any IDMS (how does the user know the IP is genuine?).
  - If the IP uses a password to authenticate the user, then compromise of this password is potentially very serious.
  - In a claim-based IDMS, i.e. where IP potentially holds PII about user, then need to be very careful about how this information is managed and disseminated.

Claim-based systems

- Certain privacy issues arising in CardSpace have been discussed in:
  - W. Alrodhan and C. J. Mitchell, ‘Addressing privacy issues in CardSpace’, in: *Proceedings of IAS ’07, Third International Symposium on Information Assurance and Security, Manchester, UK, August 2007*, IEEE Computer Society (2007), pp.285-291.
- These issues are largely the same for any claim-based IDMS.
- (Above paper also proposes possible solutions).

CardSpace issues

- CardSpace, like many other IDMSs, has a number of limitations, including:
    - Reliance on DNS names to identify IPs and RPs;
    - In default CardSpace scenario, IP is aware of the identities of the RPs (to prevent token replay attacks using “symmetric” means);
    - Reliance on user’s judgment of RP trustworthiness (which gets user PII);
    - Reliance on a single layer of authentication.

RP trustworthiness

- User judgment regarding the honesty of the RP is a security-critical task.
- RP will obtain user’s personal information in form of “asserted claims” within a security token.
- Within CardSpace, user judgment is based on one of:
  - RP’s high-assurance public key certificate.
  - RP’s ‘ordinary’ public key certificate (e.g. a certificate used for SSL/TLS);
  - No certificate at all.

Authentication

- Session security relies on a single layer of authentication, e.g. using an X.509 certificate, Kerberos v5 ticket, self-issued token or password.
- If working session is hijacked (e.g. by compromising a self-issued token), or password is cracked (e.g. via guessing, brute-force, key logging, or dictionary attacks), security of the whole system is compromised.

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Where next?

- Interoperation between IDMSs is a high priority issue – needs more research and more development/testing.
- Privacy and security issues inherent in IDMSs need to be addressed.
- In long term, to avoid high risk compromise of IP credentials, need to give users stronger credentials, e.g. card/token-based, and employing public key cryptography backed by a PKI.