ITU-T Recommendation X.805 and its application to NGN

ITU/IETF Workshop on NGN

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Outline

- Introduction to ITU-T Recommendation X.805 - *Security Architecture for Systems Providing End-to-End Communications*
  - Threat model
  - Security Layers
  - Security Planes
  - Security Dimensions
  - Overall model
  - Modular approach
- Security work in FGNGN Security Capability WG and ITU-T Recommendation X.805

ITU-T X.800 Threat Model

1 - Destruction (an attack on availability):

- Destruction of information and/or network resources

2 - Corruption (an attack on integrity):

- Unauthorized tampering with an asset

3 - Removal (an attack on availability):

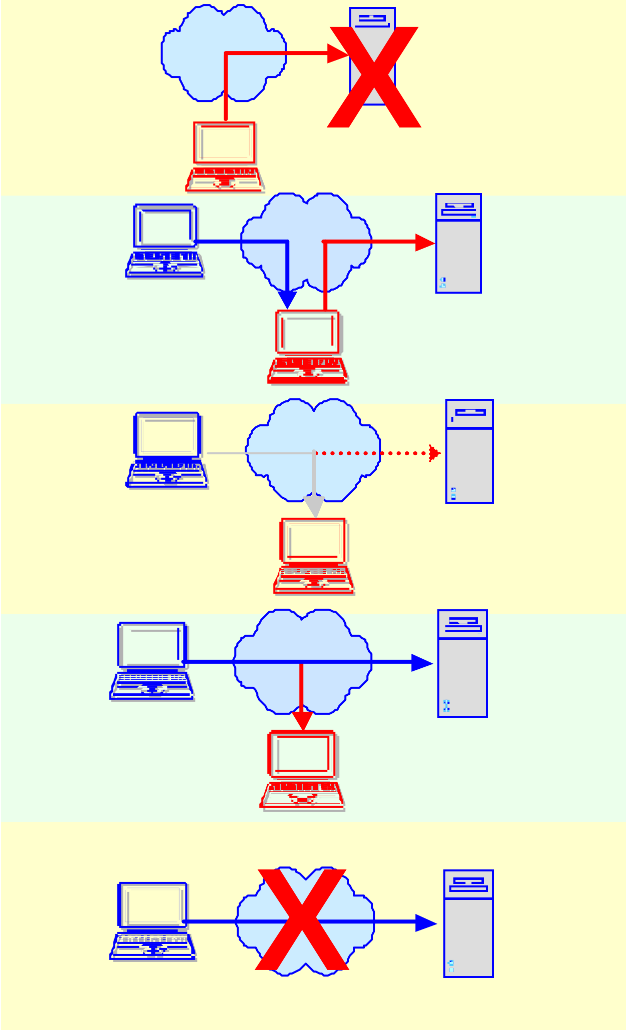
- Theft, removal or loss of information and/or other resources

4 - Disclosure (an attack on confidentiality):

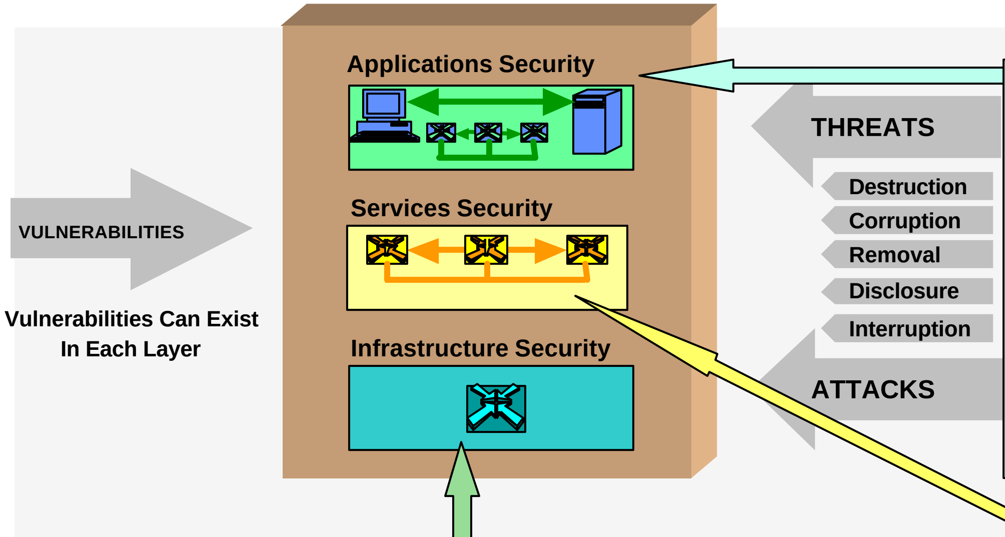
- Unauthorized access to an asset

5 - Interruption (an attack on availability):

- Network becomes unavailable or unusable



Three Security Layers



3 - Applications Security Layer:

- Network-based applications accessed by end-users
- Examples:
  - Web browsing
  - Directory assistance
  - Email
  - E-commerce

1 - Infrastructure Security Layer:

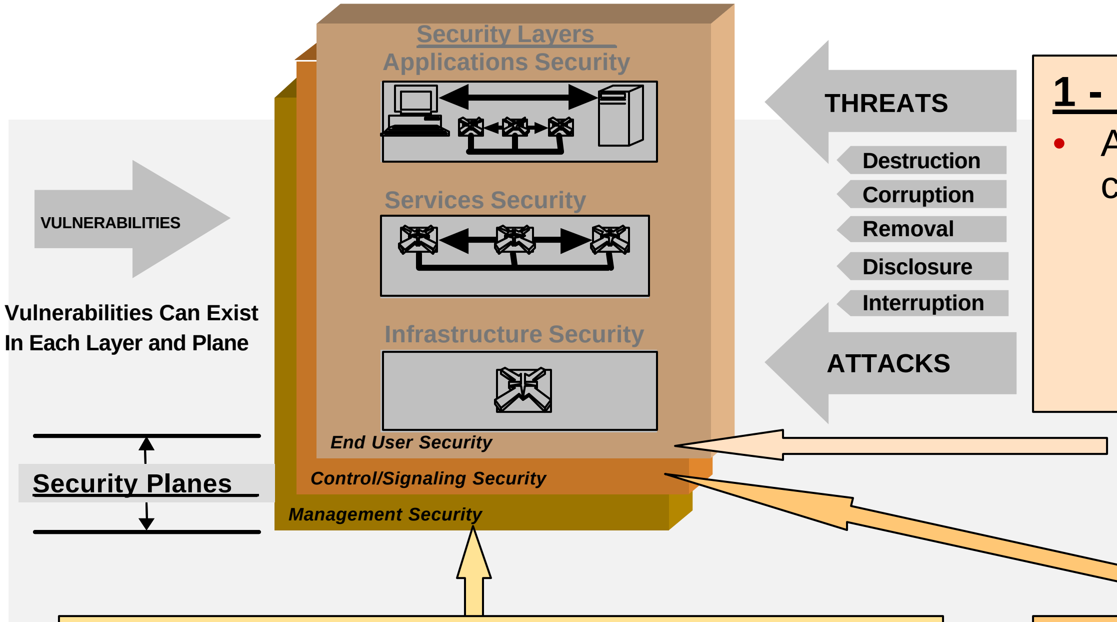
- Fundamental building blocks of networks services and applications
- Examples:
  - Individual routers, switches, servers
  - Point-to-point WAN links
  - Ethernet links

2 - Services Security Layer:

- Services Provided to End-Users
- Examples:
  - Frame Relay, ATM, IP
  - Cellular, WiFi,
  - VoIP, QoS, IM, Location services
  - Toll free call services

- **Security Layers are a hierarchy of equipment and facilities groupings**
- **Each Security Layer has unique vulnerabilities, threats, and mitigations**
- **Infrastructure security enables services security enables applications security**

Three Security Planes



1 - End-User Security Plane:

- Access and use of the network by the customers for various purposes:
  - Basic connectivity/transport
  - Value-added services (VPN, VoIP, etc.)
  - Access to network-based applications (e.g., email)

3 - Management Security Plane:

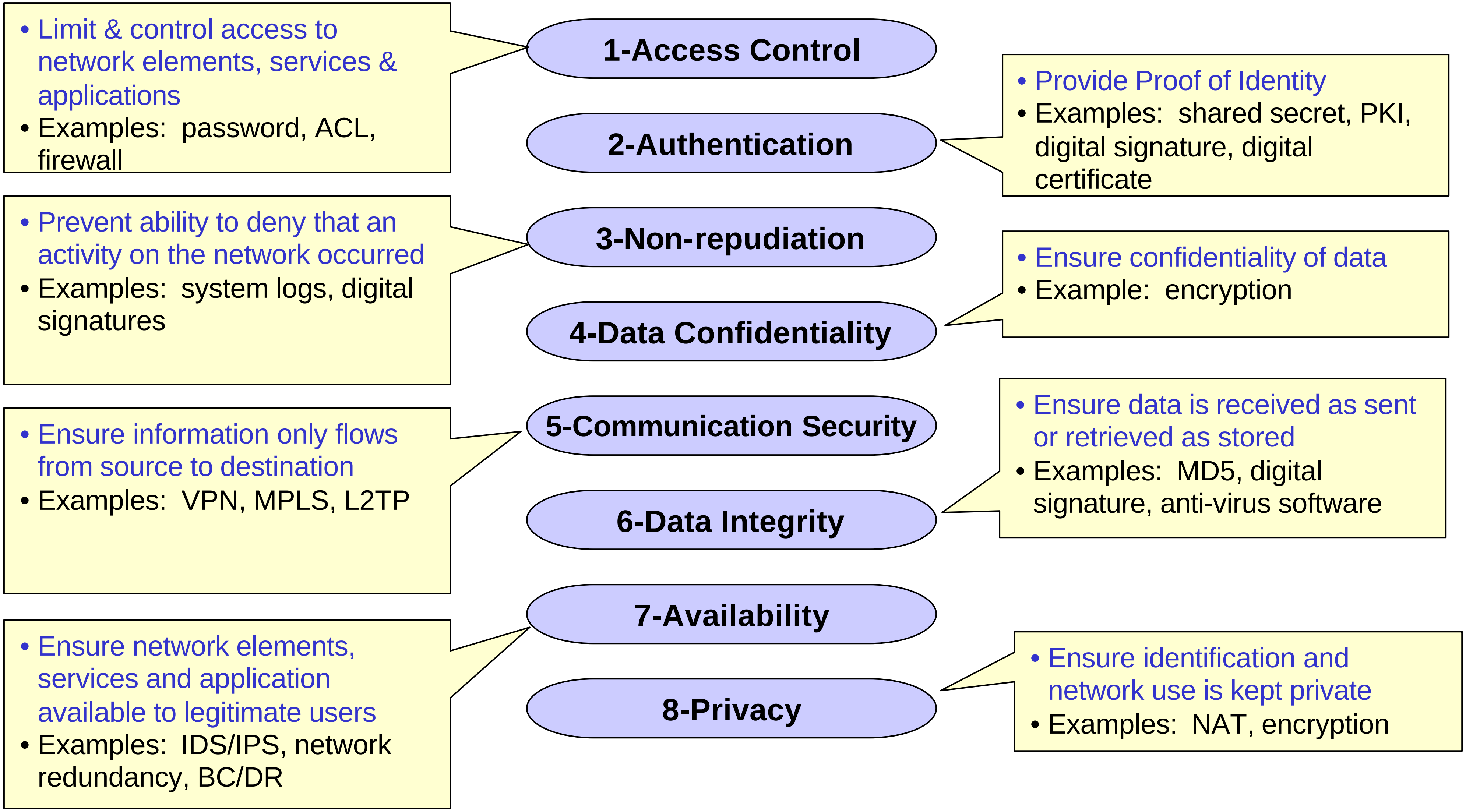
- The management and provisioning of network elements, services and applications
- Support of the FCAPS functions
- Implementation may be in-band or out-of-band

2 - Control/Signaling Security Plane:

- Activities that enable efficient functioning of the network
- Machine-to-machine communications
- Implementation may be in-band or out-of-band

- **Security Planes represent the types of activities that occur on a network.**
- **Each Security Plane is applied to every Security Layer to yield nine security Perspectives (3 x 3)**
- **Each security perspective has unique vulnerabilities and threats**

8 Security Dimensions Address the Breadth of Network Vulnerabilities



1-Access Control

- Limit & control access to network elements, services & applications
- Examples: password, ACL, firewall

2-Authentication

- Provide Proof of Identity
- Examples: shared secret, PKI, digital signature, digital certificate

3-Non-repudiation

- Prevent ability to deny that an activity on the network occurred
- Examples: system logs, digital signatures

4-Data Confidentiality

- Ensure confidentiality of data
- Example: encryption

5-Communication Security

- Ensure information only flows from source to destination
- Examples: VPN, MPLS, L2TP

6-Data Integrity

- Ensure data is received as sent or retrieved as stored
- Examples: MD5, digital signature, anti-virus software

7-Availability

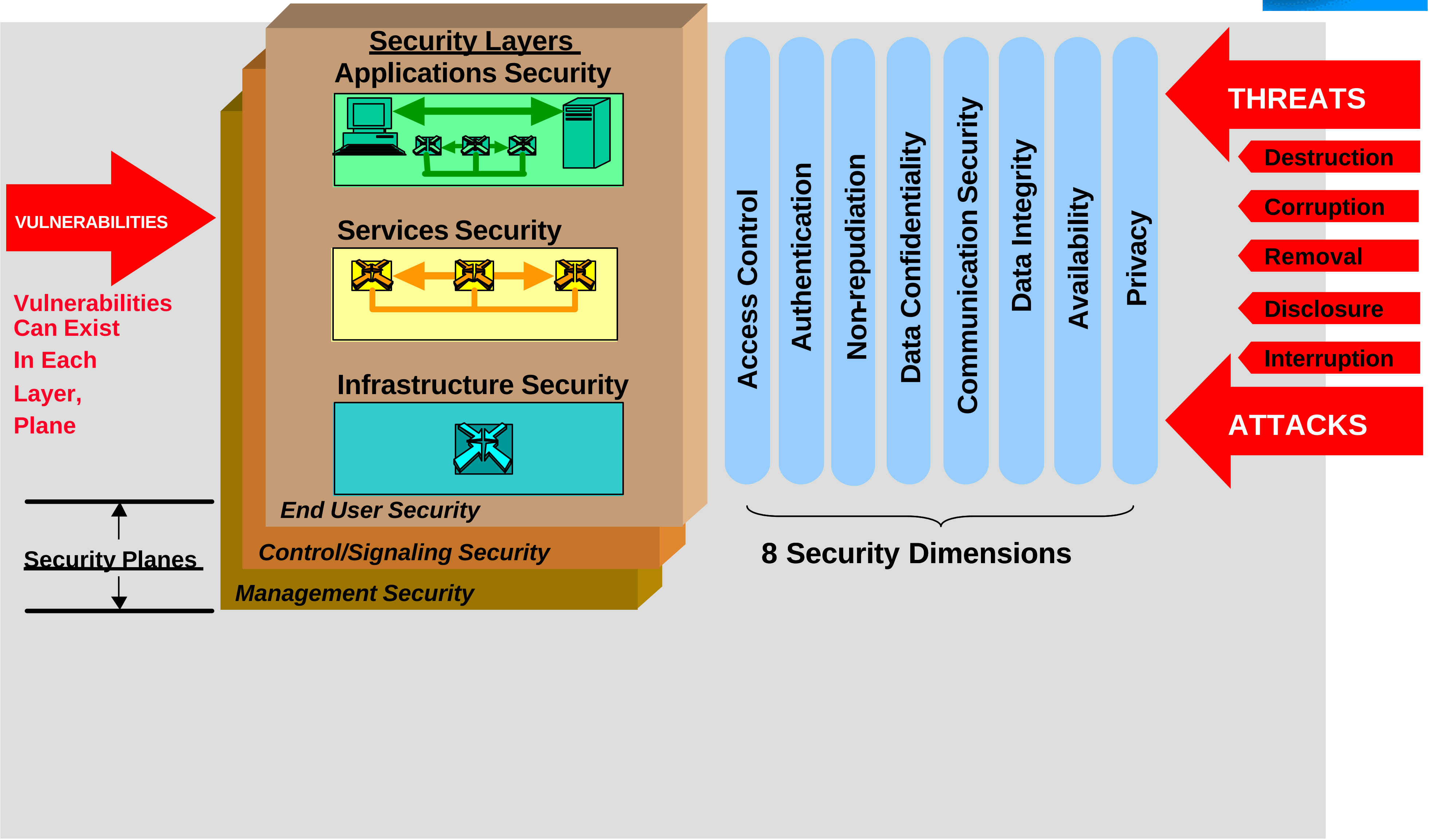
- Ensure network elements, services and application available to legitimate users
- Examples: IDS/IPS, network redundancy, BC/DR

8-Privacy

- Ensure identification and network use is kept private
- Examples: NAT, encryption

8 Security Dimensions applied to each Security Perspective (layer and plane)

ITU-T X.805: Security Architecture for Systems Providing End-to-End Communications



Modular Form of X.805

	Infrastructure Layer	Services Layer	Applications Layer
Management Plane	Module One	Module Four	Module Seven
Control/Signaling Plane	Module Two	Module Five	Module Eight
User Plane	Module Three	Module Six	Module Nine

Execute

- Management Network: Top Row
- Network Services: Middle Column
- Security Module: Layer & Plane Intersection

Access Control	Communication Security
Authentication	Data Integrity
Non-repudiation	Availability
Data Confidentiality	Privacy

The 8 Security Dimensions Are Applied to Each Security Module

Provides a systematic, organized way of performing network security assessments and planning

Conclusion: X.805 Provides A Holistic Approach to Network Security

- **Comprehensive, end-to-end network view of security**
- **Applies to any network technology**
  - Wireless, wireline, optical networks
  - Voice, data, video, converged networks
- **Applies to any scope of network function**
  - Service provider networks
  - Enterprise (service provider's customer) networks
  - Government networks
  - Management/operations, administrative networks
  - Data center networks
- **Can map to existing standards addressing**
  - Enterprise & service provider, government needs

Security work in FGNGN Security Capability WG and ITU-T Recommendation X.805

- ***Guidelines for NGN security* and X.805**
  - Security in NGN
    - NGN threat model (based on ITU-T X.800 and X.805 Recommendations)
  - Security Dimensions and Mechanisms (based on ITU-T X.805)
    - Access Control
    - Authentication
    - Non-repudiation
    - Data confidentiality
    - Communication security
    - Data integrity
    - Availability
    - Privacy
- ***NGN security requirements for Release 1* and X.805**
  - Security requirements
    - General considerations based on the concepts of X.805

Thank you!

Backup Materials

Example: Applying Security Layers to ATM & IP Networks

Applying Security Layers to ATM Networks

Infrastructure Security Layer

- Individual ATM Switches
- Point-to-Point Communication Links Between Switches (e.g., DS-3 links, E-3 links, OC-48 links, and STM-12 links)

Services Security Layer

- ATM Services Classes: CBR, VBR-RT, VBR-nRT, ABR, UBR

Applications Security Layer

- ATM-Based Video Conferencing Application

Applying Security Layers to IP Networks

Infrastructure Security Layer

- Individual Routers, Servers
- Communication Links Between Routers (Could be ATM PVCs)

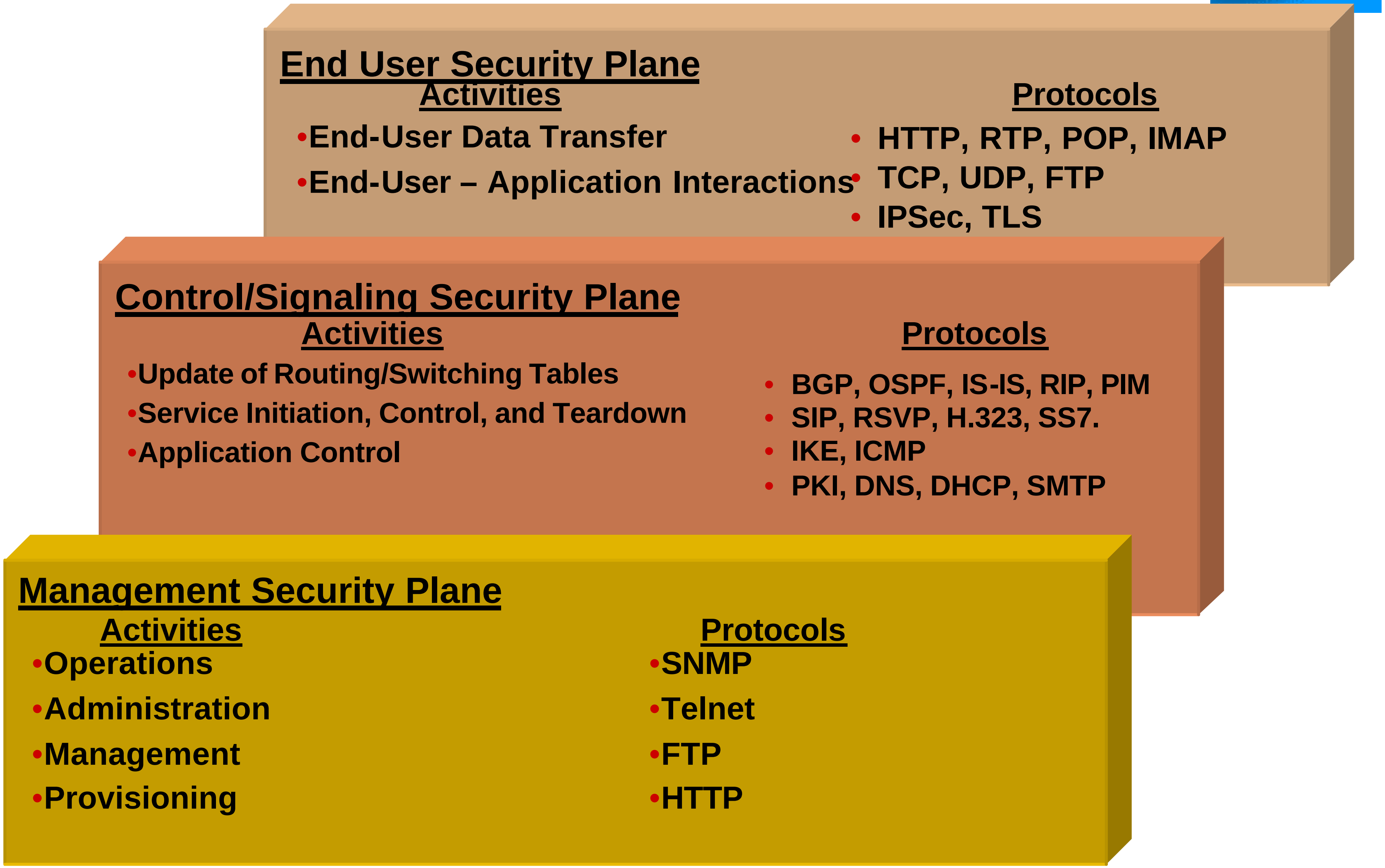
Services Security Layer

- Basic IP Transport
- IP Support Services (e.g., AAA, DNS, DHCP)
- Value-Added Services: (e.g., VPN, VoIP, QoS)

Applications Security Layer

- Basic Applications (e.g., ftp, Web Access)
- Fundamental Applications (e.g., Email)
- High-End Applications (e.g., E-Commerce, Training)

Example: Applying Security Planes to Network Protocols



End User Security Plane

Activities

- End-User Data Transfer
- End-User – Application Interactions

Protocols

- HTTP, RTP, POP, IMAP
- TCP, UDP, FTP
- IPSec, TLS

Control/Signaling Security Plane

Activities

- Update of Routing/Switching Tables
- Service Initiation, Control, and Teardown
- Application Control

Protocols

- BGP, OSPF, IS-IS, RIP, PIM
- SIP, RSVP, H.323, SS7.
- IKE, ICMP
- PKI, DNS, DHCP, SMTP

Management Security Plane

Activities

- Operations
- Administration
- Management
- Provisioning

Protocols

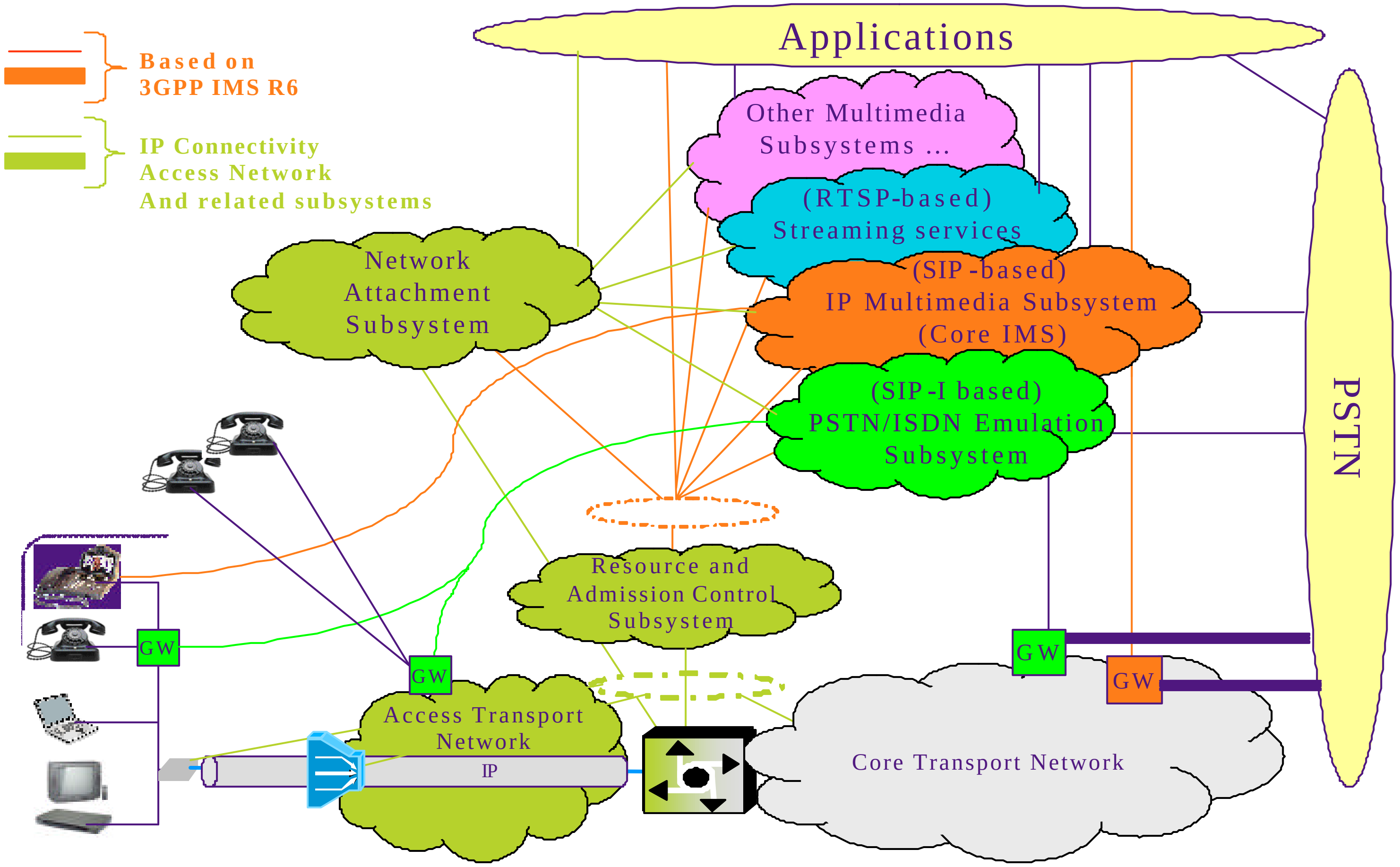
- SNMP
- Telnet
- FTP
- HTTP

How the Security Dimensions Map into the Security Threats

Security Dimension	X.800 Security Threats				
	Destruction	Corruption	Removal	Disclosure	Interruption
Access Control	✓	✓	✓	✓	
Authentication			✓	✓	
Non-Repudiation	✓	✓	✓	✓	✓
Data Confidentiality			✓	✓	
Communication Security			✓	✓	
Data Integrity	✓	✓			
Availability	✓				✓
Privacy				✓	

Provides just-in-time network security services

NGN Subsystem Architecture Overview


Based on
3GPP IMS R6
IP Connectivity
Access Network
And related subsystems
Applications
Other Multimedia
Subsystems …
(RTSP-based)
Streaming services
(SIP -based)
IP Multimedia Subsystem
(Core IMS)
(SIP -I based)
PSTN/ISDN Emulation
Subsystem
Network
Attachment
Subsystem
Resource and
Admission Control
Subsystem
Access Transport
Network
IP
Core Transport Network
GW
GW
GW
GW
PSTN