Domain 5: Identity & Access Management

MIS-5903

https://community.mis.temple.edu/mis5903sec711summer2022/

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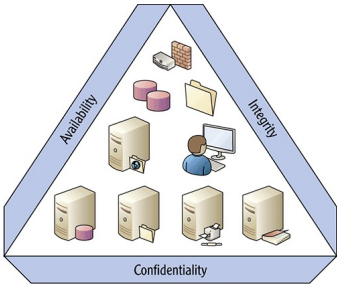
Security Principles – Availability

- Information accessible in a timely manner, so productivity not adversely affected
- Fault tolerance and recovery mechanism ensure continuity of the availability of resources
- Attributes:
  - Accuracy
  - Relevance
  - Timeliness
  - Privacy



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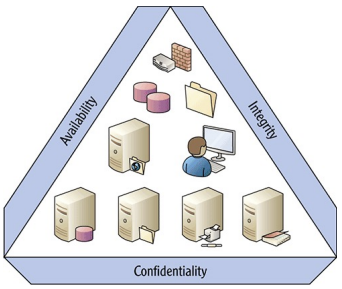
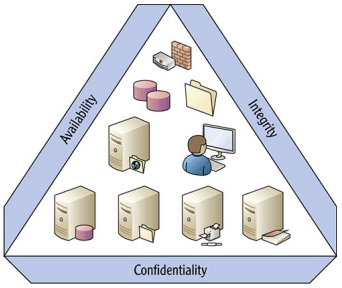
Security Principles – Integrity

- Information must be:
  - Accurate
  - Complete
  - Protected from unauthorized modification
- Protects data, or a resource, from being altered in an unauthorized fashion

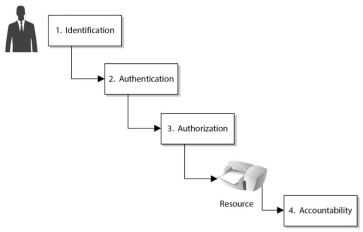


Security Principles – Confidentiality

- Information not disclosed to unauthorized
  - Individuals
  - Programs
  - Processes
- Security Mechanisms:
  - Encryption
  - Logical and Physical access controls
  - Transmission protocols
  - Database Views
  - Controlled traffic flow
  - VPN, IPSec



Four Steps to Access an Object



- Identification
  - Subjects supply identification information
  - Username, User ID, account number
- Authentication
  - Verifying the identification information
  - Passphrase, PIN Value, thumbprint, smart card, one-time password
- Authorization
  - Using identity of subject with other criteria to determine authorized actions
  - "I know who you are, now what can you do?"
- Accountability
  - Audit logs and monitoring to track subject <-> object interaction attempt(s)

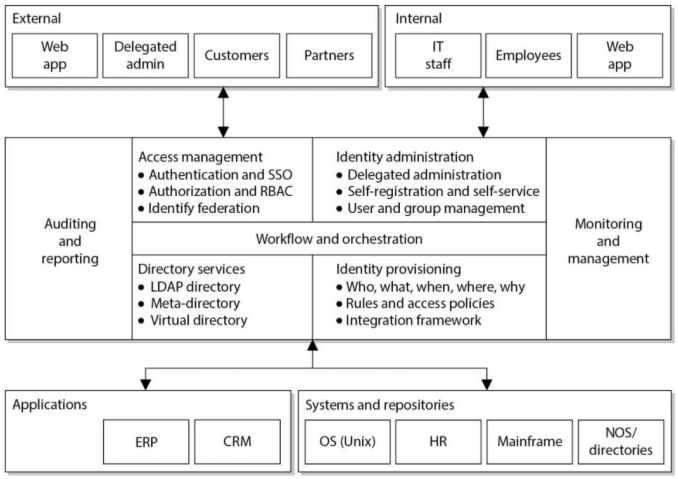
Identity Management - Identification

- Identification should be:
- Unique, for user accountability
- Standard naming scheme
- Non-descriptive of position or tasks
- Not shared between users

- Identity Management (IdM)
- Identity and Access Management (IAM)

Access Concerns

- What resources?
- Who approves?
- Maps to policies?
- Access Revocation?
- Access Review
- Compliance with
  - Regulations
  - Contracts
  - Organizational policies



Directories

- X.500, LDAP, Active Dire tory
- DN: cn=First Last, dc=temple, dc=edu
- Tree structure to organize entries using parent-child
- Attributes dictated by defined schema
- Unique identifiers are called distinguished names
- Subtrees for service, agency, department, etc.

Web Access Management (WAM)

- User sends credentials to web server
- Web server requests WAM platform to authenticate user (against LDAP)
- User (subject) requests access to object
- Web server verifies object access is authorized, and allows access to resource/object

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Password Management

- Password synchronization
- Self-service password reset
- Assisted password reset
- Legacy Single Sign On (SSO)
- Password Checkers – Is that a secure password?
- Password Hashing & Encryption (MD5) or (SHA1)
- Limit Logon attempts
- Passphrase
- Cognitive Passwords (fact or opinion-based information)

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Accounts

- Account Management
- Registration
- Provisioning
  - Identity Provisioning
- Authoritative System of Record
- Profile Update

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Ownership-Based Authentication

- Cryptographic key (PKI)
- One-Time Password (OTP) – dynamic password only valid ONCE
- SMS has been deprecated by NIST, but still in use
- Token Devices
  - Synchronous
  - Asynchronous
- Memory Cards (does not process information)
- Smart Cards

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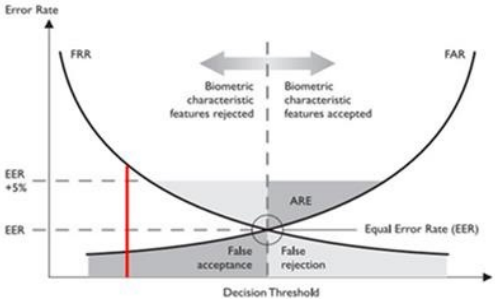
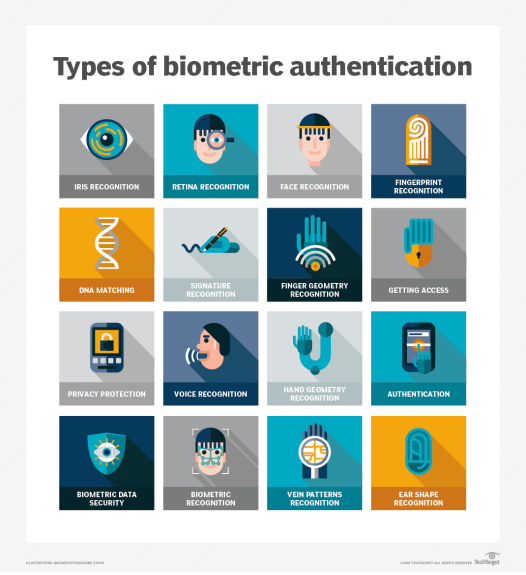
Biometrics

- Physiological – "what you are"
- Behavioral – "what you do"
- Accuracy:
  - Type 1 error – False Rejection Rate (FRR)
  - Type 2 error – False Acceptance Rate (FAR)
  - Crossover Error Rate (CER)



Biometric Methods

- Fingerprint
- Palm Scan
- Hand Geometry
- Retina Scan
- Iris Scan
- Signature Dynamics
- Keystroke Dynamics
- Voice Print
- Facial Scan
- Hand Topography



Passwords

- Password Policies – Length, Complexity, Frequency, History, Limit Logon Attempts
- Clipping Level
- Cognitive Password – fact or opinion-based information
  - CAPTCHA
- One Time Password (token, smartphone)
  - Synchronous – uses time or a counter as a core piece of authentication
  - Counter-synchronization – user triggered
  - Asynchronous – authentication server sends a challenge (“nonce”); token encrypts and sends the result to server
- Passphrase – sequence of characters longer than a password.

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Password Attacks

- Electronic monitoring
- Access the password file
- Brute Force Attacks
- Dictionary Attacks
- Social Engineering
- Rainbow Table (pre-calculated hash values)

- Password checker used by a security professional…
- Becomes a Password Cracker when used by hacker.

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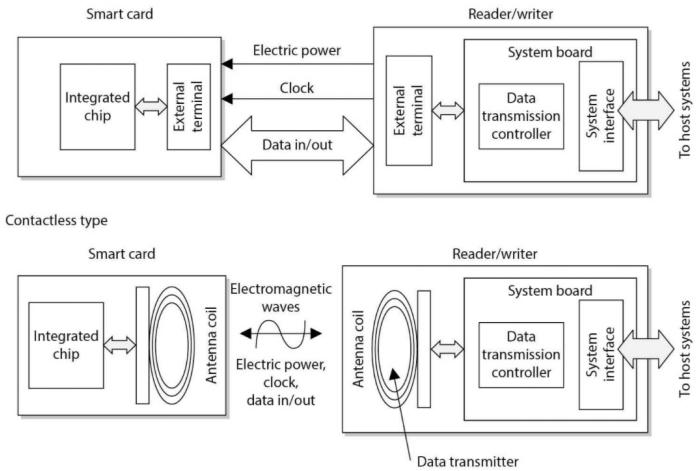
Password Hashing

- Commonly MD4 or MD5
- Salts are random values added for complexity and randomness
- Unix/Linux – "shadow"

Cards

- Radio Frequency Identification (RFID)
- Memory cards – hold information, but cannot process information
- Smart card – process information (e.g. add PIN)



Access Card Attacks

- Fault Generation
- Side Channel Attacks – nonintrusive
  - Differential power analysis
  - Electromagnetic analysis
  - Timing
  - Software attacks

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Authorization

- Access Criteria
  - Roles
  - Groups
  - Physical or Logical Location
    Time of Day
  - Temporal
  - Transaction Type (e.g. upper limit)
- Default to No Access
- Need to Know
- Beware of Authorization Creep over time

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Credential Management

- Password Managers (or vaults)
- Password Synchronization
- Self-Service Password Reset
- Assisted Password Reset
- Just-in-Time Access (JIT)
- Session Management
  - Timeout
  - Inactivity
  - Anomaly

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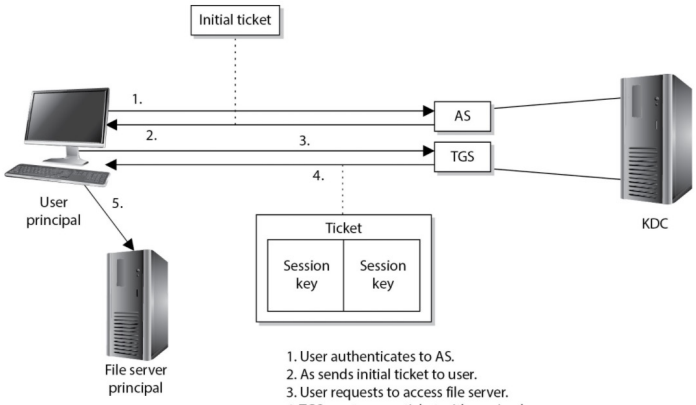
Kerberos



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Kerberos Weaknesses

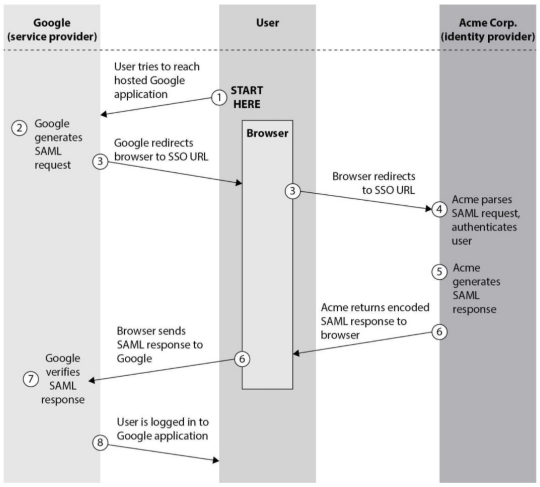
- If one KDC< Single Point of Failure
- Must be scalable, able to handle requests
  Secret keys store on user workstations temporarily
- Session keys decrypted and reside in cache or key table
- Vulnerable to password guessing.
- Must enable encryption. (not on by default)
- If keys too short, can be brute-force attacked
- Clocks must be synchronized

Security Domain

- Resources available to a subject
- Resources within the same logical structure (domain) work under the same security policy and are managed by the same group
- Federation – authenticate to Company A, Assertion authenticates to secondary company. (Federated Identity)
- Thin Clients – relies upon central server for access control, processing, and storage

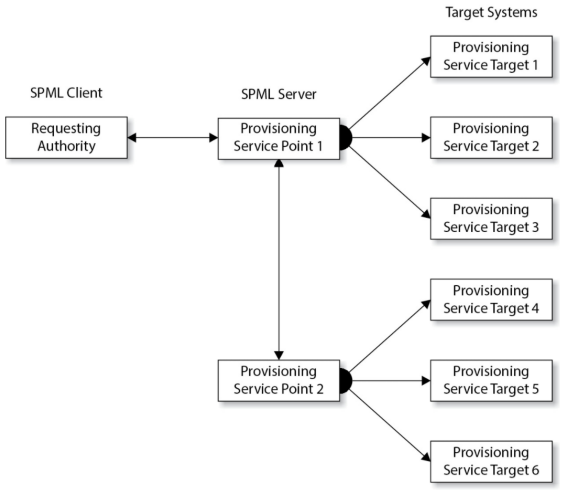
Access Control & Markup Languages - SAML

- Security Assertion Markup Language (SAML) - exchange between domains
  - User = principal
  - Cloud Provider = Service Provider
  - Organization = Identity Provider



Access Control & Markup Languages (2) - SPML

- Requesting Authority (RA)
- Provisioning Service Provider (PSP)
- Provisioning Service Target (PST) - target



Access Control & Markup Languages (3)

- Extensible Markup Language (XML)
- Web Services = Service Oriented Architecture
- Simple Object Access Protocol (SOAP)
- SAML requests send within SOAP
- Extensible Access Control Markup Language (XACML)
  - Express security policies and access rights to assets provided through web services and other enterprise application
  - Subject element (requesting entity)
  - Resource element (requested entity)
  - Action element (types of access)

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Third Party Authentication/Authorization

- OpenID – open standard for user authentication by third parties
  - End User – wants to be authenticated
  - Resource user – server owns the resource
  - OpenID provider – system where the user already has an account.
- Oauth – open standard for authorization
  - Example – authorize one web site to access content on another site
- Identity as a Service (IDaaS)
  - SaaS offering that provides SSO, federated IdM, password management.
- Integration – in-house (all on site) or outsourced (some or all off-site)

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Access Control Models

- Discretionary Access Control (DAC) – data owner assigns ACLs
  - Identity Based – user or group
- Mandatory Access Control (MAC) – operating system refers to security labels
- Role Based Access Control (RBAC) – access based on subject's role and/or functional position
  - Task Based Access Control (TBAC) – based on tasks assigned to the subject.
  - Core RBAC
- Rule-based Access Control (RB-RBAC) – Adds on rules that further restrict access
- Attribute-Based Access Control – use of attributes (software-defined network) e.g "Allow Managers to access the WAN using mobile"

Hierarchical RBAC – maps to organizational structures

- Limited (one level)
- General (many levels)
- Separation of Duties
  - Static Separation of Duty (SSD)
  - Dynamic Separation of Duty (DSD)
- Management:
  - Non-RBAC – users mapped to applications, no roles used
  - Limited RBAC – users mapped to multiple roles.
  - Hybrid RBAC – users mapped to multiapplication roles
  - Full RBAC – users mapped to enterprise roles

Access Control Techniques & Technologies

- Access Control Lists (ACLs)
- Access Control Matrix (DAC) – object shows subjects and privileges
- Capability Table – what objects can (token, ticket, key) be access?
- Constrained User Interface
- Content Dependent Access Control (filter based on sensitivity)
- Context-Dependent Access Control

Centralized Access Control Administration

- Remote Authentication Dial-In User Service (RADIUS) – AAA
  - Uses TCP
  - Only password is encrypted
  - Attribute-Value Pairs
- Terminal Access Controller Access Control System (TACACS)
  - Uses UDP
  - Encrypts all traffic
  - Separates Authentication, Authorization, Auditing
  - Supports other protocols
  - Can define ACLs, filters, user privileges, more.
- Diameter – Base + Extensions

Access Control – Administrative

- Policy and procedures
- Personnel controls
- Supervisory structure
- Security awareness training
- Testing

Access Control – Physical

- Network segregation
- Perimeter security
- Computer controls
- Work area separation
- Data backups
- Cabling
- Control Zone – based on sensitivity

Access Control – Technical

- System access
- Network architecture
- Network access
- Encryption and protocols
- Auditing

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Accountability – System Level

- Performance
- Logon attempts (successful and unsuccessful)
- Logon ID, Date & Time details
- Lockouts of users and terminals
- Use of Administrative utilities
- Devices used
- Functions performed
- Requests to alter configuration files

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Accountability – App/User Events

- Application-Level Events
  - Error messages
  - Files opened and/or closed
  - Modifications of files
  - Security violations within applications
- User-level events
  - Identification and authentication attempts
  - Files, services, resources used
  - Commands initiated
  - Security violations

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Review of Audit Information

- Audit retention
- Security Event Management (SEM)
- Security Information and Event Management (SIEM)
- Logs must be protected
- Keystroke Monitoring – be mindful of privacy issues

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Access Control Practices

- Deny undefined or anonymous accounts
- Limit and monitor privileged/powerful accounts
- Suspend or delay access after unsuccessful logon attempts
- Remove obsolete user accounts on departure
- Suspend inactive accounts after 30 to 60 days
- Enforce strict access criteria
- Enforce the need-to-know and least privilege
- Disable unneeded system features, services, ports

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Access Control Practices (2)

- Replace default password settings
- Limit and monitor global access rules
- Remove redundant resource rules from accounts and/or group memberships
- Remove redundant user IDs, accounts, role-based accounts from ACLs.
- Enforce password requirements: rotation, length, contents, lifetime, distribution, storage, transmission
- Audit System and user events and actions; review reports periodically Protect audit logs

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Unauthorized Disclosure

- Object Reuse (USB drives, etc.)
- Emanation Security
  - TEMPEST
  - White Noise
  - Control Zone
- IDS/IPS
- Honeypot – “sacrificial lamb”
  - Line between enticement and entrapment
  - Distracts attacker from bastion hosts (DMZ hosts unprotected by firewalls/routers)

Next Steps…

- Continue Discussion on Class Website
- Questions