

2013 - 2014

Tehnologii de Programare in Internet (TPI / RST)

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

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

Obiectivele disciplinei

Obiectivele disciplinei

Obiective curs (2009):

Prezentarea unor tehnologii de programare larg utilizate in Internet:

- **Desktop** (comunicatii la nivel socket TCP si UDP),
- **Web** (tehnologii pentru client si server HTTP),
- **Mobile** (Android, Windows 8/Phone);
- Acces la **Baze de Date**, acces la **Servicii Web**, etc.;

folosind diferite limbaje de programare: Java, XML, C#, HTML(5), SQL, etc.

Obiective aplicații (2009):

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 (2014)

Structura cursului



Continut curs TPI

1. Introducere in tehnologiile de programare in Internet
2. Introducere in tehnologiile desktop (SE) Java Programarea la nivel socket
3. Tehnologii de programare a aplicatiilor Web in diverse limbaje
4. Tehnologii de programare a aplicatiilor mobile (Android, Windows 8/Phone)



Structura cursului

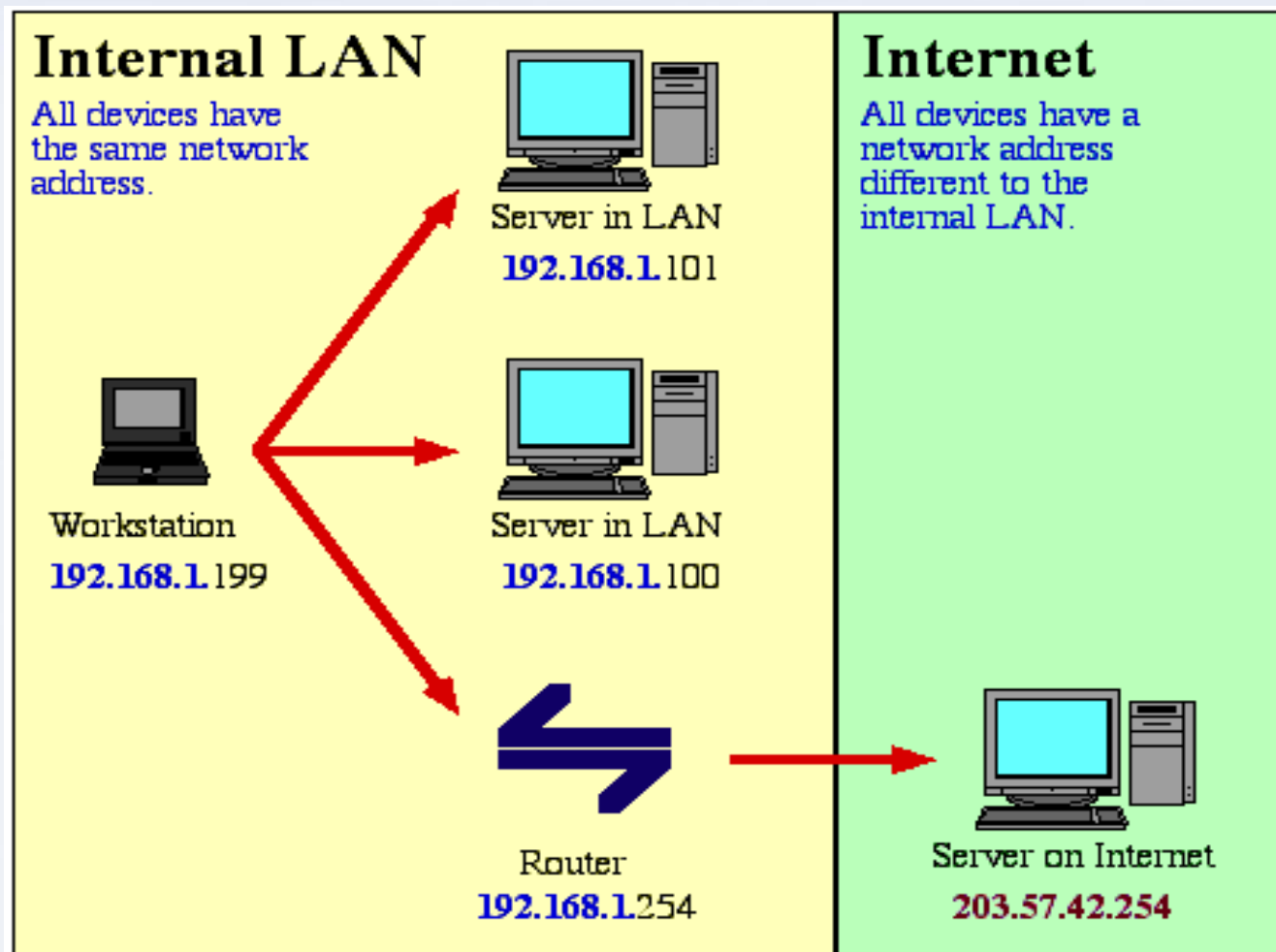


1. Introducere in tehnologiile Internet



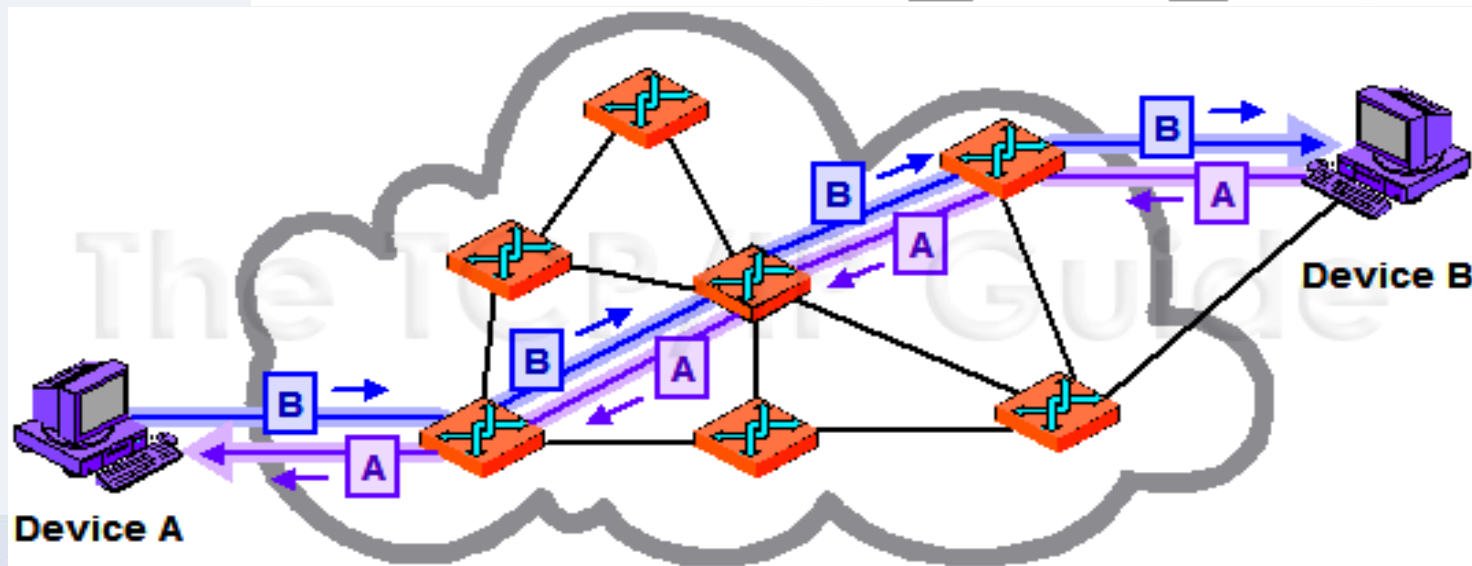
1. Introducere in TPI

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



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

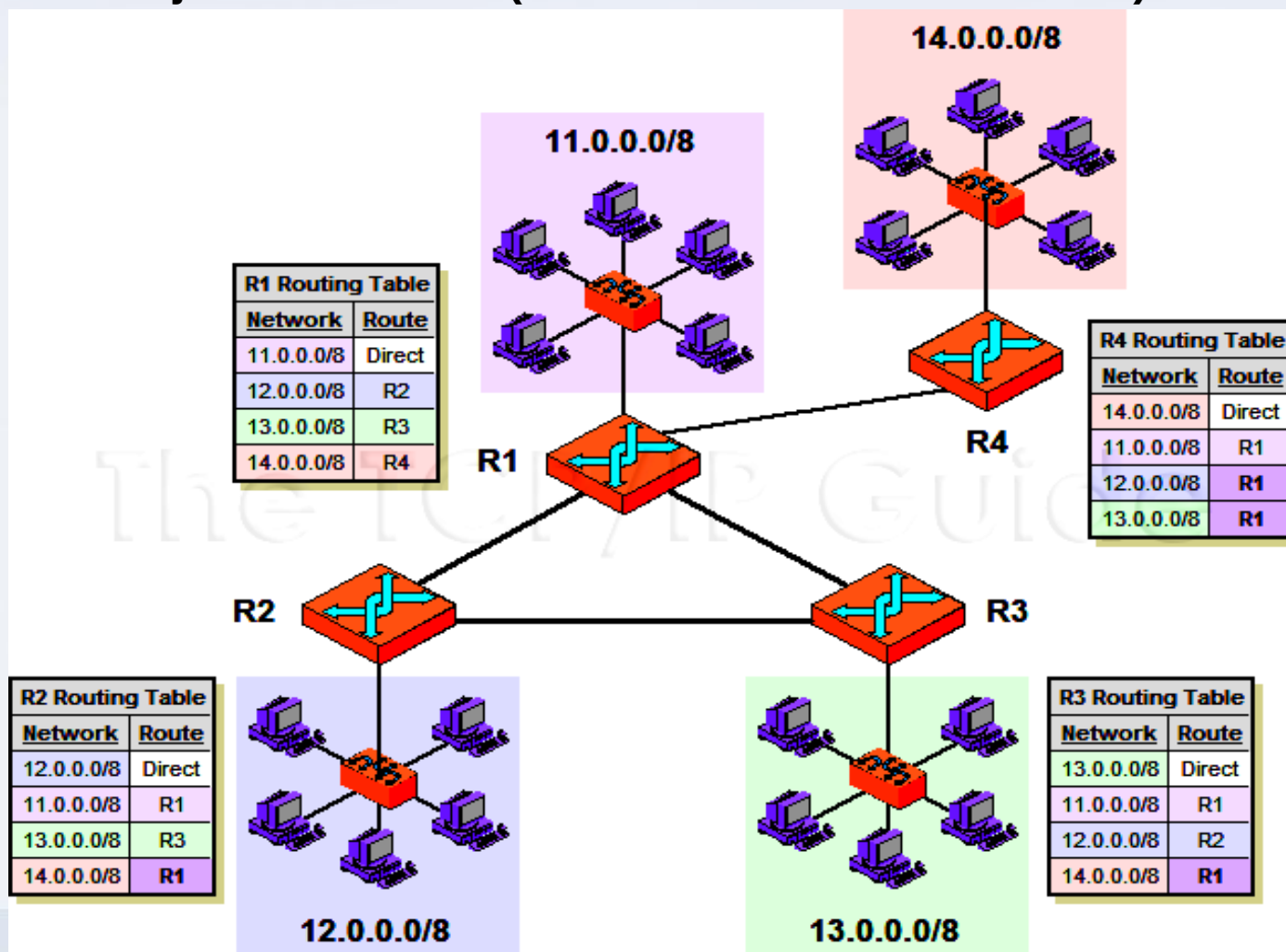
The diagram illustrates a network topology for a distributed system. It features a central cloud containing several interconnected nodes, represented by orange squares with a cross symbol. External devices, labeled 'Device A' and 'Device B', are connected to the cloud. Arrows indicate data flow paths between the devices and the internal network nodes. 'Device A' is connected to a node labeled 'B' (blue square) which then connects to a node labeled 'A' (purple square). 'Device B' is connected to a node labeled 'A' (purple square) which then connects to a node labeled 'B' (blue square). The internal nodes are interconnected in a mesh-like structure, with arrows showing the flow of data between them.



1. Introducere in TPI

Modelul comunicatiilor in Internet

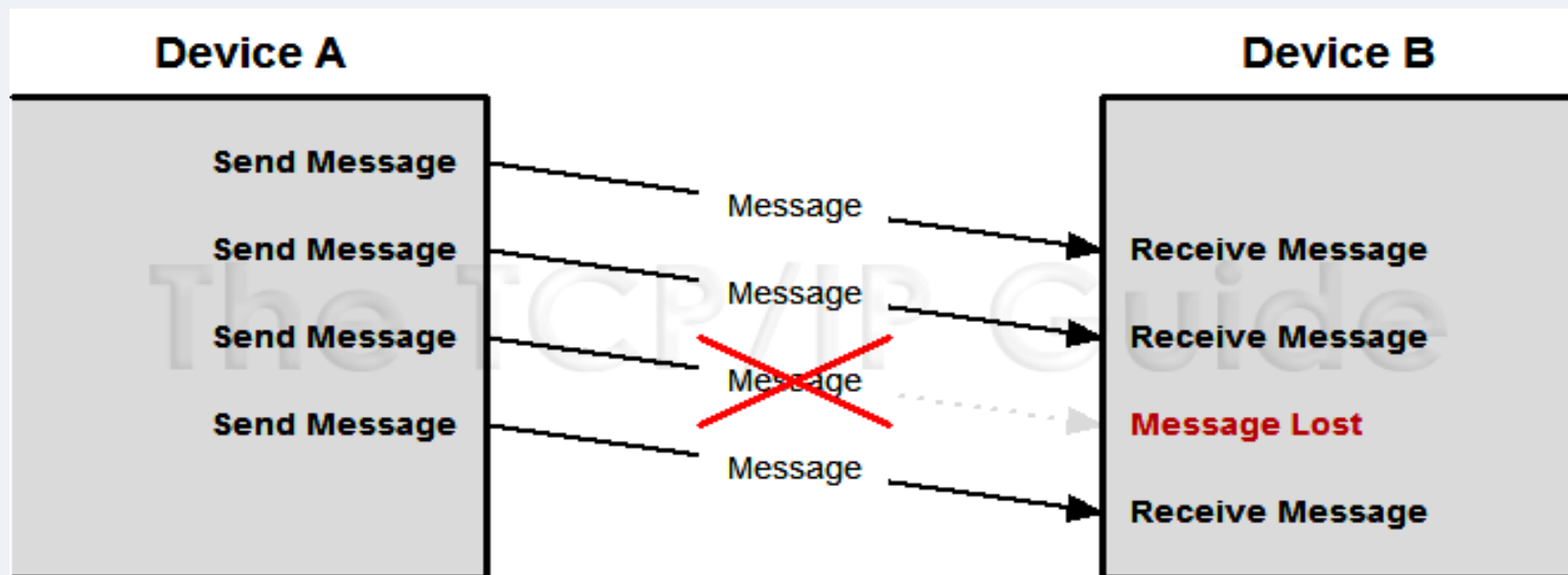
Rutarea mesajelor in Internet (la nivel IP – *Internet Protocol*)



1. Introducere in TPI

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

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



Comunicatie prin mesaje fiabila (confirmare+retransmisie)

The diagram illustrates the Stop-and-Wait protocol between Device A and Device B. It shows a sequence of events where a message is sent, received, and acknowledged, followed by a message loss and a successful retransmission.

Device A Timeline:

- Send Message and Start Timer
- Acknowledgment Received
- Send Message and Start Timer
- (Acknowledgment Not Received)
- Timer Expiration
- Re-Send Message and Start New Timer
- Acknowledgment Received

Device B Timeline:

- Receive Message
- Send Acknowledgment
- Message Lost (Acknowledgment Not Sent)
- Receive Re-Sent Message
- Send Acknowledgment

Message Flow:

- Message (Blue arrow from Device A to Device B)
- Acknowledgment (Green arrow from Device B to Device A)
- Message (Blue arrow from Device A to Device B, crossed out with a red X)
- Message Lost (Dashed blue arrow from Device A to Device B, crossed out with a red X)
- Acknowledgment (Dashed green arrow from Device B to Device A, crossed out with a red X)
- Message (Blue arrow from Device A to Device B)
- Acknowledgment (Green arrow from Device B to Device A)

1. Introducere in TPI

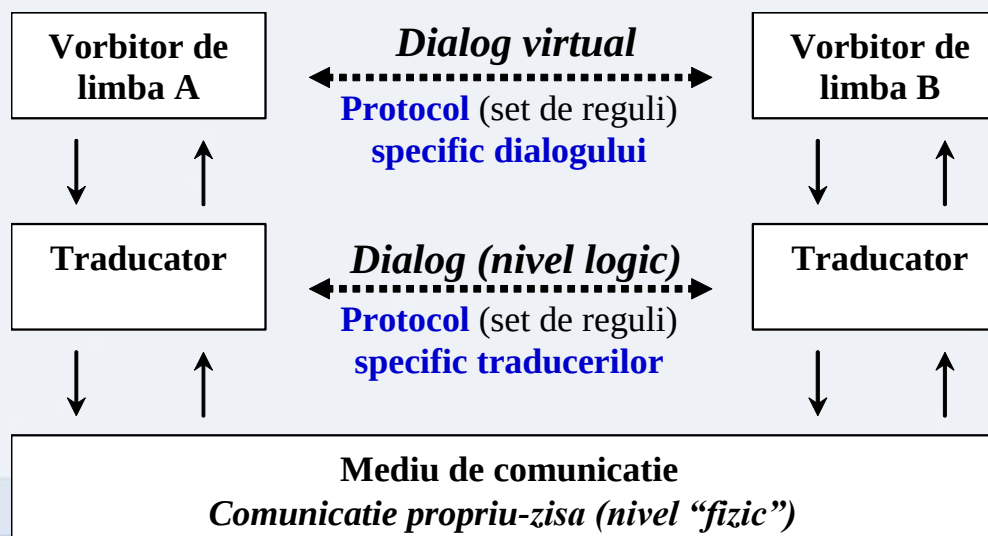
Modele de comunicatie stratificata

Exemplul unui **dialog la distanta** intre interlocutori de limbi diferite

1. Nivelul cel mai inalt (**abstract**)



2. Detaliind utilizarea unor traducatori (nivel **intermediar**)

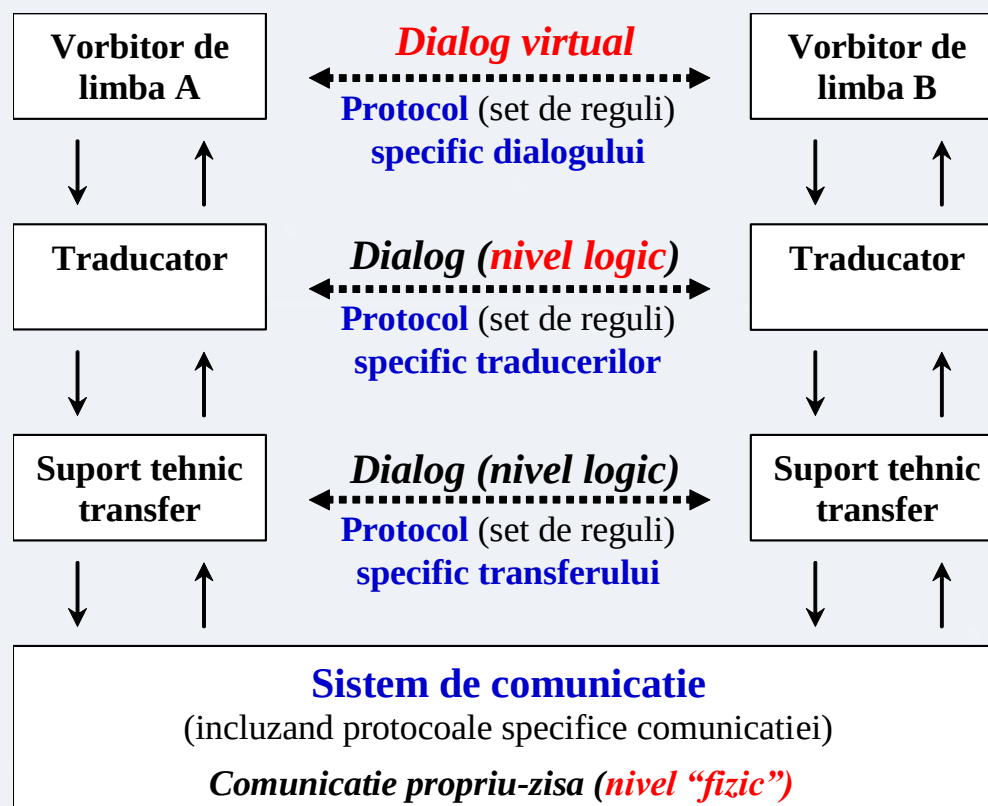


1. Introducere in TPI

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

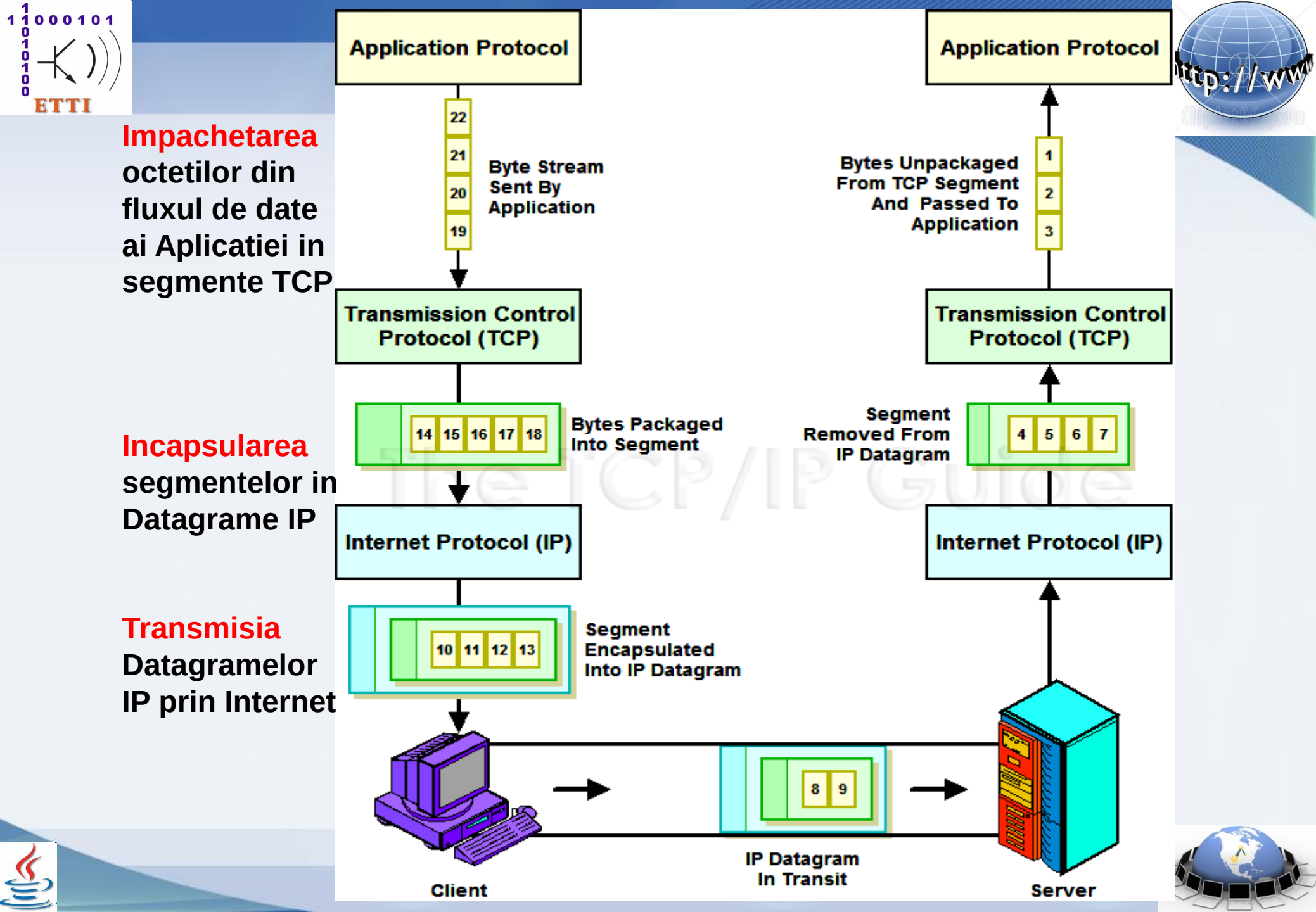
Interactiunile **pe verticala**

- **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

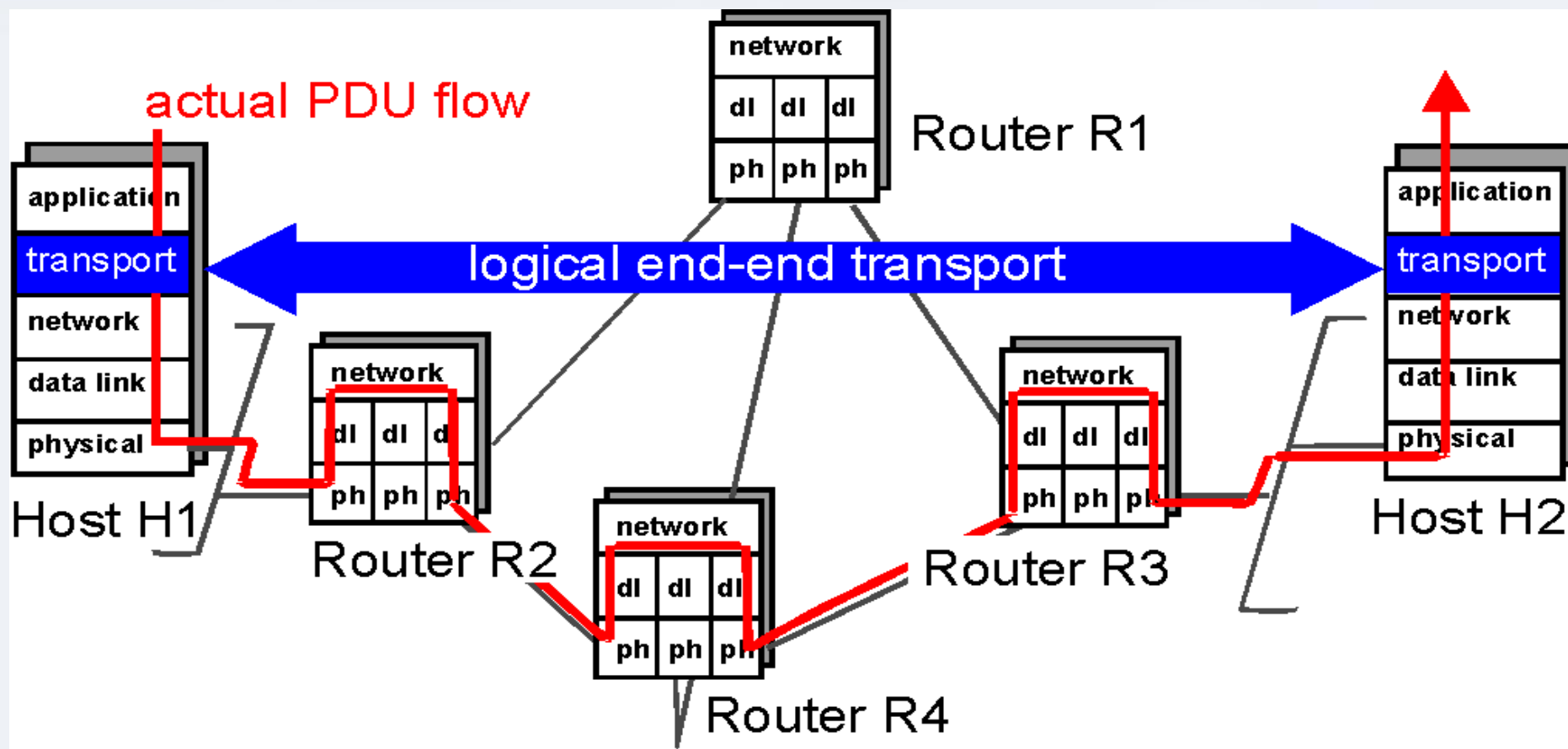




1. Introducere in TPI

Modelul comunicatiilor in Internet

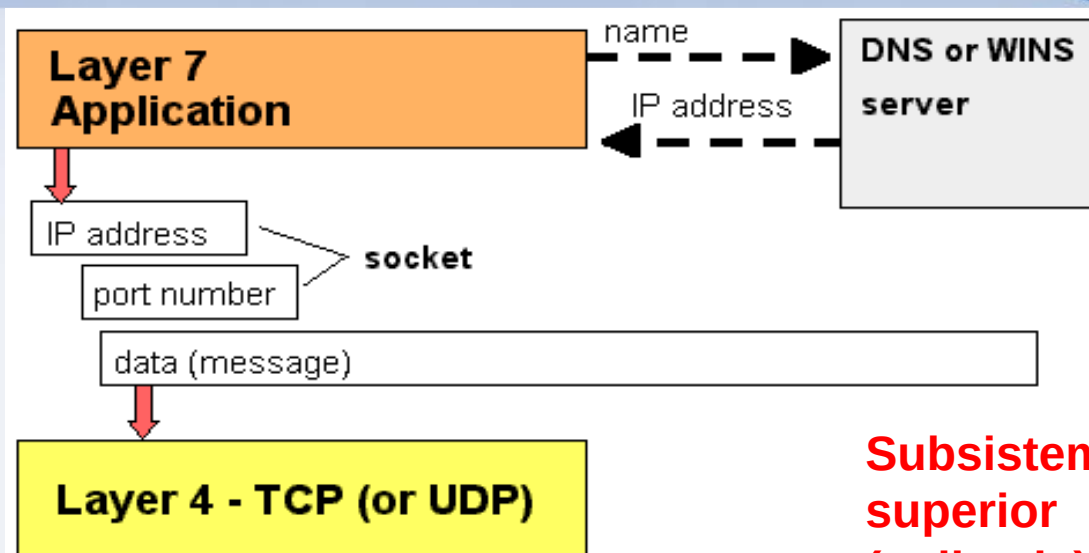
Fluxurile de date, conexiunile logice si stivele de protocoale de comunicatie



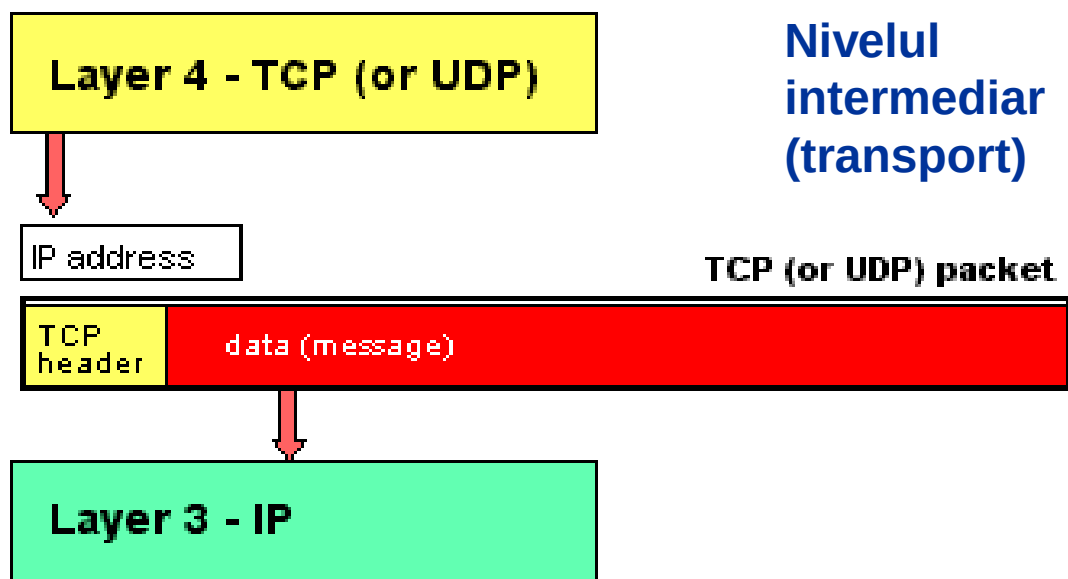
1. Introducere in TPI

Modelul comunicatiilor in Internet

Stiva de
protocoale de
comunicatie
TCP/IP



Subsistemul superior (aplicatie)



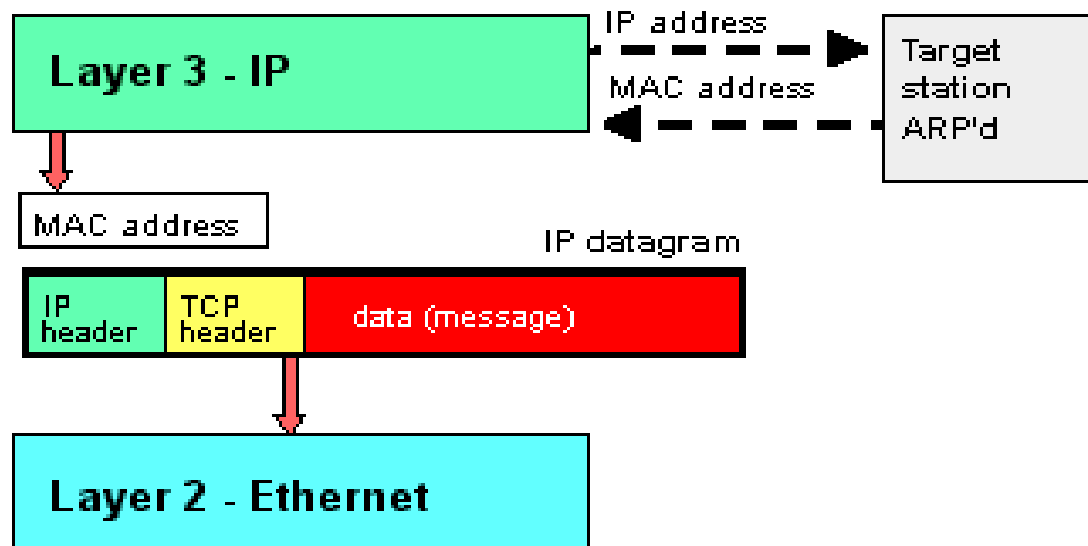
Nivelul intermediar (transport)



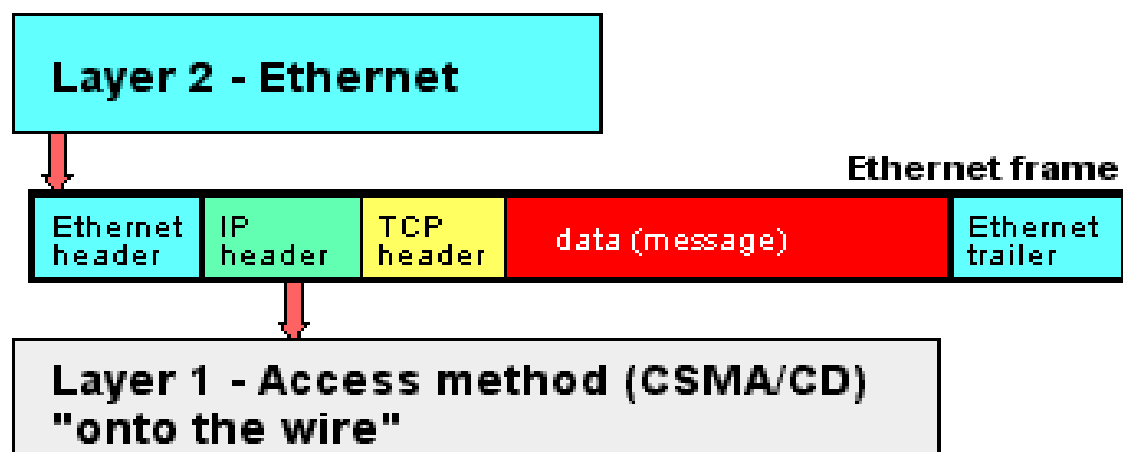
1. Introducere in TPI

Modelul comunicatiilor in Internet

Stiva de
protocoale de
comunicatie
TCP/IP



Subsistemul
inferior (retea)



Modelul comunicatiilor in Internet

Stiva de protocoale de comunicatie

TCP/IP

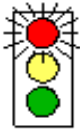
vs

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)

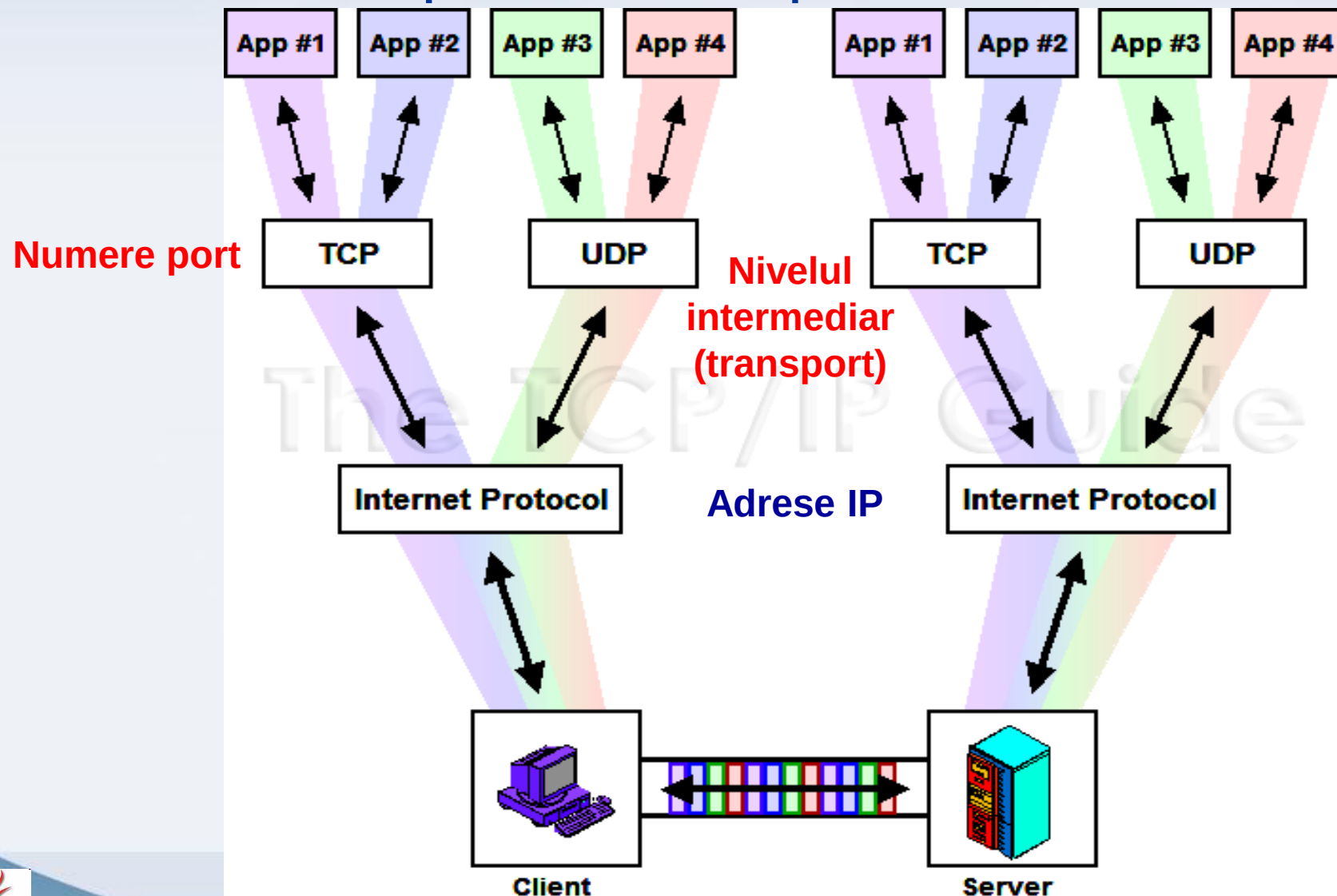
UDP (delivery
NOT
ensured)

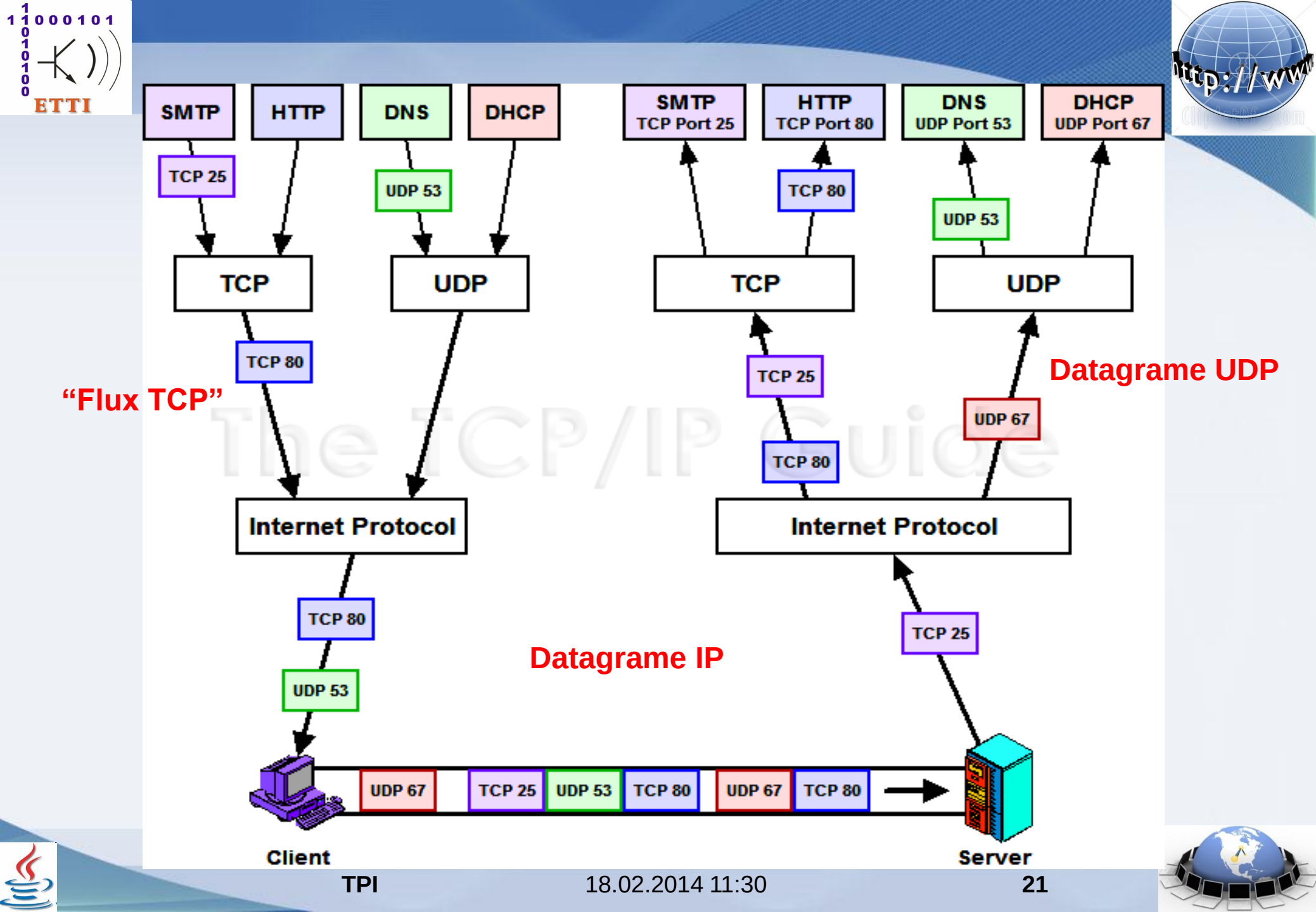
IP

(ICMP, IGMP,
ARP, RARP)

1. Introducere in TPI

Modul in care aplicatiile folosesc protocoalele TCP si UDP



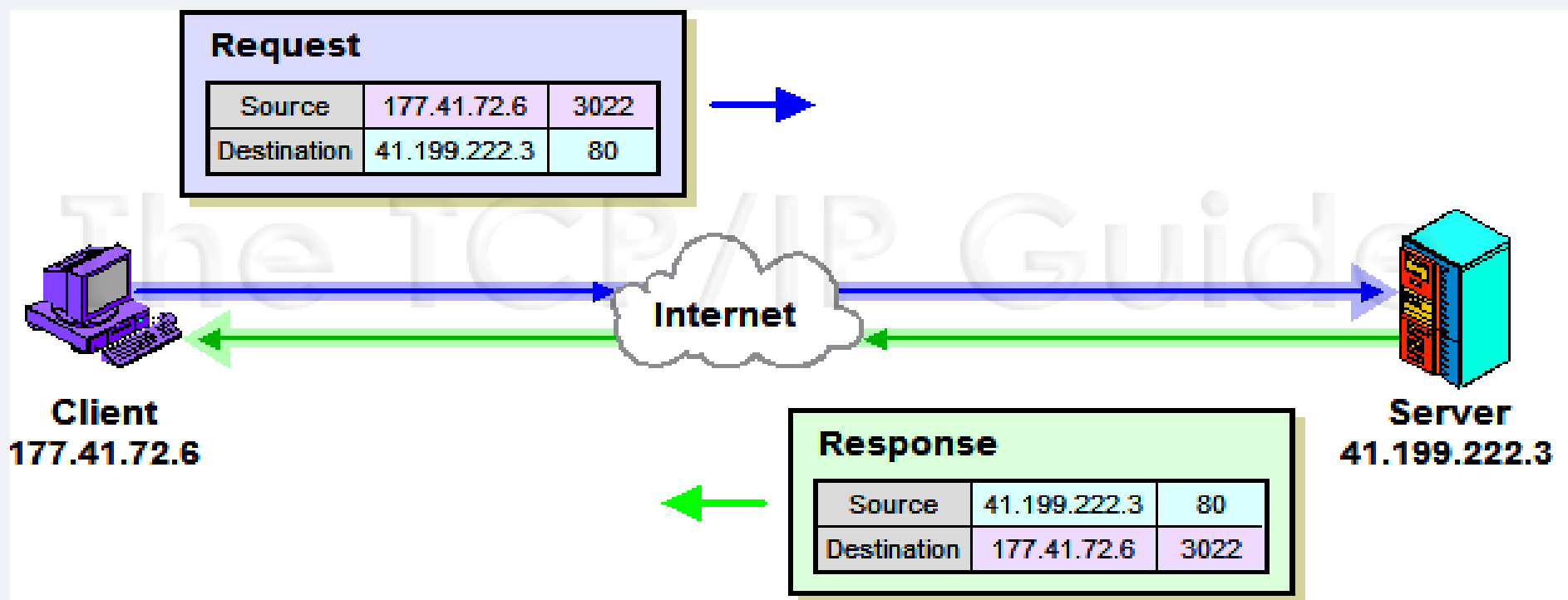


1. Introducere in TPI

Utilizarea adreselor IP pentru a identifica entitatile din Internet

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

Datagrama IP

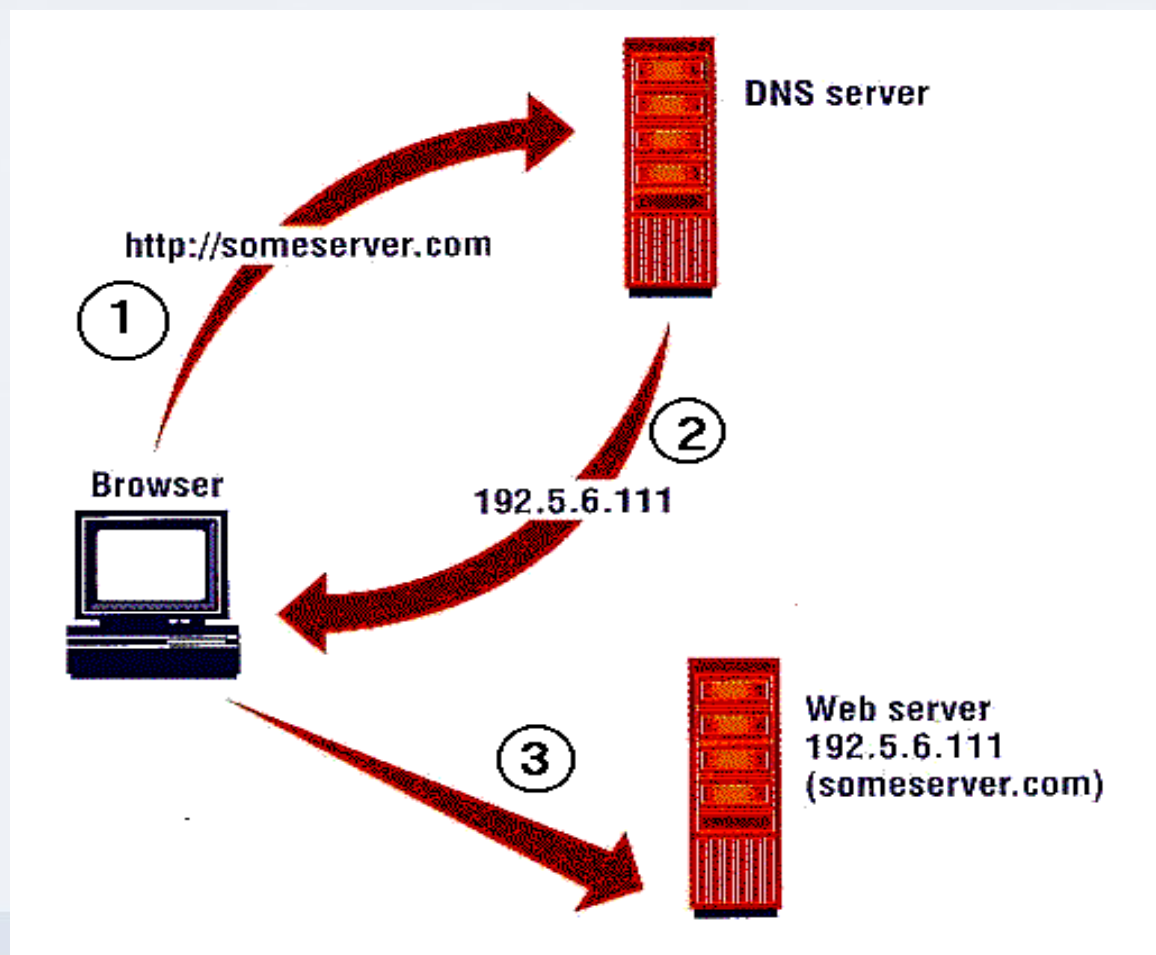


Datagrama IP

1. Introducere in TPI

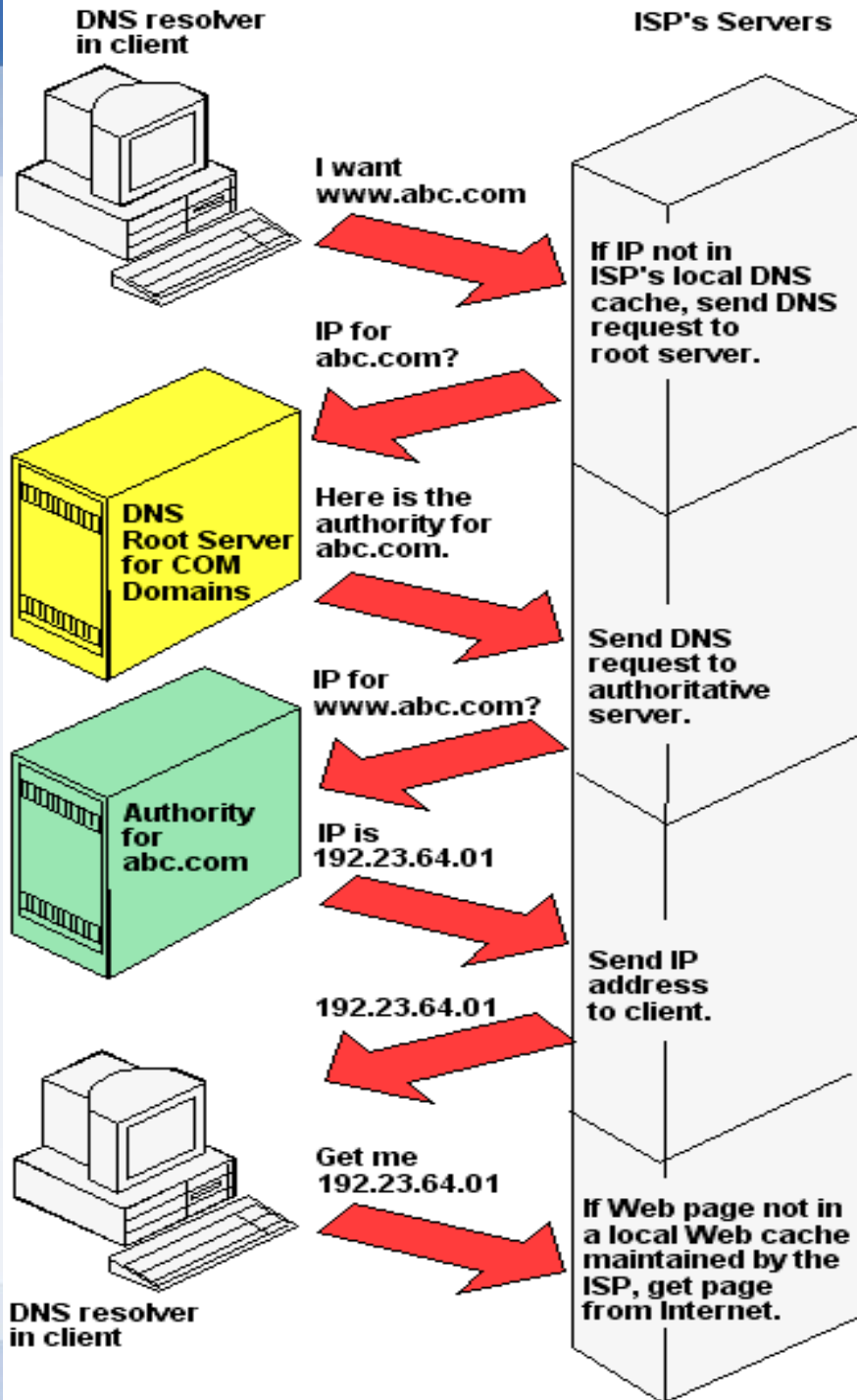
Modelul comunicatiilor in Internet

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



Modelul comunicatiilor in Internet

Utilizarea serviciului DNS



The diagram shows a central orange switch with a circular arrow icon. It is connected to six desktop computers labeled Device #1 through Device #6. Device #1 is at the top, Device #2 is at the top right, Device #3 is at the bottom right, Device #4 is at the bottom, Device #5 is at the bottom left, and Device #6 is at the top left. Three specific communication types are highlighted with colored arrows and labels:

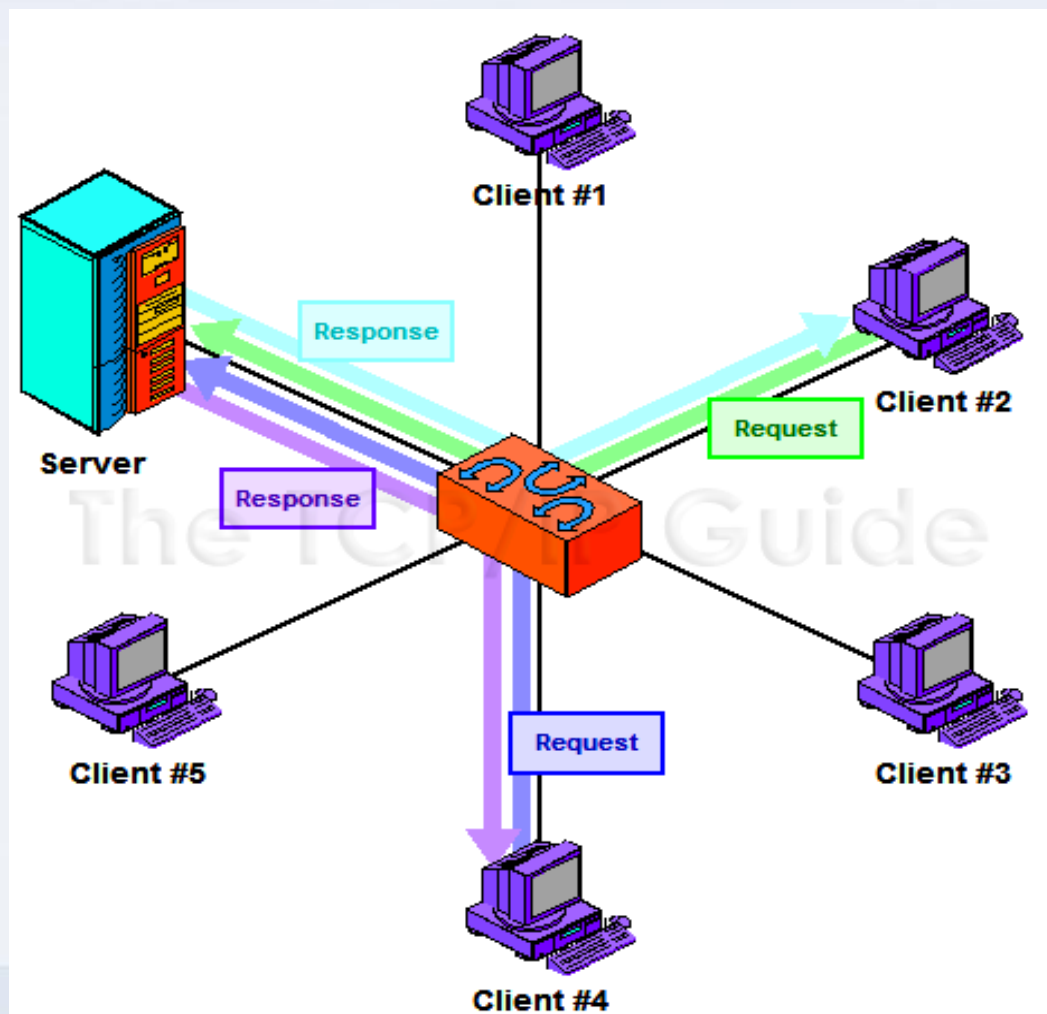
- Unicast:** A purple arrow points from the switch to Device #2, labeled "Unicast to Device #2".
- Broadcast:** A blue arrow points from the switch to Device #5, labeled "Broadcast".
- Multicast:** A green arrow points from the switch to Device #1, labeled "Multicast to 'Group X'".

Additionally, there are green shaded regions labeled "Group X" containing Device #1 and Device #3, and a purple shaded region containing Device #2. A large, faint watermark "The Network Guide" is visible across the center of the diagram.

1. Introducere in TPI

Modelul de comunicatie client-server

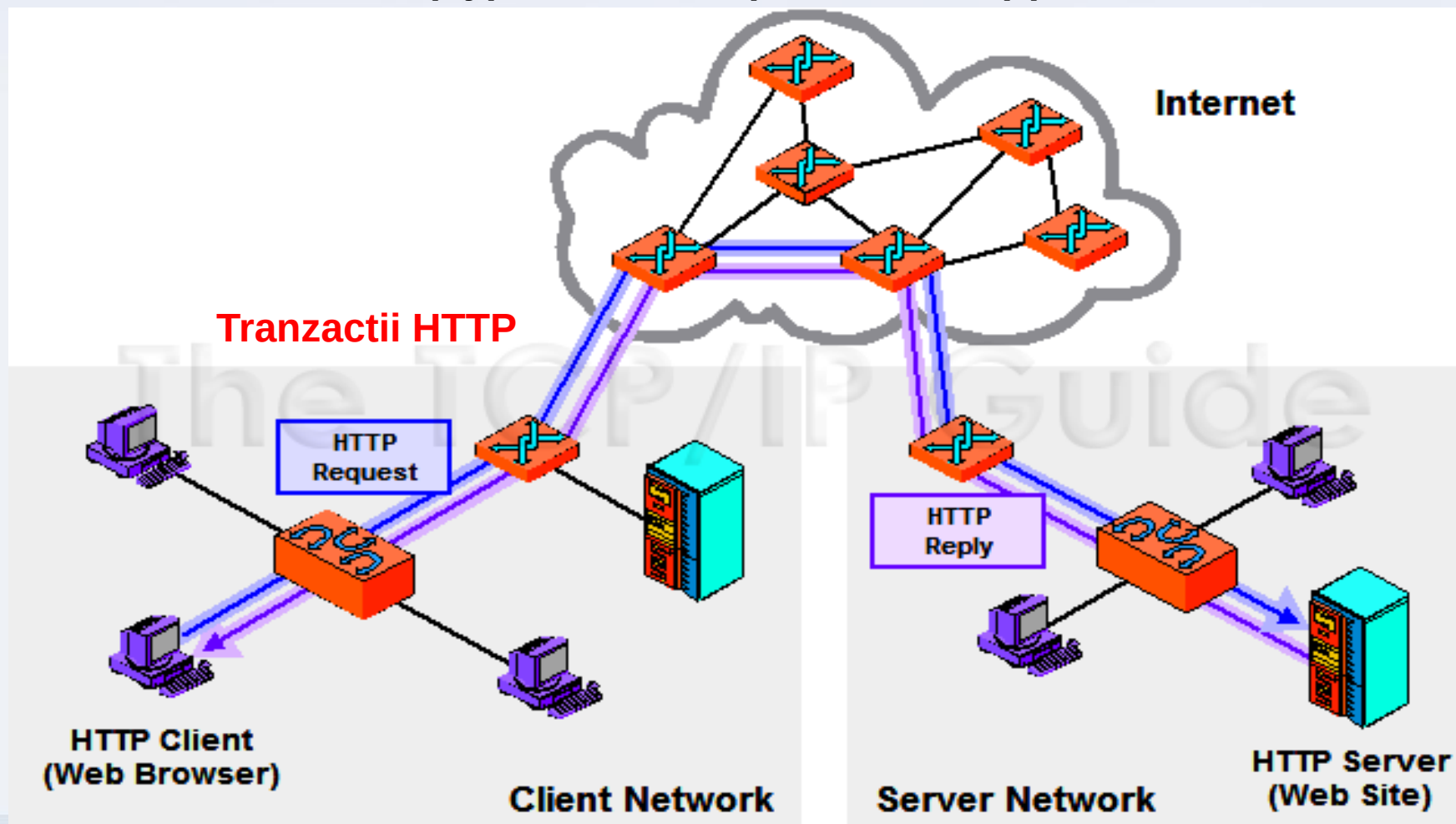
Comunicatie prin mesaje **cerere – raspuns** (tranzactionala)



1. Introducere in TPI

Modelul de comunicatie client-server (tranzactional)

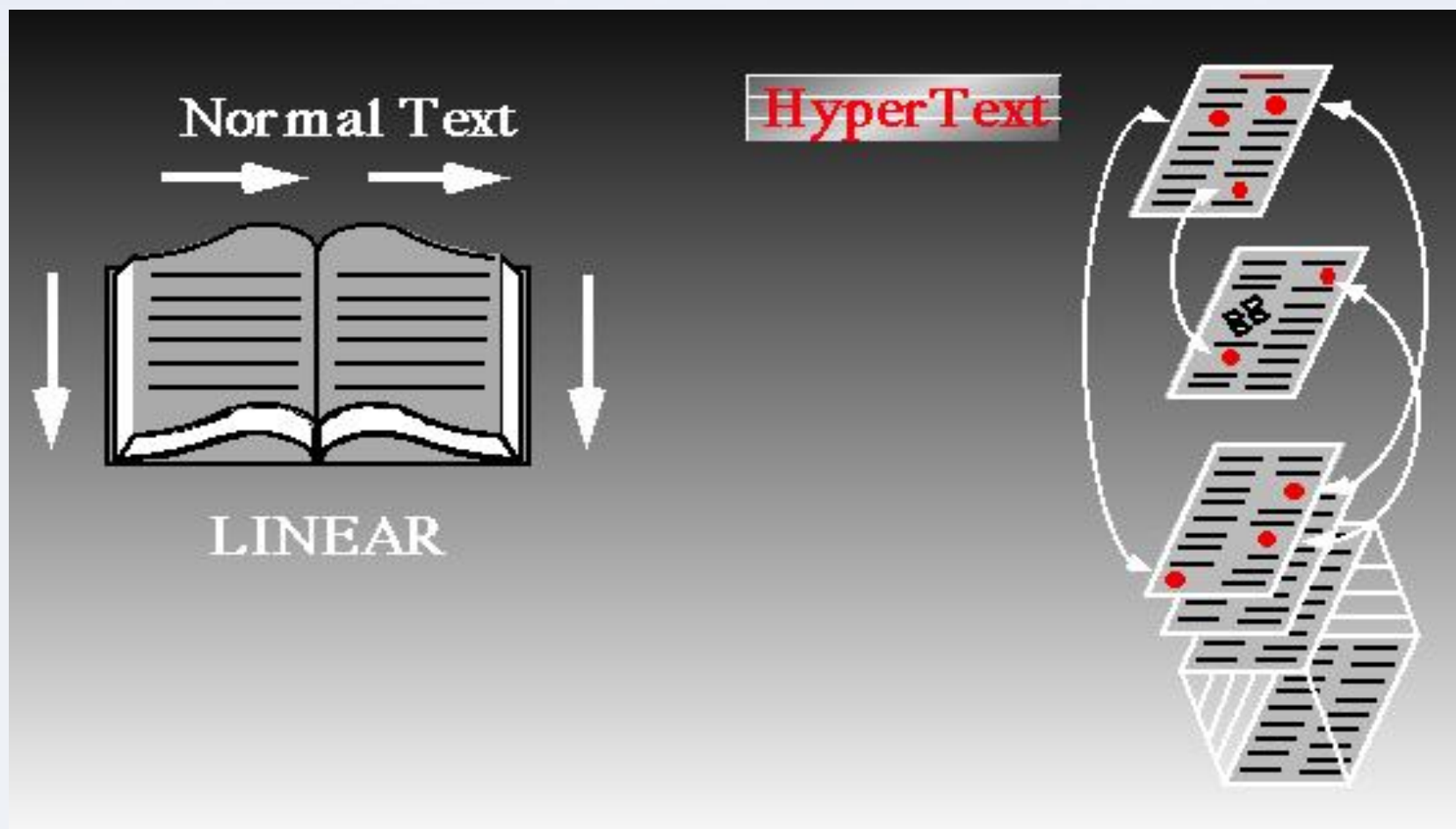
Client-server **HTTP** (*HyperText Transport Protocol*) peste **TCP/IP**



1. Introducere in TPI

Modelul client-server Web (cerere-raspuns HTTP)

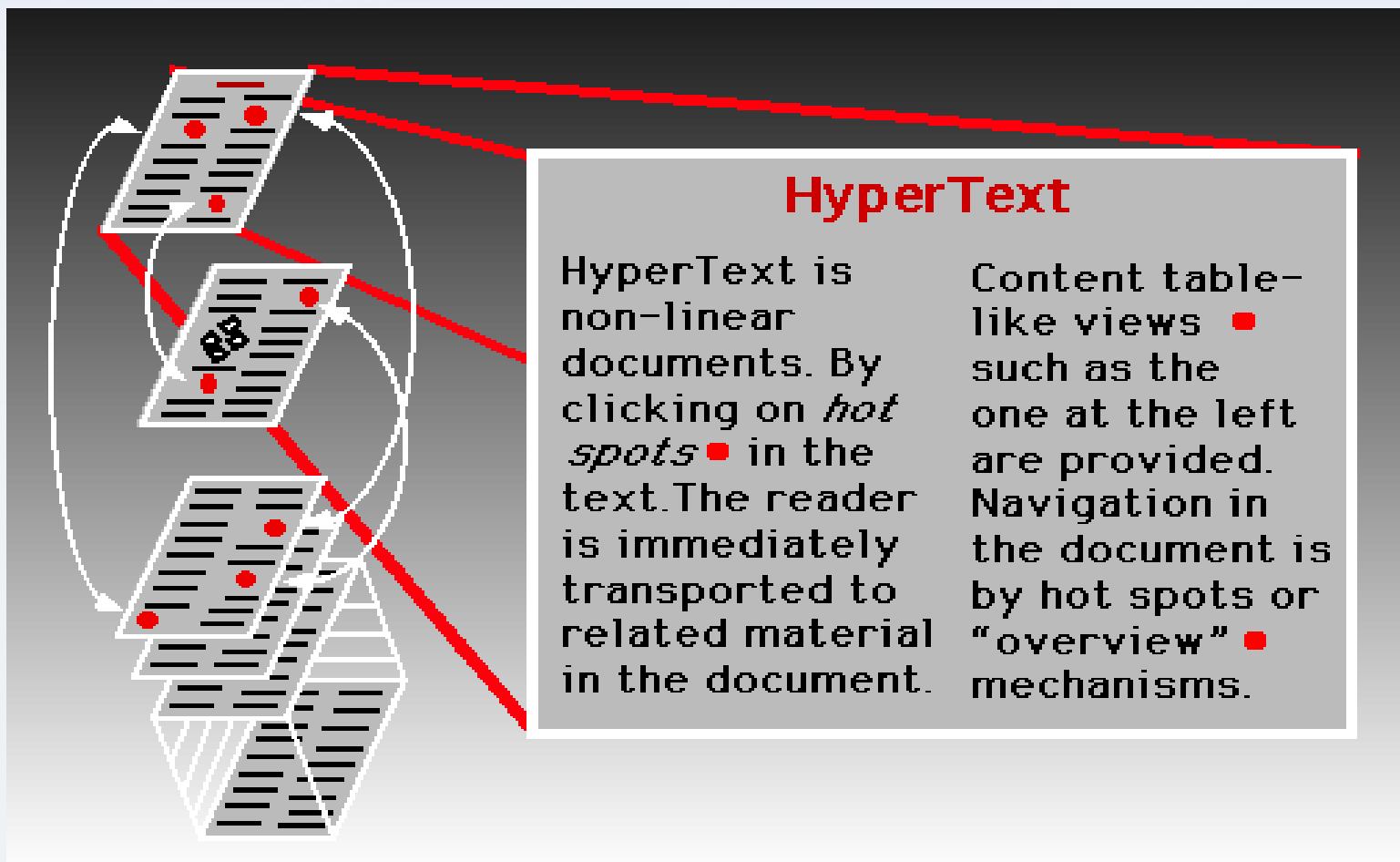
Hypertext vs text liniar



1. Introducere in TPI

Modelul client-server Web (cerere-raspuns HTTP)

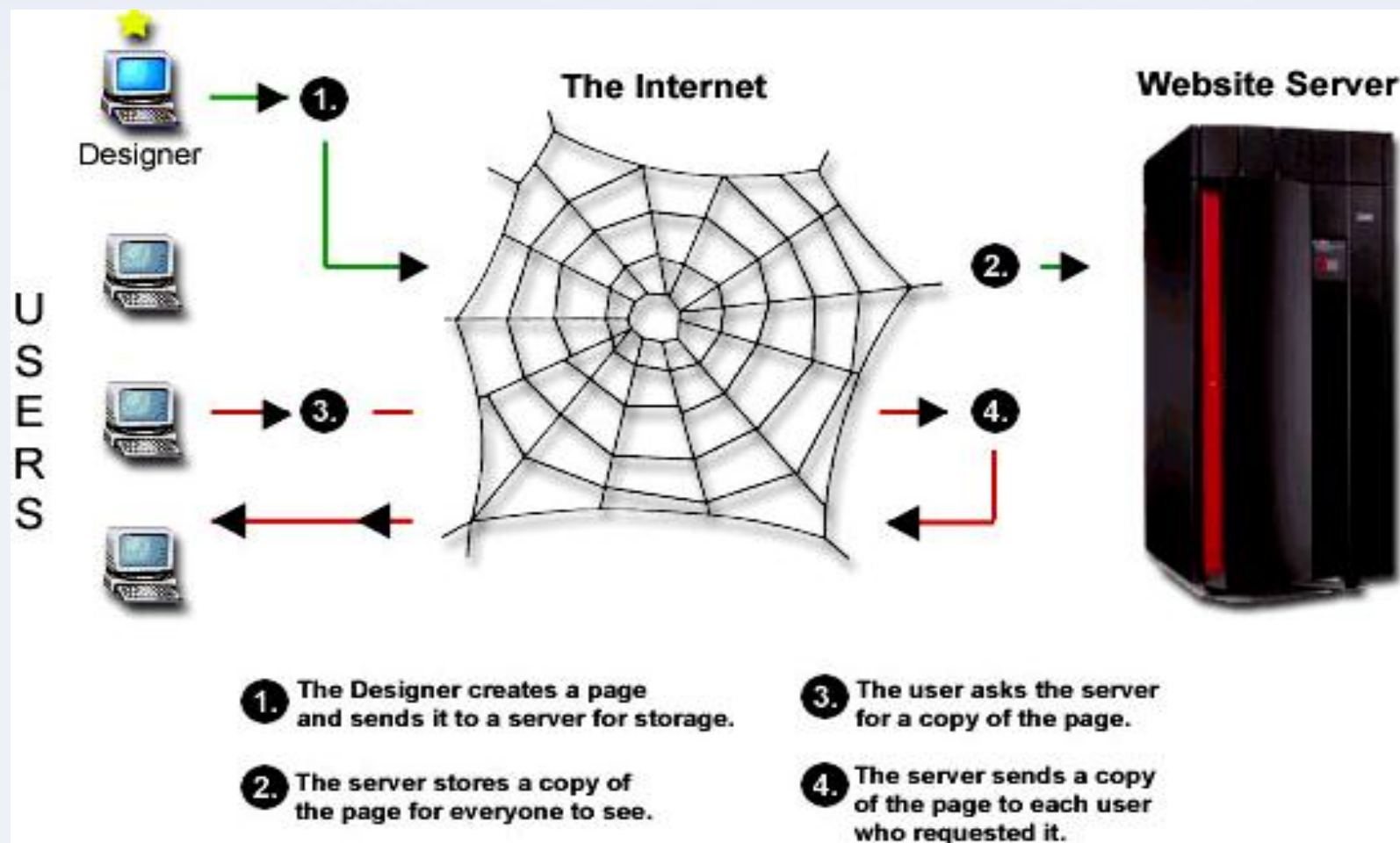
Hypertext vs text liniar



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)

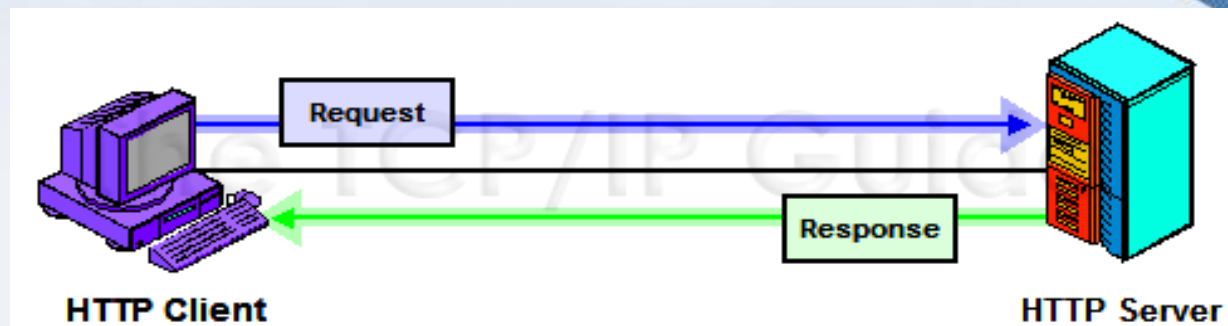
0	4	8	16	19	31
Version	IHL	Type of Service	Total Length		
Identification			Flags	Fragment Offset	
Time To Live		Protocol	Header Checksum		
Source IP Address					
Destination IP Address					
Options					Padding

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

Connection: close

General Headers

Host: www.myfavoriteamazingsite.com

From: joeblow@somewebsitesomewhere.com

Accept: text/html, text/plain

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

Request Headers

Entity Headers

**HTTP
Request**

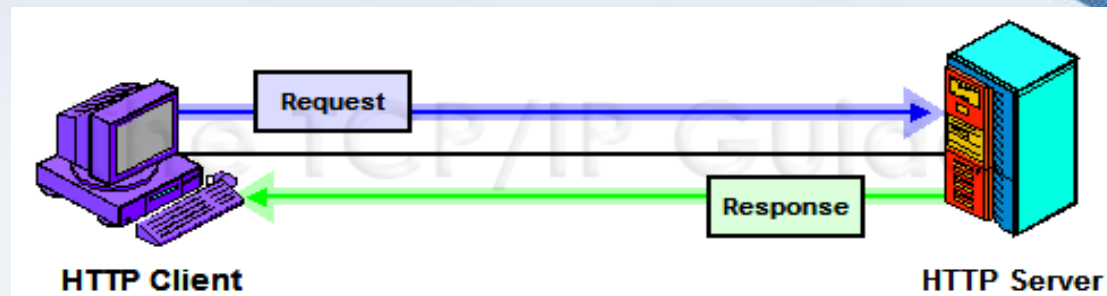
Message Body

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>

<p>This site is under construction. Please come back later. Sorry!</p>

</body>

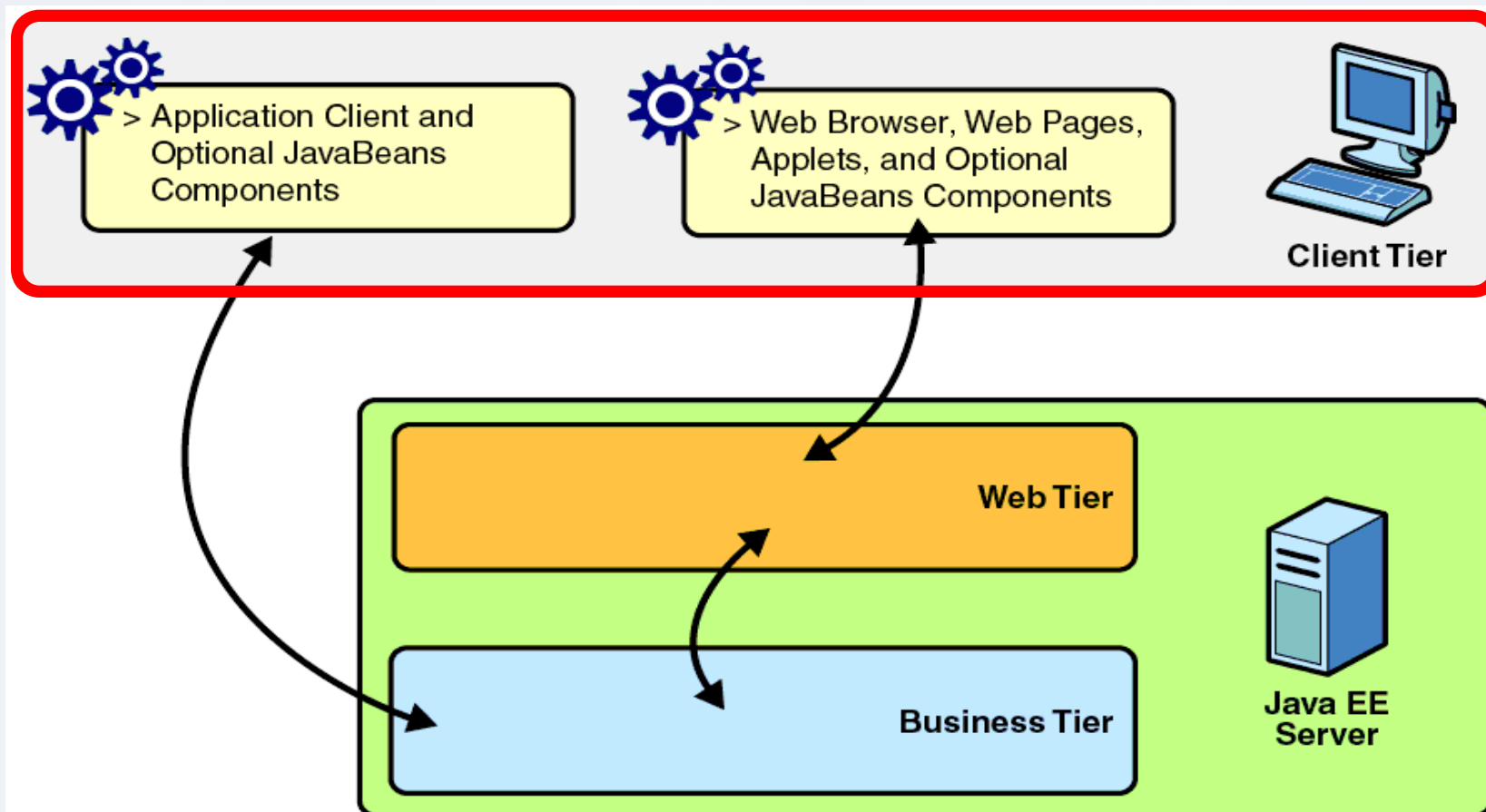
</html>

Message Body

1. Introducere in TPI

Modelul client-server cu tehnologii Java

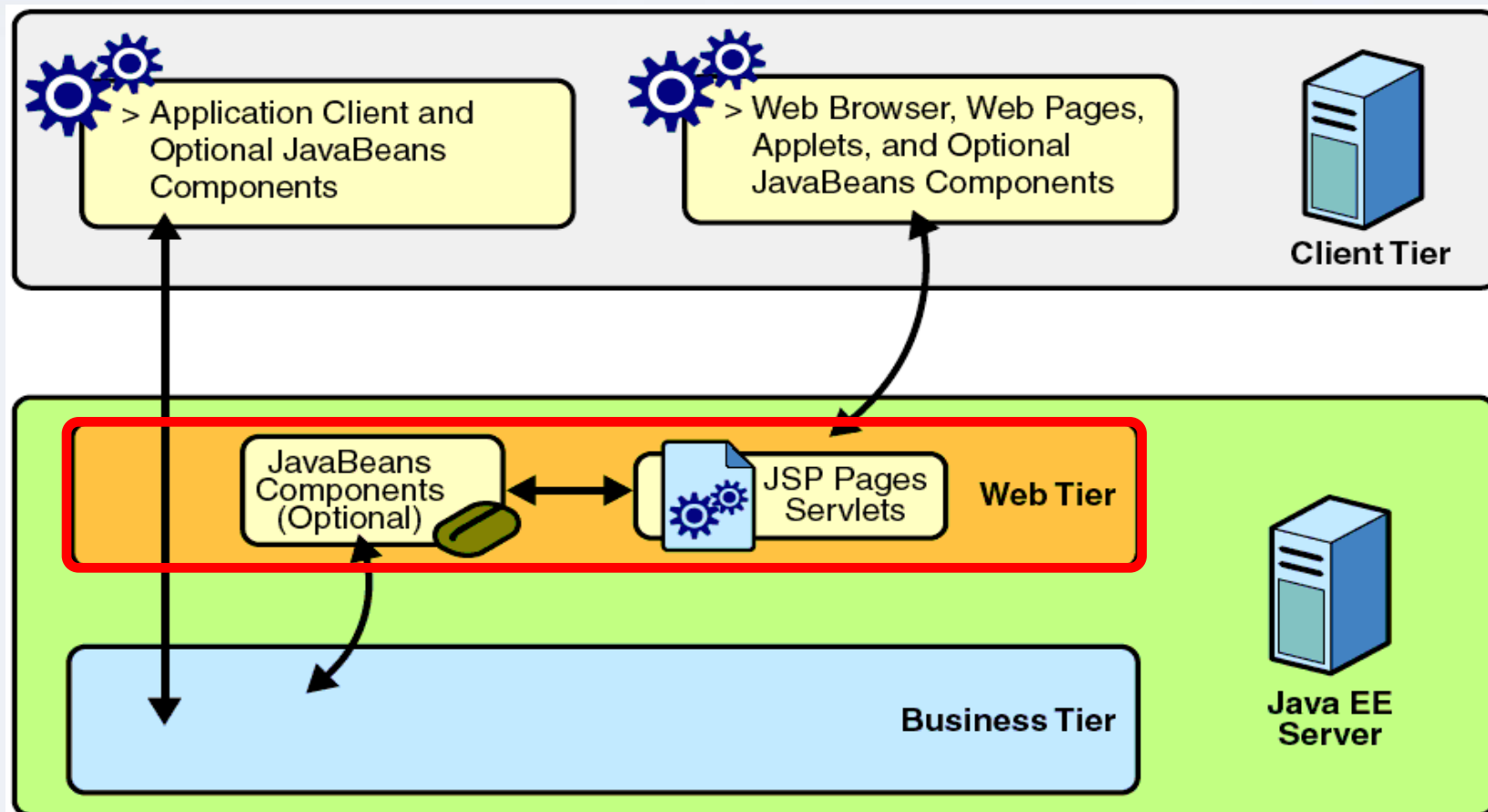
Sistemul client poate contine aplicatii de sine statatoare (desktop - Java SE) sau browsere si continut Web, si optional **JavaBeans**



1. Introducere in TPI

Modelul client-server cu tehnologii Java

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

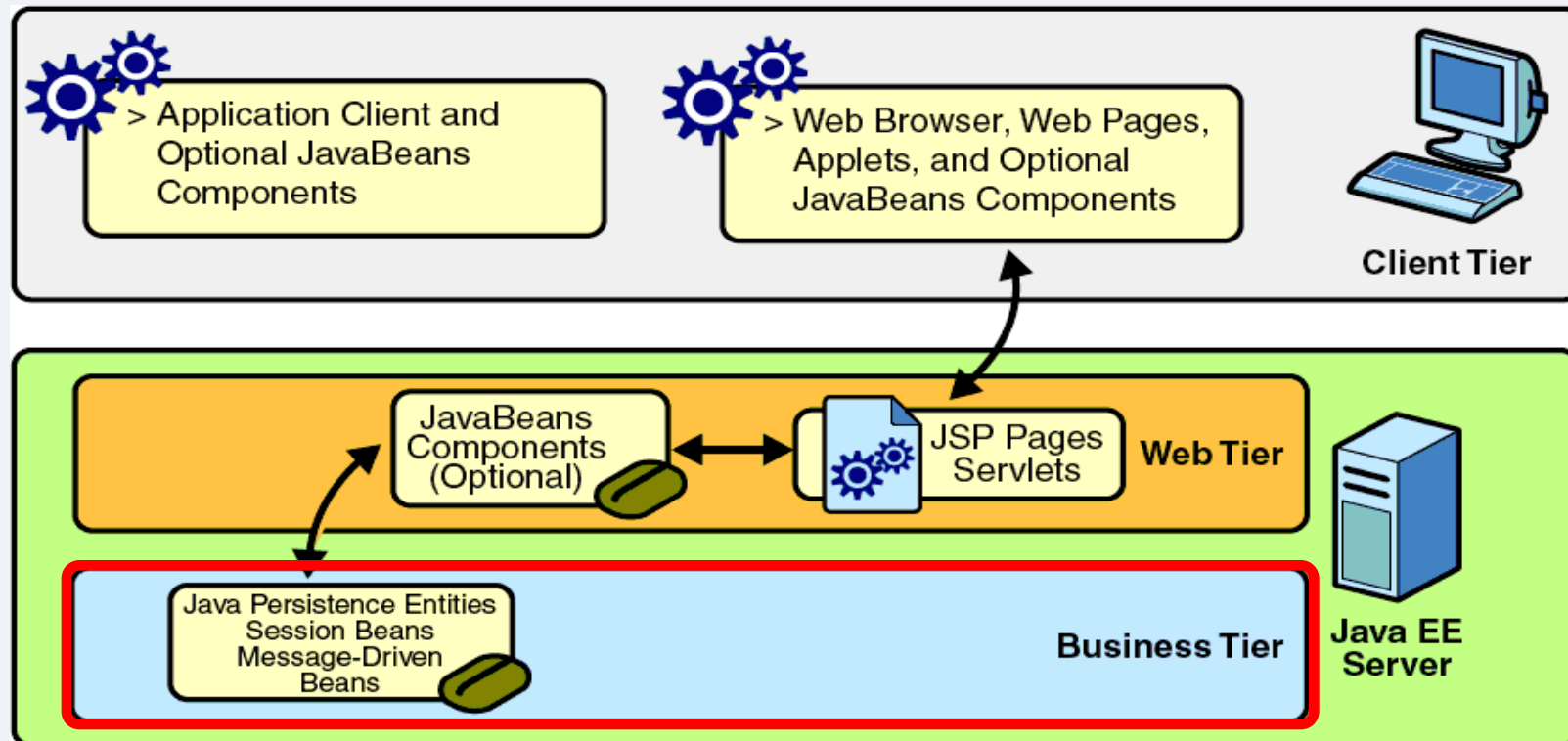


1. Introducere in TPI

Modelul client-server cu tehnologii Java

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

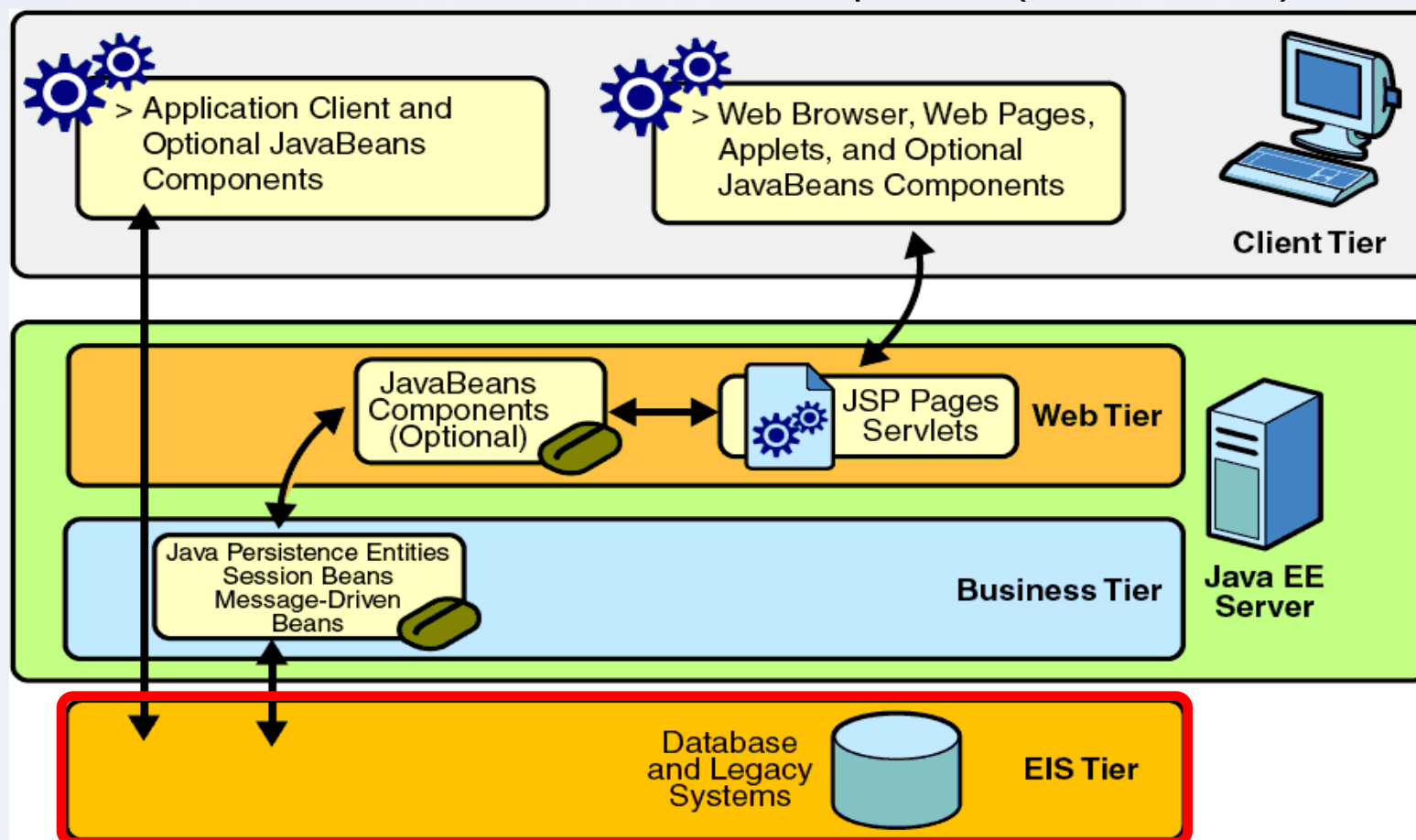
- bean-uri entitate (in EJB 2.x) sau entitati persistente (in EJB 3.0),
- bean-uri sesiune si bean-uri pt. comunicatii asincrone (MDB)



1. Introducere in TPI

Modelul client-server cu tehnologii Java

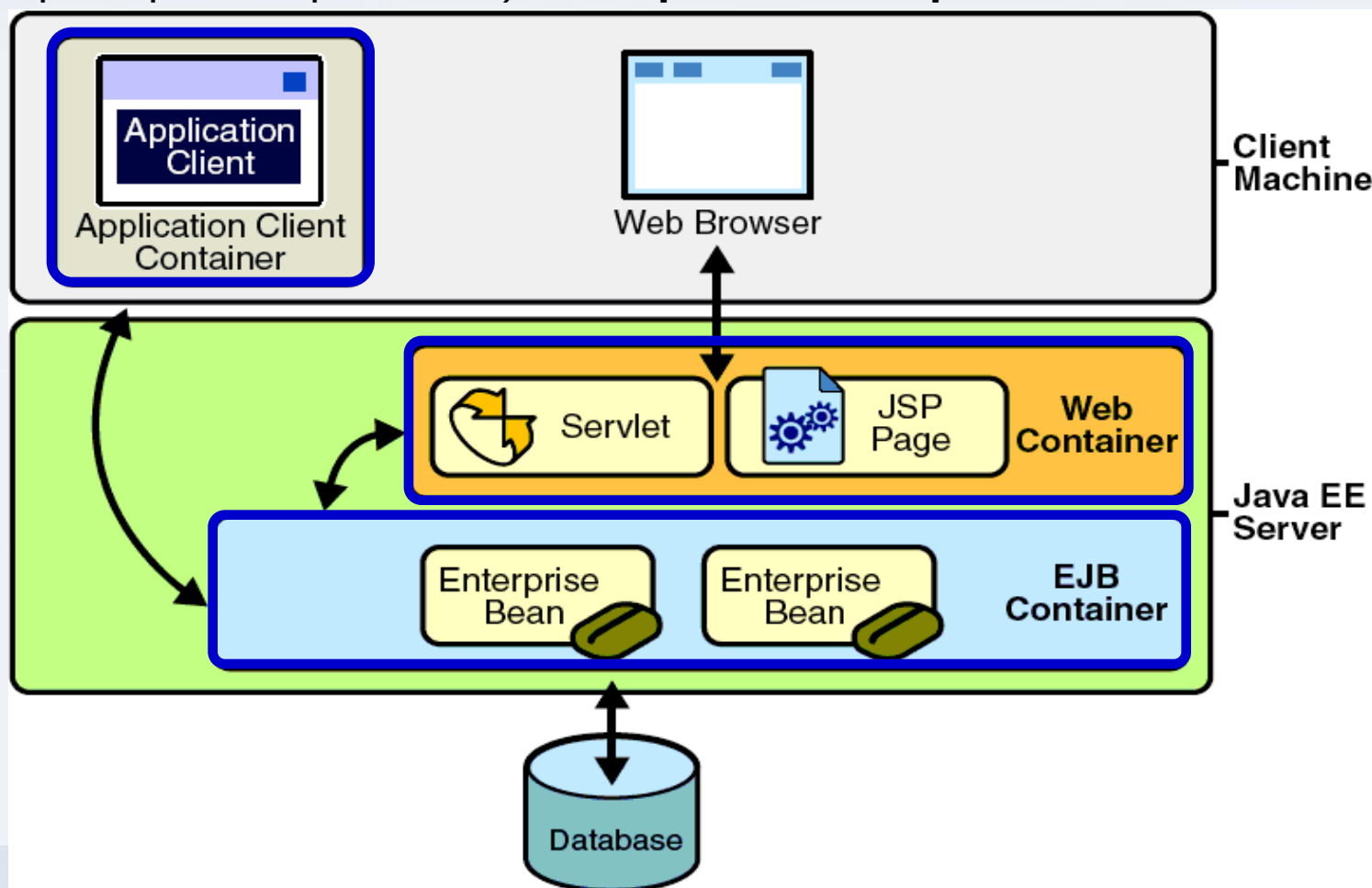
Subsistemul de integrare si management al datelor aplicatiei (**EIS tier**), contine elemente care **furnizeaza/stocheaza datele** aplicatiei (baze de date)



1. Introducere in TPI

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**



1. Introducere in TPI

Tehnologii client

- Windows
 - **Windows Phone** (mobil)
 - **Windows 8** (desktop/laptop)
- Java
 - **Android**, Java ME (*Mobile Edition*) (mobil)
 - **Java SE** (*Standard Edition*) (desktop/laptop)

Tehnologii server

- Windows
 - **.Net**
- Java
 - **Java EE** (*Enterprise Edition*)



1. Introducere in TPI



Elemente esentiale ale programarii?

OO

Elemente structurale / statice

Date

Informatii

Variabila

Spatiu ocupat

Zona de memorie

Alocare

Tip de date

Conversie de tip

Structura de date

Scop (vizibilitate interna)

Variabila locala

Parametru

Argument

Pointer

Dereferire

Referinta

Structura alocata dinamic

Nivel de acces (vizibilitate externa) v

Obiect

Clasa

Subclasare

Clasa abstracta

Interfata (in Java, UML)

Atribut (camp / variabila membru)

Atribut mostenit

Atribut ascuns

Polimorfismul atributelor

Referinta spre sine (attribute proprii)

Referinta spre attribute mostenite

Conventii Java

- **Clase**

- **variabile, cuvinte cheie**

- **CONSTANTE**



1. Introducere in TPI



Elemente esentiale ale programarii?

OO

Elemente comportamentale/dinamice

Operator

Precedenta

Asocierea operatorilor cu tipurile de date

Instructiune

Atribuire

Initializare

Functie (metoda)

Apel (invocare)

Returnare

Semnatura

Supraincarea numelor functiilor

Constructor

Constructor implicit

Supraincarea numelor constructorilor

Metoda mostenita

Metoda rescrisa

Polimorfismul metodelor

Apelul la constructor propriu

Apelul la constructor mostenit

Referinta spre sine (metode proprii)

Referinta spre metode mostenite

Conventii Java

- **metoda()**

- **Constructor()**



1. Introducere in TPI



Elemente esentiale ale programarii?

Elemente structurale / statice

Date

Informatii

Variabila

Spatiu ocupat

Zona de memorie **Stack/Heap**

Alocare

Tip de date

Conversie de tip **()**

Structura de date

Scop (vizibilitate interna)

Variabila locala

Parametru

Argument

Pointer

Dereferire

Referinta

Structura alocata dinamic **new Heap**

OO

public/protected/private

Nivel de acces (vizibilitate externa)

Obiect

Clasa **class**

Subclasare **extends**

Clasa abstracta **abstract**

Interfata (in Java, UML) **interface**

Atribut (camp / variabila membru)

Atribut mostenit

Atribut ascuns

Polimorfismul atributelor

Referinta spre sine (attribute proprii) **this.**

Referinta spre attribute mostenite **super.**

Conventii Java

- **Clase**

- **variabile, cuvinte cheie**

- **CONSTANTE** **final**



1. Introducere in TPI



Elemente esentiale ale programarii?

OO

Elemente comportamentale/dinamice

Operator
Precedenta
Asocierea operatorilor cu tipurile de date
Instructiune
Atribuire
Initializare
Functie (metoda)
Apel (invocare)
Returnare
Semnatura
Supraincarea numelor functiilor

Constructor
Constructor implicit
Supraincarea numelor constructorilor
Metoda mostenita
Metoda rescrisa
Polimorfismul metodelor
Apelul la constructor propriu **this()**
Apelul la constructor mostenit **super()**
Referinta spre sine (metode proprii) **this.**
Referinta spre metode mostenite **super.**

Conventii Java
- **metoda()**
- **Constructor()**

