Session Layer - Complete Study Notes

Overview

- **Position**: 6th layer in OSI model (counting from the bottom)
- **Layer Name**: Session Layer
- **Primary Purpose**: Managing communication sessions between applications

Core Responsibilities of Session Layer

1. Authentication and Authorization

Authentication Process

- **Definition**: Process of verifying user identity
- **Method**: Username and password validation
- **Example Scenario**: Online banking (SBI, PNB, OBC)
  - User enters credentials from their machine/laptop/mobile
  - Request sent to server
  - Server validates the identity
  - Server responds with permission to create session

Authorization Process

- **Definition**: Set of privileges granted to authenticated users
- **Purpose**: Defines what actions a user can perform after authentication
- **Example**: Online banking privileges
  - Making online payments
  - Online transactions
  - Adding beneficiaries
- **Important Note**: Users cannot access all server resources - only those authorized by the organization

2. Session Creation and Management

- **Process Flow**:
  1. Authentication completed
  2. Session created (login/home page appears)
  3. User gains access to authorized functions
- **Security Principle**: Session access only granted after successful authentication

3. Session Restoration (Checkpointing)

Browser Tab Restoration

- **Example**: Mozilla Firefox tab restoration
- **Scenario**:
  - Multiple tabs open in browser
  - System suddenly shuts down
  - Upon restart, restoration option available
  - Click restoration → all previous tabs reopen
- **Technical Implementation**: Session beans save state values

Email Services (Gmail Example)

- **Scenario**:
  - System shuts down while Gmail is open
  - Restart browser
  - Restoration option appears in top-right
  - Click restoration → automatically logged back into Gmail
- **Mechanism**: Session layer saves previous states using session beans

Banking Security Considerations

- **Example**: SBI Online Banking
- **Scenario**:
  - User nearly completes transaction (reaches OTP stage)
  - System shuts down due to power/battery issues
  - User quickly restarts system and opens browser
  - Clicks restoration option
- **Result**: SBI will NOT restore session - user must log in again
- **Reason**: Security concerns to prevent session hijacking
- **Principle**: Sensitive financial sessions are discarded for security

Download Checkpointing

- **Example**: Video download (500 MB file)
- **Implementation**:
  - Checkpoints created every 100 MB
  - Download stops at 250 MB due to connection issues

    - Resume download starts from last checkpoint (200 MB)
    - No need to restart from zero
- **Benefits**: Performance improvement and time saving

4. Flow Control and Synchronization

Web Conferencing and Webinars

- **Problem**: Lip sync issues
    - Person speaks one thing, lips show something else
    - Audio and video out of sync
- **Solution**: Session layer provides synchronization
- **Mechanism**: Ensures audio and video play simultaneously
- **Access Control**: When one person speaks in webinar, others listen (controlled access flow)

Movie Playback Issues

- **Common Problems**:
    - Dialogues come after lip movement
    - Subtitles appear after dialogue delivery
    - Audio-video desynchronization
- **Session Layer Role**: Maintains proper synchronization between audio and video streams

Key Features Summary

Primary Functions:

1. **Authentication**: Identity verification
2. **Authorization**: Privilege management
3. **Session Restoration/Checkpointing**: State preservation and recovery
4. **Flow Control**: Managing data flow between applications
5. **Synchronization**: Ensuring coordinated multimedia playback

Important Technical Distinction

Operating System vs Application Responsibility

- **What OS Provides**:
    - Network layer coding
    - Data link layer coding
    - Application layer coding

- **What OS Does NOT Provide**:
  - Session layer coding
  - Presentation layer coding

Application-Level Implementation

- **Responsibility**: Individual applications must implement session layer features
- **Examples**:
  - Mobile apps
  - Web applications
  - Banking websites

Protocol Implementation Example

- **Scenario**: Logging into SBI website
- **Process**: HTTP protocol handles username/password transmission
- **URL Format**: HTTP//sbi.com
- **Implementation Level**: Application layer (not operating system level)
- **Key Point**: Authentication and authorization are application responsibilities, not OS functions

Practical Applications

Banking Systems

- Session creation for secure transactions
- Authentication for user verification
- Authorization for transaction privileges
- Session termination for security

Media Streaming

- Synchronization of audio and video
- Flow control for smooth playback
- Session management for user preferences

File Downloads

- Checkpoint creation for resume capability
- State preservation during interruptions
- Progress tracking and recovery

Communication Platforms

- Session establishment for multi-user conferences
- Access control for speaking privileges
- Synchronization for real-time communication

Security Considerations

- **Session Hijacking Prevention**: Critical sessions (banking) don't allow restoration
- **Privilege Limitation**: Users only access authorized resources
- **Identity Verification**: Mandatory authentication before session creation
- **State Security**: Session beans protect user state information