External and Federated Identities on the Web

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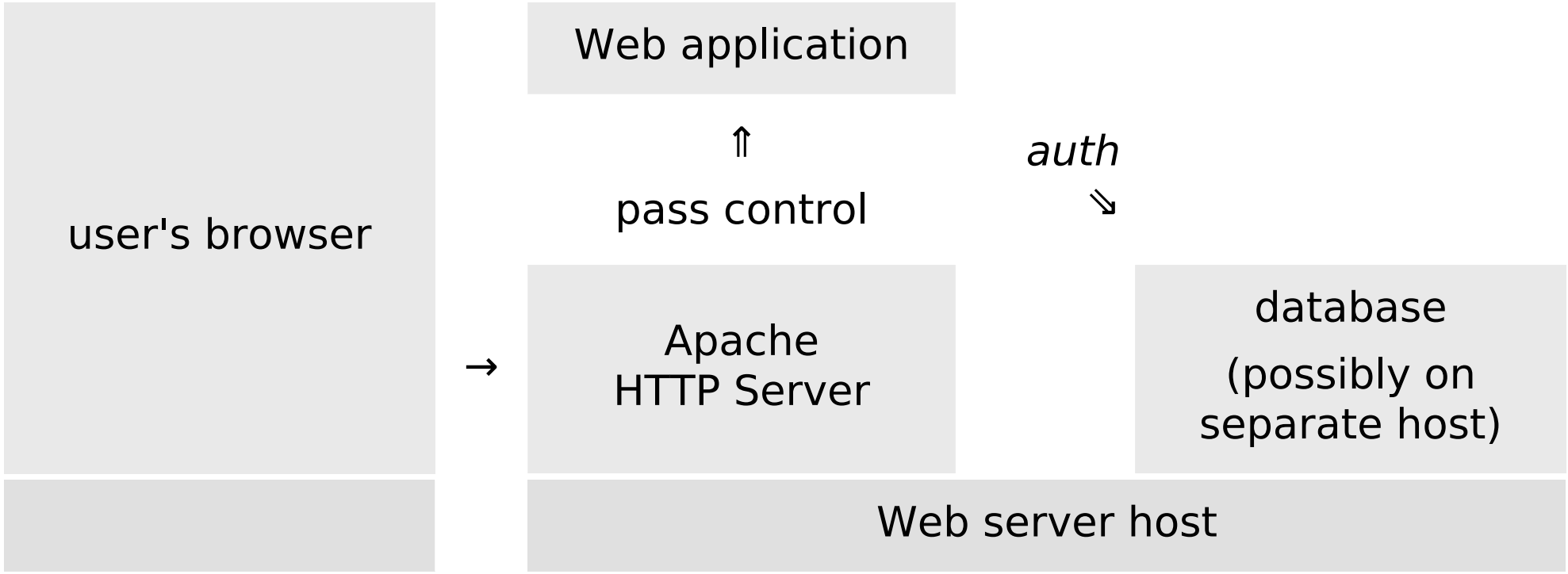
Scope and problem statement

- Applications get deployed in large organizations and across them.
- What are the recommendations for application developers concerning authentication and access control methods and protocols that they should support?

Application-level authentication

Typical small application approach

- Own database schema for users, passwords, and access policies.



Application-level authentication

Pros:

- Integrated user management, without external dependencies.
- Closely linked to custom data, including access control.

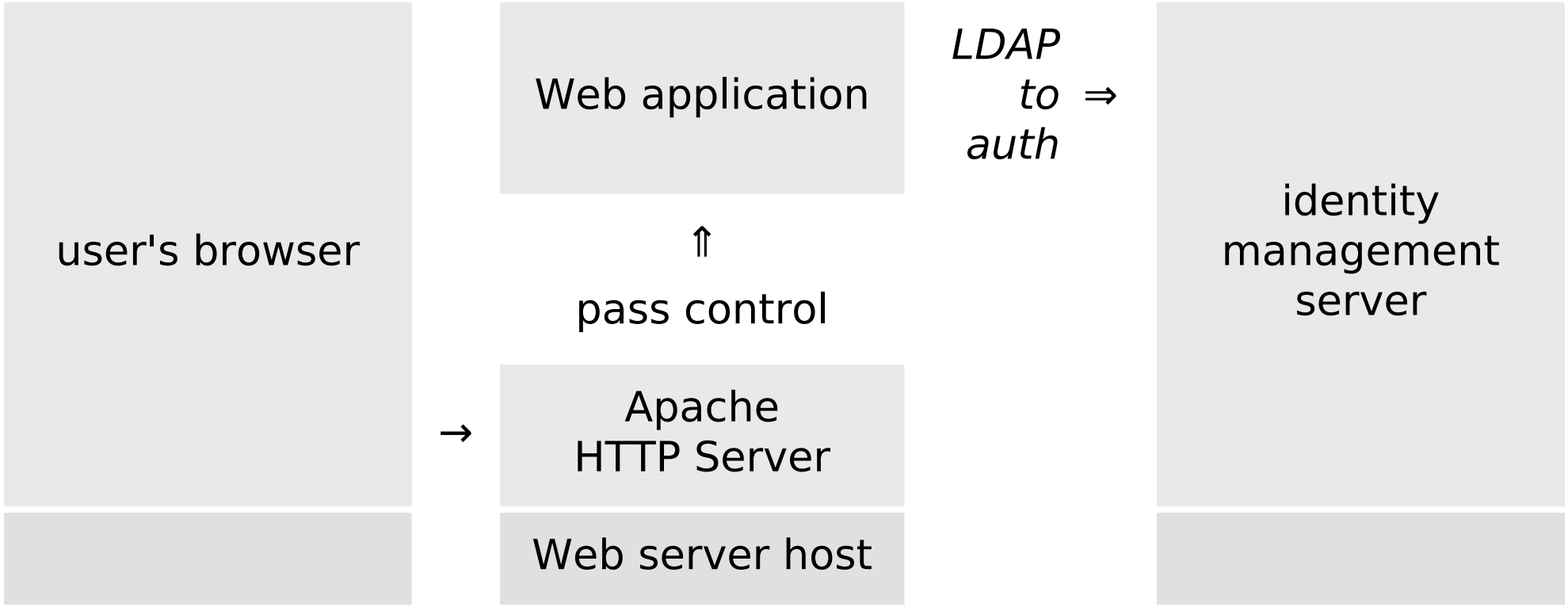
Cons:

- In large organizations, users already exist in central identity management systems.
  - LDAP, IdM/FreeIPA, Active Directory (AD), ...
  - With policies for access control.
  - Noone will sync the users manually.

Application-level LDAP auth

Developers told user identities are in LDAP

- Typical solution: add LDAP support to the application (or framework).



Application-level LDAP auth

Pros:

- Organization's primary identity source is used.

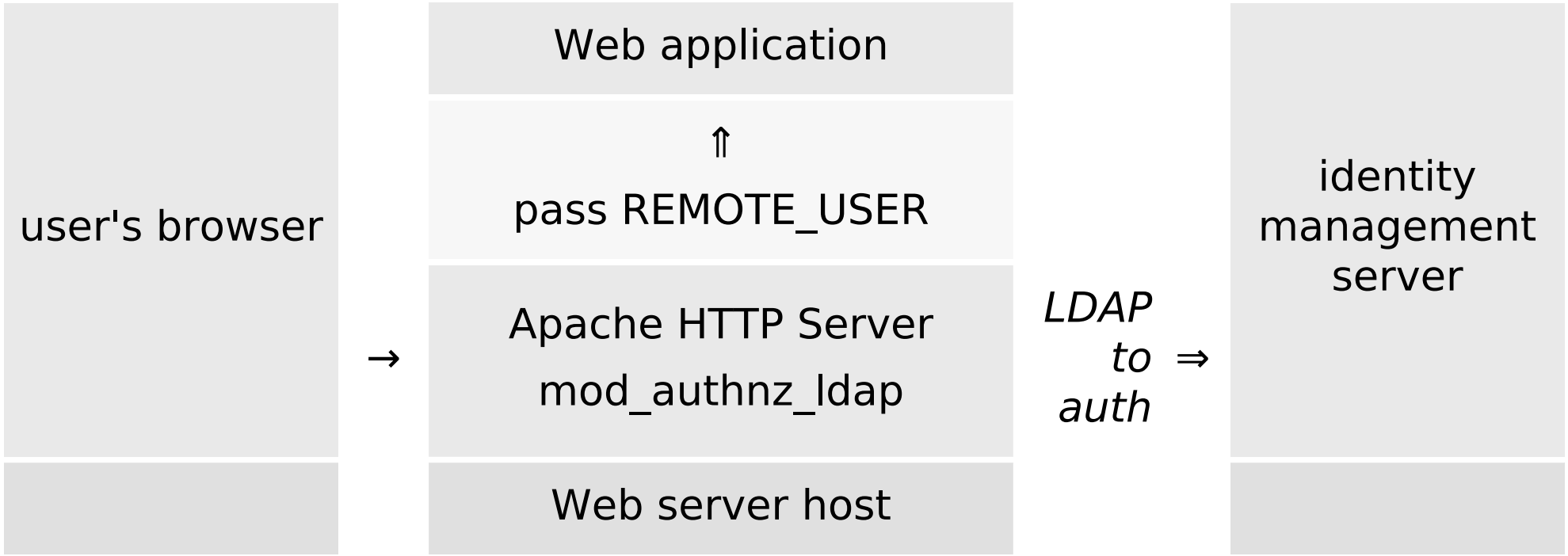
Cons:

- Getting all aspects of LDAP operations right is not easy.
  - Authentication to the LDAP server.
  - Failover, DNS discovery.
  - Multiple domains and forests (AD).
- Every new framework / project starts from scratch.
- Usually only login + password supported.
- Kerberos / GSSAPI, smartcard, or two-factor authentication usually done via different means.

Front-end (Apache) authentication

Front-end accepted for some setups

- Application supports some basic authentication methods.
- For complex ones, authentication front end (Apache HTTP Server) is used.



Front-end (Apache) authentication

Pros:

- Single solution (Apache modules) possible for various deployments.
- Failover, caching.
- Support for Active Directory Global Catalog.

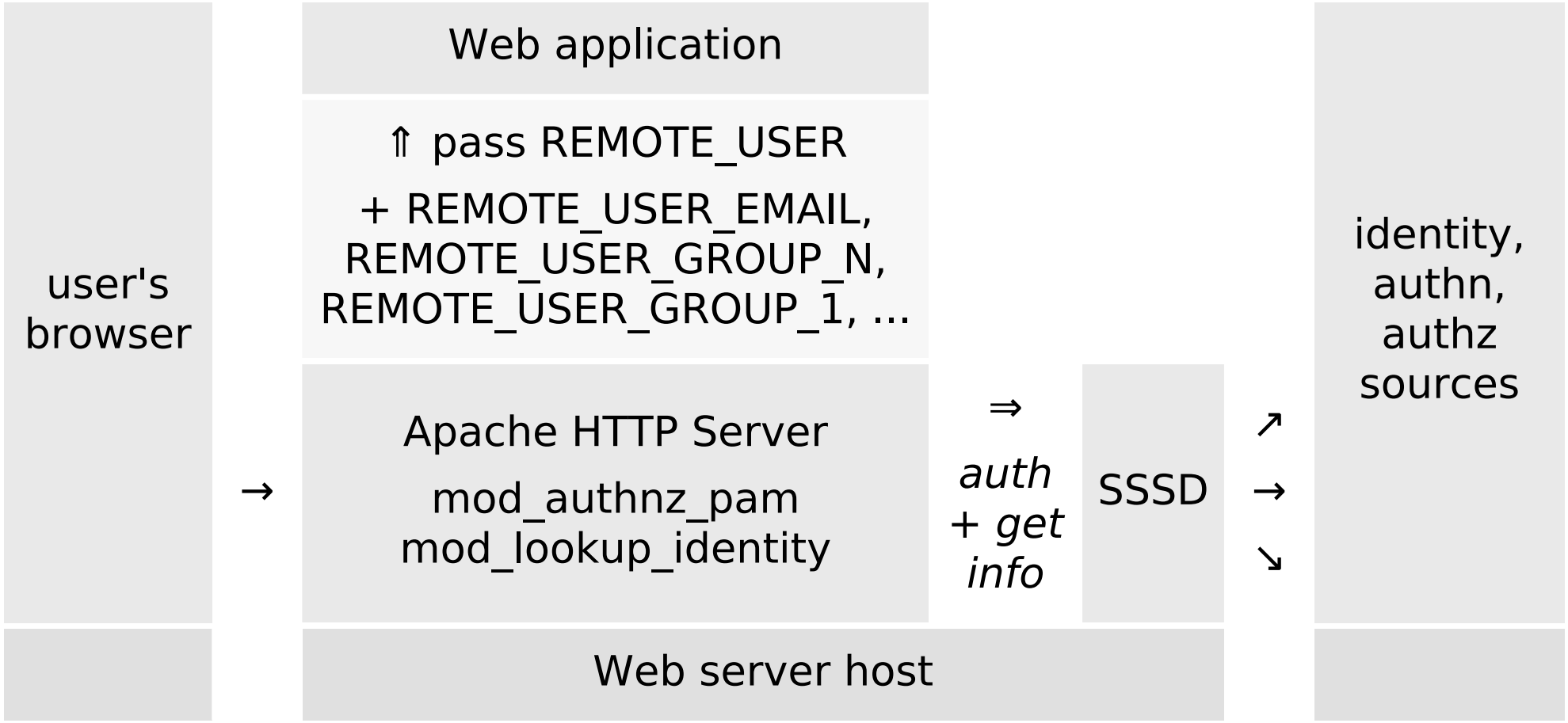
Cons:

- No support for multiple forests (AD).
- No support for Group Policy Objects (GPO) or centralized host-based access control.
- While authorization can be done on Apache level, fine-grained access control in the application not easy.
- Fewer possibilities for nice user management from the application.

OS-level tools for Web services

System Security Services Daemon (SSSD)

- Used for logon to system (ssh), can be used for Web services as well.



OS-level tools for Web services

Pros:

- Single solution (Apache modules) for various applications.
- Failover, caching, DNS discovery, cross-forest trust support (Windows users can log in to Web services on Linux).
- Host-based access control (with IdM/FreeIPA) and GPO support (with AD, via PAM) for central access management.
- Application can get additional information, not just REMOTE_USER.
  - Better user experience.
  - Fine-grained access control in apps based on group membership.

Cons:

- Fewer possibilities for nice user management from the application.

Setups within organizations

Apache modules typical in large organizations

<table>
<tr><th></th><th>Authentication</th><th>Access Check</th><th>Extra User Info</th></tr>
<tr><td>Kerberos / GSSAPI</td><td><s>mod_auth_kerb</s>
mod_auth_gssapi</td><td rowspan="4">mod_authnz_pam</td><td rowspan="5">mod_lookup_identity</td></tr>
<tr><td rowspan="2">Certificate</td><td>mod_ssl</td></tr>
<tr><td>mod_nss</td></tr>
<tr><td rowspan="2">2FA</td><td>mod_auth_form
(provider PAM)</td></tr>
<tr><td colspan="2">mod_lookup_identity
(uses mod_authnz_pam internally)</td></tr>
</table>

Authentication

- Identity is established and verified.
- The identifier (login name) can be further tweaked.

```
SSLVerifyClient require          # authenticate with mod_ssl
SSLUserName SSL_CLIENT_CERT      # r->user = whole certificate data
LookupUserByCertificate On       # find the user in IPA via SSSD
                                 # and set r->user = user login
```

- With mod_auth_gssapi and GSS-Proxy, privilege separation possible. Apache process does not need access to keytab.

```
[service/HTTP]
  mechs = krb5
  cred_store = keytab:/etc/gssproxy/http.keytab
  cred_store = ccache:/var/lib/gssproxy/clients/krb5cc_%U
  euid = 48
```

- 2FA (password + one-time code) possible if backend supports it.

Authorization / access control

- Not every authenticated user should be let in.
  - In Windows domain, everyone has Kerberos ticket granting ticket.
  - Avoid `require valid-user`.
- Editing Apache .conf files is not very flexible.
- Delegation to centralized policy definition (IdM, AD) is preferred.

```
# require group crm-admins           # do not define policy locally
require pam-account crm-production             # delegate via PAM
```

```
# /etc/pam.d/crm-production
auth    required   pam_sss.so                 # pam_sss.so for SSSD
account required   pam_sss.so                 # or other PAM module
```

- Applications can run fine-grained access mechanisms based on user group memberships, obtained from external identity sources.

Additional info

- For better user experience, applications need additional attributes.
- For application-level roles and permissions, applications need group information.
- Since we have just authenticated/authorized the user in Apache, why not get their attributes as well?

```
LookupUserAttr mail REMOTE_USER_EMAIL " "
LookupUserAttr givenname REMOTE_USER_FIRSTNAME
LookupUserAttr sn REMOTE_USER_LASTNAME
```

```
LookupUserGroupsIter REMOTE_USER_GROUP
```

  - We map SSSD's attributes to environment variables.
- Application does not need to reach out for the information.
  - And hit another round of "where to get it from? how to authenticate to that source?" issues.

Recommendations

- What are the recommendations for application developers concerning authentication and access control methods and protocols that they should support, for deployments within large organizations?
  - Accept authentication/authorization result from front-end server.
    - `REMOTE_USER` or other mechanism used.
  - Accept additional user attributes and group membership.
    - `REMOTE_USER_EMAIL`
    - `REMOTE_USER_GROUP_N`
    - `REMOTE_USER_GROUP_1`
    - `REMOTE_USER_GROUP_2`
    - or `REMOTE_USER_GROUPS` as colon-separated list

Users across organizations

Application hosted by a provider

- Users are managed by different organization (the customer).
- Likely no Kerberos as no HTTP/ service keytab from customer's KDC.
- No way to reach into customer's internal network, to IdM/FreeIPA or AD.
- Is our recent recommendation faulty?

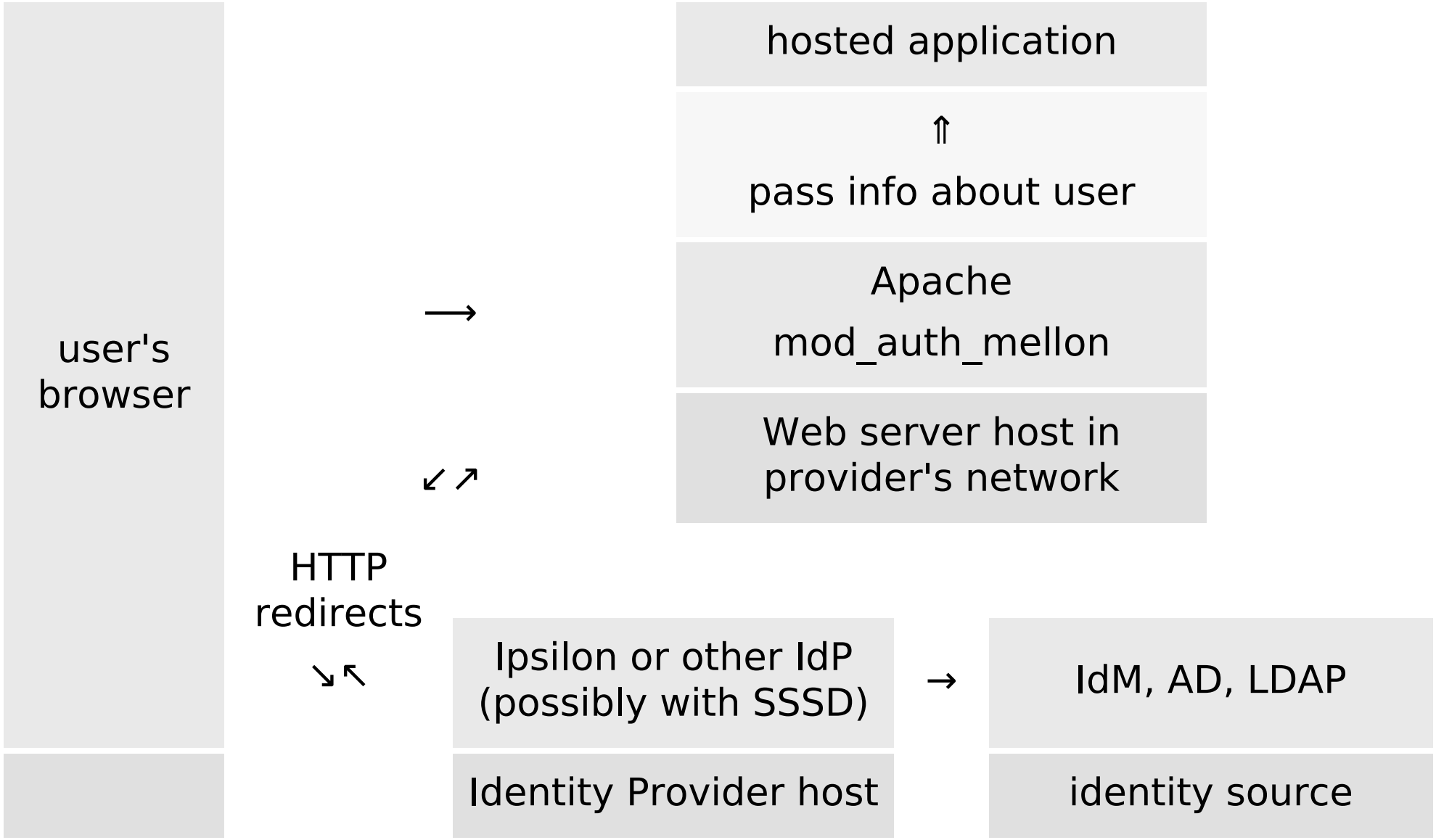
- Actually, it gets even more valid across organizations.
- With federation, all information about the user comes from the initial authentication exchange.

SAML

Security Assertion Markup Language

- Getting identity of authenticated user, their attributes, and authorization information from Identity Provider (provided by customer).
- The single sign-on on the Web.
- Client side (Service Provider, that hosted solution) implemented by Apache module: mod_auth_mellon.
- Previous agreement/setup with metadata and public key exchange needed.
  - Good or bad thing depending on point of view.
- No communication between the Service Provider and Identity Provider needed.
  - Browser handles the redirects of signed data.

SAML workflow



Ipsilon

Three-command SAML Identity Provider

- Install packages, configure, restart Apache.

```
yum install -y ipsilon ipsilon-saml2 ipsilon-authform \
        ipsilon-authgssapi ipsilon-infosssd ipsilon-tools-ipa
ipsilon-server-install --ipa yes --saml2 yes \
        --form yes --gssapi yes \
        --gssapi-httpd-keytab /etc/http.keytab \
        --info-sssd yes --info-sssd-domain example.test
service httpd restart
```

- Written in Python, with protocols and providers as plugins.
- Integrates with FreeIPA/SSSD.
- SAML, OpenID, Mozilla Persona available.
- OpenID Connect actively developed.
- Available in Fedora, coming to RHEL/CentOS soon.

Service Provider

mod_auth_mellon configuration

- Against Ipsilon server:

```
yum install -y ipsilon-client
ipsilon-client-install --saml-idp-url https://idp.example.com/idp \
        --saml-sp-name application --saml-auth /application/login
```

- Against generic SAML server:

```
yum install -y ipsilon-client
ipsilon-client-install \
        --saml-idp-metadata https://idp.example.com/saml/metadata \
        --saml-auth /application/login
```

  Generated SP metadata needs to be transferred to IdP manually.

Service Provider

mod_auth_mellon configuration

- Mapping SAML response attributes to environment variables:

```
MellonSetEnvNoPrefix REMOTE_USER_EMAIL email
MellonSetEnvNoPrefix REMOTE_USER_GROUP groups
```

- The same multivalued variables as mod_lookup_identity with

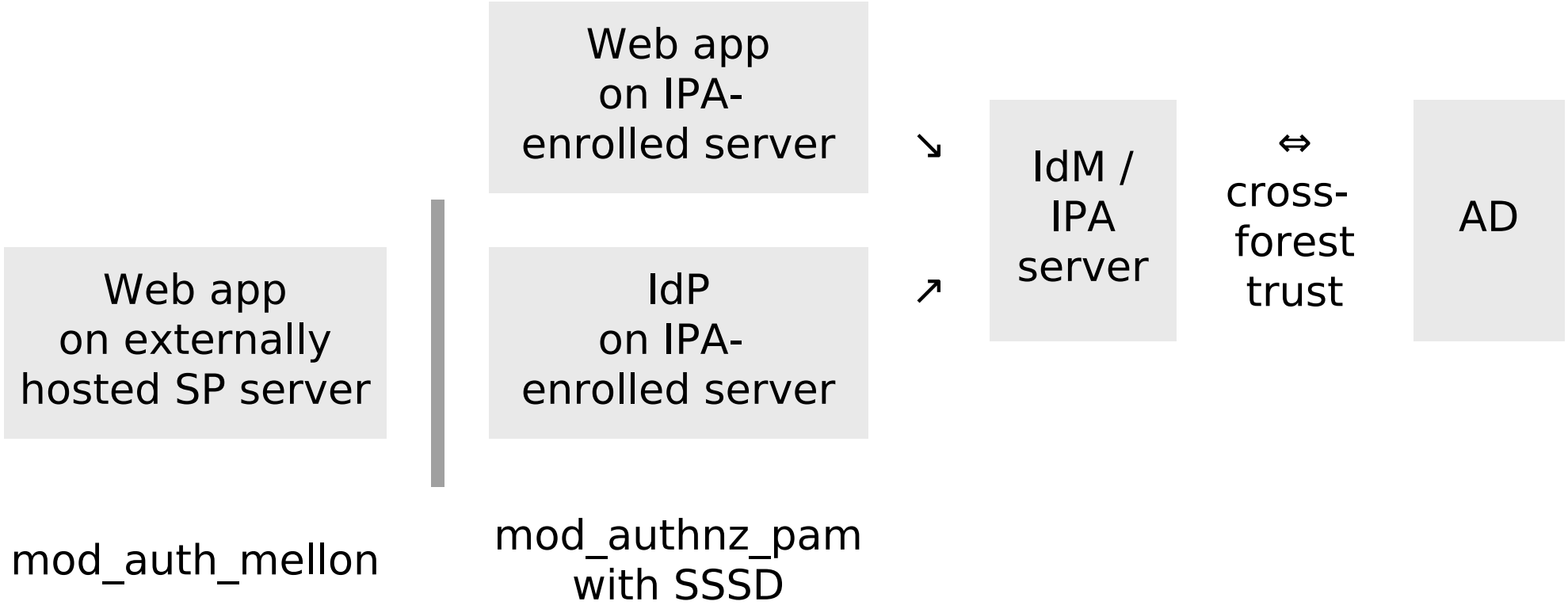
```
MellonEnvVarsIndexStart 1
MellonEnvVarsSetCount On
# MellonMergeEnvVars On ":"
```

  Version 0.11.0 needed for these directives.

- These are currently not setup by `ipsilon-client-install` automatically.

Demo

Which part of the setup should we show first?



Conclusion

- What are the recommendations for application developers concerning authentication and access control methods and protocols that they should support, for deployments across organizations?
  - The same as for setups within organizations.
  - Teach applications to accept `REMOTE_USER` and `REMOTE_USER_*`
  - The actual protocol/setup is deployment specific, using Apache HTTP Server modules.
- By merely changing Apache configuration, we can switch the application from intra-organizational to federated setup.
  - Additional application-level changes are not needed for single IdP setups when no selection is required.
- Currently looking at mapping of claims in mod_auth_openidc to `REMOTE_USER_*` for OpenID Connect federation.

References

- www.adelton.com/apache/mod_authnz_pam/
- www.adelton.com/apache/mod_lookup_identity/
- github.com/UNINETT/mod_auth_mellon
- fedorahosted.org/ipsilon
- github.com/pingidentity/mod_auth_openidc

- www.freeipa.org/page/Environment_Variables#Proposed_Additional_Variables

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