CompTIA Security+ Exam SY0-701

Lesson 4

Implement Identity and Access Management

Objectives

- Implement password-based and multifactor authentication
- Implement account policies and authorization solutions
- Implement single sign-on and federated identity solutions

Lesson 4

Topic 4A

Authentication

Authentication Design

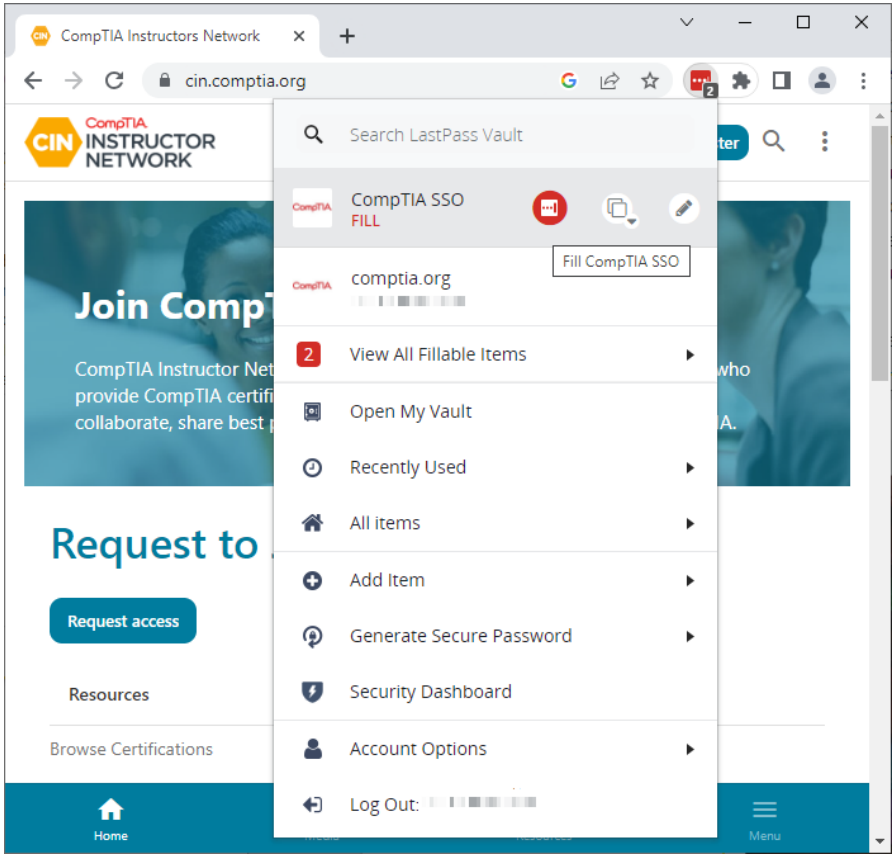
- Meet requirements for confidentiality, integrity, and availability
  - Keeps credentials secure (confidentiality
  - Threat actors cannot bypass or subvert the authentication mechanism (integrity)
  - Mechanism does not cause undue delay or support issues (availability)
- Something you know: knowledge factor
  - Password
  - Personal identification number (PIN)

Screenshot used with permission from Microsoft.

Password Concepts

- Length
- Complexity
  - Character combinations
- Aging
- Reuse and history
  - Expiration
- NIST guidance
  - Password hints

Password Managers



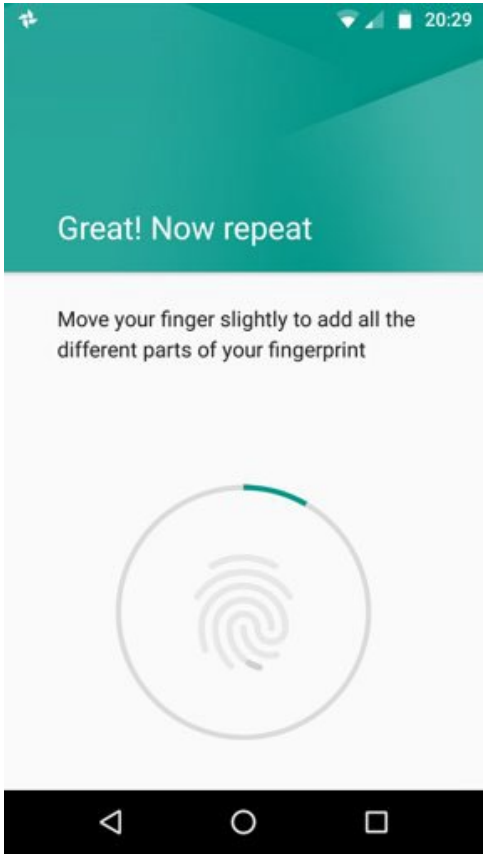
- Vault and master password
  - Built-in OS/browser password managers
  - Third-party cloud/plug-in
- Per-site password generation
- Secure filling

Multifactor Authentication

- Multifactor authentication (MFA)
  - Something you KNOW and something you HAVE
  - NOT something you KNOW and something else you KNOW
- Something you have
  - Ownership factor: hardware tokens and fobs
- Something you are/do
  - Biometric factor: fingerprint and facial scans
- Somewhere you are
  - Geolocation via location services
  - IP/network location

Biometric Authentication

- Enrollment
  - Sensor and feature extraction
  - Sensor/camera types
- Efficacy rates and considerations
  - False Rejection Rate (FRR) or Type I error
  - False Acceptance Rate (FAR) or Type II error
  - Throughput, cost, and inaccessibility
- Fingerprint recognition
- Facial recognition



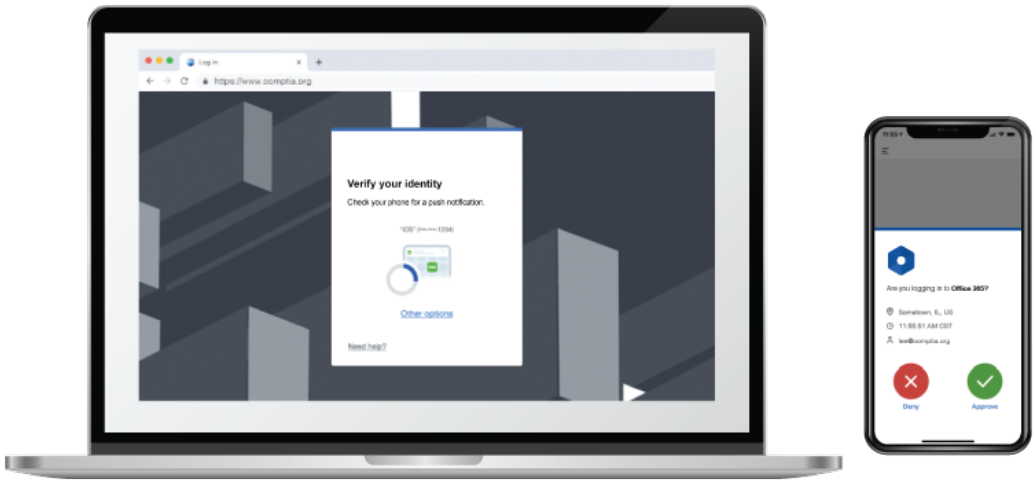
Android is a trademark of Google LLC.

Hard Authentication Tokens

- Token generation types
  - Certificate-based (requires PKI)
  - One-time password (OTP)
  - Fast Identity Online (FIDO) Universal 2nd Factor (U2F)
- Authenticator form factors
  - Smart card
  - One-time password (OTP) fob
  - Security key
    - Activation method to show presence

Soft Authentication Tokens

- Transmit a code via an out-of-band channel
  - Short message service (SMS)
  - Email account
  - Phone call
  - Push notification
- Authenticator app
- Possibility of interception



Passwordless Authentication

- Rely on authenticator rather than password
  - Accounts identified by public/private key pair, but doesn’t have to use PKI
  - Private key stored only on authenticator
  - Authenticator can require biometric or PIN proof of presence (local gesture)
- Attestation
  - Verify authenticator as root of trust

Review Activity: Authentication

- Authentication design
  - Something you know/are/have
- Password concepts and password managers
- Multifactor authentication
- Biometric authentication
- Hard authentication tokens
  - Smart cards, OTP generators, FIDO U2F
- Soft authentication tokens
  - Two-step verification
- Passwordless authentication

Lab Activity

- Assisted Lab Managing Password Security

Lesson 4

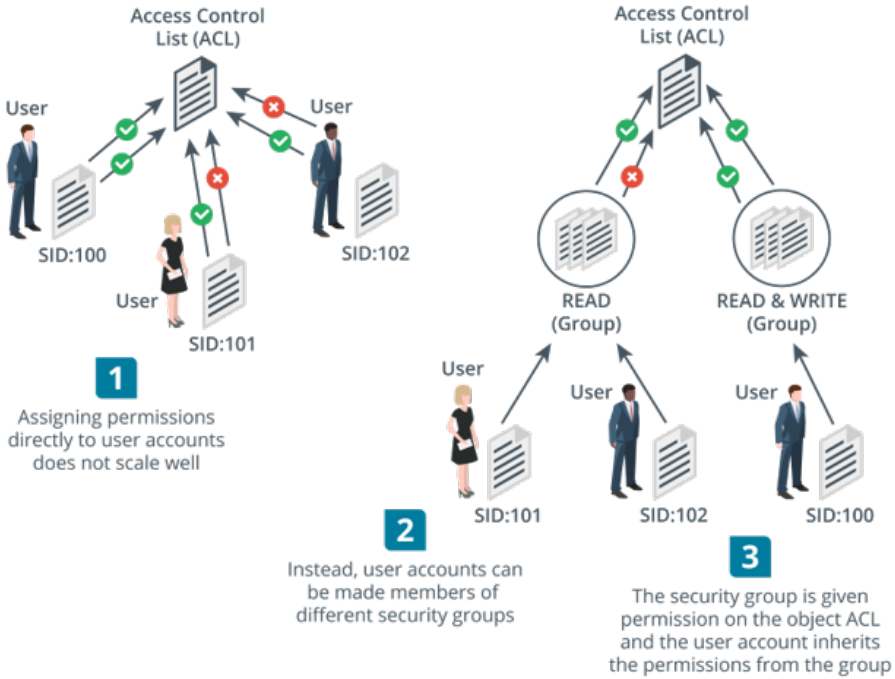
Topic 4B

Access Management

Discretionary and Mandatory Access Control

- Access control model determines how users receive permissions/rights
- Discretionary Access Control (DAC)
  - Based on resource ownership
  - Access Control Lists (ACLs)
  - Vulnerable to compromised privileged user accounts
- Mandatory Access Control (MAC)
  - Labels and clearance
  - System policies to restrict access

Role-based and Attribute-Based Access Control



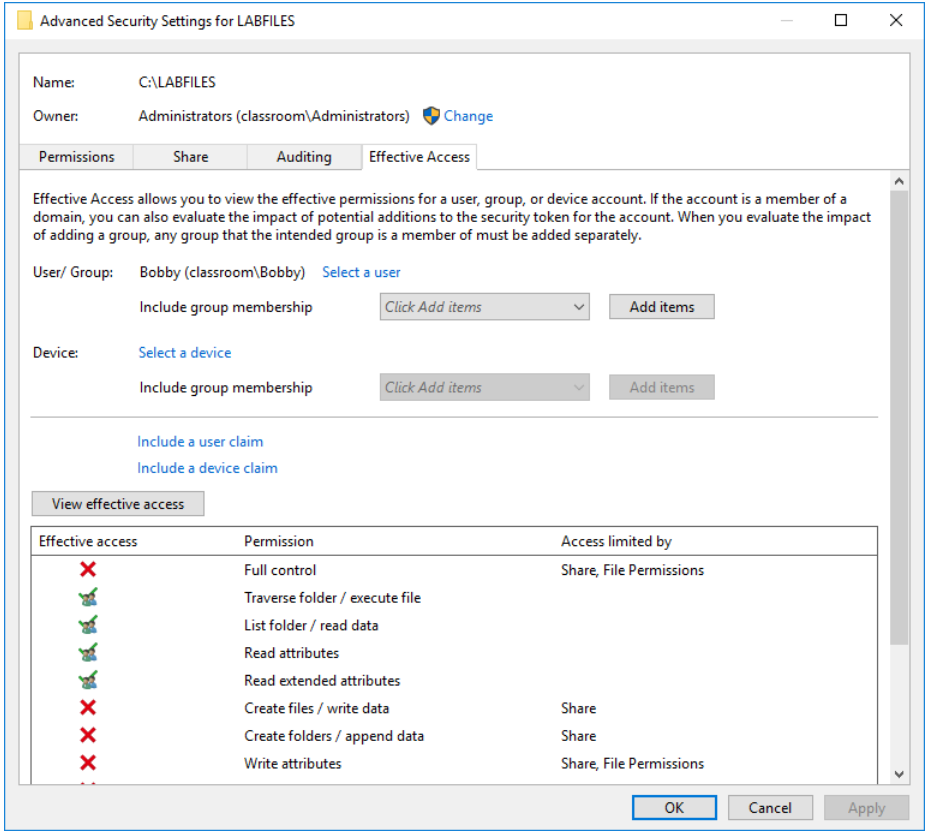
- Role-Based Access Control (RBAC)
  - Non-discretionary and more centralized control
  - Based on defining roles then allocating users to roles
  - Users should only inherit role permissions to perform particular tasks
- Security groups
  - Assign permissions to security groups and assign user accounts to relevant groups
  - Groups can be mapped to roles
- Attribute-Based Access Control (ABAC)
  - Access decisions based on a combination of subject and object attributes plus any context-sensitive or system-wide attributes

Rule-Based Access Control

- Non-discretionary
  - System determines rules, not users
  - MAC, RBAC, and ABAC
- Conditional access
  - Continual authentication
  - User account control (UAC) and sudo

Least Privilege Permission Assignments

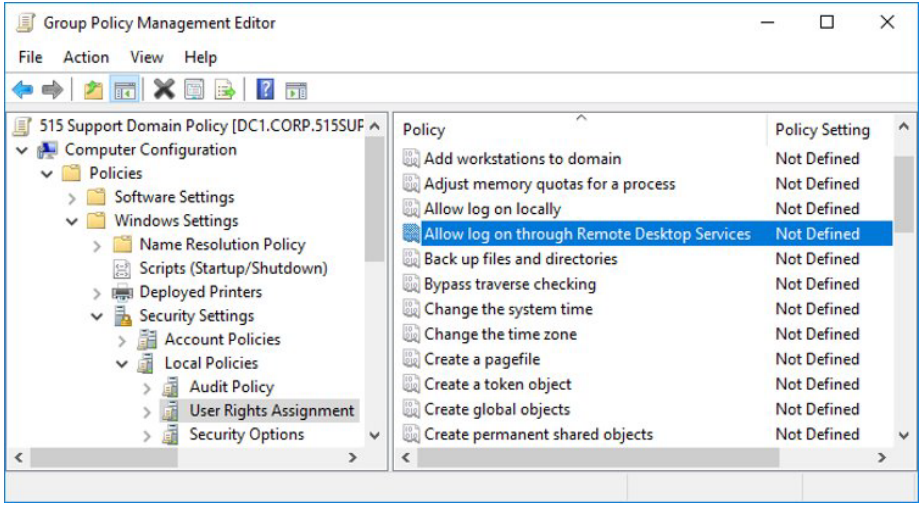
- Principle of least privilege
  - Sufficient permissions only
- Implications
  - Insufficient permissions
  - Authorization creep
  - Auditing



User Account Provisioning

- Provisioning
  - Identity proofing
  - Issuing credentials
  - Asset allocation
  - Policy awareness and security education
  - Permission assignments and implications
- Deprovisioning
  - Employees or contractors leaving company or project, or changing roles
  - Remove or disable permission assignments

Account Attributes and Access Policies



Screenshot used with permission from Microsoft.

- Account attributes
  - Security identifier (SID, account name, credential)
  - Extended profile attributes
  - Per-app settings and files
- Access policies
  - File permissions
  - Access rights
  - Active Directory Group Policy Objects (GPOs)

Account Restrictions

- Location-based policies
  - Network/logical location
  - Geolocation
    - By IP address
    - By Location Services
- Time-based restrictions
  - Logon hours
  - Logon duration
  - Impossible travel time/risky login
  - Temporary permissions

Privileged Access Management

- Policies, procedures, and technical controls to prevent the malicious abuse of privileged accounts
  - Accounts with system-wide access
  - Secure administrative workstations
- Policies for zero standing privileges for administrators
  - Temporary elevation
  - Password vaulting/brokering
  - Ephemeral credentials

Review Activity: Access Management

- Discretionary and mandatory access control
- Role-based and attribute-based access control
- Rule-based access control
- Least privilege permission assignments
- User account provisioning
  - Identity proofing, secure credentials, asset allocation, policy/awareness training, permissions assignments
- Account attributes and access policies
- Account restrictions
  - Location- and time-based
- Privileged access management
  - Zero standing privileges and ephemeral/vaulted credentials

Lab Activity

- Assisted Lab: Managing Permissions

Lesson 4

Topic 4C

Identity Management

Local , Network, and Remote Authentication

- Authentication providers
  - Passwords versus password hashes
- Windows authentication
  - Local sign-in
  - Network sign-in (Kerberos and NTLM)
  - Remote sign-in
- Linux authentication
  - /etc/passwd and /etc/shadow
  - Pluggable authentication modules (PAMs)

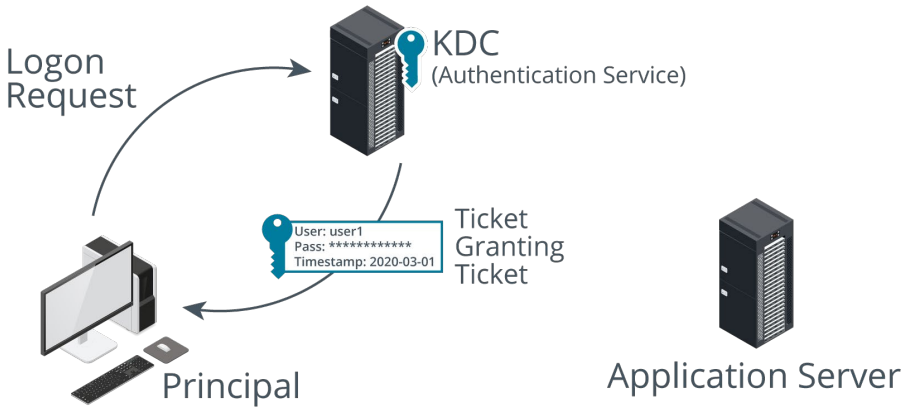
Directory Services

- Database of subjects
  - Users, computers, security groups/roles, and services
- Access Control Lists (authorizations)
- X.500 and Lightweight Directory Access Protocol (LDAP)
  - Distinguished names
  - Attribute=Value pairs

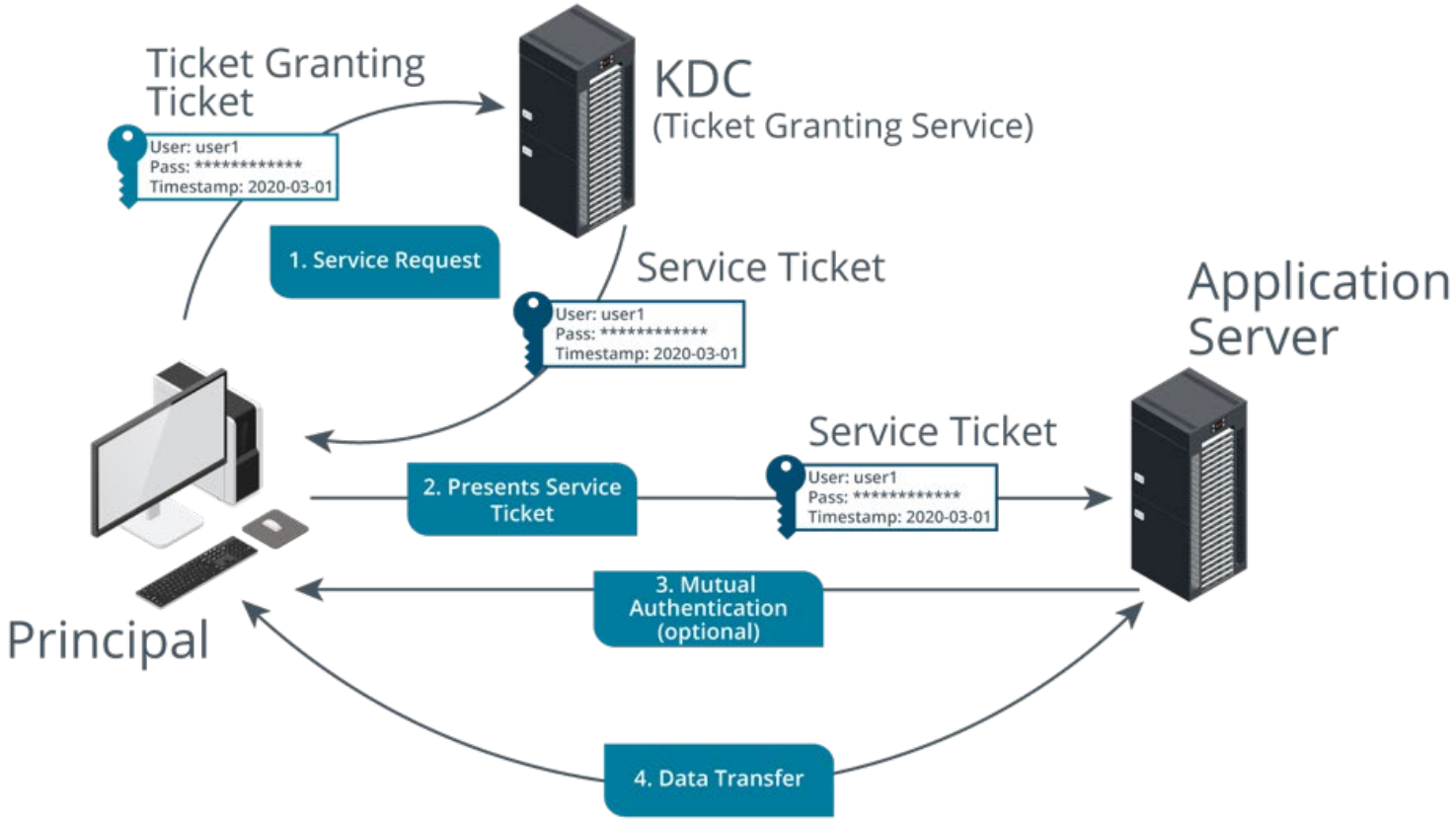
```
CN=WIDGETWEB, OU=Marketing, O=Widget, C=UK, DC=widget, DC=foo
```

Single Sign-on Authentication

- Kerberos
  - Clients
  - Application servers
  - Key Distribution Center (KDC)
- Authentication Service – Ticket Granting Ticket
- Ticket Granting Service – Service Ticket



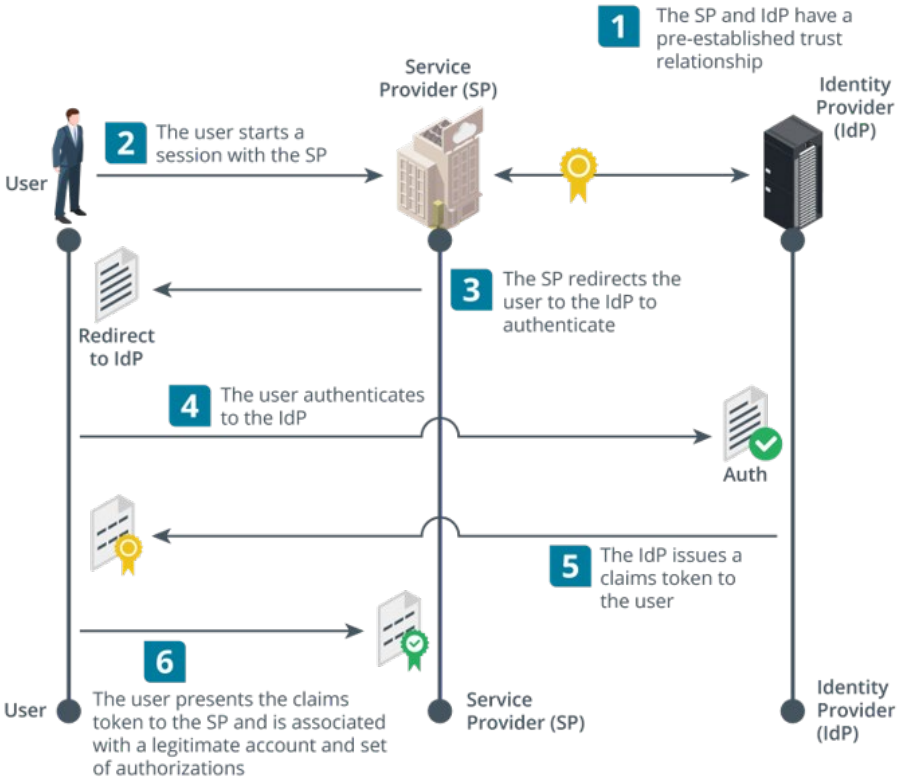
Single Sign-on Authorization



Images © 123rf.com.

Federation

- Networks under separate administrative control share user identities
- Identity providers and claims
- Interoperability
  - Service providers and identity providers
  - Shared frameworks and protocols



Images © 123rf.com.

Security Assertion Markup Language

- Open standard for implementing identity and service provider communications
- Attestations/assertions
  - XML format
  - Signed using XML signature specification
- Communications protocols
  - HTTPS
  - Simple Object Access Protocol (SOAP)

```
<samlp:Response xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol"
xmlns:saml="urn:oasis:names:tc:SAML:2.0:assertion" ID="200"
Version="2.0"
IssueInstant="2020-01-01T20:00:10Z "
Destination="https://sp.foo/saml/acs" InResponseTo="100".
 <saml:Issuer>https://idp.foo/sso</saml:Issuer>
 <ds:Signature>...</ds:Signature>
 <samlp:Status>...(success)...</samlp:Status.
<saml:Assertion xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema" ID="2000" Version="2.0"
IssueInstant="2020-01-01T20:00:09Z">
<saml:Issuer>https://idp.foo/sso</saml:Issuer>
<ds:Signature>...</ds:Signature>
  <saml:Subject>...
  <saml:Conditions>...
   <saml:AudienceRestriction>...
   <saml:AuthnStatement>...
   <saml:AttributeStatement>
      <saml:Attribute>...
      <saml:Attribute>...
   </saml:AttributeStatement>
  </saml:Assertion>
</samlp:Response>
```

Open Authorization

- “User-centric” federated services better suited to consumer websites
  - Representational State Transfer (REST) Application Programming Interfaces (APIs) (RESTful APIs)
  - Framework for implementation not a protocol
- OAuth
  - Designed to communicate authorizations, rather than explicitly authenticate a subject
  - Client sites and apps interact with OAuth IdPs and resource servers that hold the principal’s account/data
  - Different flow types for server to server or mobile app to server
  - JavaScript object notation (JSON) web token (JWT)

Review Activity: Identity Management

- Local, network, and remote authentication
- Directory services
  - LDAP and distinguished name attributes
- Single sign-on authentication and authorization
  - Kerberos
- Federation
  - Identity providers and service providers
- Security Assertion Markup Language
- Open authorization (OAuth)

Lesson 4

Summary