

2009 - 2010

Tehnologii de Programare in Internet (TPI / RST)

Titulari curs: **Mihnea Magheti**, Eduard-Cristian Popovici

Suport curs: <http://discipline.elcom.pub.ro/tpi/>

Moodle: <http://electronica07.curs.ncit.pub.ro/course/category.php?id=3>

Obiectivele disciplinei

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Obiective curs:

Prezentarea unor tehnologii de programare larg utilizate in Internet:

- Desktop (comunicatii la nivel socket TCP si UDP),
- Web (tehnologii pentru client si server HTTP),
- Acces la Baze de Date, Servicii Web, etc.;

folosind diferite limbaje de programare: HTML, Java, XML, SQL, etc.

Obiective aplicații:

Crearea abilităților de a aplica cunoștințele generale privind tehnologiile de programare predate, in cadrul mai multor categorii de mini-proiecte.

Posibilitatea de a alege si concepe arhitectura si componentele software necesare, si de a realiza programe concrete care sa raspunda cerintelor formulate.

Structura cursului

Structura cursului



Continut curs TPI

1. Introducere in tehnologiile Internet

2. Introducere in tehnologiile desktop (SE) Java

2.1. Elemente de baza. Tipuri de date referinta. Clase de biblioteca

2.2. Clase pentru fluxuri de intrare-iesire (IO)

3. Programarea la nivel socket in Java

3.1. Introducere in Protocolul Internet (IP) si stiva de protocoale IP

3.2. Socketuri flux (TCP) Java si programe multifilare (threads)

3.3. Socketuri datagrama (UDP) Java

4. Tehnologii Java de programare a aplicatiilor Web (EE) Java

4.1. Tehnologii client. Miniaplicatii Java (applet-uri)

4.2. Clase pentru interfete grafice cu utilizatorul (AWT, Swing)

4.3. Platforma Java EE. Arhitectura si tehnologiile implicate

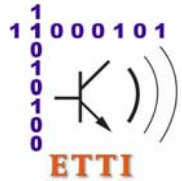
4.4. Tehnologii server. Tehnologia Java Servlet

4.5. Tehnologia Java ServerPages (JSP)

4.6. Accesul la baze de date prin tehnologii Java (JDBC, Hibernate)

4.7. Tehnologii avansate (frameworks, componente EJB, Servicii Web)





Structura cursului

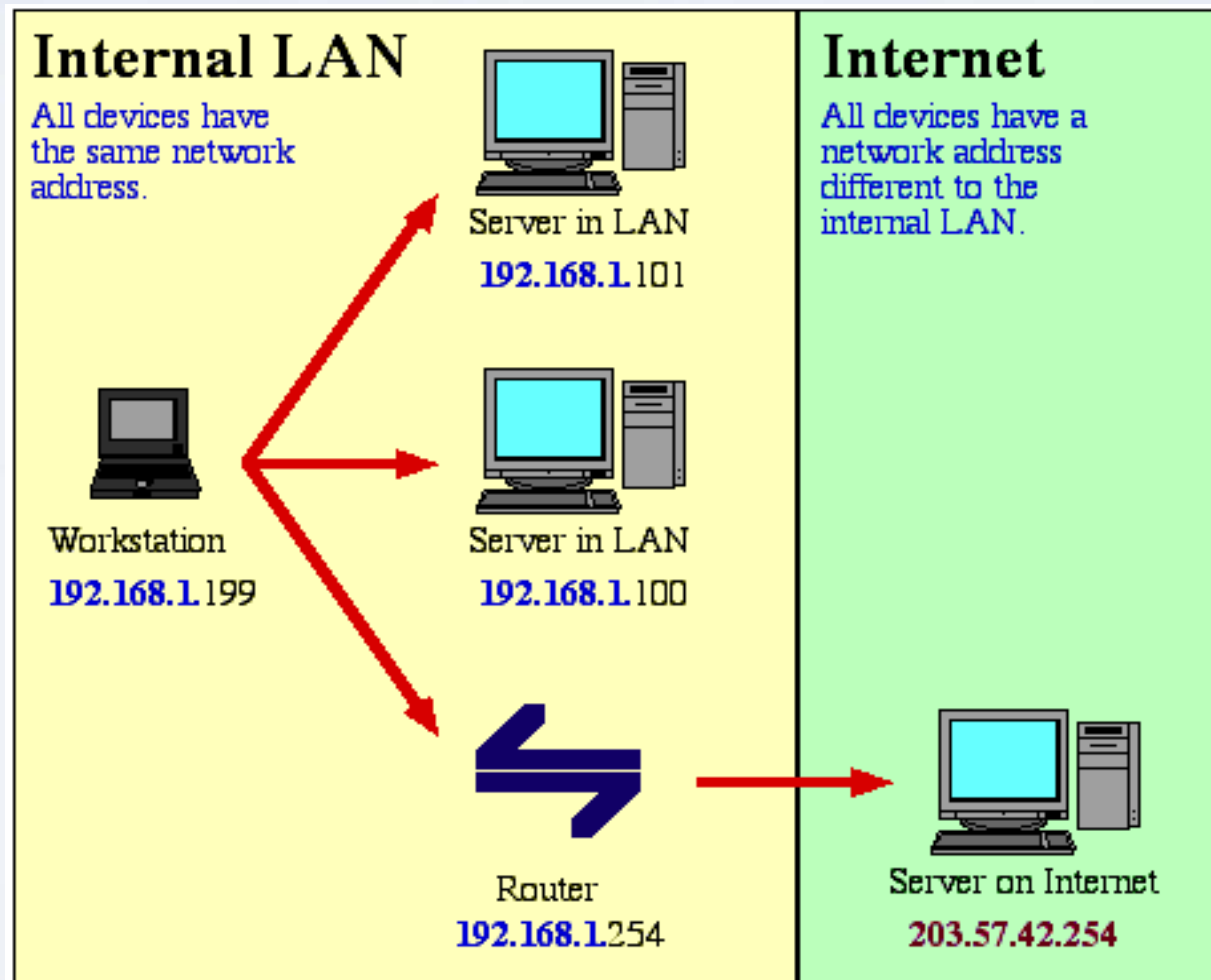


1. Introducere in tehnologiile Internet



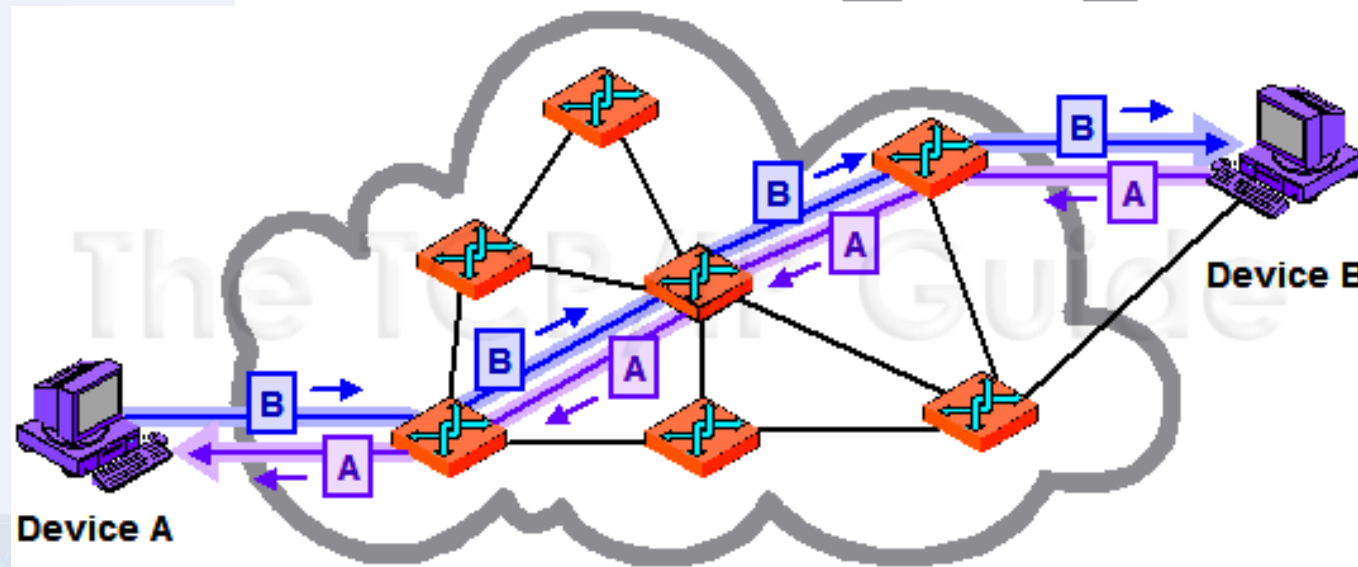
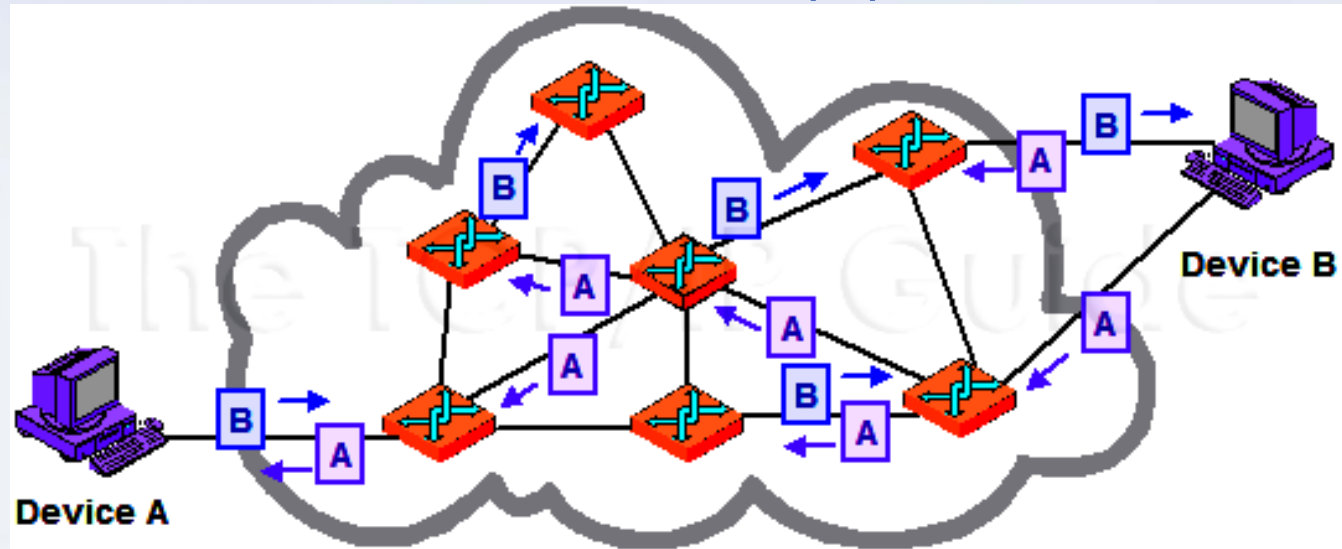
1. Introducere in TPI

Transmiterea mesajelor in retea locala si in Internet
(retea de retele globale)



1. Introducere in TPI

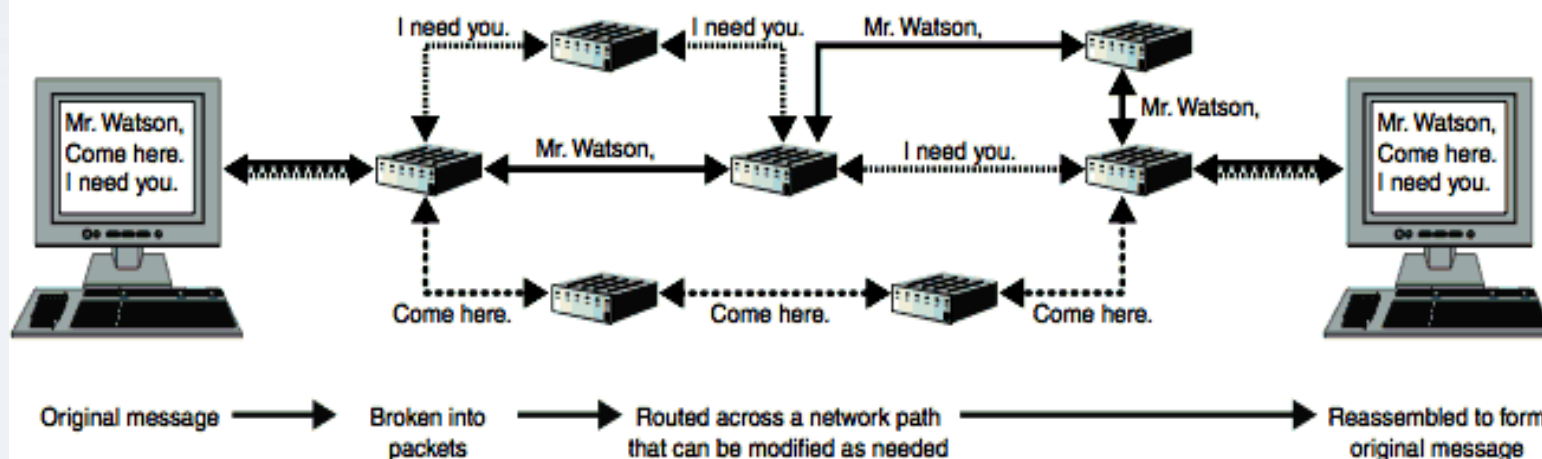
Comunicatia prin comutatie de pachete (IP) vs comutatie de circuite



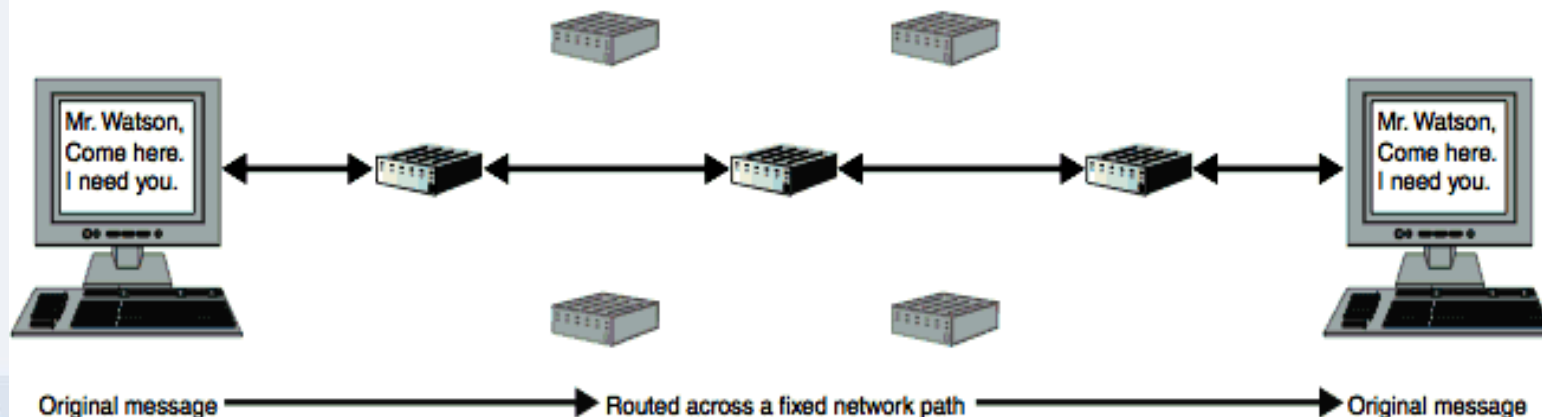
1. Introducere in TPI

Comunicatia prin comutatie de pachete (Internet Protocol)
vs comutatie de circuite (canal dedicat, de ex. telefonie clasica)

Packet-switched network



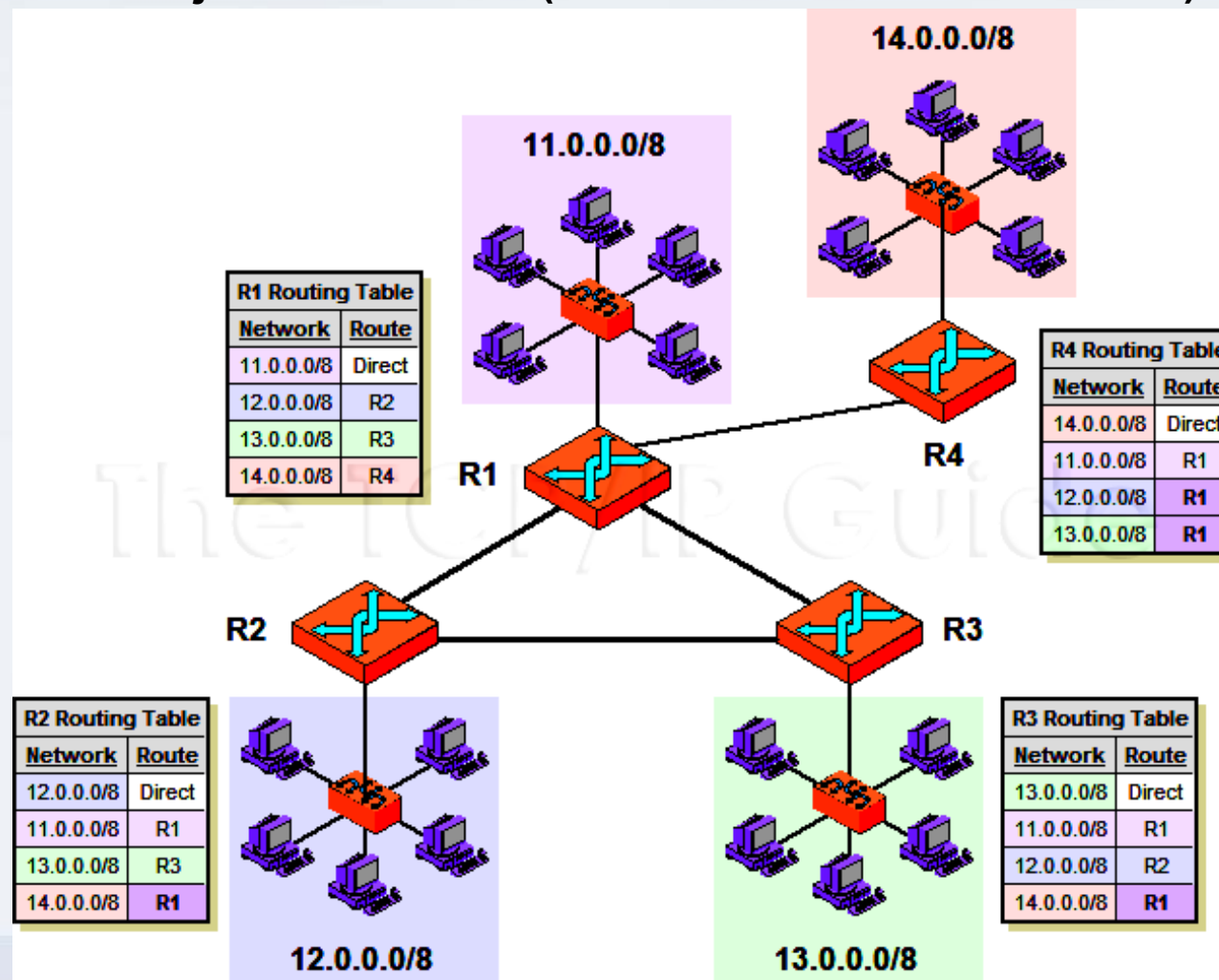
Circuit-switched network



1. Introducere in TPI

Modelul comunicatiilor in Internet

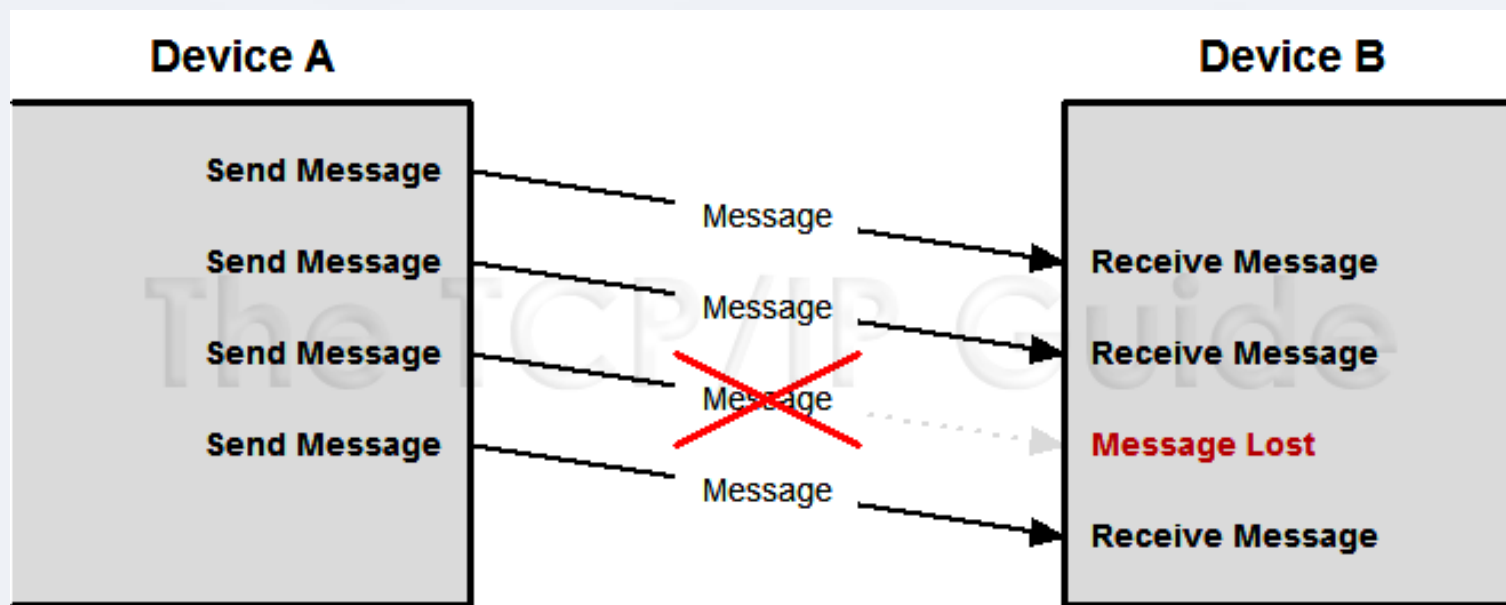
Rutarea mesajelor in Internet (la nivel IP – *Internet Protocol*)



1. Introducere in TPI

Comunicatie prin mesaje non-fiabila (fara confirmare sau retransmisie) ca in

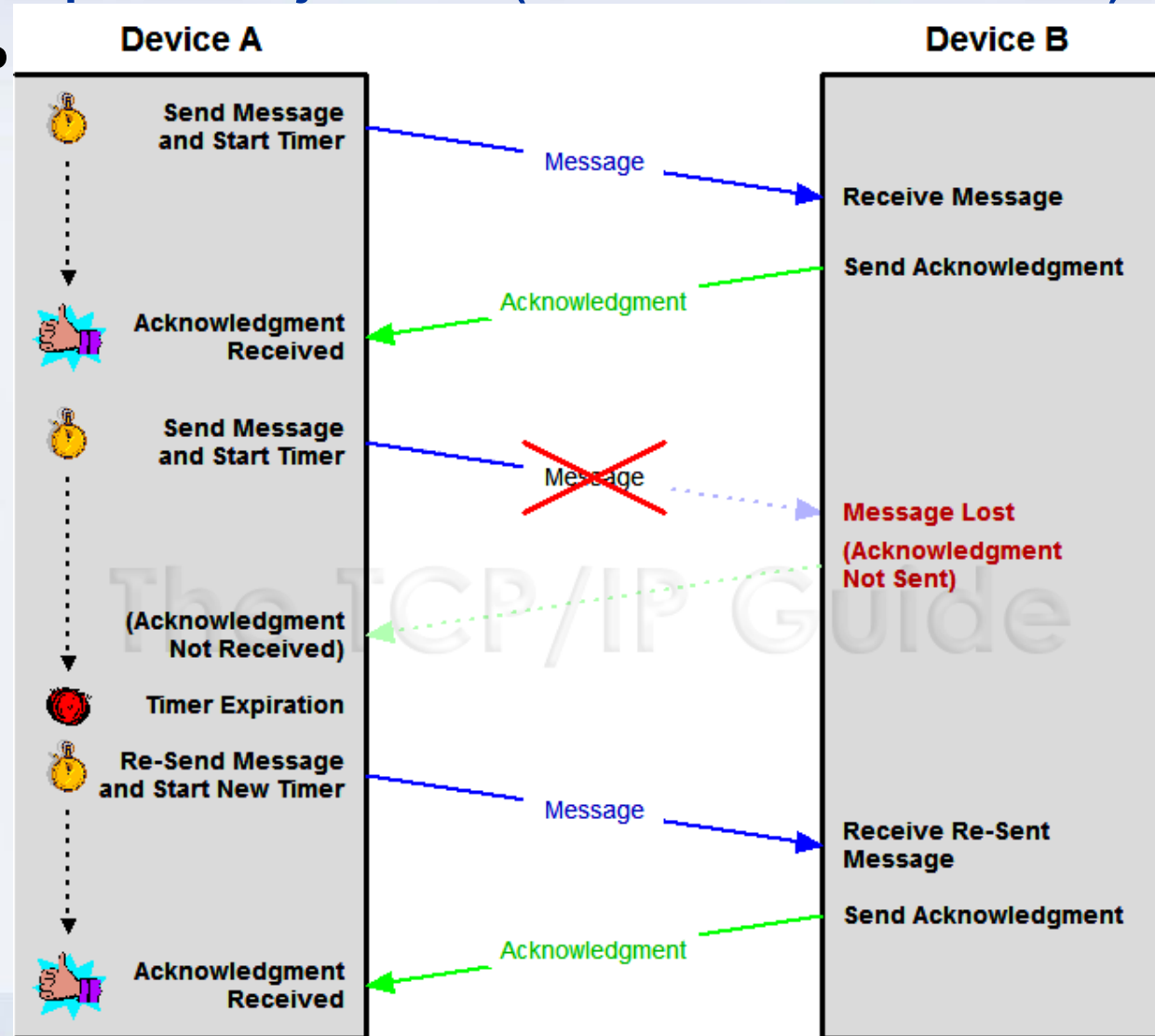
- IP (*Internet Protocol*) si
- UDP (*User Datagram Protocol*)



1. Introducere in TPI

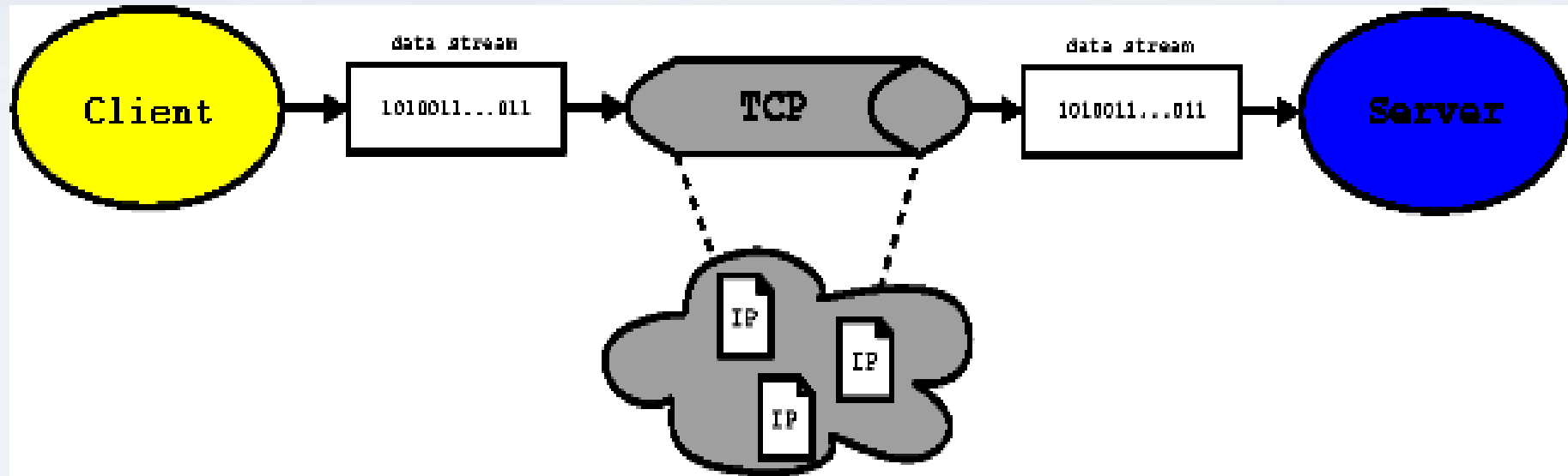
Comunicatie prin mesaje fiabila (confirmare+retransmisie)

- ca in TCP

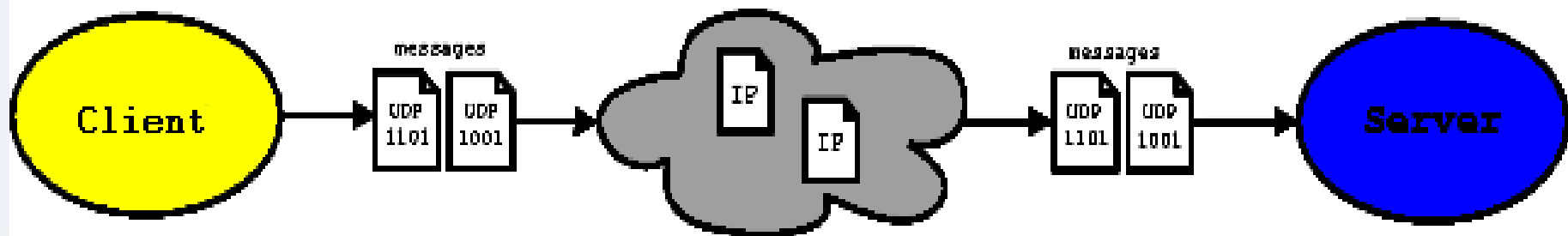


1. Introducere in TPI

Comunicatia orientata spre conexiune (flux) TCP prin comutatie de pachete IP

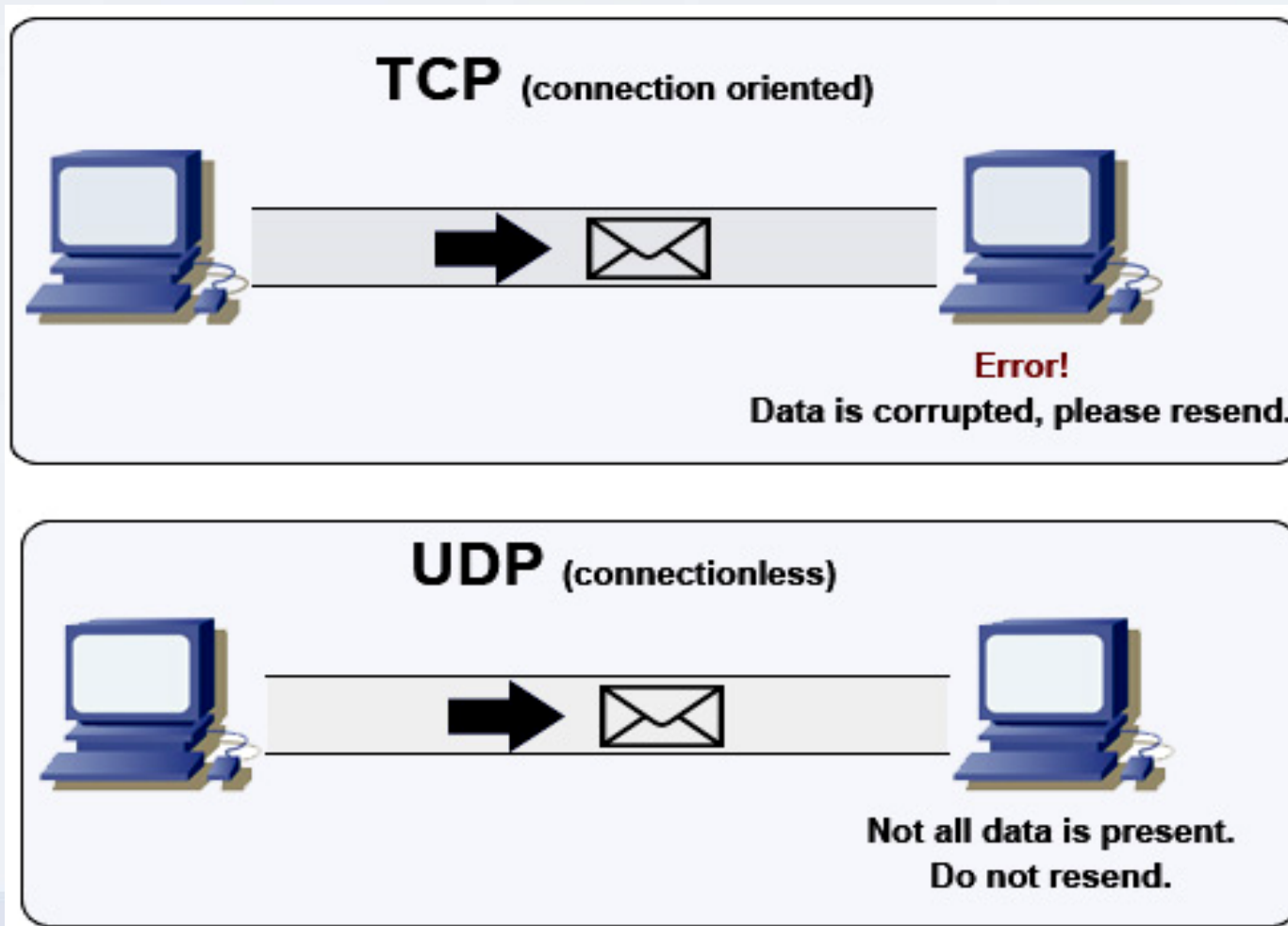


Comunicatia fara conexiune prin datagramme (pachete) UDP (incapsulate in datagramme IP)



1. Introducere in TPI

Comunicatia TCP orientata spre conexiune, fiabila, prin comutatie de pachete IP **versus** comunicatia UDP fara conexiune, non-fiabila, prin datagrame (incapsulate in datagrame IP)



1. Introducere in TPI

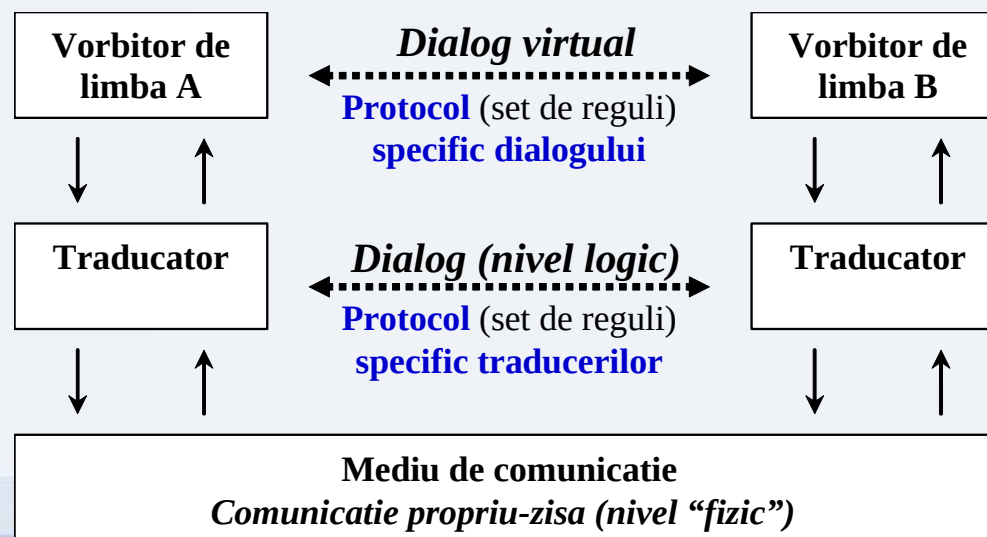
Modele de comunicare stratificata

Exemplul unui dialog la distanta intre interlocutori de limbi diferite

1. Nivelul cel mai inalt (abstract)



2. Detaliind utilizarea unor traducatori (nivel intermediar)

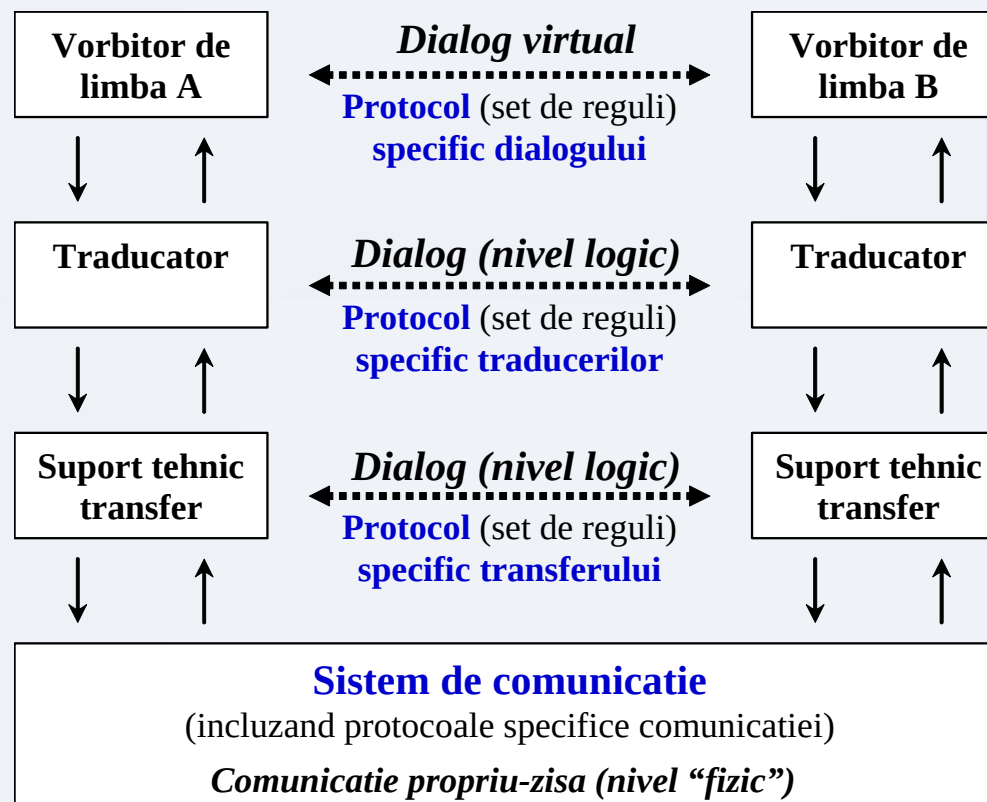


1. Introducere in TPI

Modele de comunicatie stratificata

Exemplul unui dialog la distanta intre interlocutori de limbi diferite

3. Detaliind utilizarea unui suport tehnic local si a unui sistem de comunicatie propriu-zis



1. Introducere in TPI

Modele de comunicatie stratificata

Protocolul de comunicatie este un

- **set de reguli si conventii** care au fost **convenite** intre participantii la o comunicatie pentru a **asigura buna desfasurare a dialogului**
- bazat pe **mesaje / pachete / cadre** / etc. (unitati de date) **schimbate** si pe **primitive / automate** / etc. (elemente de comportament)

Interactiunile **pe orizontala** se desfasoara

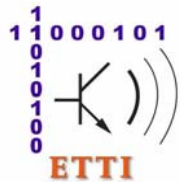
- **conform protocolului de la respectivul nivel**, care consta in **interactiuni virtuale**, realizate prin interactiuni la nivelurile inferioare

Interactiunile **pe verticala**

- **transmit si preiau sarcini si unitati de date** cu scopul transferului unitatilor de date catre / de la partenerul de la acelasi nivel

Serviciul este un

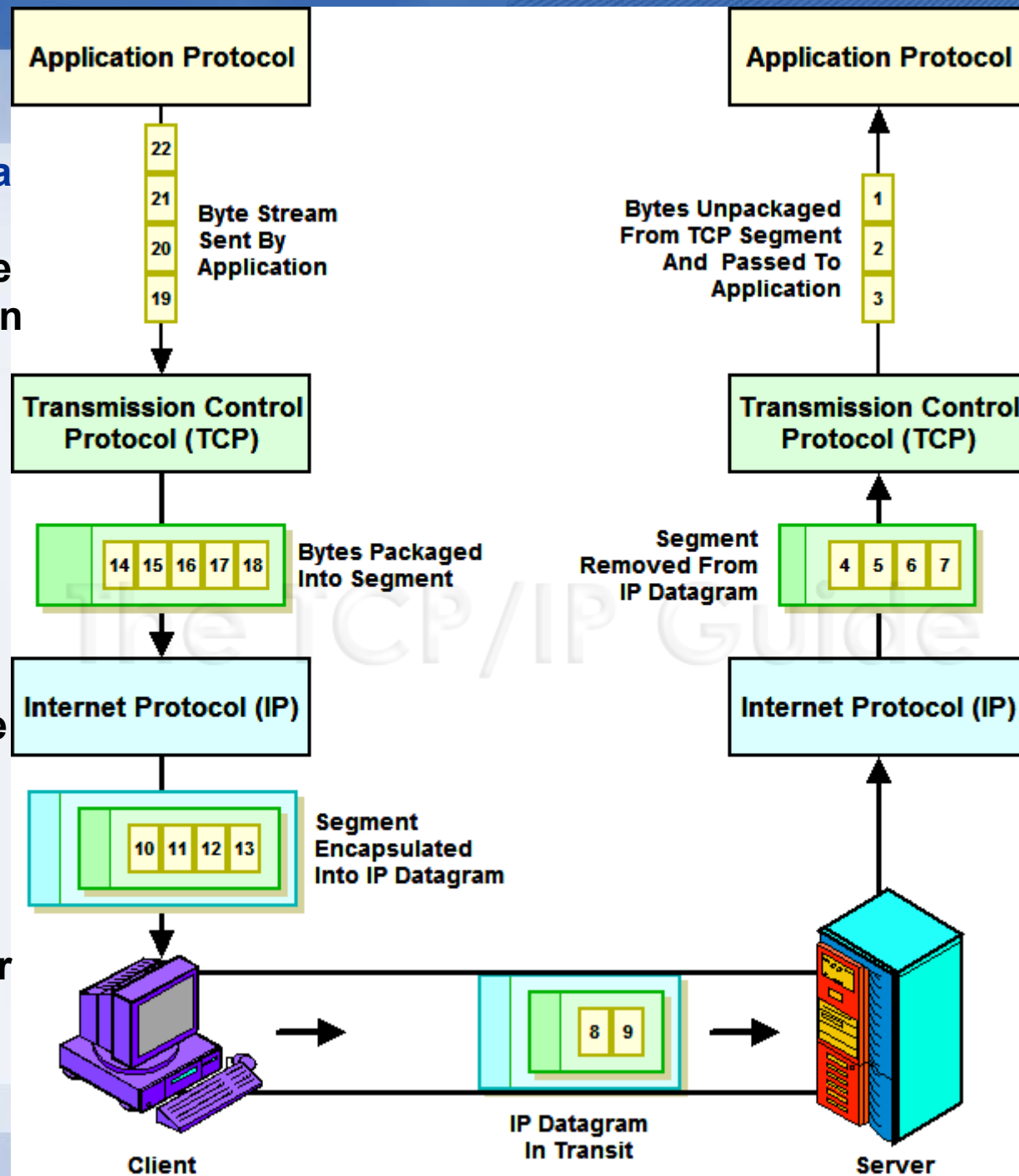
- **set de functii** posibil de **oferit de catre nivelul inferior**, respectiv
- **setul de sarcini** posibil **de solicitat de catre nivelul superior**, in interactiunile pe verticala



Impachetarea
octetilor din
fluxul de date
ai Aplicatiei in
segmente
TCP

Incapsularea
segmentelor
in Datagram
IP

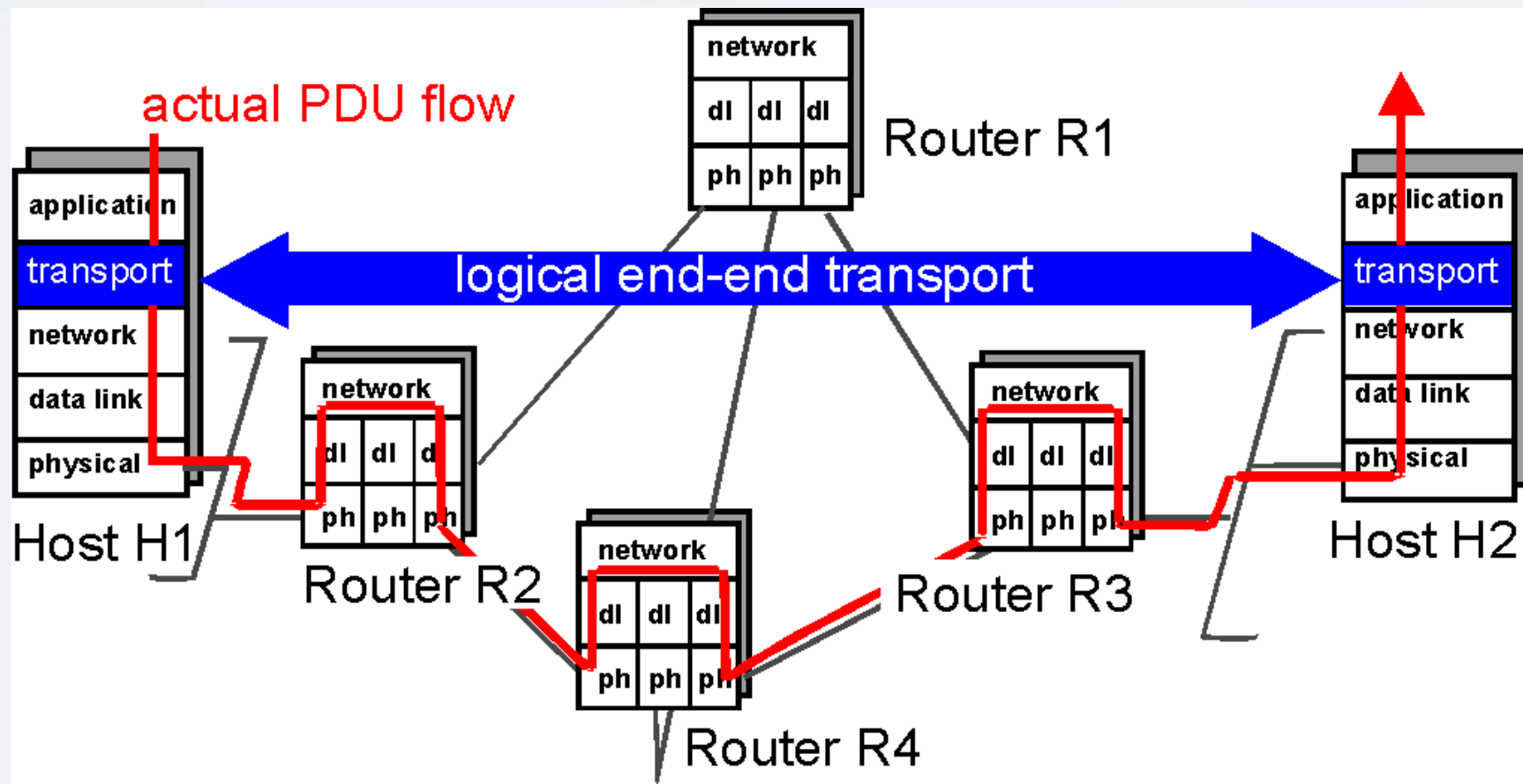
Transmisia
Datagramelor
IP prin
Internet



1. Introducere in TPI

Modelul comunicatiilor in Internet

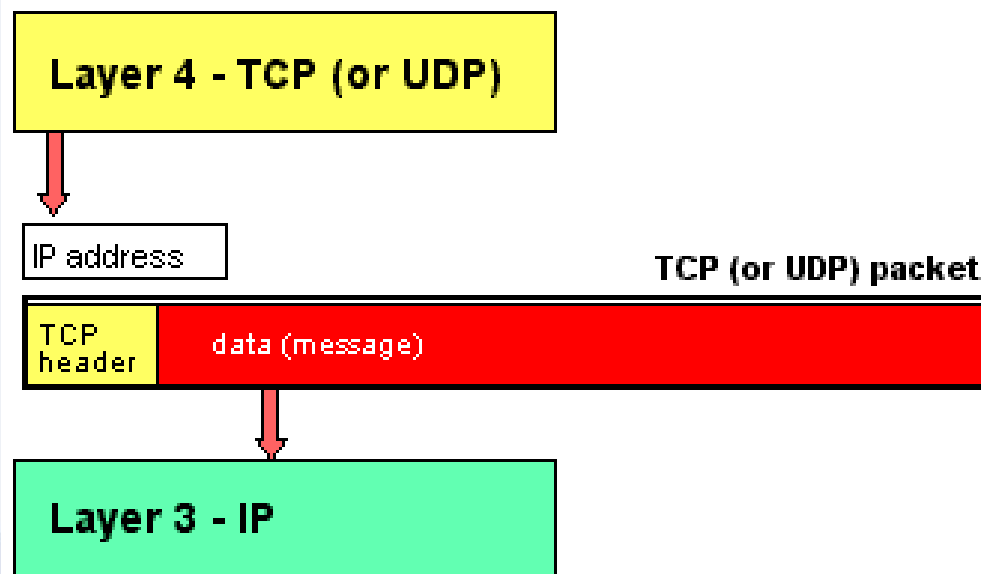
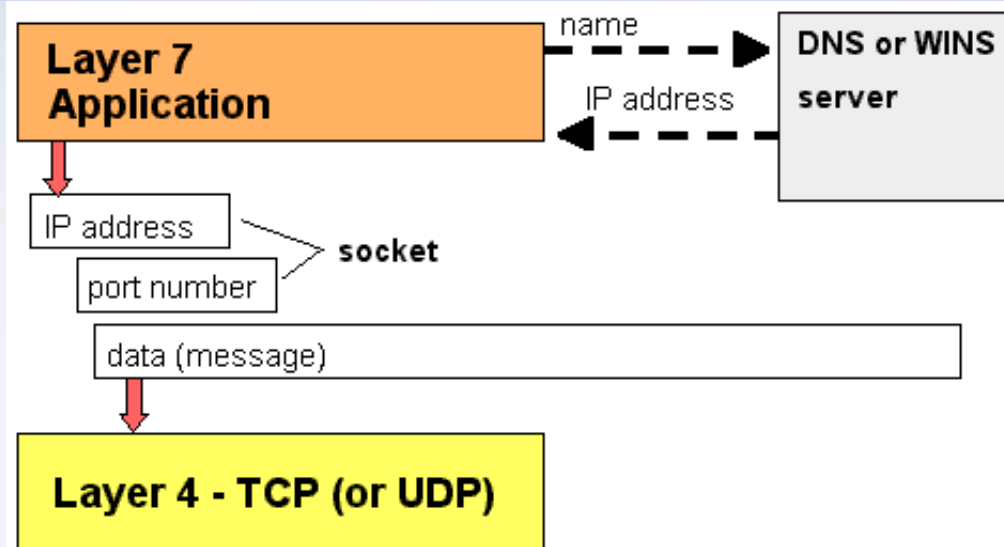
Fluxurile de date, conexiunile logice si stivele de protocoale de comunicatie



1. Introducere in TPI

Modelul comunicatiilor in Internet

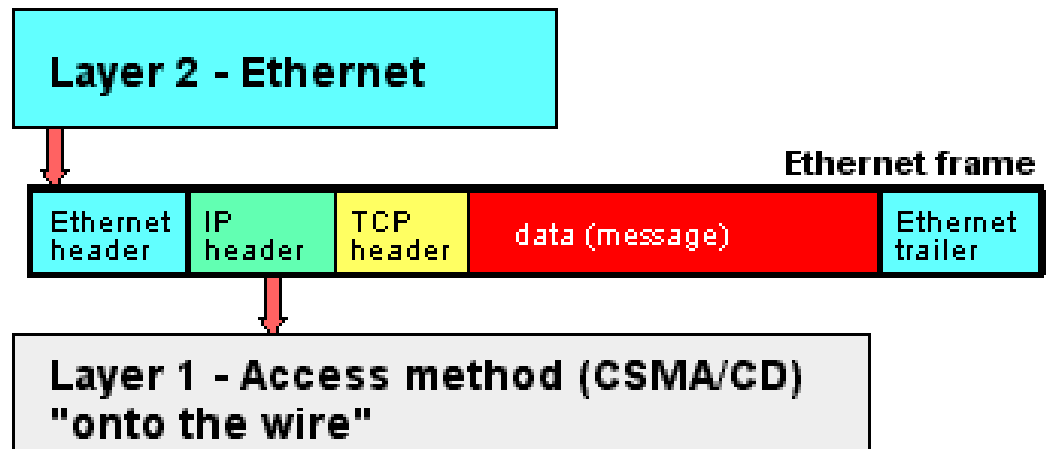
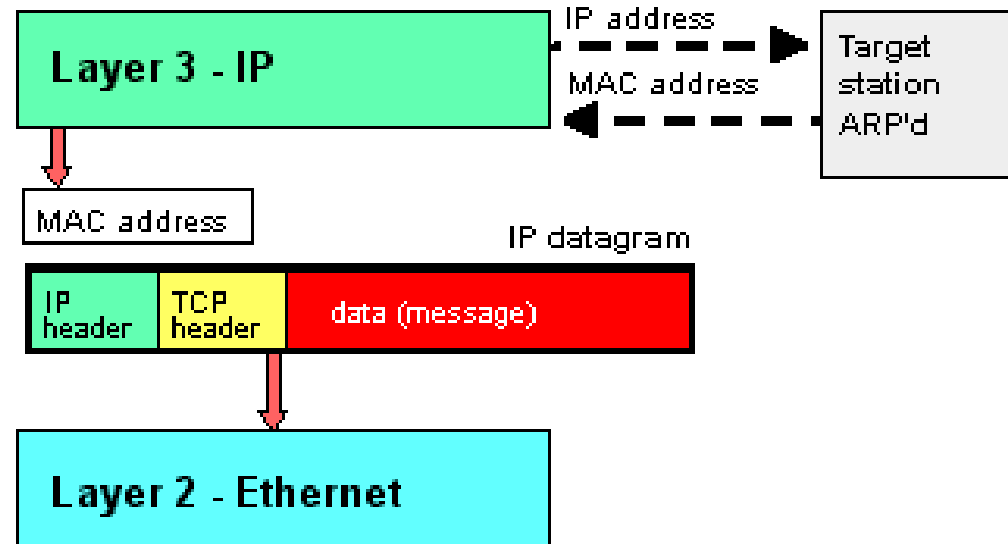
Stiva de
protocoale de
comunicatie
TCP/IP

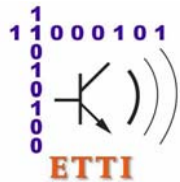


1. Introducere in TPI

Modelul comunicatiilor in Internet

Stiva de protocoale de comunicatie TCP/IP





Modelul comunicatiilor in Internet

Stiva de protocoale de comunicatie TCP/IP

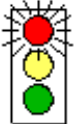
vs

Stiva de referinta OSI a protocoalelor de comunicatie

si rolul fiecarui nivel in parte



OSI MODEL

7		Application Layer Type of communication: E-mail, file transfer, client/server.
6		Presentation Layer Encryption, data conversion: ASCII to EBCDIC, BCD to binary, etc.
5		Session Layer Starts, stops session. Maintains order.
4		Transport Layer Ensures delivery of entire file or message.
3		Network Layer Routes data to different LANs and WANs based on network address.
2		Data Link (MAC) Layer Transmits packets from node to node based on station address.
1		Physical Layer Electrical signals and cabling.

TCP / IP

FTP,
Telnet,
HTTP,
SNMP,
DNS,
OSPF,
RIP,
Ping,
Traceroute

TCP (delivery
ensured)

UDP (delivery
NOT
ensured)

IP
(ICMP, IGMP,
ARP, RARP)

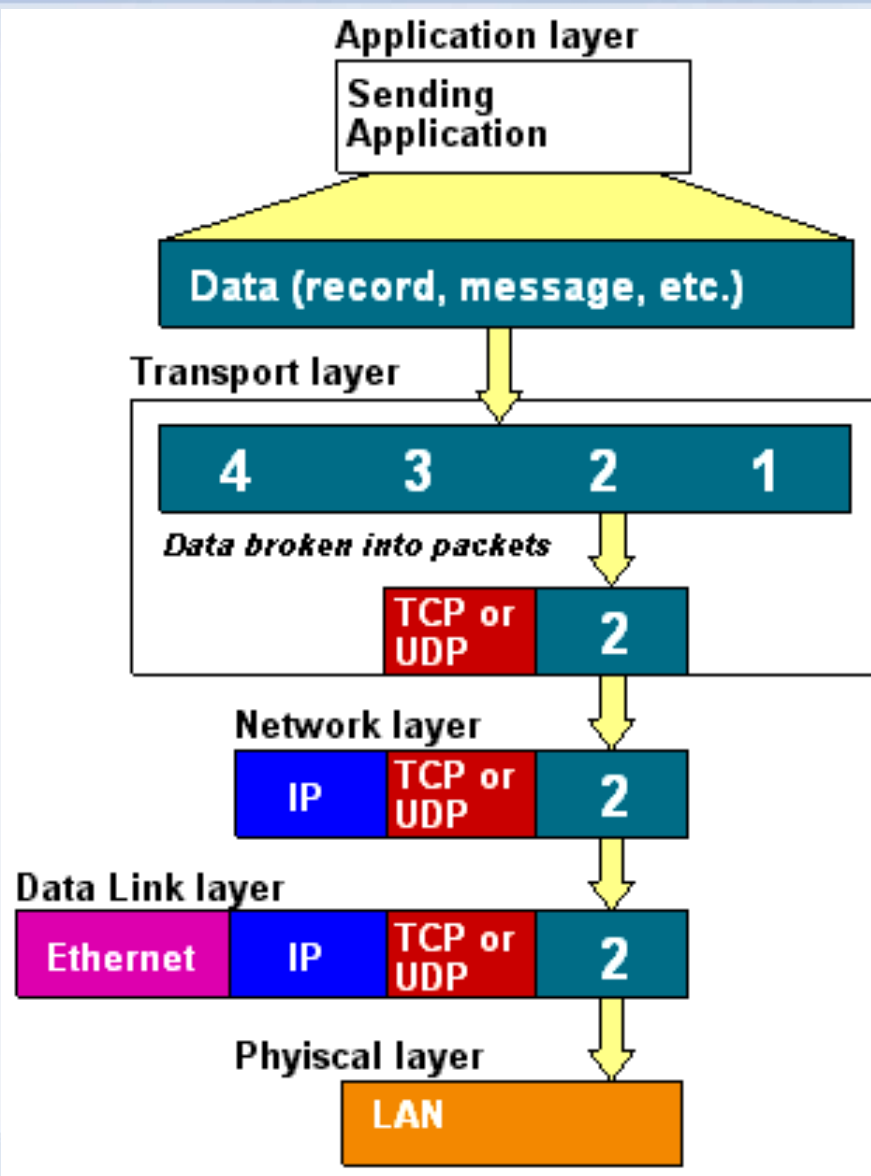


1. Introducere in TPI

Modelul comunicatiilor in Internet

Stiva de
protocoale de
comunicatie
TCP/IP

si modul in care
se formeaza
pachetele de
date din
mesajele
aplicatiei la
transmitator

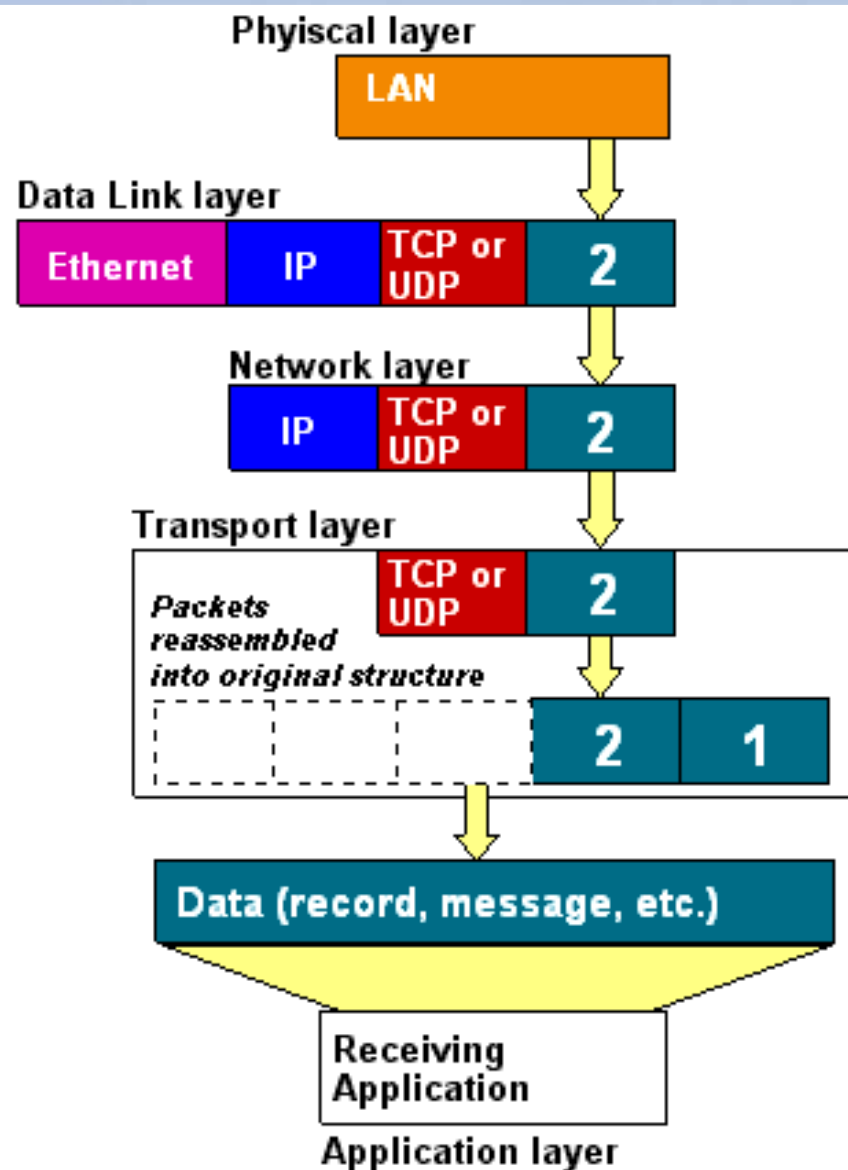


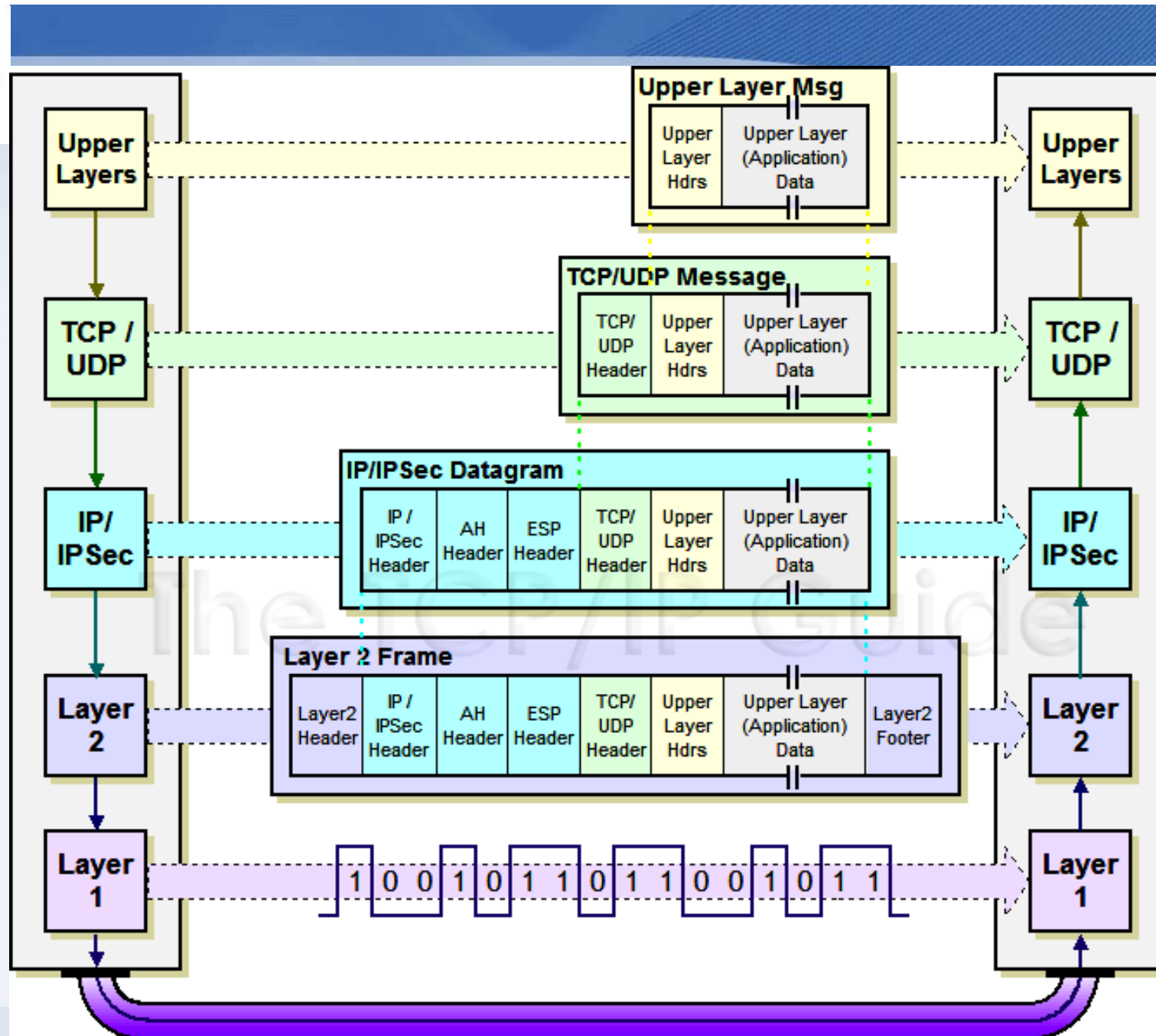
1. Introducere in TPI

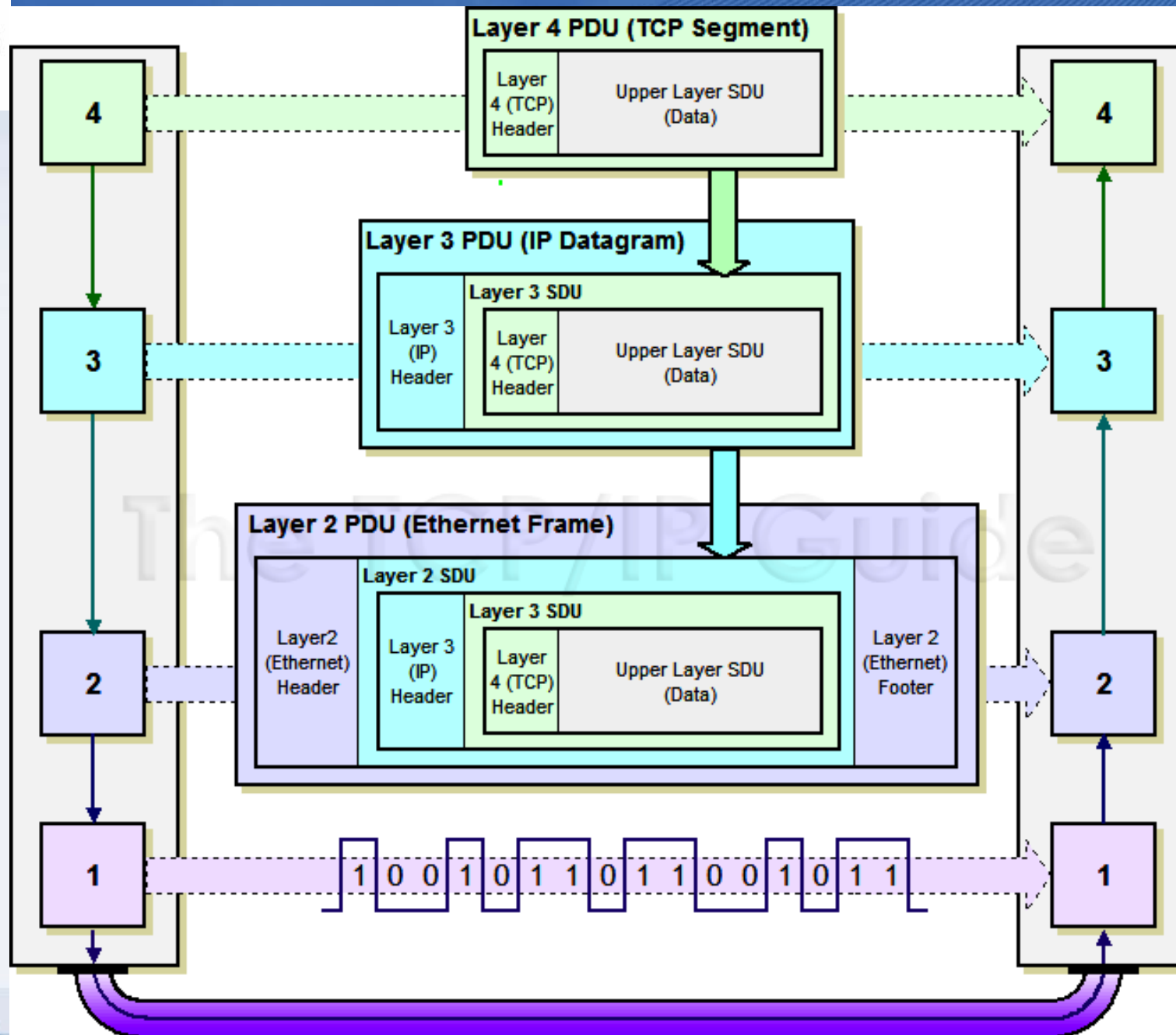
Modelul comunicatiilor in Internet

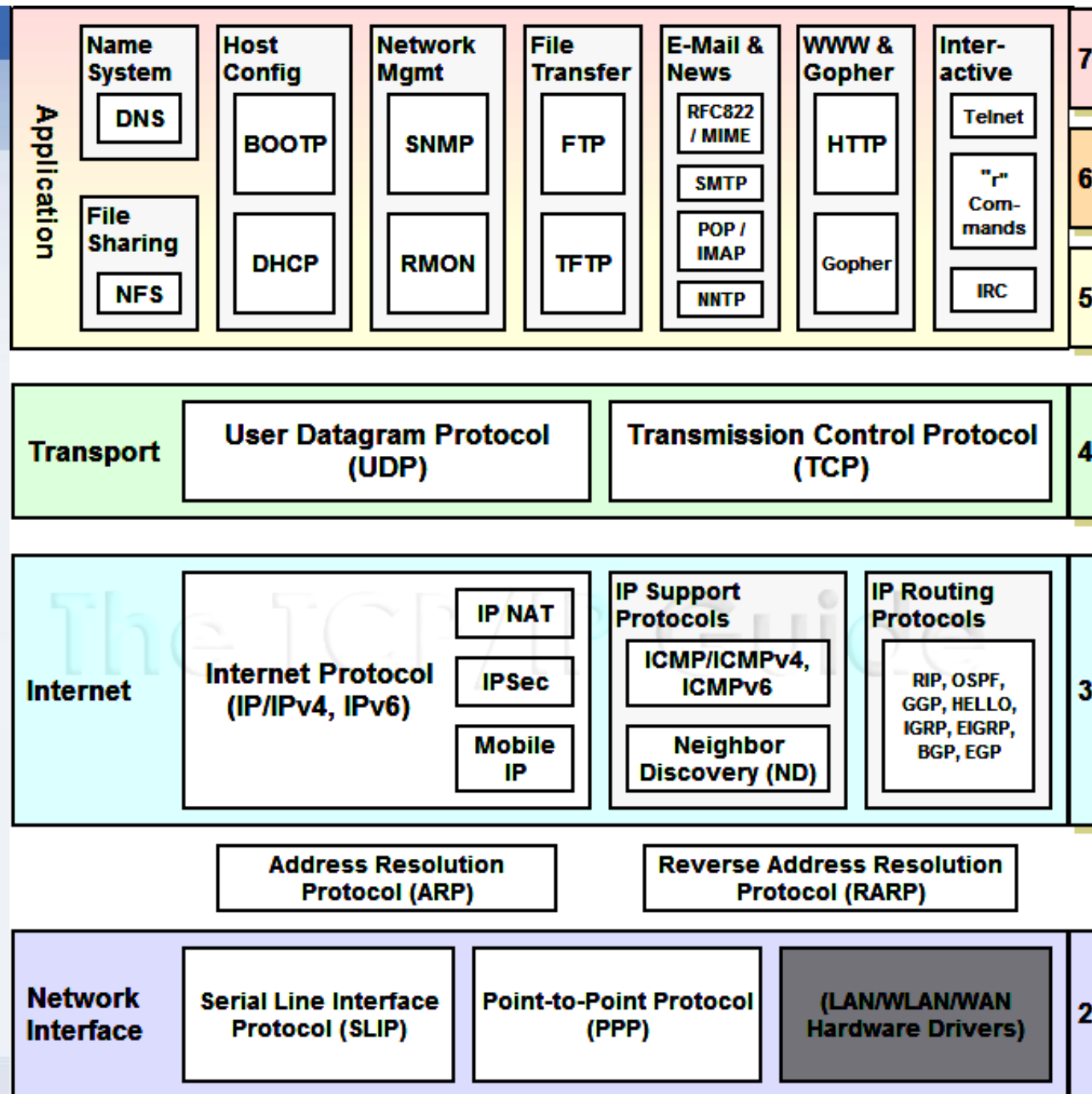
Stiva de
protocoale de
comunicatie
TCP/IP

si modul in care
se refac
mesajele
aplicatiei din
pachetele de
date la
receptor



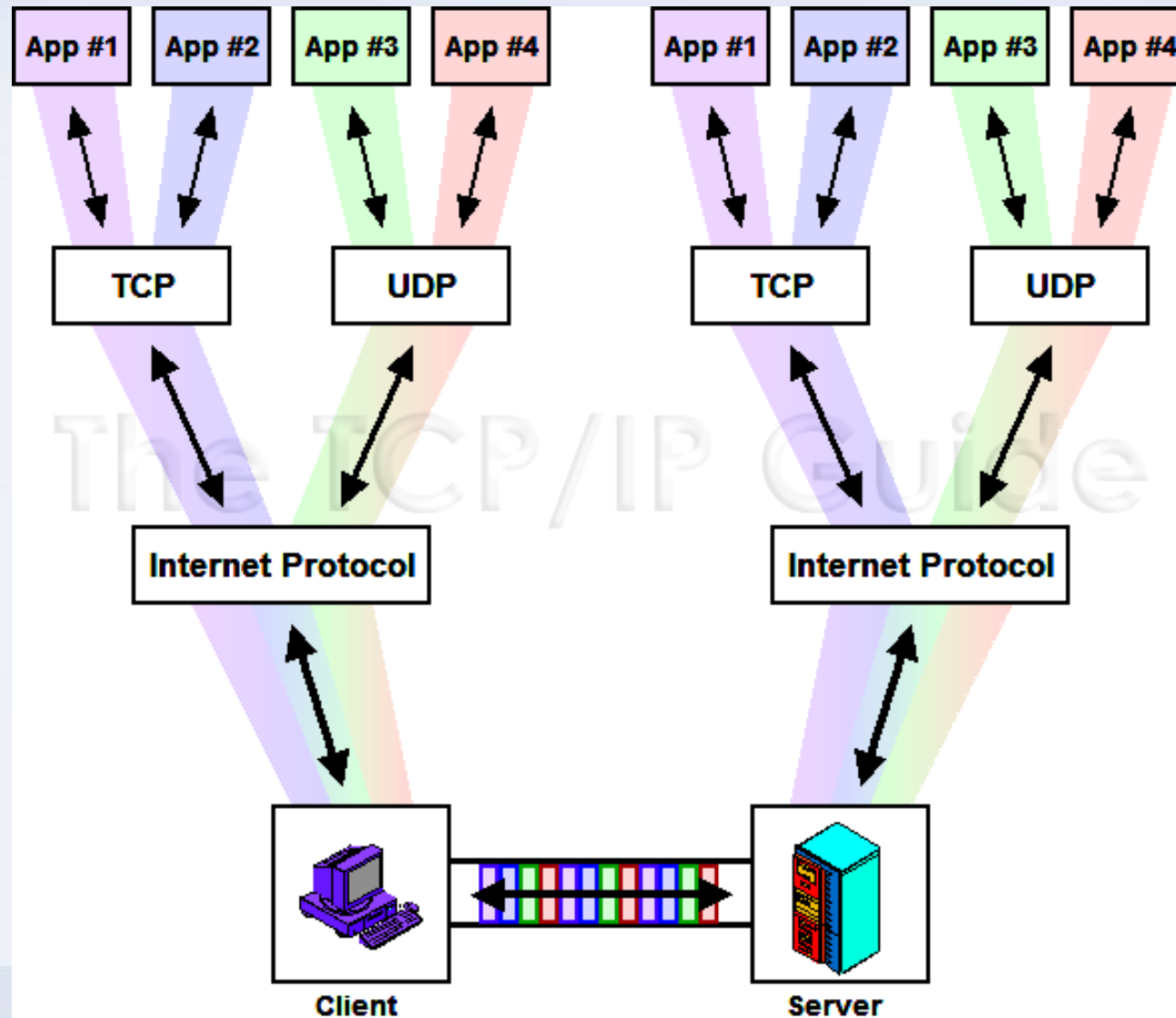


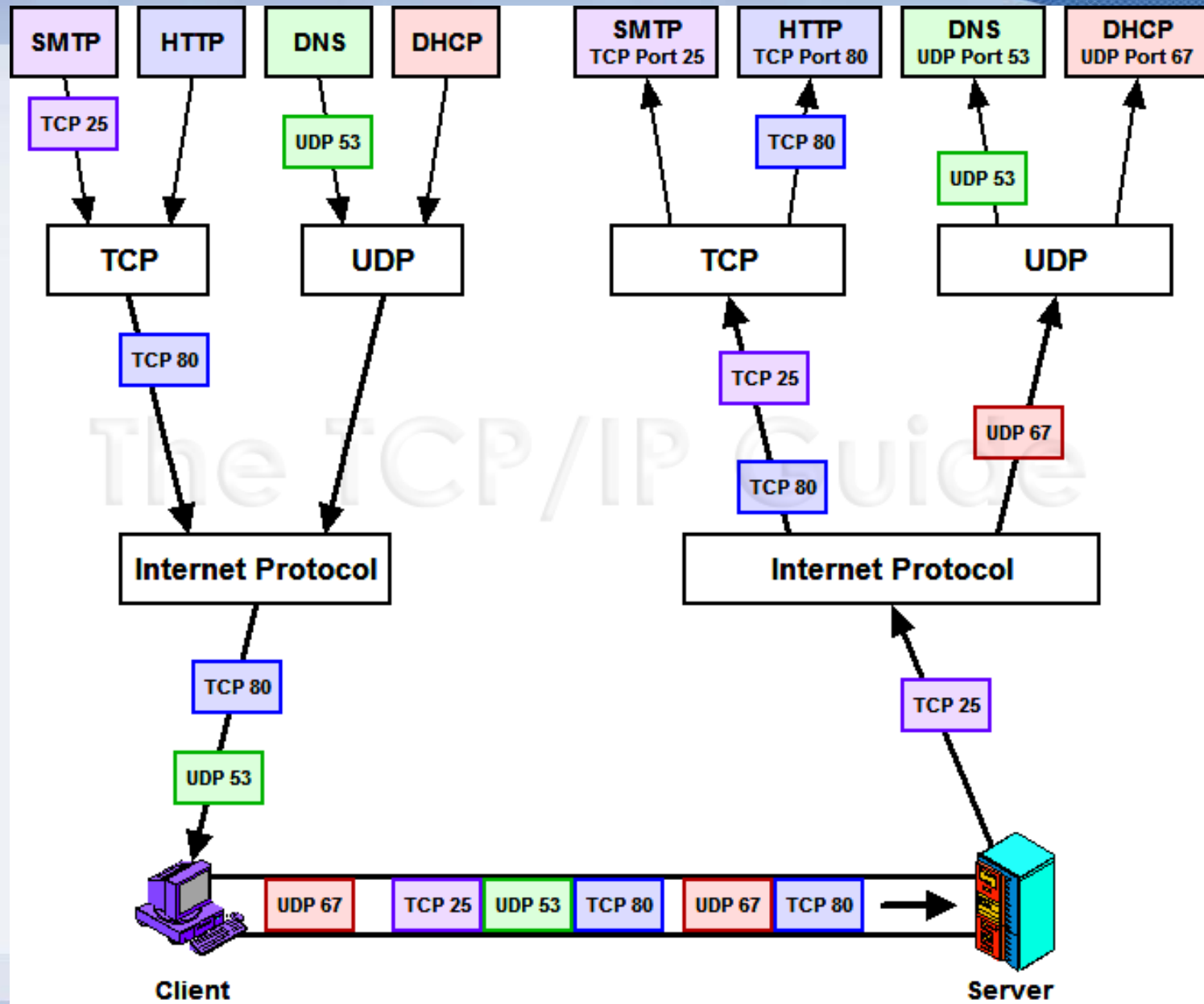




1. Introducere in TPI

Modul in care aplicatiile folosesc protocoalele TCP si UDP



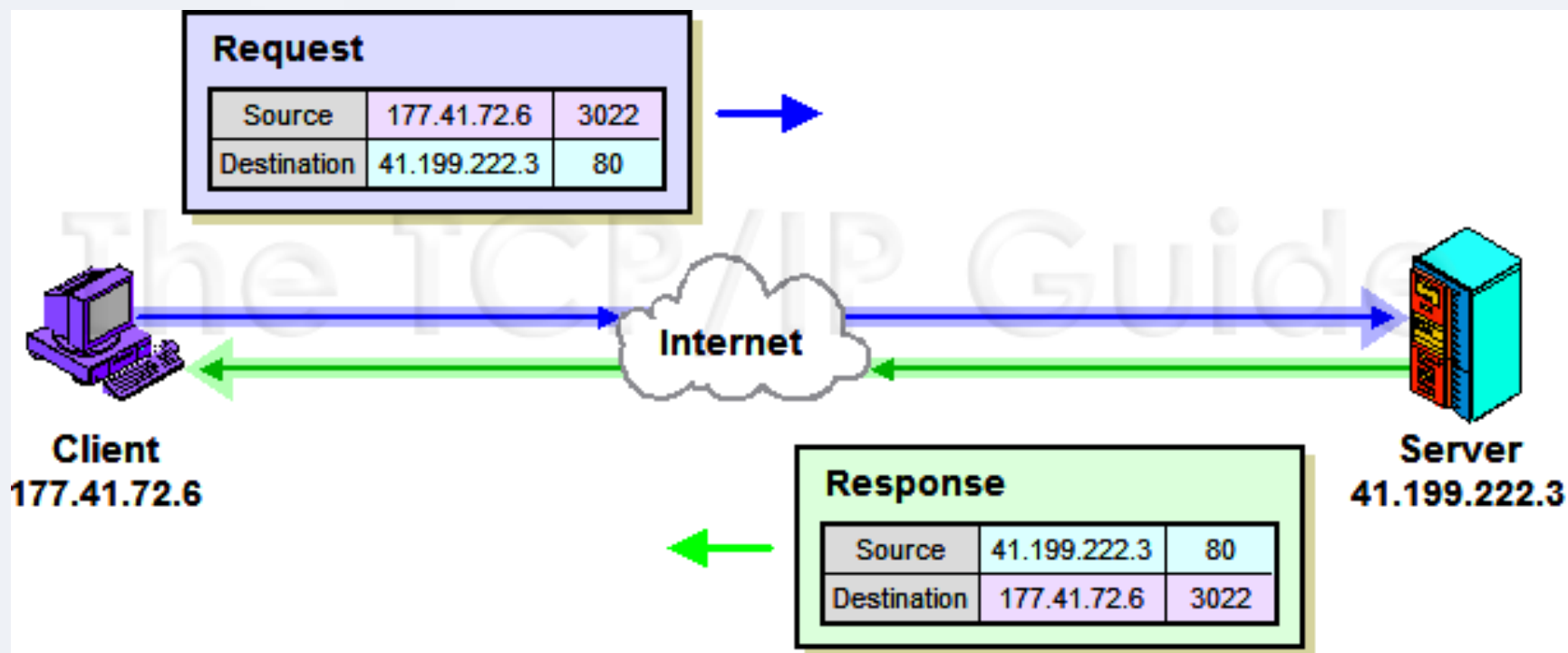


The TCP/IP Guide

1. Introducere in TPI

Utilizarea adreselor IP pentru a identifica entitatile din Internet

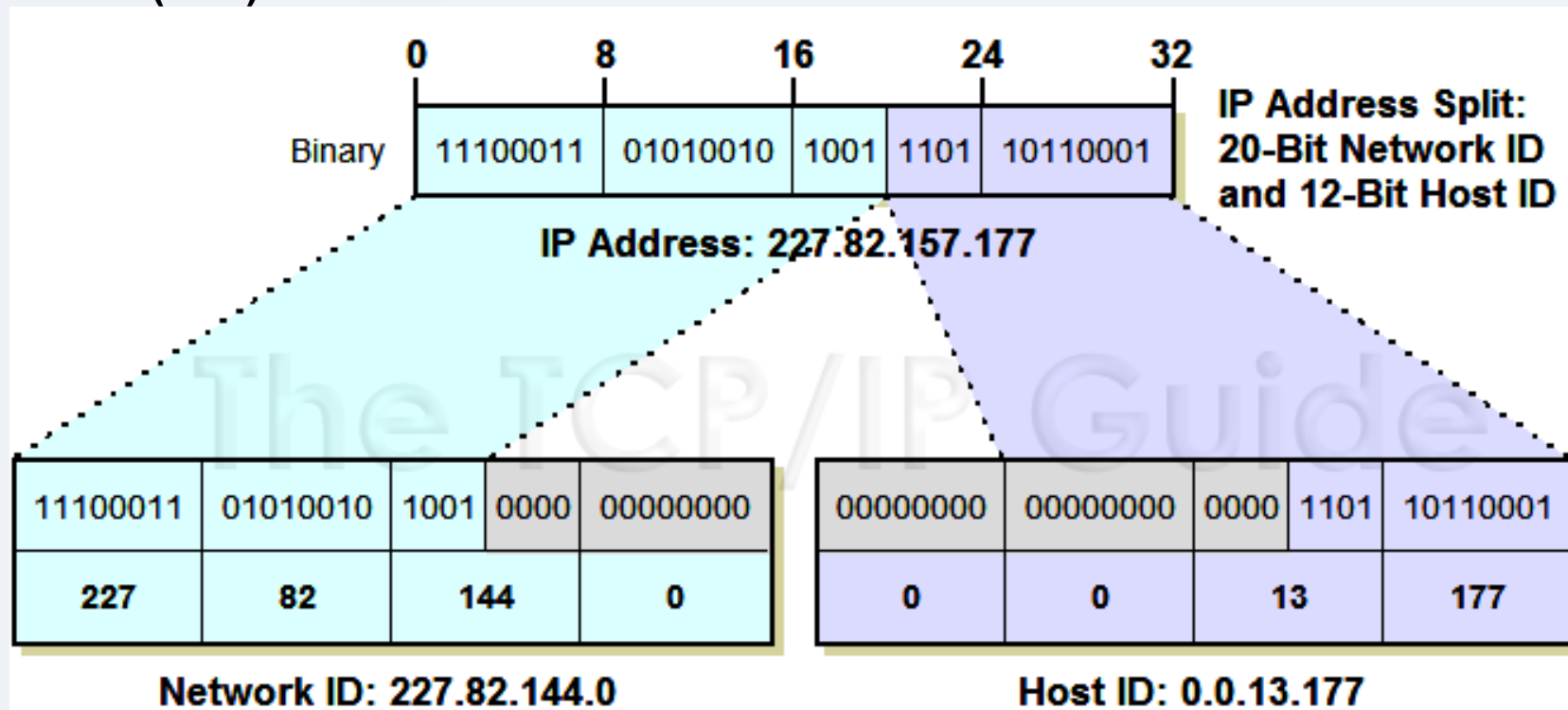
Porturile (80 al server-ului si 3022 al client-ului) permit identificarea proceselor / protocolelor la nivel aplicatie



1. Introducere in TPI

Structura adreselor IP

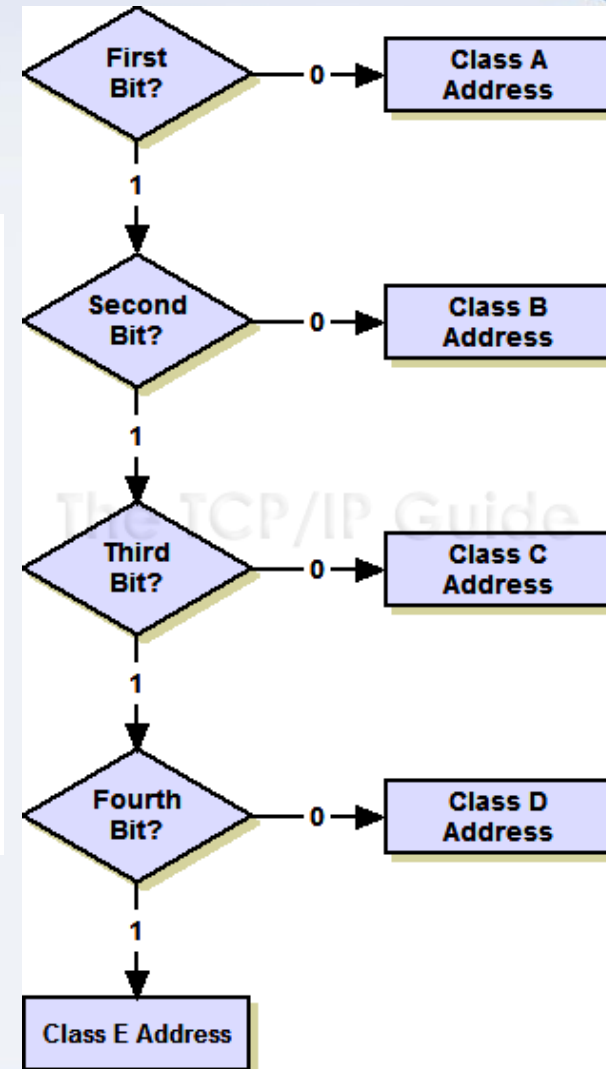
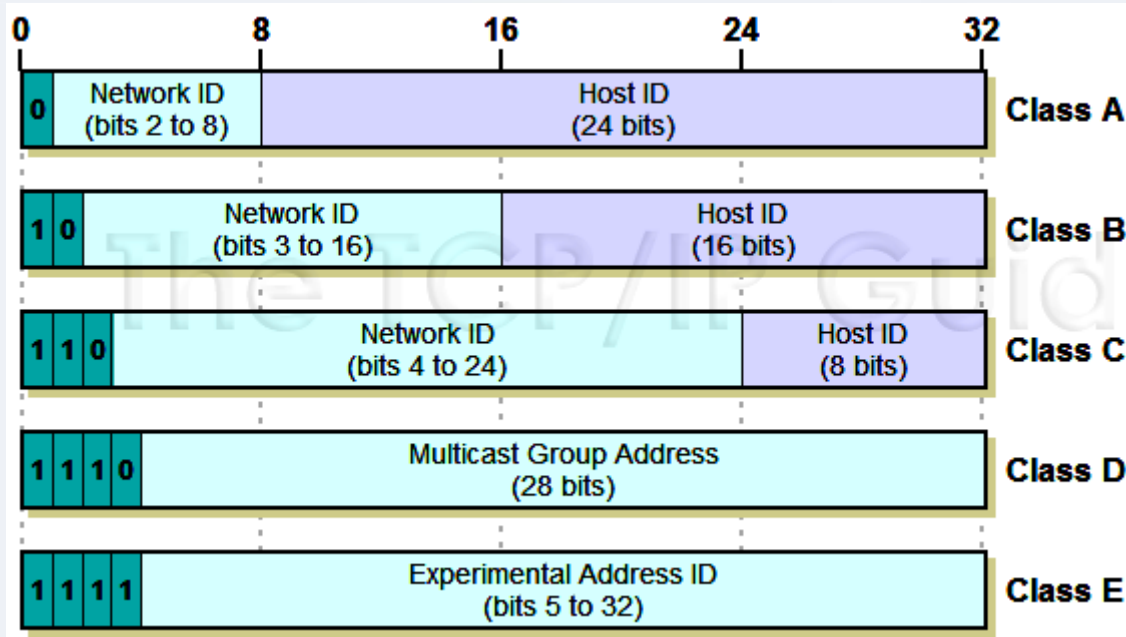
- *Network ID* = componenta care identifica (sub)retea din Internet
- *Host ID* = componenta care identifica masina de calcul in (sub)retea



1. Introducere in TPI

Modelul comunicatiilor in Internet

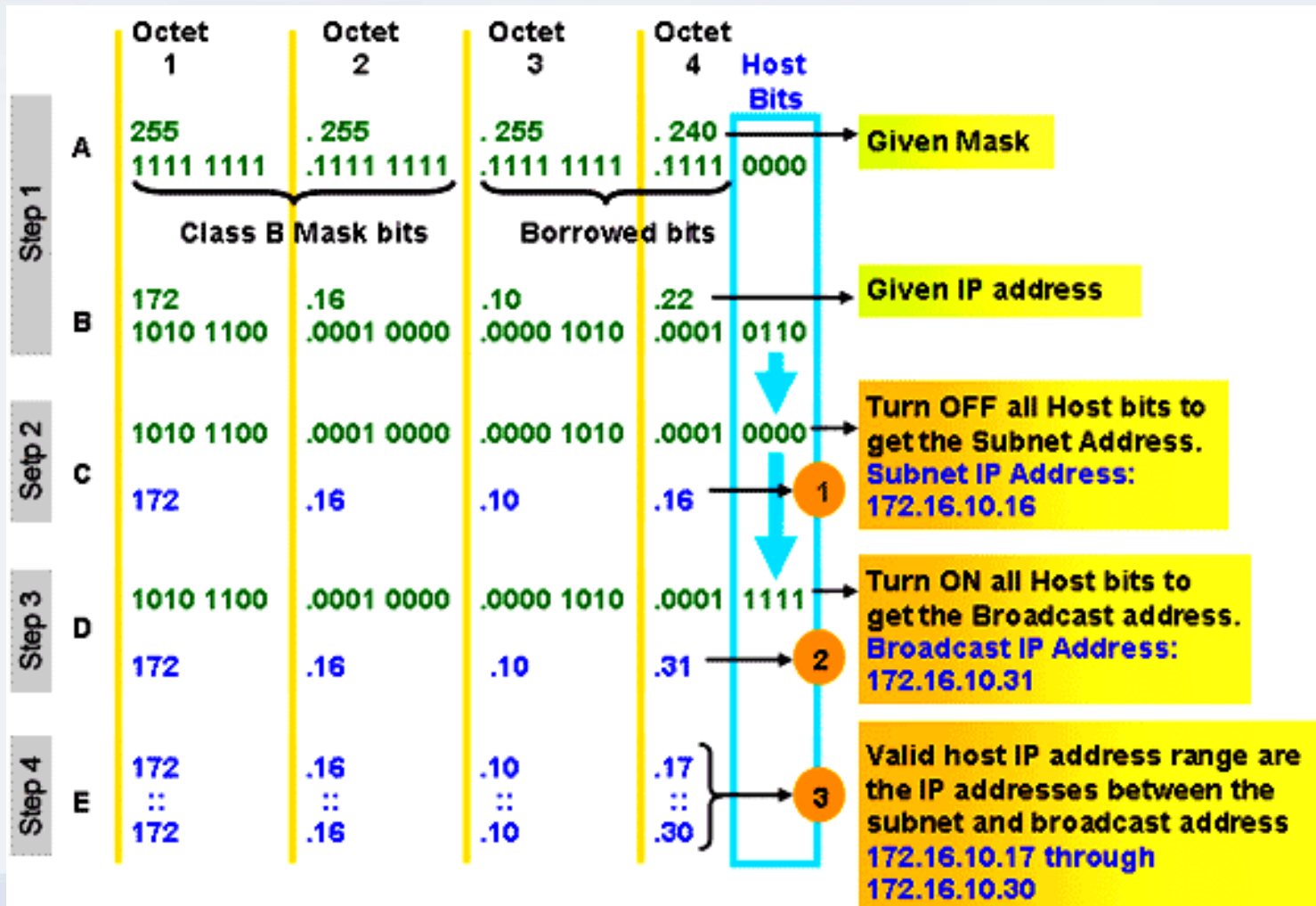
Clase de adrese numerice IP



1. Introducere in TPI

Modelul comunicatiilor in Internet

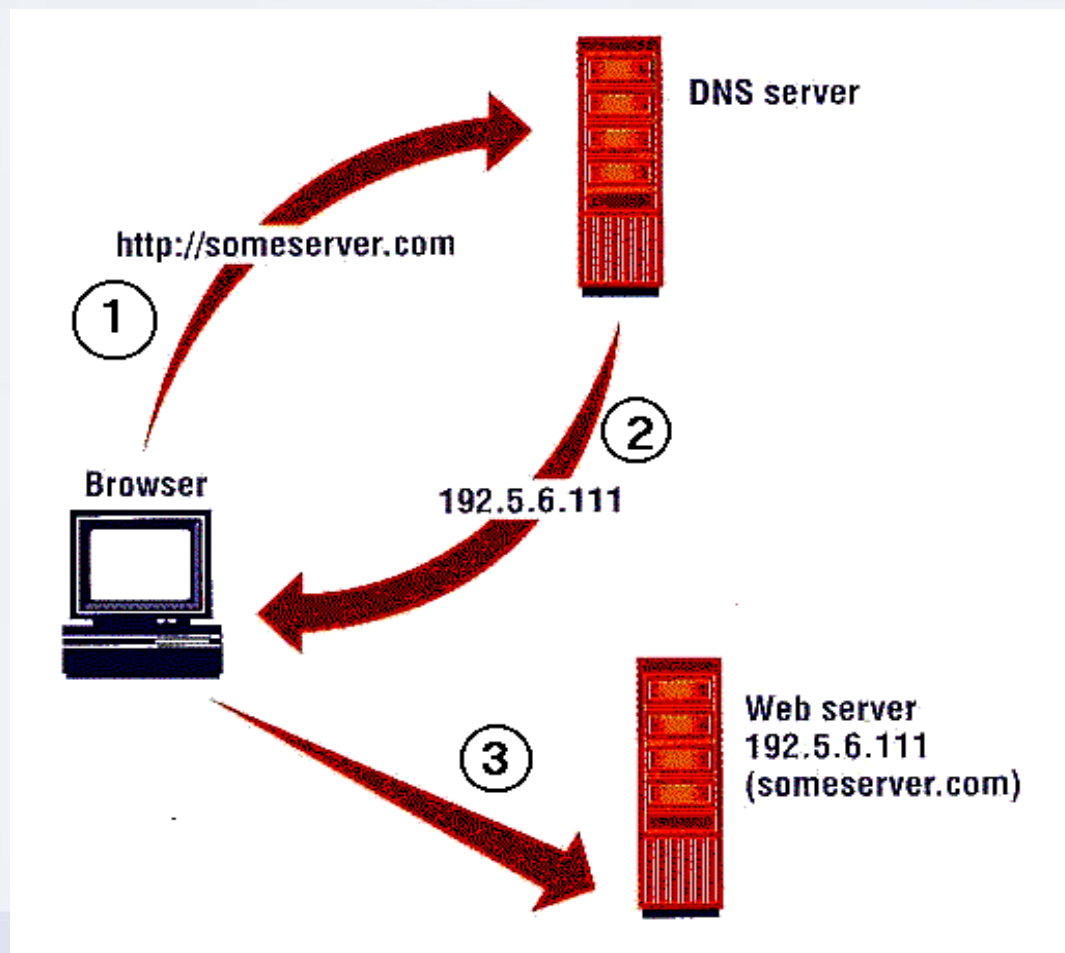
Clase de adrese numerice IP



1. Introducere in TPI

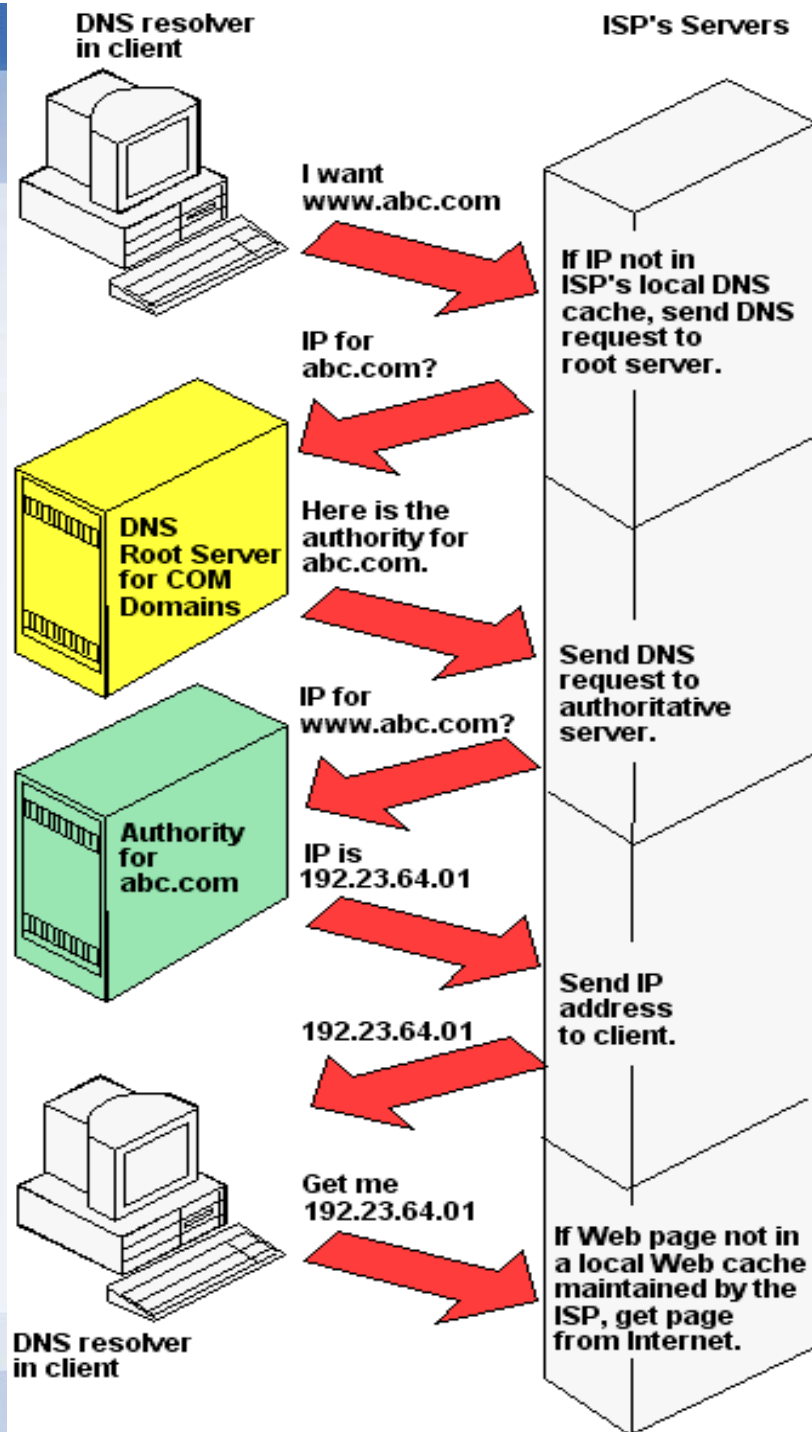
Modelul comunicatiilor in Internet

Utilizarea serviciului DNS (*Domain Name Server*) pentru **obtinerea** adresei numerice IP echivalenta numelui masinii de calcul



Modelul comunicatiilor in Internet

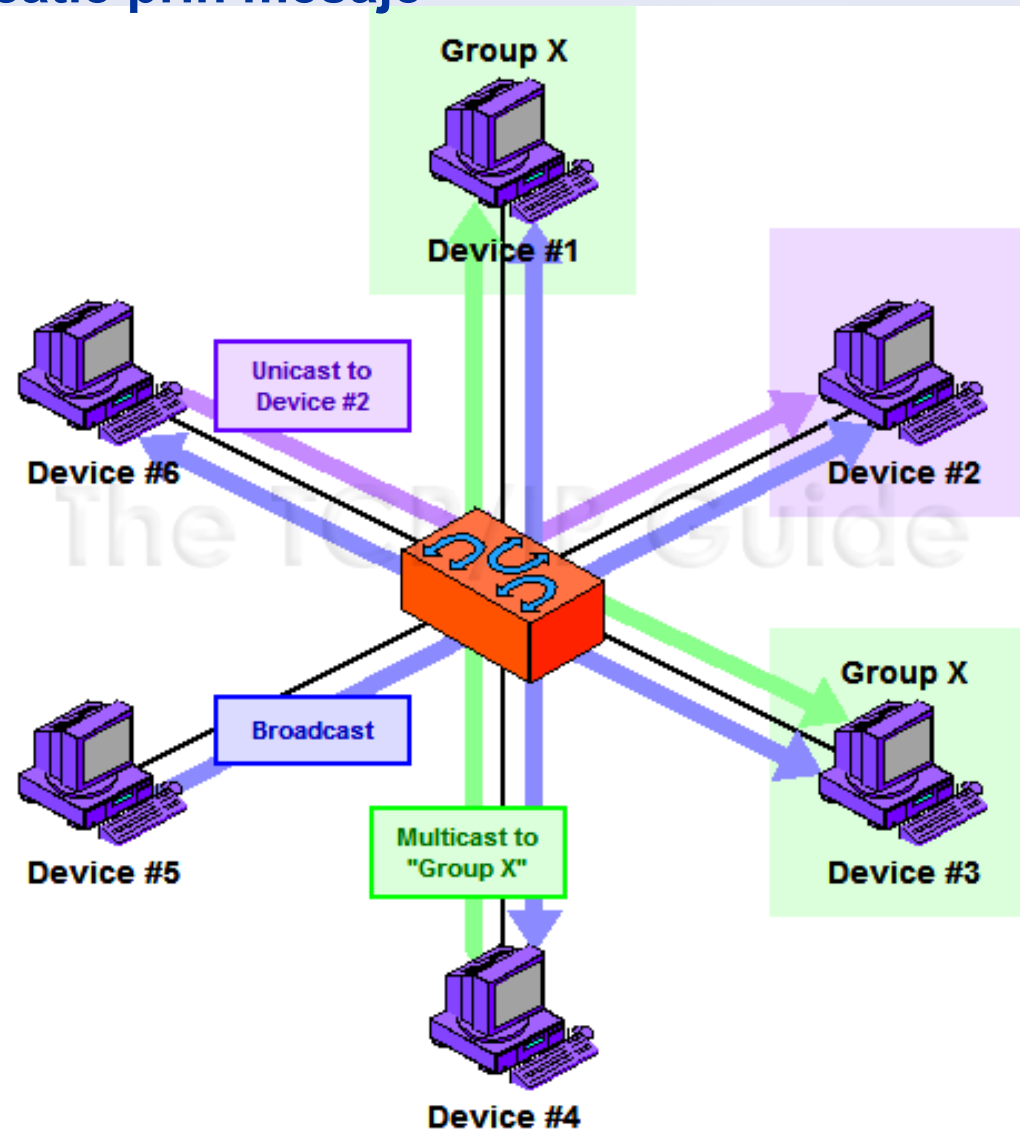
Utilizarea serviciului DNS



1. Introducere in TPI

Modele de comunicatie prin mesaje

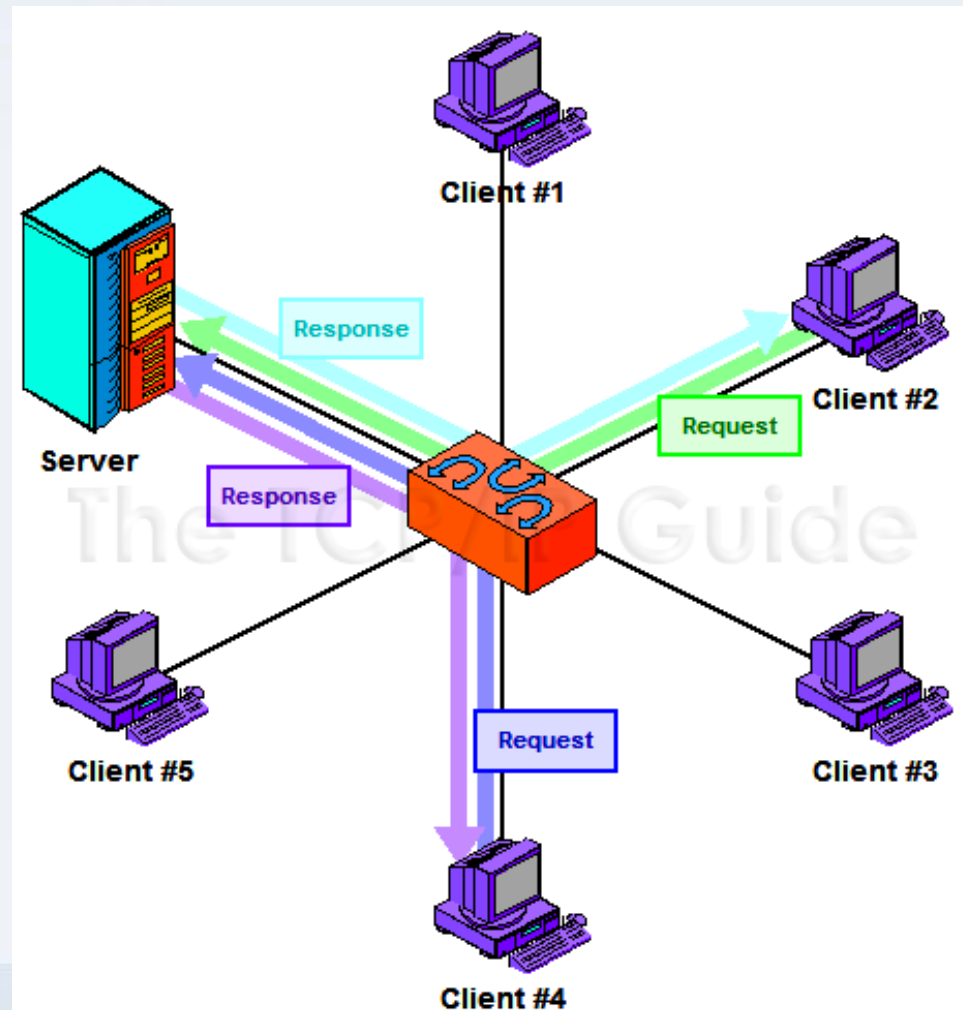
- unicast (1 la 1)
- broadcast (difuzare catre oricine)
- multicast (1 la N)



1. Introducere in TPI

Modelul de comunicatie client-server

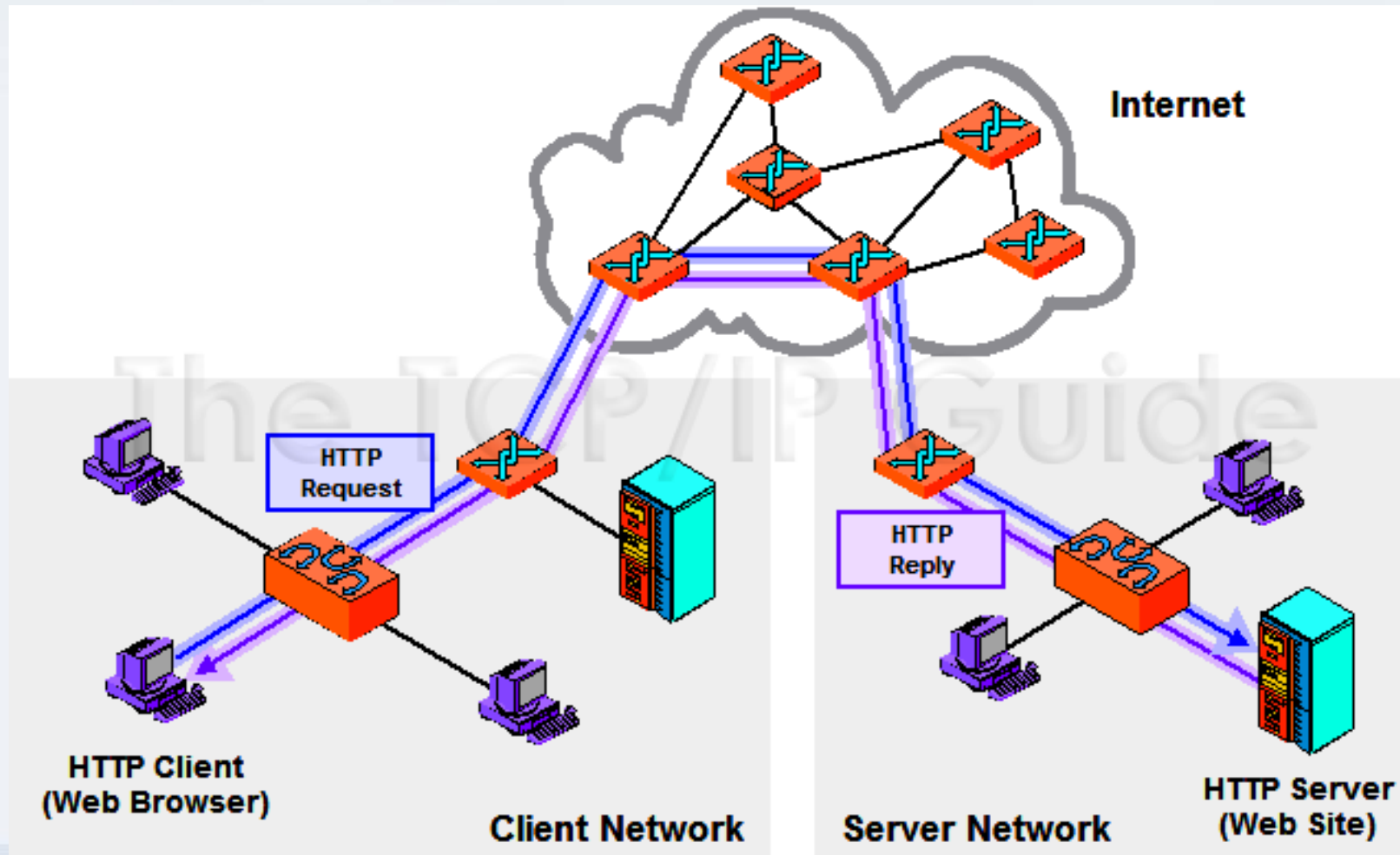
Comunicatie prin mesaje cerere – raspuns (tranzactionala)



1. Introducere in TPI

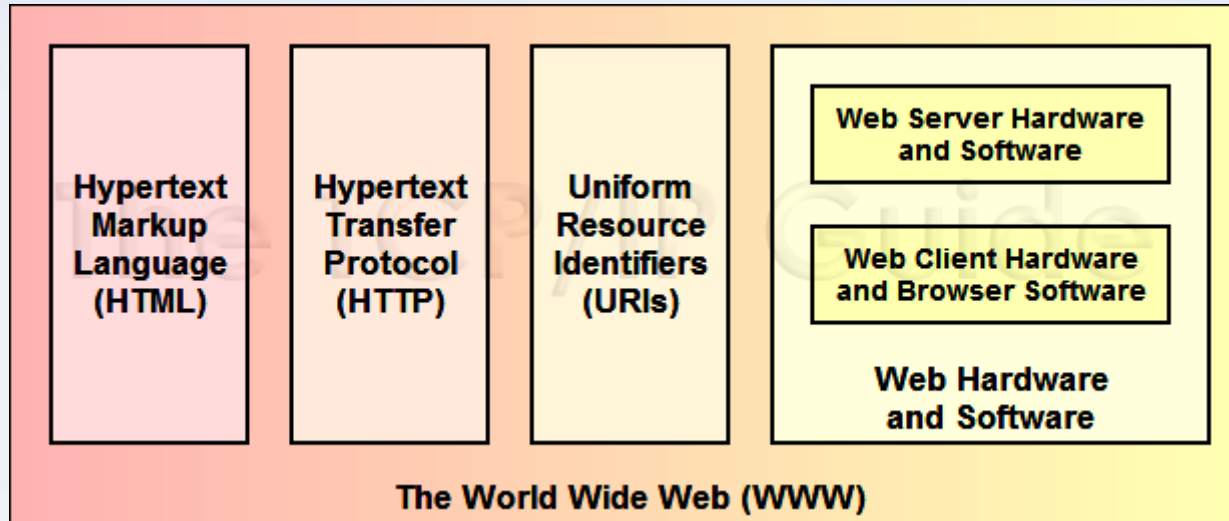
Modelul de comunicatie client-server (tranzactional)

Client-server HTTP (*HyperText Transport Protocol*) peste TCP/IP



1. Introducere in TPI

Componentele functionale majore ale WWW (World Wide Web)



“Adresa” HTTP = URL (*Uniform Resource Locator*)

http://joe:xx123@www.mysite.org:8080/cgi-bin/pix.php?Wedding03#Reception07

<scheme>

<user>

<password>

<host>

<port>

<url-path>

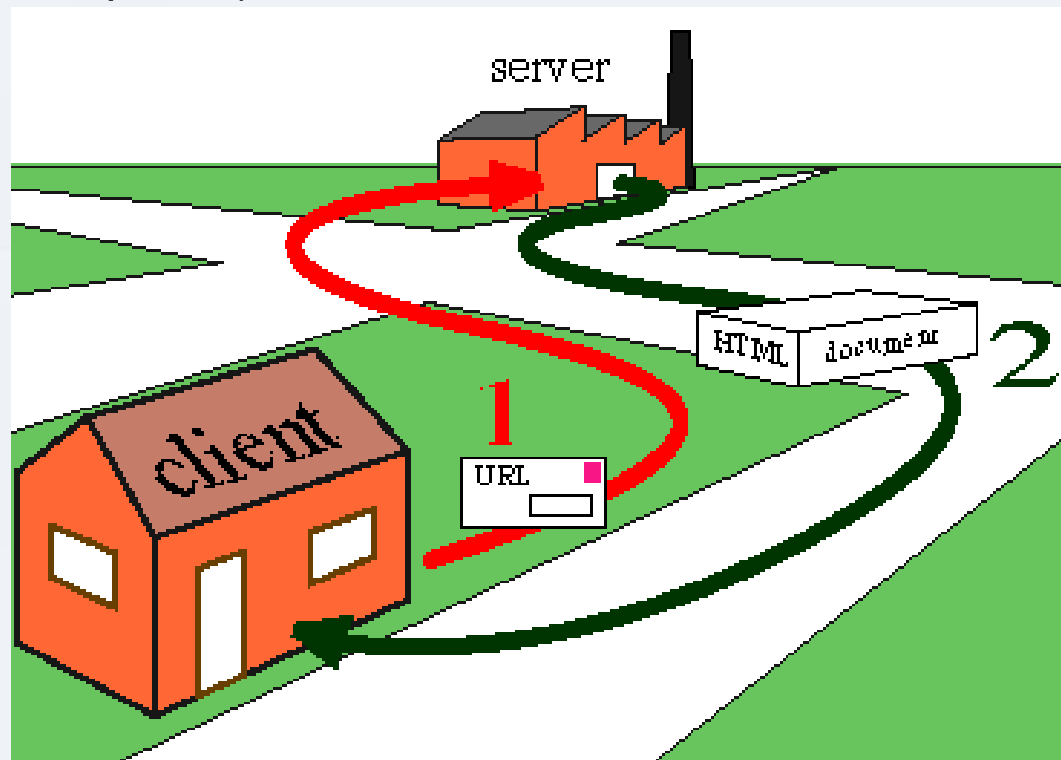
<query>

<fragment>

1. Introducere in TPI

Modelul client-server Web (cerere-raspuns HTTP)

- 1 – **clientul** furnizeaza adresa continutului **HTML** dorit, sub forma unei referinte **URL** (incapsulata intr-un mesaj **HTTP request**)
- 2 – **serverul** returneaza continutul **HTML** dorit (incapsulat intr-un mesaj **HTTP response**)

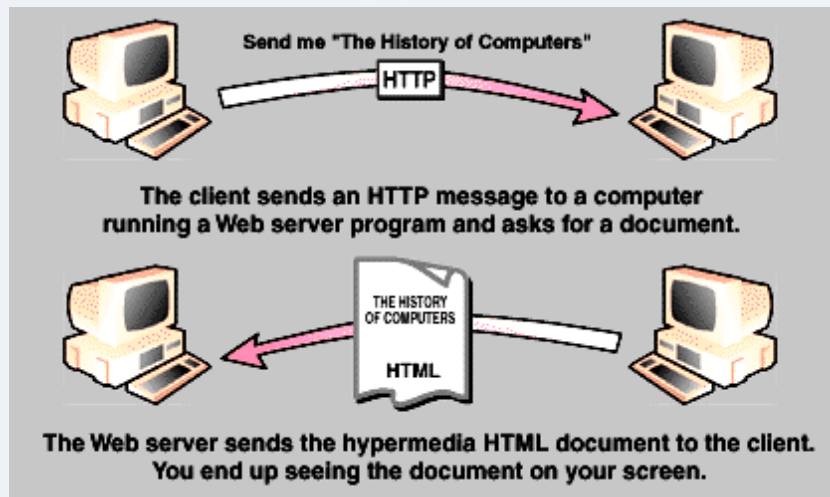


1. Introducere in TPI

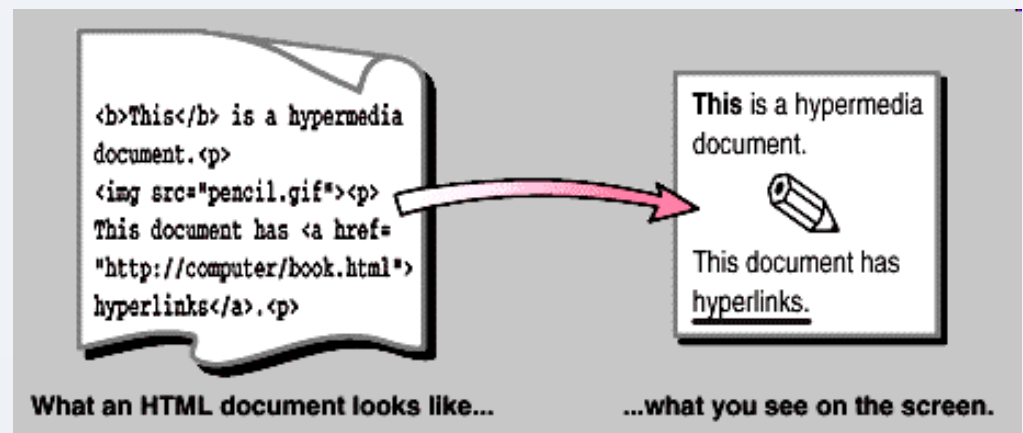
Modelul client-server Web (cerere-raspuns HTTP)

1 – **clientul** furnizeaza adresa continutului **HTML** dorit

2 – **serverul** returneaza continutul **HTML** dorit



Continutul HTTP este transformat (interpretat) la afisarea pe ecran

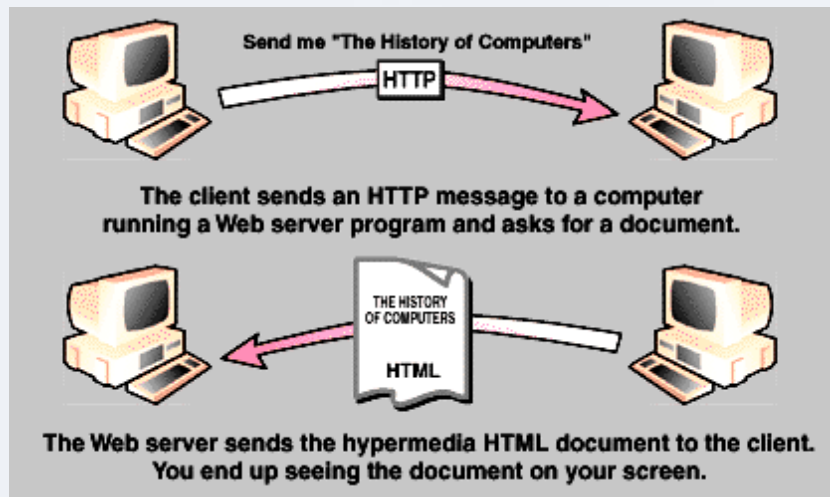


1. Introducere in TPI

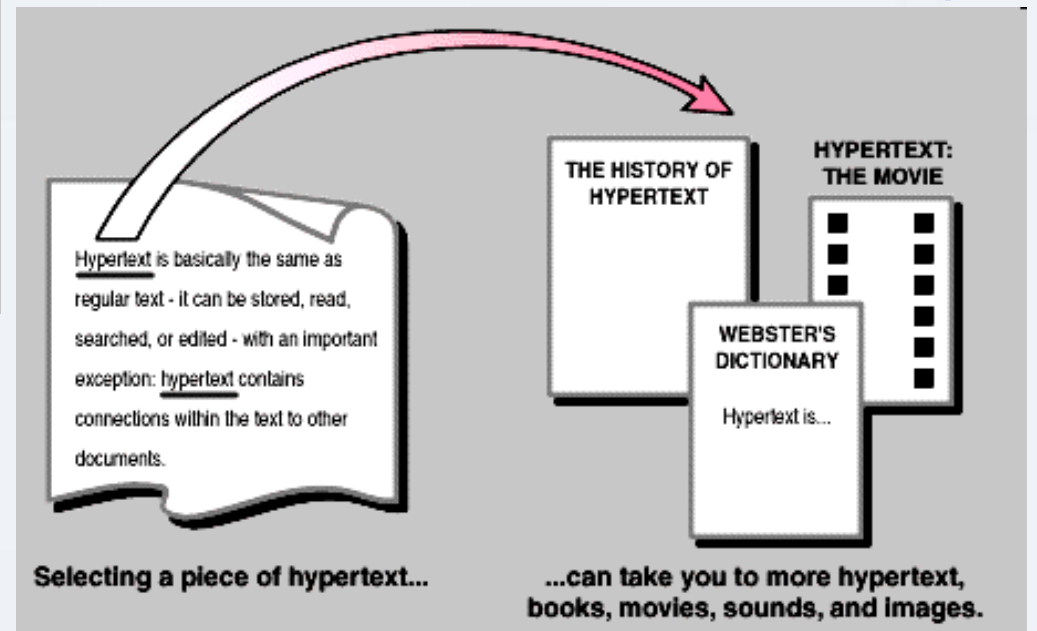
Modelul client-server Web (cerere-raspuns HTTP)

1 – **clientul** furnizeaza adresa continutului **HTML** dorit

2 – **serverul** returneaza continutul **HTML** dorit



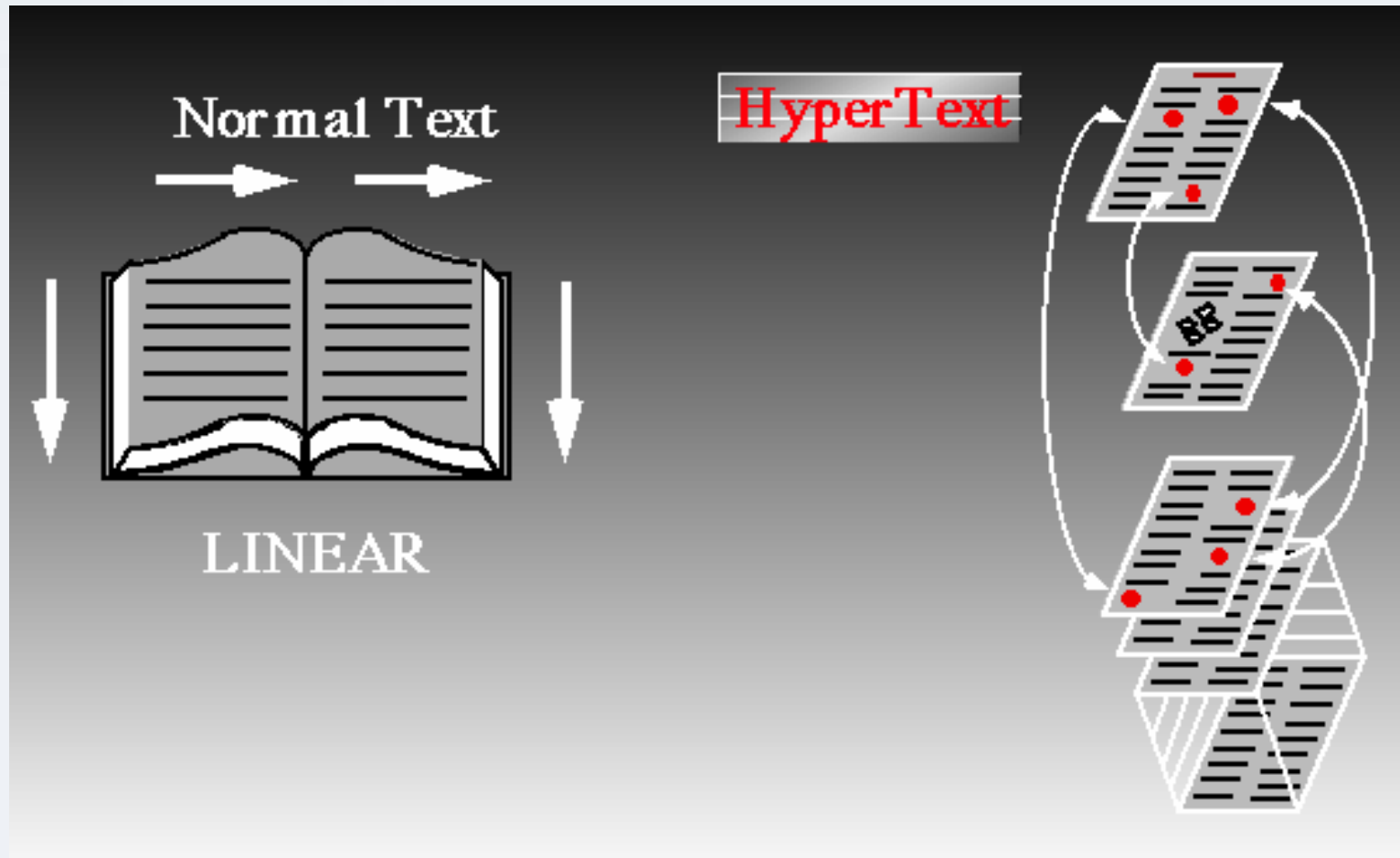
Continutul HTTP il duce pe user la alte continuturi HTTP (prin asta se creeaza panza *hypertext* – *web-ul*)



1. Introducere in TPI

Modelul client-server Web (cerere-raspuns HTTP)

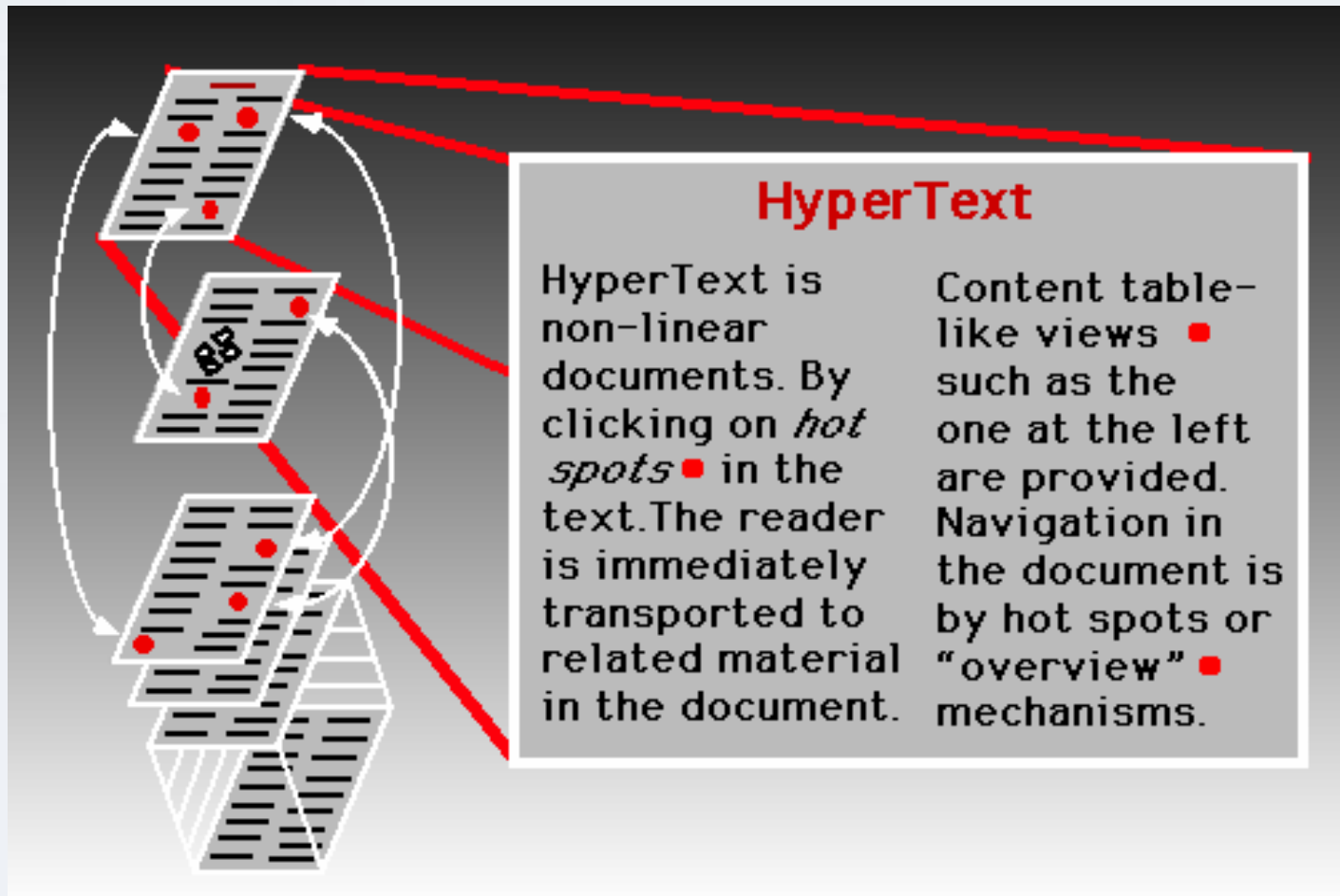
Hypertext vs text liniar



1. Introducere in TPI

Modelul client-server Web (cerere-raspuns HTTP)

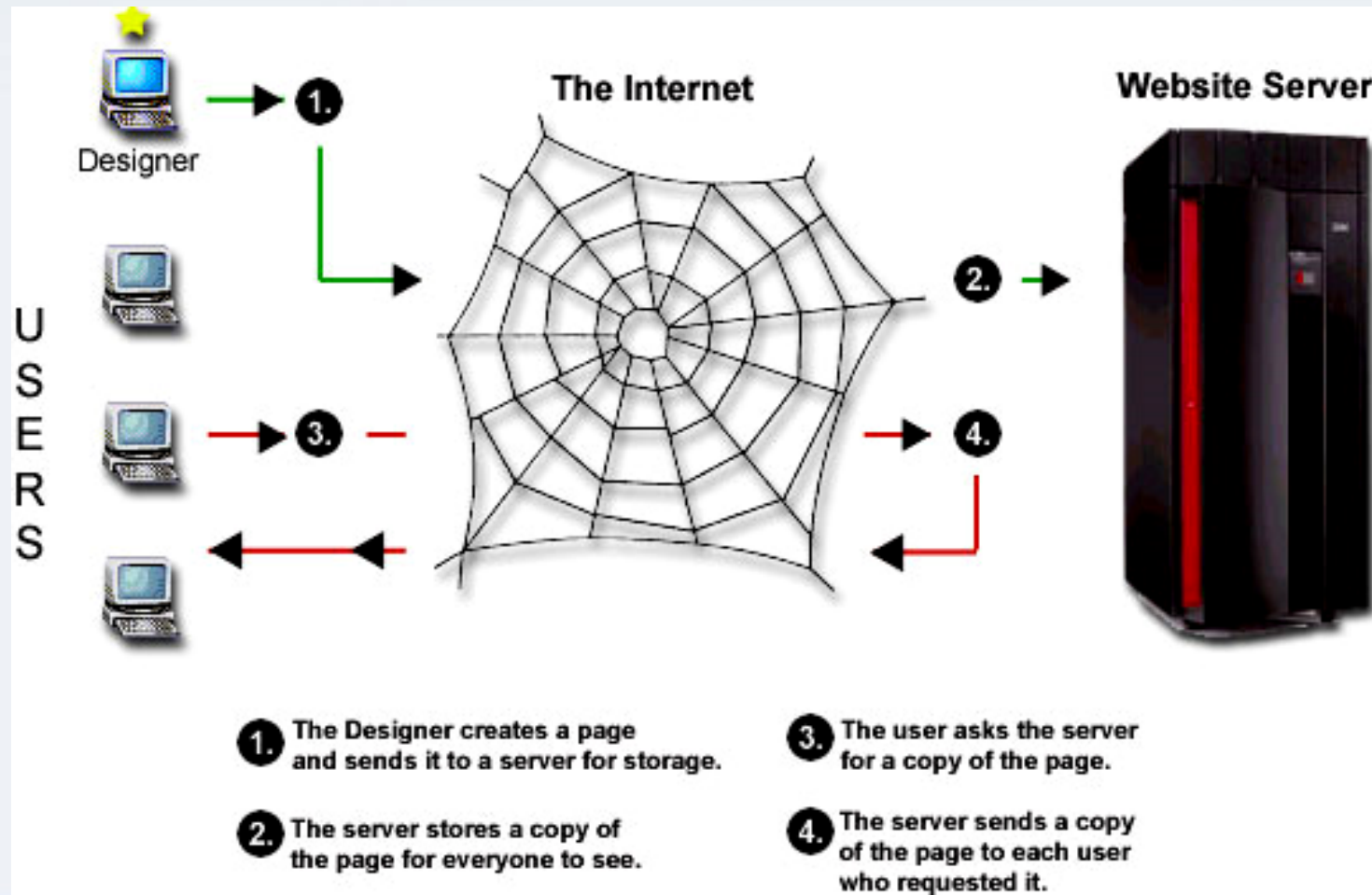
Hypertext vs text liniar



1. Introducere in TPI

Modelul client-server Web (cerere-raspuns HTTP)

Publicarea continutului HTML (1+2) si accesul la continut (3+4)



1. Introducere in TPI

Modelul comunicatiilor in Internet

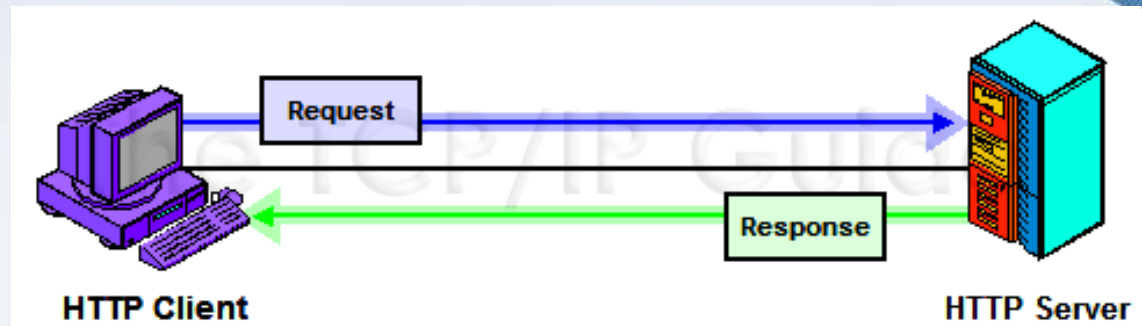
Formatul pachetului IP (structura de biti)

0	4	8	16	19	31
Version	IHL	Type of Service	Total Length		
Identification			Flags	Fragment Offset	
Time To Live		Protocol	Header Checksum		
Source IP Address					
Destination IP Address					
Options					Padding

1. Introducere in TPI

Modelul client-server Web (cerere-raspuns HTTP)

Formatul cererii HTTP
(text)



GET /index.html HTTP/1.1

Request Line

Date: Thu, 20 May 2004 21:12:55 GMT

General Headers

Connection: close

Host: www.myfavoriteamazingsite.com

From: joebloe@somewebsitesomewhere.com

Request Headers

Accept: text/html, text/plain

User-Agent: Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.1)

HTTP Request

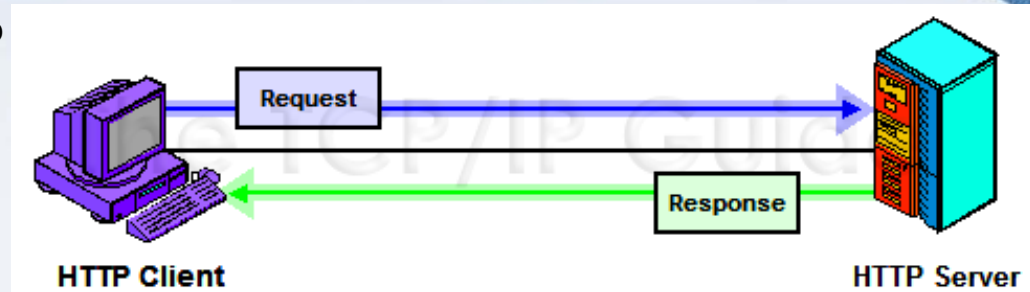
Entity Headers

Message Body

1. Introducere in TPI

Modelul client-server Web (cerere-raspuns HTTP)

Formatul raspunsului HTTP (text)

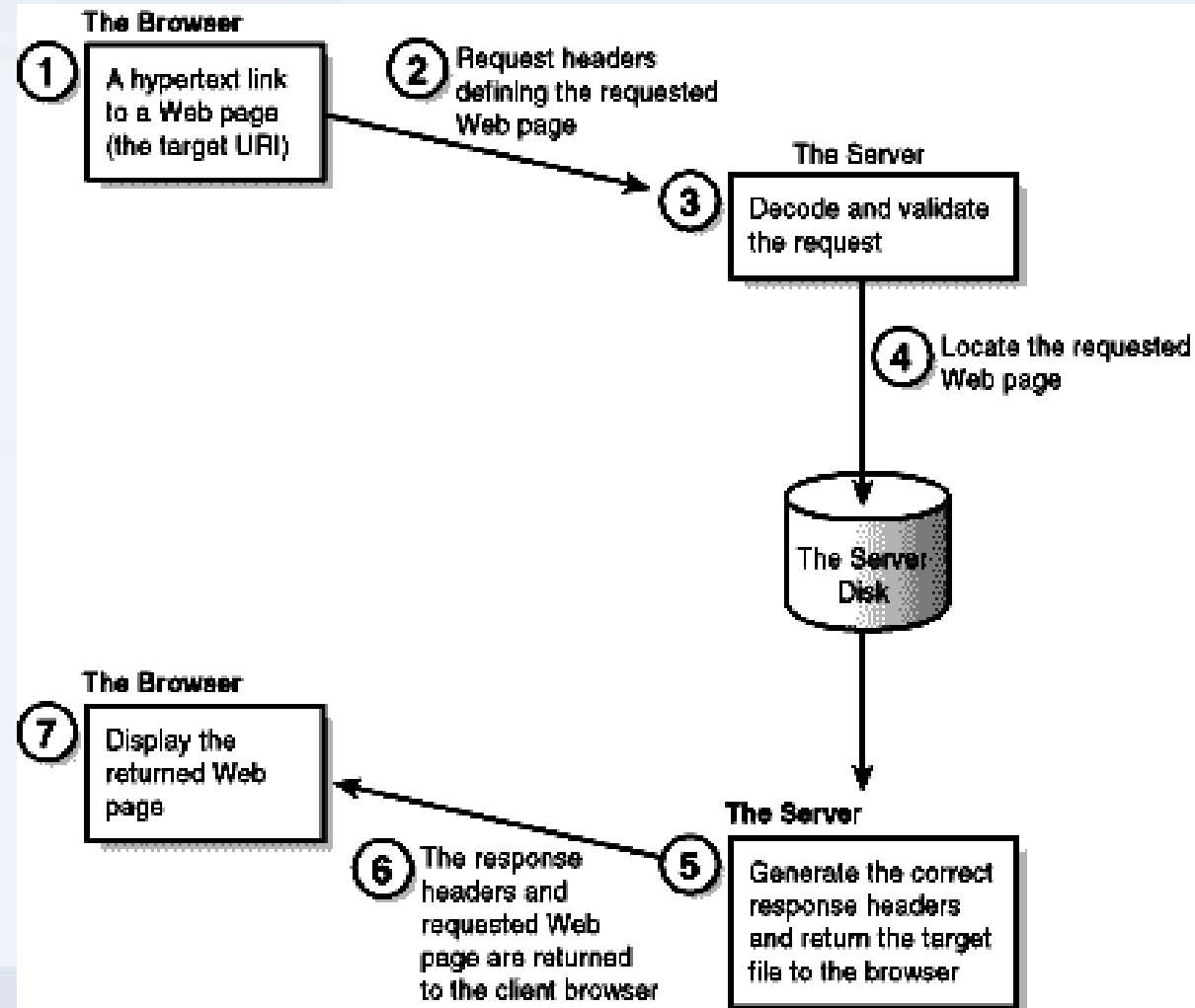


HTTP/1.1 200 OK	Status Line
Date: Thu, 20 May 2004 21:12:58 GMT	General Headers
Connection: close	
Server: Apache/1.3.27	Response Headers
Accept-Ranges: bytes	
Content-Type: text/html	Entity Headers
Content-Length: 170	
Last-Modified: Tue, 18 May 2004 10:14:49 GMT	HTTP Response
<html>	
<head>	
<title>Welcome to the Amazing Site!</title>	
</head>	
<body>	Message Body
This site is under construction. Please come back later. Sorry!	
</body>	
</html>	

1. Introducere in TPI

Modelul client-server Web (cerere-raspuns HTTP)

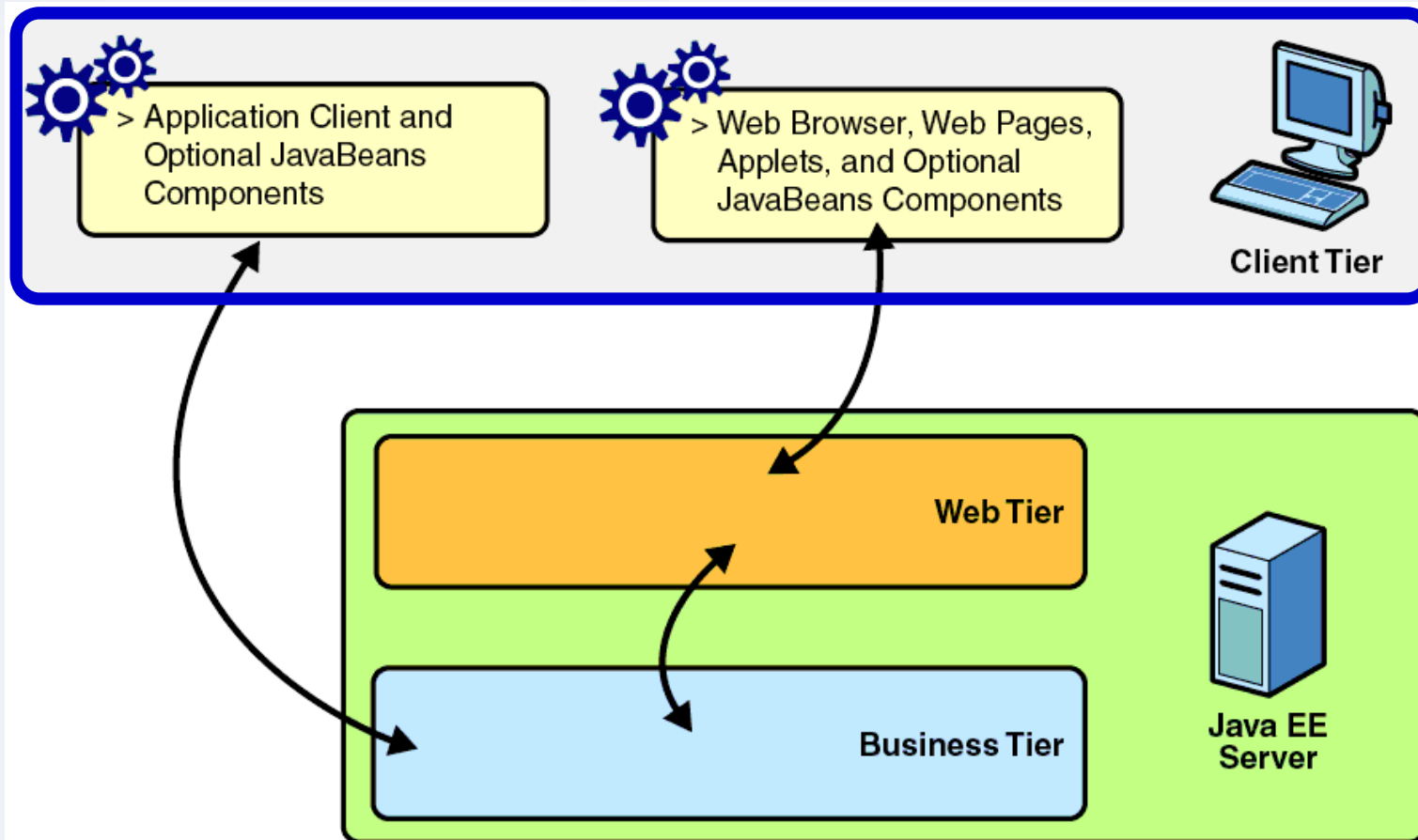
Pasii detaliate ai obtinerii continutului HTML



1. Introducere in TPI

Modelul client-server cu tehnologii Java

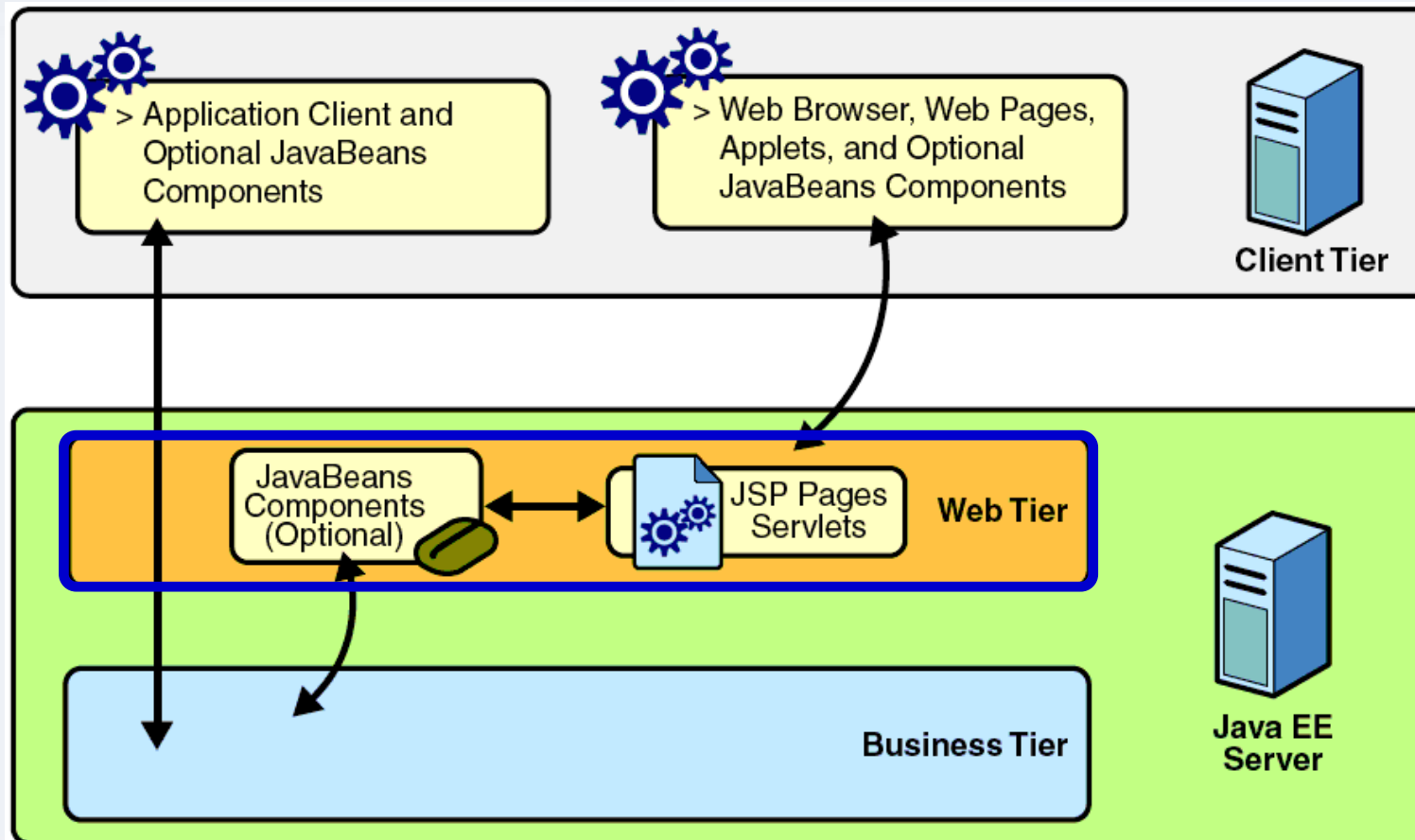
Sistemul client poate contine **aplicatii de sine statatoare** (Java SE) sau **browsere si continut Web** (incluzand applet-uri), si optional **JavaBeans**



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Subsistemul Web al serverului contine componente Web (Java EE): servlet-uri Java si JSP (*Java ServerPages*), si optional **JavaBeans**

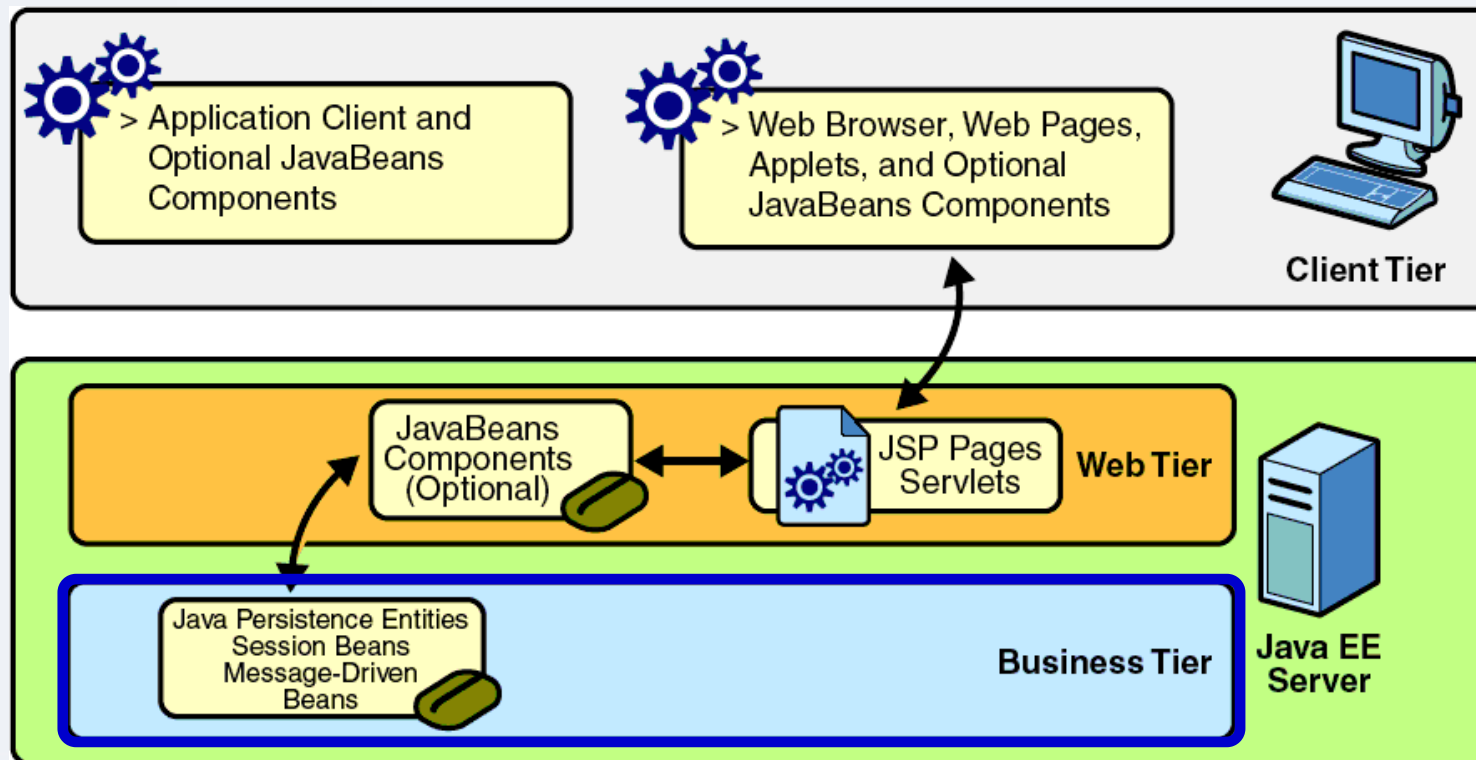


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Subsistemul *business* al serverului indeplineste sarcinile aplicatiei, poate fi distribuit, contine componentele *business* (**EJB – *Enterprise JavaBeans***):

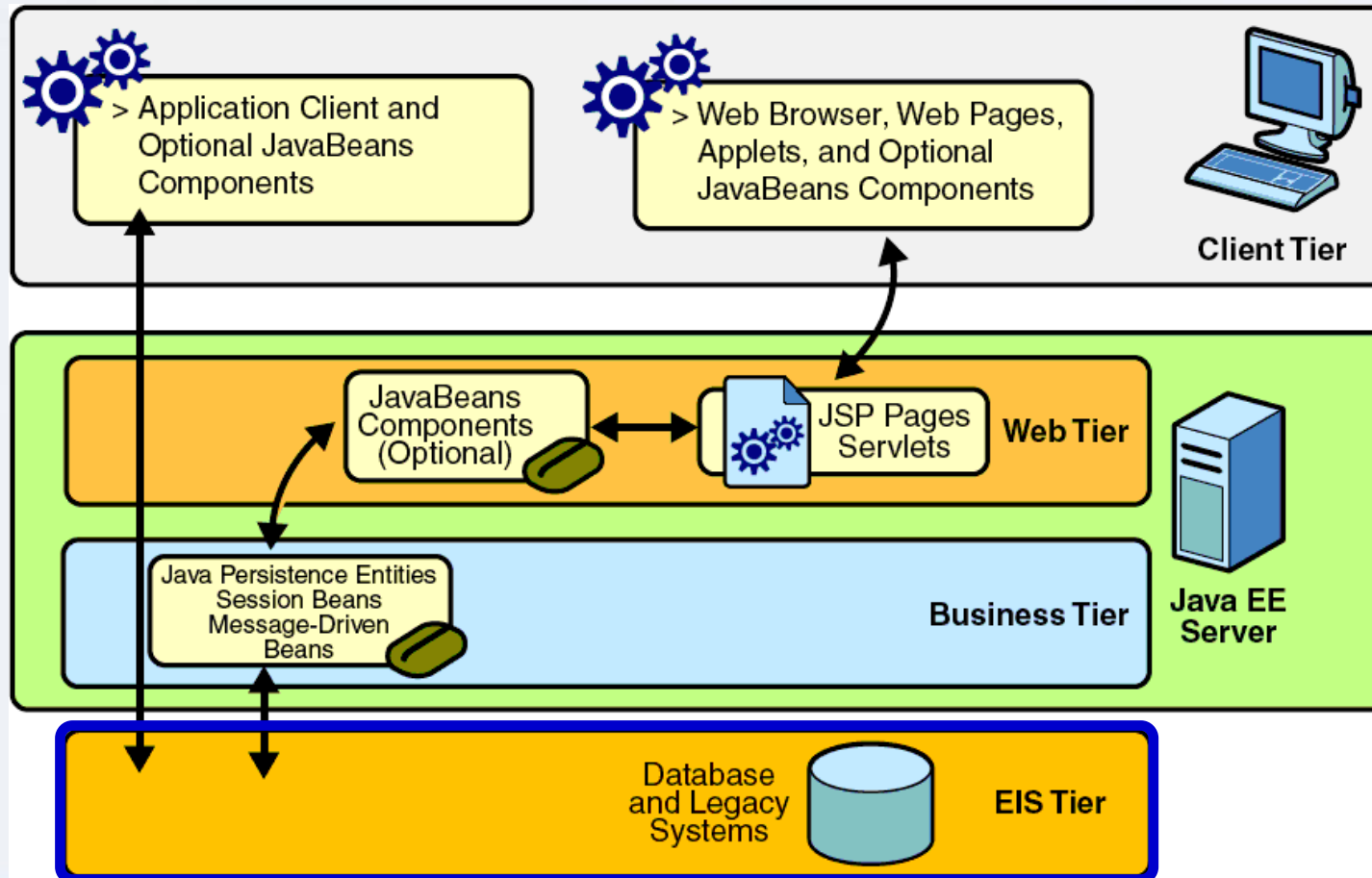
- **bean-uri entitate** (in EJB 2.x) sau **entitati persistente** (in EJB 3.0),
- **bean-uri sesiune** si **bean-uri pt. comunicatii asincrone (MDB)**



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Subsistemul de integrare si management al datelor aplicatiei (*EIS tier*), contine elemente care **furnizeaza/stocheaza datele** aplicatiei (baze de date)



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Modelul client-server cu tehnologii Java

Arhitectura Java EE se bazeaza pe mai multe containere (ofera servicii de nivel jos / suport specifice platformei) **aflate pe serverul aplicatiei Web**

