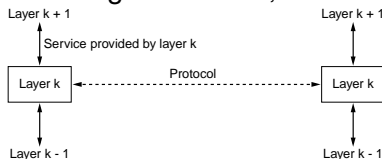


Zusammenfassung & Übersicht

ISO/OSI Referenzmodell

- ▶ 7 Schichten
- ▶ Trennung von Dienst, Schnittstelle, Protokoll



- ▶ Kapselung höherer Schichten

Internet Referenzmodell

- ▶ 5 Schichten

Bitübertragungsschicht

- ▶ Taktrückgewinnung (Synchronisierung), Gleichspannungsfreiheit
- ▶ Kodierverfahren: (Non) return to zero, Manchester, AMI,...

Sicherungsschicht

- ▶ Rahmenbildung
 - ▶ Flag Bytes, Byte Stuffing, Bit Stuffing
- ▶ Fehlermanagement
 - ▶ Cyclic Redundary Checks
 - ▶ Hamming Codes
- ▶ Flußkontrolle
 - ▶ Stop-and-Wait Protokoll, Sliding Window Protokoll
 - ▶ Automatic Repeat Request (ARQ)
 - ▶ Stop-and-Wait ARQ
 - ▶ Go-Back-n ARQ
 - ▶ Selective Repeat ARQ
- ▶ Mehrfachzugriffsverfahren (Multiple Access)
 - ▶ Alohanet, Ethernet
- ▶ Beispiele
 - ▶ PPP, Ethernet (z.B. Ethernet Adressen)

Sicherungsschicht

- ▶ Address Resolution Protokoll (ARP)
 - ▶ Bestimmung der Sicherungsschicht-Adresse
- ▶ ARP Poisoning
 - ▶ ARP Spoofing
 - ▶ Ausspähen von Paketen der Sicherungsschicht

Vermittlungsschicht (Netzwerkschicht, Internetschicht)

- ▶ Weiterleitung und Routing zu Knoten des Netzes
- ▶ Verbindungsaufbau
- ▶ Leitungsvermittlung, Paketvermittlung
- ▶ Internetprotokoll
 - ▶ IPv4, Fragmentierung, Prüfsummenbildung
 - ▶ IP Adressen, Netzklassen, Classless Inter-Domain Routing (CIDR), Network Address Translation (NAT)
 - ▶ Internet Control Message Protokoll (ICMP)

IP Routing

- ▶ Autonome Systeme (AS), intra-AS, inter-AS
- ▶ Routingverfahren
 - ▶ Distance Vector Algorithms
 - ▶ Link State Algorithms
 - ▶ Path Vector Algorithms
- ▶ Bellmann-Ford Algorithmus
 - ▶ Count-to-Infinity Problem
- ▶ Dijkstra Algorithmus
- ▶ Broadcast Routing
 - ▶ Flooding, multidestination Routing, reverse path forwarding
- ▶ Multicast Routing

Routing Protokolle

- ▶ Routing Information Protokoll (RIP)
- ▶ Open Shortest Path First (OSPF)
 - ▶ Link State Algorithmus (Dijkstra)
 - ▶ Intra-AS Routing
 - ▶ Load Balancing
 - ▶ hierarchische Aufbau aus AS möglich
- ▶ Border Gateway Protocol
 - ▶ Routertypen: Internal, Area Border, Backbone, Boundary

IPv6

- ▶ Unterschiede zu IPv4
 - ▶ 128bit Adressen (ausreichende Anzahl an Adressen)
 - ▶ Vereinfachung, Verbesserung der Effizienz
 - ▶ Bessere Unterstützung von Roaming, Sicherheit, Multicast

Transportschicht

- ▶ verbindungsorientierte und verbindungslose Dienste
- ▶ Verbindungsaufbau, Verbindungsabbau
 - ▶ three-way handshake
 - ▶ two-army / coordinated attack Problem

Transmission Control Protocol (TCP)

- ▶ gesicherter, verbindungsorientierter Transport
- ▶ genau zwei Endpunkte
- ▶ Rahmen und Header Aufbau
- ▶ Paketbezeichner SYN, FIN, ACK, RST
- ▶ Zustandsmodell
 - ▶ Verbindungsaufbau und -abbau
- ▶ Window Management

Transportschicht - Transmission Control Protocol (TCP)

- ▶ Nagle Algorithmus
- ▶ TCP Optionen
 - ▶ MSS, Timestamp, Window Scale, Selective ACK
- ▶ TCP Flußkontrolle
 - ▶ Slow Start / Congestion Avoidance
 - ▶ Fast Retransmit / Fast Recovery

Mitnick Attacke

User Datagram Protocol (UDP)

- ▶ Header
- ▶ Rahmengröße

Berkeley Sockets (BSD Socket API)

Domain Name System (DNS)

- ▶ Verzeichnisaufbau, Top Level Domain, DNS Zonen
- ▶ DNS Rahmen
- ▶ Resource Records
- ▶ Auflösen von Namen
- ▶ Reverse Lookup

Hypertext Transport Protocol (HTTP)

- ▶ SMTP Grundlagen
 - ▶ Header, Statuscodes, Kodierung (Base16/64)
- ▶ HTTP 1.1
 - ▶ Uniform Resource Identifier (URI)
 - ▶ HTTP Header
 - ▶ Authentication
- ▶ Session Management
 - ▶ Cookies

Transport Layer Security (TLS)

- ▶ RSA
 - ▶ Verschlüsselung und Entschlüsselung
 - ▶ Schlüsselerzeugung
 - ▶ Sicherheit
 - ▶ Digitale Signatur
- ▶ Chain of Trust, Zertifikate

Abstrakte Syntax Notation (ASN)

- ▶ Basistypen
- ▶ Tagging
- ▶ Konkrete Syntax
 - ▶ Kodierregeln, Datentypen

IP Multicast

- ▶ Internet Group Management Protocol (IGMP)
- ▶ Multicast Routing

Real-Time Transport Protocol (RTP)

- ▶ Rahmen, Header
- ▶ Payload (z.B. MPEG-1 Video)
- ▶ Mixer, Translator

RTP Control Protocol (RTCP)

- ▶ Pakettypen
 - ▶ Sender/Receiver Report, Source Description,...
- ▶ Sendeintervall

Robust Header Compression (ROHC)

- ▶ Anwendungen, Einsparpotentiale
- ▶ Konzept
- ▶ Modi der ROHC
 - ▶ Unidirectional, Bidirectional, Bidirectional Reliable
- ▶ Zustände Compressor und Decompressor
- ▶ Zustandsübergänge

H.323

- ▶ Architektur, Protokoll Stapel

Session Description Protocol (SDP)

- ▶ Aufbau einer Nachricht
 - ▶ Session Parameter, Attribute
 - ▶ Augmented Backus Naur Form (ABNF)
- ▶ Regeln, Operatoren

Session Initiation Protocol (SIP)

- ▶ Transport, Transaktionen
- ▶ Routing, Forwarding
 - ▶ Server Routing, Client Routing
 - ▶ Request, Response
- ▶ SIP mit PSTN, NAT
- ▶ Simple Traversal of User Datagram (STUN)
- ▶ Vergleich H.323 und SIP

IP Multimedia Subsystem (IMS)

- ▶ Sitzungsaufbau
- ▶ Architektur
- ▶ Call Session Control Function (CSCF)
 - ▶ Proxy CSCF, Serving CSCF, Interrogating CSCF
- ▶ verschiedene Verarbeitungsblöcke
- ▶ Szenarien
 - ▶ Registrierung aus Fremdnetz
 - ▶ Telefonat IMS zu IMS, IMS zu PSTN, PSTN zu IMS
- ▶ DIAMETER Protocol
 - ▶ Rahmen
 - ▶ Header
- ▶ XDMS / XCAP

Congestion Control

- ▶ Open Loop und Closed Loop Congestion Control
- ▶ Strategien zur Vermeidung von Congestion
 - ▶ Sicherungsschicht, Vermittlungsschicht, Transportschicht
- ▶ Verbindungsorientierte und -lose Übertragung
 - ▶ Alternative Routing, Warning Bit, Choke Packets, Load Shedding, RED, Jitter Control

Quality of Service (QoS)

- ▶ Anforderungen von Anwendungen, QoS Klassen
- ▶ Techniken
 - ▶ Buffering, Traffic Shaping, Leaky Bucket, Token Bucket, Resource Reservation, Admission Control, Proportional Routing, Packet Scheduling
- ▶ Resource Reservation Protocol (RSVP)
- ▶ Differentiated Services (DiffServ)
 - ▶ Expedited Forwarding, Assured Forwarding

UMTS

- ▶ Übersicht über die Architektur, UTRAN
- ▶ RRC-, RLC-, MAC- und PHY-Layer
- ▶ Verbindungsaufbau durch UE oder Netzwerk
- ▶ Prinzip von Wideband CDMA
 - ▶ Spreading zur Nutzer Trennung
 - ▶ RAKE Empfänger für Mehrwegeausbreitung

TCP Timer Management

- ▶ Berechnung Round Trip Time (RTT)
- ▶ Berechnung Retransmission Time-out (RTO)
- ▶ Karn's Algorithm, Persistence und Keepalive Timer

ARQ Beispiele

- ▶ Bitmap-ARQ, Hybrid ARQ