Retele de calculatoare – Informatica anul 3 (2019-2020)

Note de Laborator Retele de calculatoare	**Specializare: Informatica anul 3** **Contact:** **retelecdsd@gmail.com** **http://www.cdsd.ro**

Comunicatii de Date si Sisteme Distribuite
http://www.cdsd.ro

Laborator 11

1. Obiective:

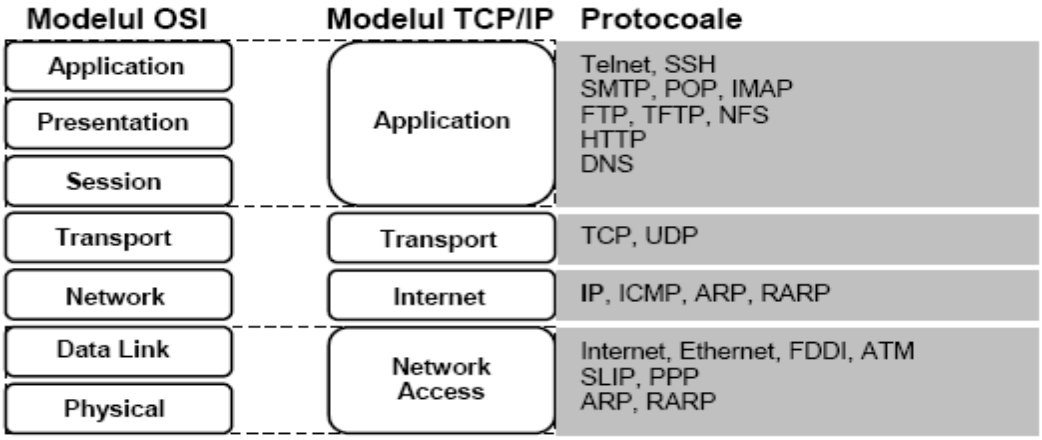
- Protocoale de nivel Aplicatie
- Clasa URL (Java); Modulul urllib (Python); Alicatii http si SSL (Java/Python)
- Aplicatii Modeler/Omnet++ (http://www.omnetpp.org)

2. Consideratii teoretice (Partea practica- pag.10; Tema pag. 30)

2.0. Cursurile C_10+C_11 (http://www.cdsd.ro/

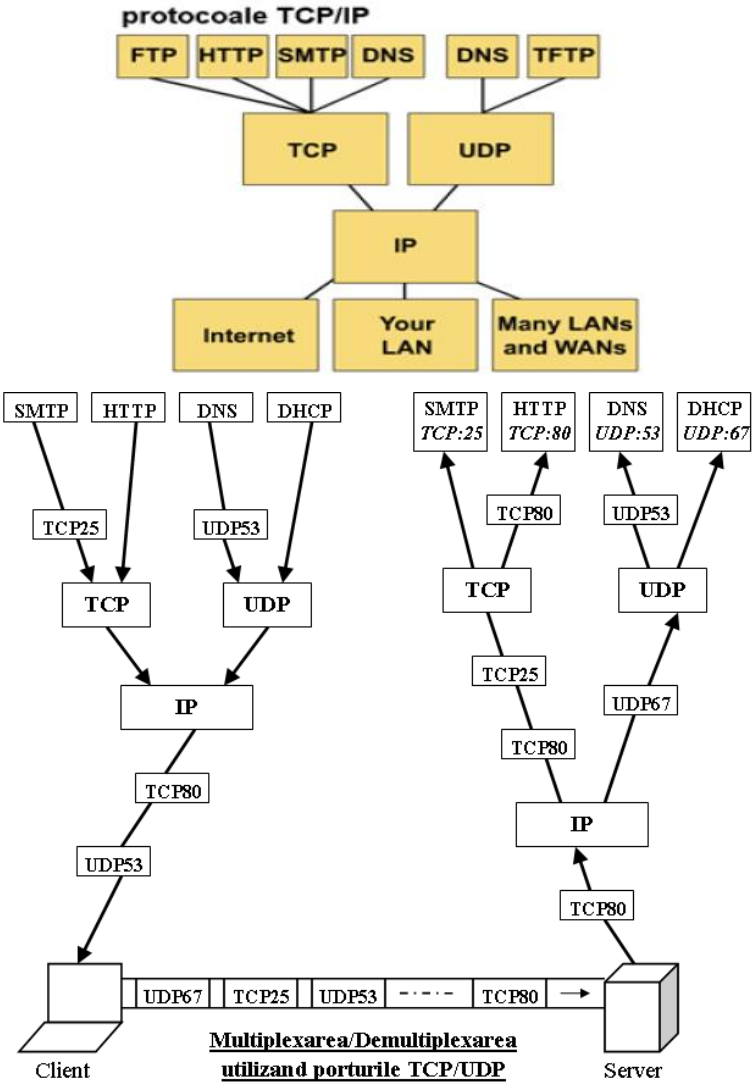
2.1. Protocoale de nivel Aplicatie

Nivelul Aplicatie (Modelele OSI si TCP/IP)



TCP/IP DoD Model			OSI Model
Application Layer (Services Layers 5,6,7) **PDU: Data**	HTTP: port **80** HTTPS/TLS/SSL: port **443** NNTP: port **119** FTP: port **21, 20** Telnet: port **23** SSH: port **22** POP3: port **110** IMAP4: port **143** SMTP: port **25**	DNS: port **53** TFTP: port **69** DHCP/BootP: port **67,68** SNMP: port **162, 161** NTP: port **123** Syslog: port **514**	Application Layer (7) **Scribe**. APIs, network services Presentation Layer (6) **Translator**. Reformats, encrypts/de-crypts, compress/de-compress Session Layer (5) **Negotiator**. Establishes, manages and ends sessions.
Transport Layer (Host to Host Layer 4) **PDU: Segments**	TCP: protocol 6	UDP: protocol 17	Transport Layer (4) **Middle Manager**.
Internet Layer (Network Layer 3) **PDU: Packets**	IP	IP	Network Layer (3) **Mail Room Guy**. IP Routing
Network Acces Layer 1 & 2 **PDU: Frame**	Ethernet, PPP Frame Relay MAC addresses, ARP	Ethernet, PPP Frame Relay MAC addresses, ARP	Data-Link Layer (2) **Envelope Stuffer**. Arranged bits in frames
Network Access Layer 1 & 2 **PDU: Bits or Data Stream**	Electrons, RF or Light	Electrons, RF or Light	Physical Layer (1) **The Truck**. Movement of bits.

Nivelul 7 Aplicatie (Application)	**Securitate: Confidentialitate, autentificare, integritatea datelor, nerepudierea originii (non-repudiation)** **Protocoale**: FTP (File Transfer Protocol), TFTP (Trivial File Transfer Protocol), TELNET, SMTP (Simple Mail Transfer Protocol), HTTP (HyperText Transfer Protocol), SNMP (Simple Network Management Protocol), GOPHER etc	• **Furnizeaza** servicii de retea • Are rolul de "fereastra" de comunicatie intre utilizatori, acestia fiind reprezentati de entitatile aplicatie (programele). Nivelul aplicatie nu comunica cu aplicatiile ci **controleaza mediul in care se executa aplicatiile**, punandu-le la dispozitie servicii de comunicatie. **Functii:** • **Identificarea partenerilor** de comunicatie, **determinarea disponibilitatii** acestora si **autentificarea** lor • **Sincronizarea aplicatiilor** cooperante si **selectarea** modului de dialog • **Stabilirea responsabilitatilor pentru tratarea erorilor** • **Identificarea constrangerilor** asupra reprezentarii datelor • **Transferul** informatiei **Obs :** Nivelul aplicatie **nu** furnizeza servicii altor nivele.



Retele de calculatoare – Informatica anul 3 (2019-2020)

Protocoale:

Protocoale:

- **FTP** (File Transfer Protocol – 21 TCP Control; 20 TCP Date) - transferul de fişiere
- **TFTP** (Trivial File Transfer Protocol 69 UDP) - transferul de fişiere care permite numai doua operatii: citirea unui fisier respectiv scrierea unui fisier.
- **HTTP** (HyperText Transfer Protocol 80 TCP) - transferul paginilor web
- **HTTPS** (Secure HTTP) – 443 TCP
- **SMTP** (Simple Mail Transfer Protocol 25 TCP) - transmiterea mesajelor în format electronic pe Internet.
- **SNMP** (Simple Network Management Protocol 161 UDP; 162 UDP-mesaje trap) - administrarea reţelei
- **POP3 (**Protocolul Post Office – Versiunea 3 – portul TCP 110)
- **IMAP 4 (**Internet Message Access Protocol Versiunea 4) - portul TCP 143

Obs: IMAP permite accesul la mesaje din foldere de e-mail de pe un server. Spre deosebire de POP3, care este proiectat pentru a transfera şi şterge e-mail-urile de pe server (recomandat cand se foloseste o singura masina), scopul IMAP este de a le stoca pe toate pe server, pentru a putea fi oricând accesate din orice loc (IMAP – « minibaza se date ») – recomandat cand se folosesc clienti de e-mail de pe masini diferite

- **NNTP** - Network News Transfer Protocol – 433 TCP, folosit pentru transferul articolelor (ştiri),
- **DNS** - Domain Name Services – 53 TCP/UDP (serviciul numelor de domenii), pentru stabilirea corespondenţei dintre numele gazdelor şi adresele rţelelor;
- **TELNET** – 23 TCP permite utilizatorului să se conecteze pe o maşină aflată la distanţă şi să lucreze ca şi cum s-ar afla într-adevar lângă aceasta.
- Secure Shell (SSH) –22/TCP,UDP, conectare sigura (confidentialitate+autentificare+integritate) file transfers (scp, sftp) si port forwarding

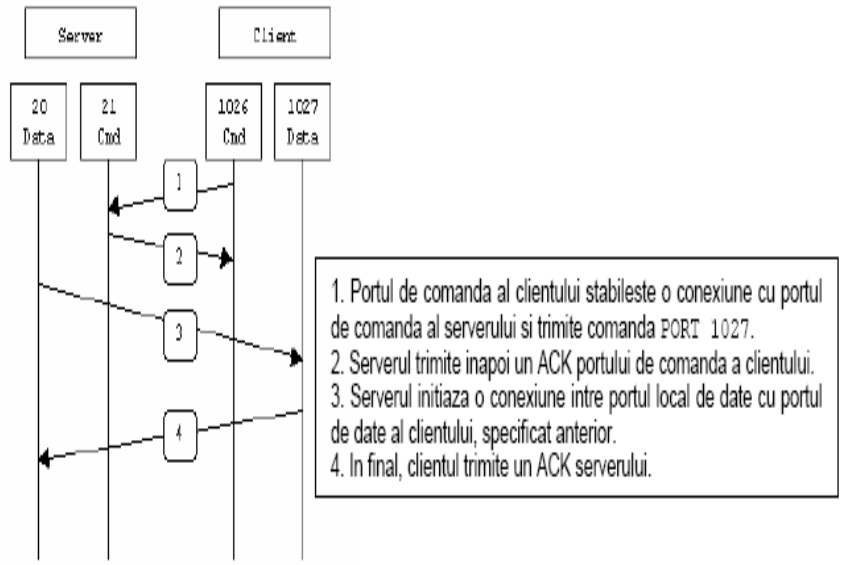
Reserved Port Numbers (http://www.iana.org)

Port	Description	Status
20/TCP	FTP – data	Official
21/TCP	FTP—control (command)	Official
22/TCP,UDP	Secure Shell (SSH)—used for secure logins, file transfers (scp, sftp) and port forwarding	Official
23/TCP	Telnet protocol—unencrypted text communications	Official
25/TCP,UDP	Simple Mail Transfer Protocol (SMTP)—used for e-mail routing between mail servers	Official
53/TCP,UDP	Domain Name System (DNS)	Official
69/UDP	Trivial File Transfer Protocol (TFTP)	Official
80/TCP,UDP	Hypertext Transfer Protocol (HTTP)	Official
107/TCP	Remote TELNET Service[15] protocol	Official
110/TCP	Post Office Protocol 3 (POP3)	Official
118/TCP,UDP	SQL (Structured Query Language) Services	Official
119/TCP	Network News Transfer Protocol (NNTP)—used for retrieving newsgroup	Official

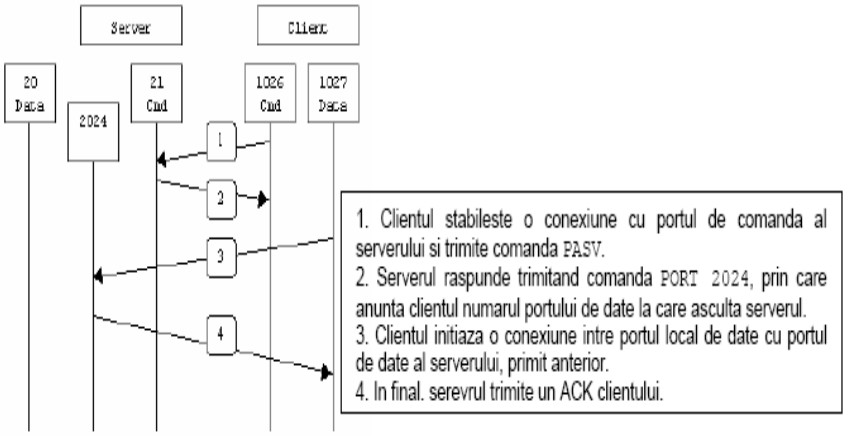
	messages	
123/UDP	Network Time Protocol (NTP)—used for time synchronization	Official
143/TCP,UDP	Internet Message Access Protocol (IMAP)—used for retrieving, organizing, and synchronizing e-mail messages	Official
161/TCP,UDP	Simple Network Management Protocol (SNMP)	Official
162/TCP,UDP	Simple Network Management Protocol Trap (SNMPTRAP)[8]	Official
443/TCP,UDP	Hypertext Transfer Protocol over TLS/SSL (HTTPS)	Official
992/TCP,UDP	TELNET protocol over TLS/SSL	Official
993/TCP	Internet Message Access Protocol over SSL (IMAPS)	Official
995/TCP	Post Office Protocol 3 over TLS/SSL (POP3S)	Official

2.2.Moduri de conexiune la un server FTP

2.2.1. Modul FTP activ:



2.2.2. Modul FTP pasiv:



2.3. Un ***socket*** (canal de comunicatie) este un ***punct terminal al unei comunicatii punct–la–punct***, avand un **nume** si o **adresa.** Din perspectiva programatorului, un *socket* ***ascunde detaliile retelei***
O **adresa socket** pe o retea TCP/IP consta din doua parti: **o adresa IP** *si* **o adresa (numar) de port**.
Un socket furnizeaza facilitati pentru crearea de fluxuri de intrare/iesire, care permit schimburile de date intre client si server. Atunci cand se stabileste o conexiune, atat clientul cat si serverul vor avea cate un socket, comunicarea efectiva realizandu-se intre socketuri.

Alocarea numărului de porturi este gestionată de IANA pentru a asigura compatibilitate universală pe întregul Internet. Există **trei domenii de numere de porturi:**

- *Well-known (Privileged) Port Numbers*
  0-1023 → system port numbers → utilizate pentru cele mai universale aplicaţii TCP/IP (standardizate - RFC)
- *Registered (user) Port Numbers*
  1024-49151 → user port numbers → utilizate pentru aplicaţii neprecizate prin RFC-uri. Pentru a asigura că nu există conflicte, IANA alocă numărul de porturi celor care au creat aplicaţii server viabile, de regulă accesibile oricărui utilizator.

- *Private/Dynamic Port numbers*
  49152-65535 → nu sunt rezervate şi gestionate de IANA. Pot fi utilizate de oricine, fără înregistrare → protocoale private pentru organizaţii private.

Exista doua forme ale comunicarii prin sockets:
- orientata spre conexiune
- prin datagrame (neorientat spre conexiune)

Obs: Suita de protocoale TCP/IP suporta ambele metode prin implementarea protocolului TCP (Transmission Control Protocol) si a protocolului UDP (User Datagram Protocol).

2.3.1. TCP (Transmission Control Protocol)
Protocolul TCP este orientat spre conexiune aflat pe nivelul transport -asigura servicii de comunicare sigure cu detectarea si corectarea erorilor intre doua gazde. Stabilirea unei conexiuni se bazeaza pe adresa IP a maşinii destinaţie si pe numărul portului pe care aceasta asteaptă cereri de conectare.

2.3.2. UDP (User Datagram Protocol)
UDP este un protocol neorientat spre conexiune care transmite datele cu ajutorul protocolului IP. UDP oferă aplicaţiilor acces direct la serviciul de transmitere a datelor dar nu oferă mecanisme de corectare a erorilor. Spre deosebire de TCP, UDP nu realizeaza o conexiune logica intre cele doua gazde, ci incapsuleaza informatia in pachete independente (datagrame), impreuna cu adresa destinatie si numarul portului, si apoi le transmite prin retea.

2.4.
2.4.1. Clasa URL (Java)

Clasa `URL` furnizeaza acces la datele de la distanta. Un obiect de tipul `java.net.URL` este o abstractizare a unui `URL` (Uniform Resource Locator) cum ar fi http://www.cdsd.ro/ sau ftp://ftp.redhat.com/pub . Un astfel de obiect poate fi utilizat pentru accesarea datelor de la locatia

indicata fara a fi nevoie sa cunoastem detalii despre protocolul folosit, formatul datelor sau modalitatea de comunicare cu serverul. Pentru anumite tipuri de date, limbajul Java poate furniza datele deja incapsulate in alte obiecte asemanatoare. **Exemplu:** un URL poate furniza date text incapsulate intr-un obiect `String`.

Constructorul cel mai utilizat al clasei URL este:

```
public URL (String url) throws MalformedURLException
```

Exemplu de instantiere al clasei URL:

```
try{
 URL siteFacultate=new URL(http://www.univ-ovidius.ro/math/index.php);
}catch(MalformedURLException e){
  System.out.println(e.getMessage());
 }
```

Pe langa salvarea URL-ului, clasa cu acelasi nume incapsuleaza si alte informatii despre protocol, hostname, port, cale, sirul de interogare si referinta, informatii care pot fi obtinute folosind metodele *accesor* ale clasei.

Semnatura	Descriere
`String getFile()`	Intoarce numele fisierului
`String getHost()`	Extrage numele masinii gazda
`String getPort()`	Intoarce portul utilizat
`String getProtocol()`	Intoarce numele protocolului
`String getRef()`	Intoarce referinta(ancora)
`String getQuerry()`	Extrage sirul de interogare
`String getPath()`	Extrage calea si numele fisierului

Obtinerea datelor de la locatia indicata de un URL
Clasa URL are trei metode pentru obtinerea datelor de la distanta.

- `public final InputStream openStream( ) throws IOException`
- `public URLConnection openConnection( ) throws IOException`
- `public final Object getContent( ) throws IOException`

Metoda `openStream()` deschide o conexiune la adresa referita de obiectul URL si intoarece un obiect `InputStream` prin care se pot citi datele. Acestea sunt intr-o forma neinterpretata (cod ASCII daca este citit un fisier text, cod HTML daca este citit un fisier
HTML, si asa mai departe). Putem prelua aceste date din `InputStream` folosind un ciclu *while*.

```
try {
      URL u = new URL("http://www.univ-ovidius.ro/math/index.php");
      InputStream in = u.openStream( );
      int c;
      while ((c = in.read( )) != -1)
            System.out.write(c);
      }catch (IOException e) {
            System.out.println(e.getMessage());
}
```

2.4.2. `urllib` — URL handling modules

Source code: Lib/urllib/

`urllib` is a package that collects several modules for working with URLs:

- `urllib.request` for opening and reading URLs
- `urllib.error` containing the exceptions raised by `urllib.request`
- `urllib.parse` for parsing URLs
- `urllib.robotparser` for parsing `robots.txt` files

urllib.request is a Python module for fetching URLs (Uniform Resource Locators). It offers a very simple interface, in the form of the *urlopen* function. This is capable of fetching URLs using a variety of different protocols. It also offers a slightly more complex interface for handling common situations - like basic authentication, cookies, proxies and so on. These are provided by objects called handlers and openers.

urllib.request supports fetching URLs for many "URL schemes" (identified by the string before the `":"` in URL - for example `"ftp"` is the URL scheme of `"ftp://python.org/"`) using their associated network protocols (e.g. FTP, HTTP). This tutorial focuses on the most common case, HTTP.

For straightforward situations *urlopen* is very easy to use. But as soon as you encounter errors or non-trivial cases when opening HTTP URLs, you will need some understanding of the HyperText Transfer Protocol. The most comprehensive and authoritative reference to HTTP is **RFC 2616**. This is a technical document and not intended to be easy to read. This HOWTO aims to illustrate using *urllib*, with enough detail about HTTP to help you through. It is not intended to replace the `urllib.request` docs, but is supplementary to them. (https://docs.python.org/3/howto/urllib2.html)

2.5. Riverbed Modeler ACADEMIC EDITION

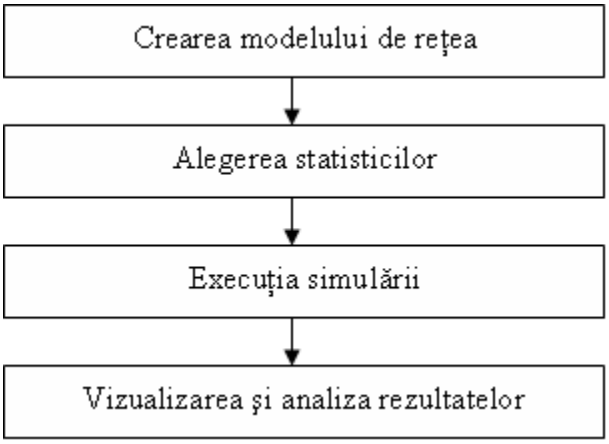
2.5.1. Introducere (vezi Lab 1)

Riverbed Modeler Academic Edition – mediu de simulare a retelelor de calculatoare - furnizează software de management pentru aplicaţii şi reţele, care oferă soluţii pentru:

- Planificarea capacităţii reţelelor,
- Modelare şi simulare pentru reţele şi aplicaţii
- Managementul configurării reţelelor
- Managementul performanţelor aplicaţiilor

Riverbed oferă **Modeler Academic Edition**) - include modele standard pentru protocoale şi echipamentele disponibile în tehnologia IT (disponibile, dupa instalare, în subdirectoarele C:\Riverbed EDU\17.5.A\models\std.

Etapele de lucru avute în vedere:



Etapele de lucru Modeler pentru simularea şi analiza unei reţele

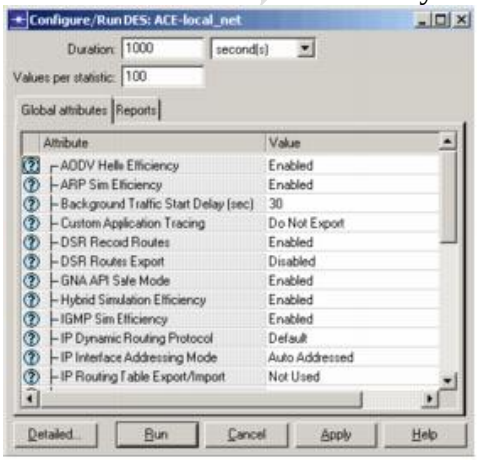
Obs: O statistica este o caracteristica numerica a unui esantion (Anexa 3, pag.79, Lab_02)

- **Statistica** este stiinta colectarii, clasificarii, prezentarii, interpretarii datelor numerice si a folosirii acestora pentru a formula concluzii si a lua decizii.
- **Statistica descriptiva (**Descriptive Statistics) se ocupa cu colectarea, clasificarea si prezentarea datelor numerice.
- **Statistica inferentiala** (Inferential Statistics) se ocupa cu interpretarea datelor oferite de statistica descriptiva si cu folosirea acestora pentru a formula concluzii si lua decizii.

Obs: (http://www.wansolutionworks.com/Modeler.asp)

Riverbed Products	
Riverbed Modeler	
Riverbed Modeler	#MD **Our Price: $46,010.00**
Riverbed Modeler Wireless Suite	#MDW **Our Price: $73,830.00**
Riverbed Modeler Wireless Suite for Defense	#MDWDEF **Our Price: $119,840.00**

Configure/Run DES Dialog Box (Simple) The Configure/Run DES dialog box lets you configure and run a discrete event simulation for the current scenario. The simple version of the dialog box, (shown in the following figure), which appears when the DES configuration mode is set to “simple”, presents a reduced set of controls to simplify configuration and execution of **discrete event simulations**. Only single simulation runs are supported.



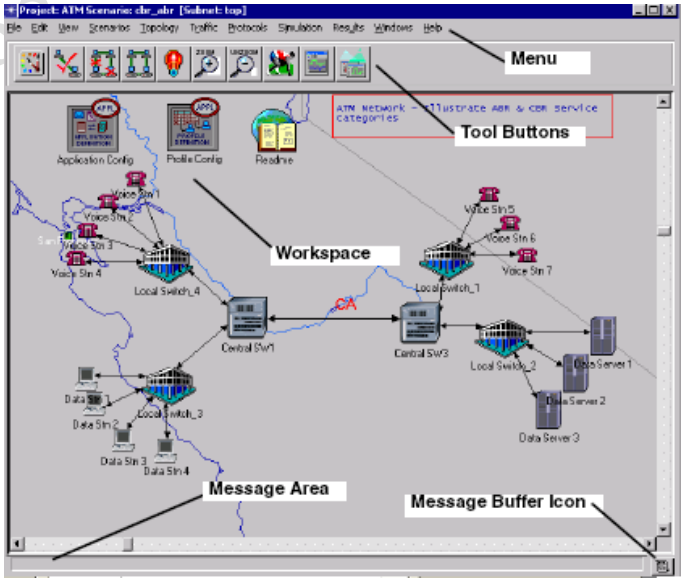
The simple Configure/Run DES dialog box has two pages of controls. These controls are organized by type and can be selected by clicking the corresponding tab. The following table lists the controls in this dialog box.

Element	Description
Basic controls	Duration field—Sets the duration of the simulation. Specify units with the pull-down menu following this field. This value sets the “duration” simulation preference. Values per statistic field—Sets the maximum number of values collected for each statistic. This value sets the “num_collect_values” simulation preference.
Global Attributes page	Use this page to define the values of global simulation attributes. This page is similar to the Global Attributes page—Used to define the values of global simulation attributes for the simulation. seen in Detailed mode, except that you cannot set multiple values for an attribute or automatically reset the default value.
Reports page	Use this page to select Statistic reports and Service Level Agreement (SLA) reports for the simulation. Reports are predefined sets of statistic probes. This page is identical to the Configure/Run DES Dialog Box (Detailed)—Report Controls seen in Detailed mode.
Dialog box controls	Detailed… button—Switches temporarily to detailed mode and the detailed Configure/Run DES dialog box, as described in Configure/Run DES Dialog Box (Detailed). (This button does not change the des.configuration_mode preference.) Run button—Saves the current settings, closes the dialog box, and runs the simulation. Running a simulation from here opens the Simulation Execution Dialog Box. Cancel button—Closes the dialog box without saving any changed settings. Apply button—Saves the current settings and keeps the dialog box open. Help button—Opens a help file for the dialog box.

Workspace este spaţiul de lucru din partea centrală a ferestrei editorului, care este folosit pentru crearea modelului reţelei, selectarea şi deplasarea obiectelor reţelei, alegerea operaţiilor specifice conextului.

Message Area, plasată în partea de jos a ferestrei, furnizează informaţii despre starea *tool-ului.*

Message Buffer Window, plasata în partea de jos în stânga, permite accesul la o listă de mesaje, notificări, atenţionări.



Project Editor Window

Butoane folosite în *Project Editor*

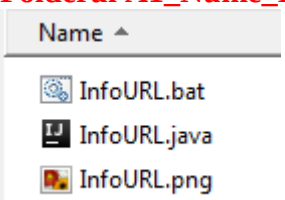
Semnificația butoanelor din *Project Editor*

1. *Open object palette*	*6. Zoom*
2. Check link consistency	*7. Restore*
3. Fail Selected objects	*8. Configure discrete event simulation*
4. Recover selected objects	*9. View simulation results*
5. Return to parent subnet	*10. Hide or show all graphs*

3. Partea practica (Tema pag. 30)

3.1. Aplicatia A1: Program care afiseaza informatiile continute intr-un obiect URL

Folderul A1_Nume_Prenume:

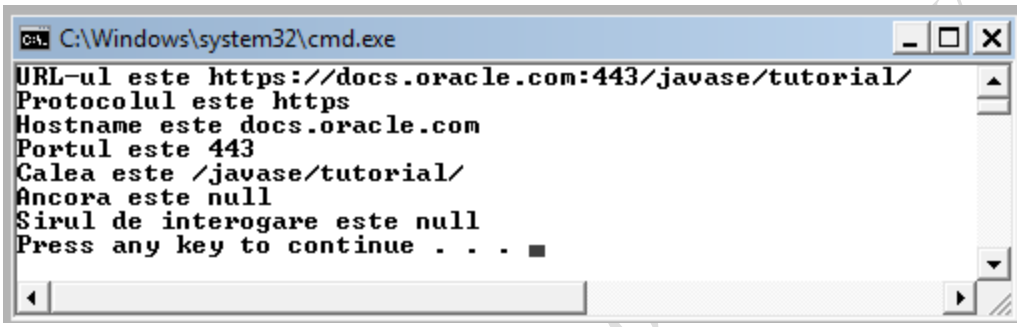


Indicatii:

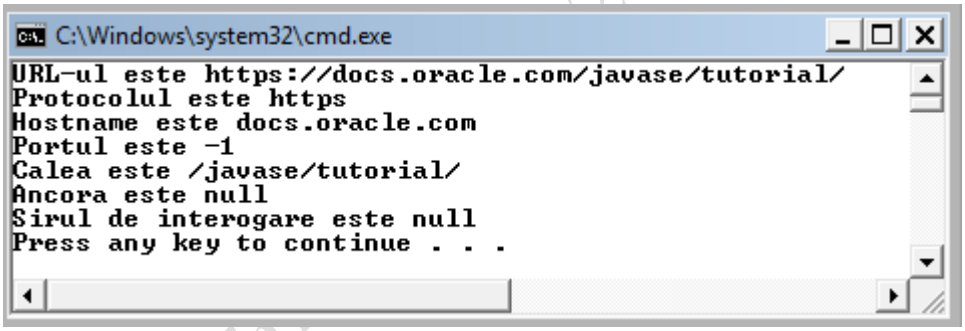
```
import java.net.*;

public class InfoURL{
   public static void main(String args[]) {

    try {
       URL u =
        new URL("https://docs.oracle.com:443/javase/tutorial/");

        System.out.println("URL-ul este" + u);
        System.out.println("Protocolul este " + u.getProtocol( ));

        String host = u.getHost( );
             if (host != null) {
```

```
            int atSign = host.indexOf('@');
            if (atSign != -1) host = host.substring(atSign+1);
              System.out.println("Hostname este " + host);
              }
            else {
             System.out.println("Nu avem hostname.");
            }

            System.out.println("Portul este " + u.getPort( ));
            System.out.println("Calea este " + u.getPath( ));
            System.out.println("Ancora este " + u.getRef( ));
            System.out.println("Sirul de interogare este " + u.getQuery( ));
      }catch (MalformedURLException e) {
            System.err.println(e.getMessage());}

  } // end main
} // end InfoURL
```

a.



b.



Obtinerea datelor de la locatia indicata de un URL

Clasa URL are trei metode pentru obtinerea datelor de la distanta.

- `public final InputStream openStream( ) throws IOException`
- `public URLConnection openConnection( ) throws IOException`
- `public final Object getContent( ) throws IOException`

Metoda `openStream()` deschide o conexiune la adresa referita de obiectul URL si intoarece un obiect `InputStream` prin care se pot citi datele. Acestea sunt intr-o forma neinterpretata (cod ASCII daca este citit un fisier text, cod HTML daca este citit un fisier
HTML, si asa mai departe). Putem prelua aceste date din `InputStream` folosind un ciclu *while*.

```
try {
      URL u = new URL("http://www.univ-ovidius.ro/math/index.php");
      InputStream in = u.openStream( );
```

```
      int c;
      while ((c = in.read( )) != -1)
            System.out.write(c);
      }catch (IOException e) {
            System.out.println(e.getMessage());
}
```

3.2. Aplicatia A2: Programul permite citirea datele referite de un obiect URL si afisarea acestora intr-o forma neprelucrata.

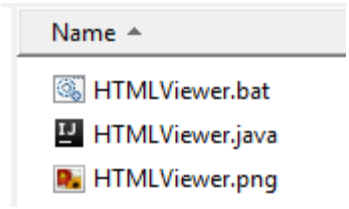
Metoda `openConnection()` realizeaza o conexiune prin socketuri la resursa indicata de URL si intoarce un obiect `URLConnection`. Clasa `URLConnection` abstractizeaza o conexiune deschisa catre resursa referita. Metoda `openConnection()` este folosita atunci cand dorim sa comunicam direct cu serverul. Pe langa datele in format HTML, obiectul `URLConnection` ofera si headerele folosite de protocolul utilizat.

```
try {
  URL u = new URL("https://docs.oracle.com/javase/tutorial/");
      try {
            URLConnection uc = u.openConnection( );
            InputStream in = uc.getInputStream( );

        // citeste date

   }catch (IOException e) {
            System.out.println(e.getMessage());}
   }catch (MalformedURLException e) {
            System.err.println(e.getMessage());
}
```

Indicatii:

```
import java.net.*;
import java.io.*;

public class HTMLViewer {
      public static void main (String[] args) {
     try {
     //Deschide URL pentru citire
    URL u = new URL("https://docs.oracle.com/javase/tutorial/");
        InputStream in = u.openStream( );
        // foloseste un buffer pentru a imbunatati performantele
        in = new BufferedInputStream(in);
        // conecteaza obiectul InputStream la un obiect Reader
        Reader r = new InputStreamReader(in);
        int c;
        while ((c = r.read( )) != -1) {
              System.out.print((char) c);
        }
    }catch (MalformedURLException e) {
      System.out.println(" Nu este o adresa URL valida");
    }catch (IOException e) {
      System.out.println(e);}
    } // end main
} // end class
```

Folderul A2_Nume_Prenume:



Metoda `getContent()` returneaza continutul resursei referite sub forma unui obiect al carui tip este ales in functie de tipul fisierului indicat de obiectul URL. Daca fisierul referit de URL este un fisier in format GIF sau JPEG, atunci metoda `getContent()` va intoarce un obiect `java.awt.ImageProducer`. In cazul in care tipul de date nu este specificat, metoda va incerca sa determine tipul fisierului dupa extensie, prin examinarea campului `Content-type` al header-ului MIME.

Limbajul Java recunoaste urmatoarele extensii de fisier.

Extensie	Tip MIME
.exe	application/octet-stream
.zip	application/zip
.gif	image/gif
.jpeg	image/jpeg
.java	text/plain
.cpp	text/plain
.c	text/plain
.html	text/html

Get File Extension Using Java

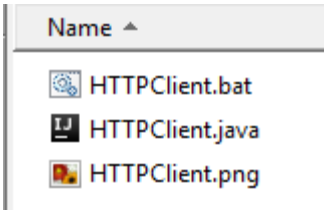
Sursa: http://www.technicalkeeda.com/java-tutorials/get-file-extension-using-java

3.3. Aplicatia A3: Obtinerea unei pagini Web prin intermediul unui socket

Obs: Se porneste serverul Web (vezi Anexa 2)

Pentru a stabili o conexiune HTTP trebuie sa cream un socket pe care sa-l conectam la serverul Web si sa-i trimitem mesaje conforme cu specificatiile protocolului HTTP. Serverul va decoda cererile trimise si va raspunde prin mesaje HTTP. Acestea sunt alcatuite din antet si continut.

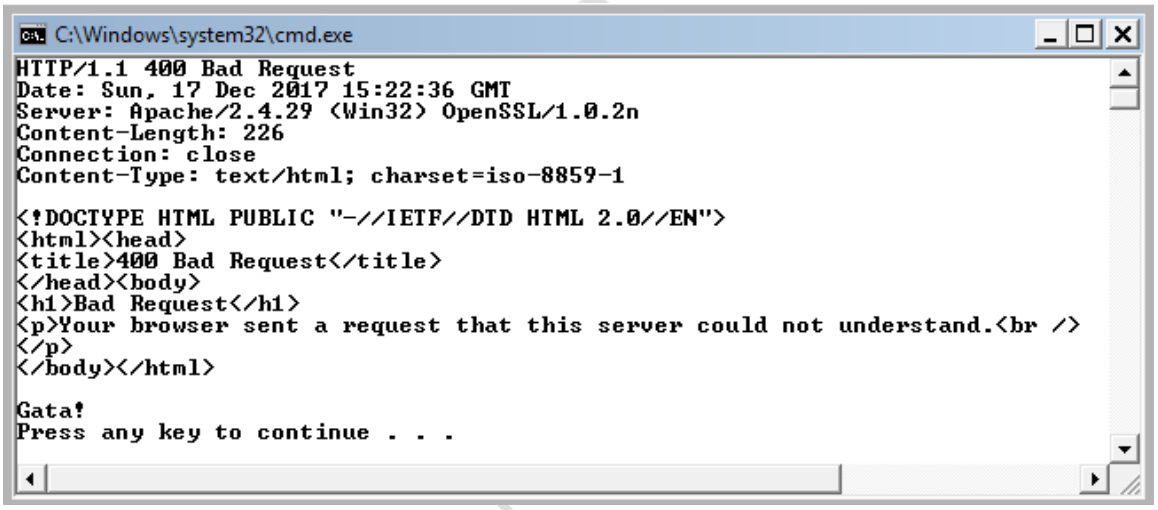
Folderul A3_Nume_Prenume:

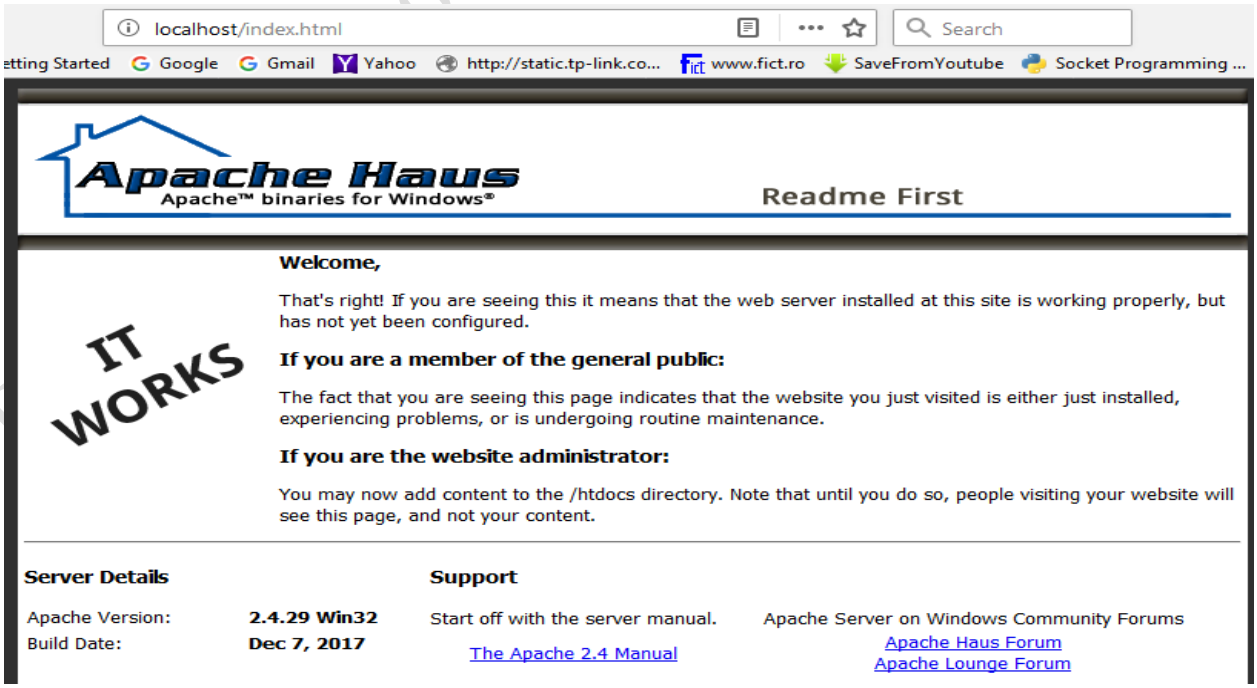


Indicatii:

```
import java.io.*;
import java.net.*;

public class HTTPClient{
    String gazda;
    String fisier;
    int port;
    Socket socket = null;
    DataInputStream dis=null;
    DataOutputStream dos=null;

  public HTTPClient(String adresaURL) throws IOException{
      obtineInfo(adresaURL);
  }

  public void obtineInfo(String adresaURL) throws MalformedURLException{
      //obtinerea unui obiect URL
      URL url=new URL(adresaURL);
      //aflarea gazdei
      gazda=url.getHost();
      //aflarea portului
      port=url.getPort();
      if (port==-1) port=80;
      //obtinerea fisierului
      fisier=url.getFile();
      }

  public void conectare() throws IOException{
      //crearea unui socket pentru comunicare
      socket=new Socket(gazda,port);
      dis= new DataInputStream(socket.getInputStream());
     dos = new DataOutputStream(socket.getOutputStream());
     }

 //realizeaza o cerere get catre masina de la distanta
 public void descarca() throws IOException{
     String mesaj = "GET " + fisier + " HTTP/1.0\r\n\n";
     dos.writeBytes(mesaj);

 //realizeaza o replica a fisierului de pe server pe masina locala
    DataOutputStream fis = new DataOutputStream(
     new FileOutputStream(fisier) );

   int c;
   while( (c=dis.read()) != -1) {
     System.out.print("" + (char) c);
     fis.write(c);
   }
 }
```

```
  public void deconectare() throws IOException{
    dis.close();
    dos.close();
    socket.close();
  }

 public static void main(String[] sir) throws IOException {
    String adresa="http://localhost/index.html";
    HTTPClient pag=new HTTPClient(adresa);
    pag.conectare();
    pag.descarca();
    pag.deconectare();
    System.out.println("\nGata!");
  }
}
```





3.4. Aplicatia A4: Browser Web

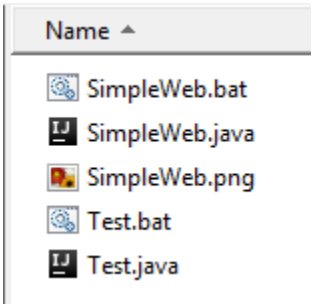
Clasa `javax.swing.JEditorPane` este o componenta grafica capabila sa afiseze cod HTML.
Constructorii clasei JEditorPane sunt:

- `public JEditorPane( )`
- `public JEditorPane(URL initialPage) throws IOException`
- `public JEditorPane(String url) throws IOException`

Pentru a schimba pagina care este afisata se pot folosi metodele

```
public void setPage(URL page) throws IOException
public void setPage(String url) throws IOException
public void setText(String html)
```

Folderul A4_Nume_Prenume:



Aplicatia A4 : Urmatorul program foloseste un JEditorPane pentru a afisa o pagina HTML
Obs: Se porneste serverul Web (vezi Anexa 2)
Indicatii:

SimpleWeb.java:

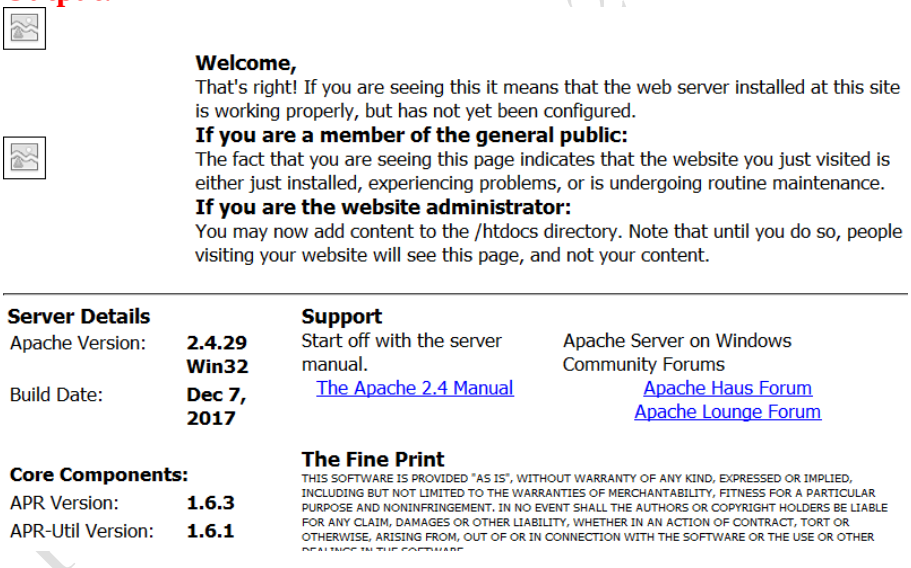
```
import javax.management.openmbean.SimpleType;
import javax.swing.*;
import java.io.*;
import java.awt.*;

public class SimpleWeb extends JFrame{

    public SimpleWeb(String title){

        Container contentPane = getContentPane();

        JEditorPane jep = new JEditorPane();
        jep.setEditable(false);
```

```
        try{
            jep.setPage("http://localhost");
        }catch (IOException e){
            jep.setContentType("text/html");
            jep.setText("<html>Pagina nu a putut fi incarcata</html>");
        }
            JScrollPane scrollPane = new JScrollPane(jep);

            contentPane.add(scrollPane);
    }
}
```

Test.java:

```
import javax.swing.WindowConstants;
public class Test {
    public static void main(String[] args){
        SimpleWeb f = new SimpleWeb("web");
        f.setDefaultCloseOperation(WindowConstants.DISPOSE_ON_CLOSE);
        f.setSize(512, 342);
        f.show();
    }
}
```

Output:



Atunci cand utlizatorul apasa pe un link intr-un `JEditorPane` needitabil , acesta lanseaza un `HyperlinkEvent`. Acest tip de eveniment este capturat de obiecte care implementeaza interfata ascultator `javax.swing.event.HyperlinkListener`. Interfata defineste o singura metoda, si anume

```
public void hyperlinkUpdate(HyperlinkEvent e)
```

Pentru a obtine URL-ul care este referit de link, se utilizeaza metoda `getURL()`.

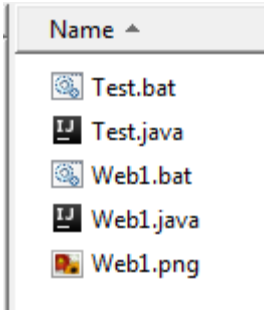
Evenimentele de tipul `HyperlinkEvent` sunt lansate nu numai atunci cand utilizatorul a facut un click pe link, ci si atunci cand cursorul intra sau iese din zona link-ului. Pentru a obtine tipul evenimentului se utilizeaza metoda `getEventType()`

```
public HyperlinkEvent.EventType getEventType()
```

Metoda va intoarce una dintre urmatoarele valori
`HyperlinkEvent.EventType.EXITED`
`HyperlinkEvent.EventType.ENTERED`
`HyperlinkEvent.EventType.ACTIVATED`

3.5 Aplicatia A5: Urmatorul program este un browser simplu de web.
Obs. Se porneste serverul Web (vezi anexa 2)

Folderul A5_Nume_Prenume:



Indicatii:
Web1.java

```
import javax.swing.*;
import javax.swing.text.*;
import javax.swing.event.*;

import java.io.*;
import java.awt.*;


public class Web1 extends JFrame implements HyperlinkListener{

    JEditorPane jep;

    public Web1(String title){

            Container contentPane = getContentPane();

            jep = new JEditorPane();
            jep.setEditable(false);
            jep.addHyperlinkListener(this);
```

```
            try{

                jep.setPage("http://localhost");
            }catch (IOException e){
                jep.setContentType("text/html");
                jep.setText("<html>Pagina nu a putut fi incarcata</html>");
            }
            JScrollPane scrollPane = new JScrollPane(jep);
            contentPane.add(scrollPane);
    }

        @Override
    public void hyperlinkUpdate(HyperlinkEvent evt) {
            // TODO Auto-generated method stub
            if (evt.getEventType() == HyperlinkEvent.EventType.ACTIVATED){
                try {
                    jep.setPage(evt.getURL());
                }catch (Exception e){ System.out.println(e.getMessage());}
            }
    }
}
```

Test.java:

```
import javax.swing.WindowConstants;

public class Test {
    public static void main(String[] args){
        Web1 f = new Web1("Web");
        f.setDefaultCloseOperation(WindowConstants.DISPOSE_ON_CLOSE);
        f.setSize(512, 342);
        f.show();
    }
}
```

Output:

Welcome,
That's right! If you are seeing this it means that the web server installed at this site is working properly, but has not yet been configured.

If you are a member of the general public:
The fact that you are seeing this page indicates that the website you just visited is either just installed, experiencing problems, or is undergoing routine maintenance.

If you are the website administrator:
You may now add content to the /htdocs directory. Note that until you do so, people visiting your website will see this page, and not your content.

Server Details

Apache Version:	**2.4.29 Win32**
Build Date:	**Dec 7, 2017**

Core Components:

APR Version:	**1.6.3**
APR-Util Version:	**1.6.1**

Support

Start off with the server manual.
The Apache 2.4 Manual

Apache Server on Windows Community Forums
Apache Haus Forum
Apache Lounge Forum

The Fine Print

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3.6. Exercitiu: Adaugati browser-ului web o interfata grafica minimala, care sa includa butoane pentru navigare intre pagini, caseta de specificare a URL-ului, etc.

Bibliografie:
http://www.java2s.com/Code/Java/Swing-JFC/CreateasimplebrowserinSwing.htm
http://forum.codecall.net/topic/57029-simple-java-web-browser/
https://alvinalexander.com/blog/post/jfc-swing/how-create-simple-swing-html-viewer-browser-java

3.7 Aplicatia A7: EchoClient-EchoServer SSL (Java)

3.7.1 Consideratii teoretice

SSL – Secure Socket Layer/ TLS – Transport Layer
https://wiki.mozilla.org/Security/Server_Side_TLS ; https://www.trumarkonline.org/docs/default-source/pdfs/all-browsers.pdf?sfvrsn=2; https://docs.microsoft.com/en-us/windows-server/security/tls/tls-schannel-ssp-changes-in-windows-10-and-windows-server ; https://datatracker.ietf.org/wg/tls/charter/ este un protocol de securitate care oferă **comunicare secretă prin Internet**. Protocolul permite aplicaţiilor client / server să comunice astfel incat sa **se împiedice capturarea, modificarea sau falsificarea mesajelor.**
Versiuni: SSL 1.0, 2.0 and 3.0; TLS 1.0 (SSL 3.1); TLS 1.1 (SSL 3.2); TLS 1.2 (SSL 3.3)

Protocolul SSL oferă securitatea conexiunii, având **trei proprietăţi**:

- **Conexiunea este privată -** Criptarea se utilizează după un înţelegerea iniţială pentru definirea cheii secrete. Criptografia simetrică se utilizează pentru criptarea simetrica a datelor (AES, 3DES, RC6 etc.)
- **Identitatea părţilor se autentifică utilizând criptografie asimetrică** (RSA, Curbe eliptice, DSS etc.)
- **Conexiunea este de încredere -** Transportul mesajului include verificarea acestuia cu un MAC (Message Authentication Code) parametrizat. Pentru calcularea MAC-ului se folosesc funcţiile de dispersie SHA, MD5, MAC-uri etc.

Scopurile protocolului SSL, în ordinea priorităţilor sunt:
1. **Securitatea criptografică**: SSL ar trebui să se utilizeze pentru conexiune sigură între două părţi.
2. **Inter-operabilitate**: Programatori independenţi ar trebui să fie capabili de a dezvolta aplicaţii SLL care să funcţioneze cu succes fără ca aceştia să aibă cunoştinţă de codul scris de altcineva.
3. **Extensibilitatea**: SSL încearcă să furnizeze un cadru în care să se integreze metode noi de criptare (simetrică sau asimetrică), acest lucru contribuind la evitarea creării unui protocol nou (riscând implicit să se introducă noi slăbiciuni) şi evitarea scrierii unei biblioteci de securitate noi.
4. **Eficienţa relativă**: Operaţiile criptografice tind să fie puternic procesor intensive, în particular criptografia cu chei publice. Din acest motiv, SSL a înglobat un **mecanism de caching al sesiunii** pentru a reduce numărul de conexiuni ce trebuie stabilite în totalitate.

3.7.2 Certificate

Pentru a crea un certificat putem sa utilizam programul *keytool.exe* care face parte din Java SDK.

https://docs.oracle.com/javase/8/docs/technotes/tools/unix/keytool.html (https://www.ibm.com/support/knowledgecenter/en/SSYKE2_7.0.0/com.ibm.java.security.component.70.doc/security-component/keytoolDocs/keytool_overview.html , http://www.entrust.net/knowledge-base/technote.cfm?tn=8425)
Programul poate fi gasit in directorul `$JAVA_HOME/bin`

Comanda pentru a genera un certficat este

```
keytool -genkey -keystore mySrvKeystore -keyalg RSA
```

Programul va solicita informatii despre proprietarul certificatului precum si o parola. Introduceti parola 123456. Puteti sa folositi orice parola (CEEA CE ESTE SI INDICAT: FOLOSIREA UNEI PAROLE CORECT ALESE....
https://www.sans.org/security-resources/policies/general/pdf/password-protection-policy ; https://www.sans.org/security-resources/policies/general/pdf/password-construction-guidelines) dar in acest caz trebuie modificat si codul programelor/comenzilor. Dupa generare, certificatul va fi salvat in directorul de lucru sub numele de **`mySrvKeystore`**.

Pure-Python Java Keystore (JKS) library
https://pypi.python.org/pypi/pyjks
PyJKS enables Python projects to load and manipulate Java KeyStore (JKS) data without a JVM dependency. PyJKS supports JKS, JCEKS, BKS and UBER (BouncyCastle) keystores

KeyStore Explorer is an open source GUI replacement for the Java command-line utilities keytool and jarsigner. KeyStore Explorer presents their functionality, and more, via an intuitive graphical user interface. **http://keystore-explorer.org/**

3.7.3 EchoClient-EchoServer SSL (Java)

Indicatii:
Pasul 1: Certificate
Pentru a crea un certificat putem sa utilizam programul *keytool.exe* care face parte din Java SDK.
Programul poate fi gasit in directorul `$JAVA_HOME/bin`

Comanda pentru a genera un certficat este:

```
keytool -genkey -keystore mySrvKeystore -keyalg RSA
```

Atentie
Informatii de interes (care trebuies si aplicate !!!!!) cu privire la alegerea corecta a unei parole:
https://www.sans.org/security-resources/policies/general/pdf/password-protection-policy ; https://www.sans.org/security-resources/policies/general/pdf/password-construction-guidelines

Programul va solicita informatii despre proprietarul certificatului precum si o parola. Introduceti parola 123456. Puteti sa folositi orice parola dar in acest caz trebuie modificat si codul programelor. Dupa generare, certificatul va fi salvat in directorul de lucru sub numele de **`mySrvKeystore`**.

EXEMPLU:

```
C:\Users\ep>keytool -genkey -keystore mySrvKeystore -keyalg RSA
Enter keystore password:
Re-enter new password:
What is your first and last name?
  [Unknown]:  student info
What is the name of your organizational unit?
  [Unknown]:  info3
What is the name of your organization?
  [Unknown]:  univ_ov
What is the name of your City or Locality?
  [Unknown]:  cta
What is the name of your State or Province?
  [Unknown]:  cta
What is the two-letter country code for this unit?
  [Unknown]:  ro
Is CN=student info, OU=info3, O=univ_ov, L=cta, ST=cta, C=ro correct?
  [no]:  yes

Enter key password for <mykey>
        (RETURN if same as keystore password):

C:\Users\ep>_
```

Pasul 2: EchoServerSSL

Indicatii:

```
import javax.net.ssl.SSLSocket;
import java.io.*;

public class EchoServerSSL
{
    public static void main(String[] args) {
        try {
            SSLServerSocketFactory sslserverfactory =
                    (SSLServerSocketFactory)SSLServerSocketFactory.getDefault();
            SSLServerSocket sslserversocket =
                    (SSLServerSocket)sslserverfactory.createServerSocket(9999);
            SSLSocket sslsocket = (SSLSocket) sslserversocket.accept();
            InputStream input = sslsocket.getInputStream();
            InputStreamReader inputreader = new InputStreamReader(input);
            BufferedReader br = new BufferedReader(inputreader);
            String string = null;

            while ((string = br.readLine()) != null) {
                System.out.println(string);
                System.out.flush();
            }
        }catch (Exception e) {
            e.printStackTrace();
        }
    }
}
```

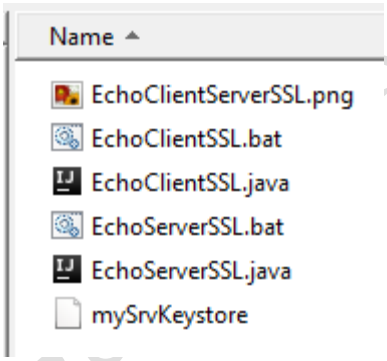
Pasul 3. EchoClientSSL

Indicatii:

```
import javax.net.ssl.SSLSocket;
import javax.net.ssl.SSLSocketFactory;
import java.io.*;

public class EchoClientSSL
{
    public static void main(String[] args) {
        try {
            SSLSocketFactory sslsocketfactory =
                    (SSLSocketFactory) SSLSocketFactory.getDefault();
            SSLSocket sslsocket =
                    (SSLSocket) sslsocketfactory.createSocket("localhost", 9999);
            BufferedReader br = new BufferedReader(new InputStreamReader(System.in));
            OutputStream outputstream = sslsocket.getOutputStream();
            OutputStreamWriter outputwriter = new OutputStreamWriter(outputstream);
            BufferedWriter bw = new BufferedWriter(outputwriter);
            String string = null;
            while ((string = br.readLine()) != null) {
                bw.write(string + '\n');
                bw.flush();
            }
        } catch (Exception e) {
            e.printStackTrace();
        }
    }
}
```

Folderul A7_Nume_Prenume:



Pasul 4. Rularea aplicatiei client-server SSL

Certificatul creat la pasul 1 trebui copiat in directorul care contine fisierul bytecode pentru Server si acesta trebuie lansat folosind comanda

EchoServerSSL 12/18/2017 4:17 PM Windows Batch File

```
@echo OFF
@echo ServerSSL
@echo:
javac EchoServerSSL.java
java -Djavax.net.ssl.keyStore=mySrvKeystore -Djavax.net.ssl.keyStorePassword=123456 EchoServerSSL
pause
```

```
java -Djavax.net.ssl.keyStore=mySrvKeystore
     -Djavax.net.ssl.keyStorePassword=123456
      EchoServerSSL
```

EchoClientSSL 12/18/2017 4:16 PM Windows Batch File

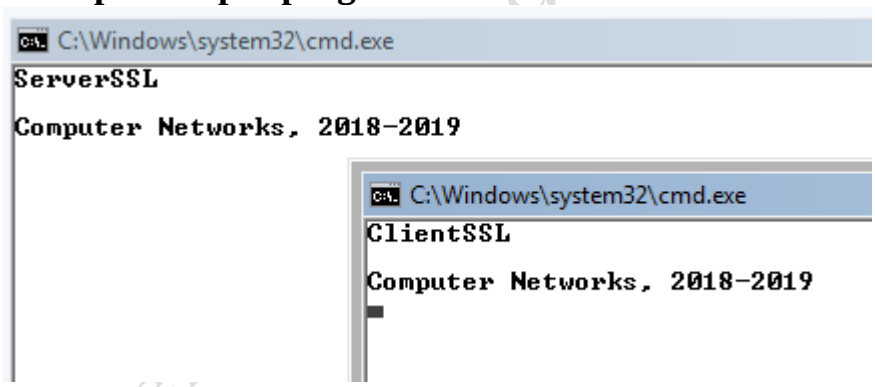
```
@echo OFF
@echo ClientSSL
@echo:
javac EchoClientSSL.java
java -Djavax.net.ssl.trustStore=mySrvKeystore -Djavax.net.ssl.trustStorePassword=123456 EchoClientSSL
pause
```

Daca au fost utilizate alte valori la crearea certificatului, comanda trebuie modificata corespunzator.

Copiati certificatul in directorul care contine fisierul class pentru Client si lansati comanda

```
java -Djavax.net.ssl.trustStore=mySrvKeystore
     -Djavax.net.ssl.trustStorePassword=123456
      EchoClientSSL
```

Exemplu Output program:



3.8 Exercitiu (TEMA !!!!!)

- Realizati o aplicatie **client-server SSL** (Solutie Java/Python, C etc...) care foloseste protocolul TCP: un “joc” al carui scop este ghicirea unui numar. Atunci cand serverul este pornit el va salva un numar aleator intre 0 si 500.

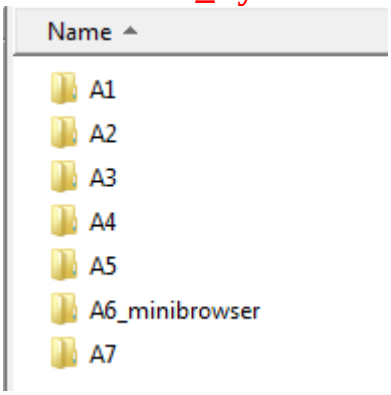
Indicatie (0-500):

```
int randomNumber=(int)(Math.random()*500);
```

- Clientul va citi numere de la tastatura si va trimite aceste numere la server. Serverul va raspunde prin mesaje (MARE, MIC, CORECT). Clientul trebuie sa poata introduce numere pana cand primeste valoarea CORECT.

3.9. Aplicatii Python

Folderul 3.9_Python:



Fiecarea subfolder A_i contine fisierele A_i.py si A_i.png

Aplicatia A1: Program care afiseaza informatiile continute intr-un obiect URL

Indicatii:

A1.py

```
1  # http://pythonprogramming.net/parse-website-using-regular-expressions-urllib/
2  import urllib.request
3  import re
4
5  url = 'https://www.python.org/'
6
7  req = urllib.request.Request(url)
8  resp = urllib.request.urlopen(req)
9  respData = resp.read()
10 paragraphs = re.findall(r'<p>(.*?)</p>',str(respData))
11 for eachP in paragraphs:
12     print(eachP)
```

Output:

```
(base) C:\Users\ >python A1.py
<strong>Notice:</strong> While Javascript is not essential for t
he content will be limited. Please turn Javascript on for the fu
<strong>Notice:</strong> Your browser is <em>ancient</em> and <a
>Microsoft agrees</a>. <a href="http://browsehappy.com/">Upgrade
ef="http://www.google.com/chromeframe/?redirect=true">install Go
a better web.
The core of extensible programming is defining functions. Python
ents, keyword arguments, and even arbitrary argument lists. <a h
ntrolflow.html#defining-functions">More about defining functions
Lists (known as arrays in other languages) are one of the compou
s. Lists can be indexed, sliced and manipulated with other built
n.org/3/tutorial/introduction.html#lists">More about lists in Py
Calculations are simple with Python, and expression syntax is st
</code>, <code>-</code>, <code>*</code> and <code>/</code> work
ode> can be used for grouping. <a href="http://docs.python.org/3
thon-as-a-calculator">More about simple math functions in Python
Experienced programmers in any other language can pick up Python
```

Aplicatia A2. Programul permite citirea datele referite de un obiect URL si afisarea acestora intr-o forma neprelucrata.

Indicatii:

A2.py

```
1  #https://www.pythonforbeginners.com/requests/using-requests-in-python
2  import requests
3
4  link = "https://www.python.org/"
5  f = requests.get(link)
6  print(f.text)
```

Aplicatia A3: Obtinerea unei pagini Web prin intermediul unui socket

Aplicatia A4: Browser Web

Aplicatia A5 (Challenge): Adaugati browser-ului web o interfata grafica minimala, care sa includa butoane pentru navigare intre pagini, caseta de specificare a URL-ului, etc.

Aplicatia A6 (Challenge): EchoClient-EchoServer SSL

Indicatii: Recapitulare Python

- Python_intro (Lab_02, Lab_03)
- Programare_Python (Lab_02, Lab_03)
- Byte-of-python (Lab_02, Lab_03)
- Python socket network programming_1 (Lab_08)
- Python socket network programming_2 (Lab_08)
- Python Files and os.path (Lab_09)
- Programarea socket-urilor de retea in Python (Lab_09: BasicsOfSockets.pdf)
- Multithreading in Python (Lab_10)

Obs: Anexa 4 - The Programming Process (pag.35)

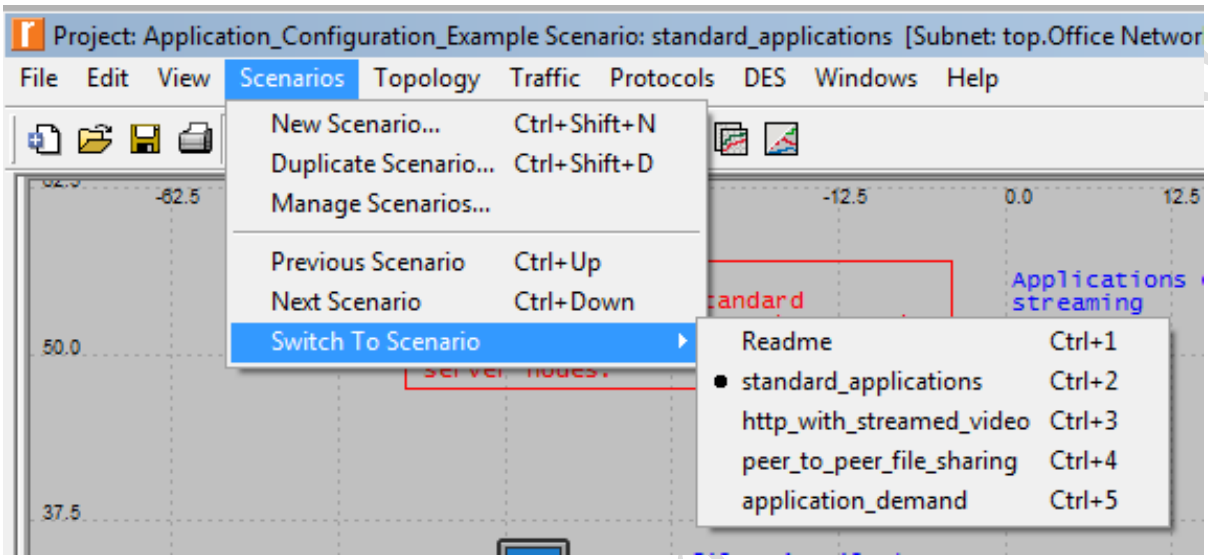
Challenge: Interfata grafica

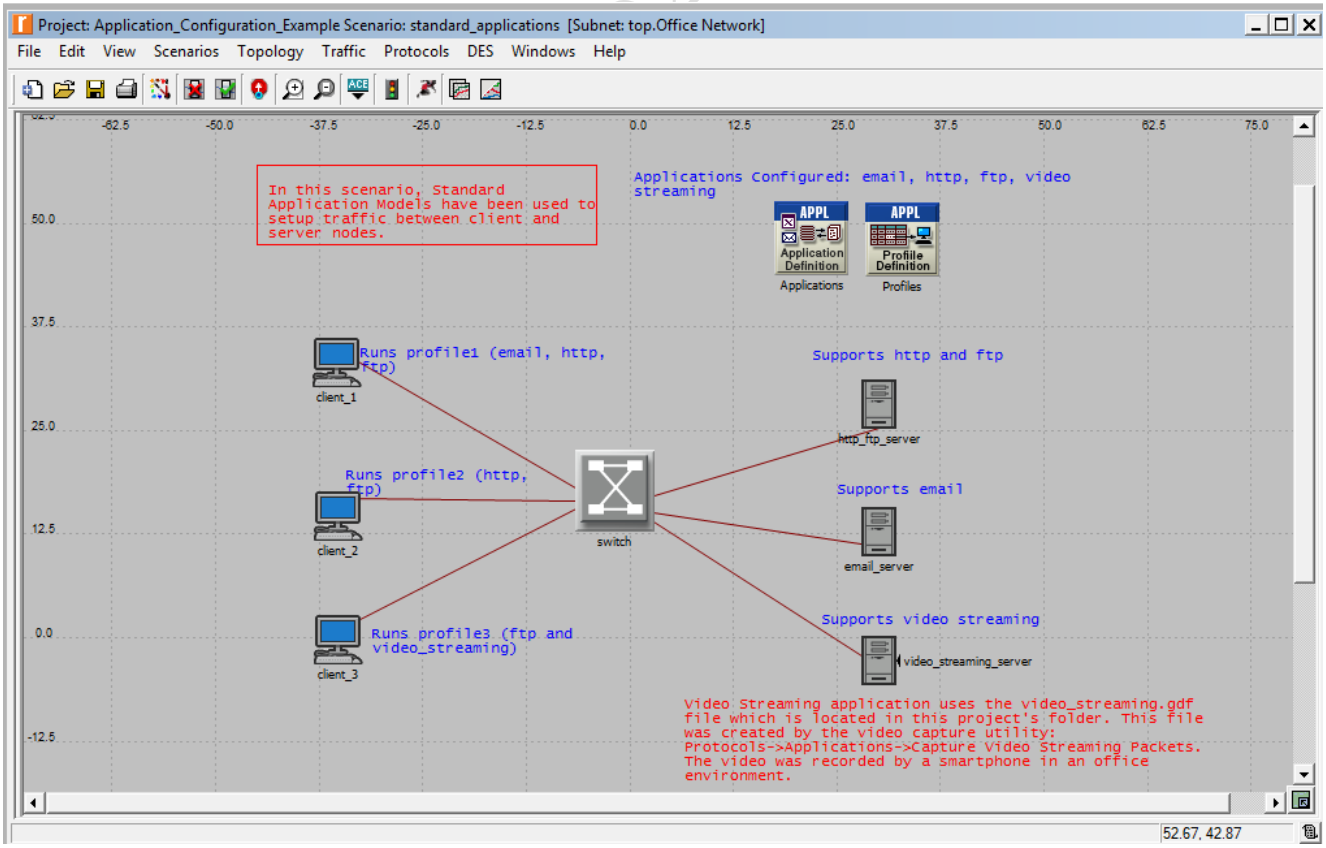
Recomandare: Qt Designer , cu Designer din Anaconda prompt).
http://pythonforengineers.com/your-first-gui-app-with-python-and-pyqt/, https://www.codementor.io/deepaksingh04/design-simple-dialog-using-pyqt5-designer-tool-ajskrd09n, https://wiki.python.org/moin/PyQt/Tutorials

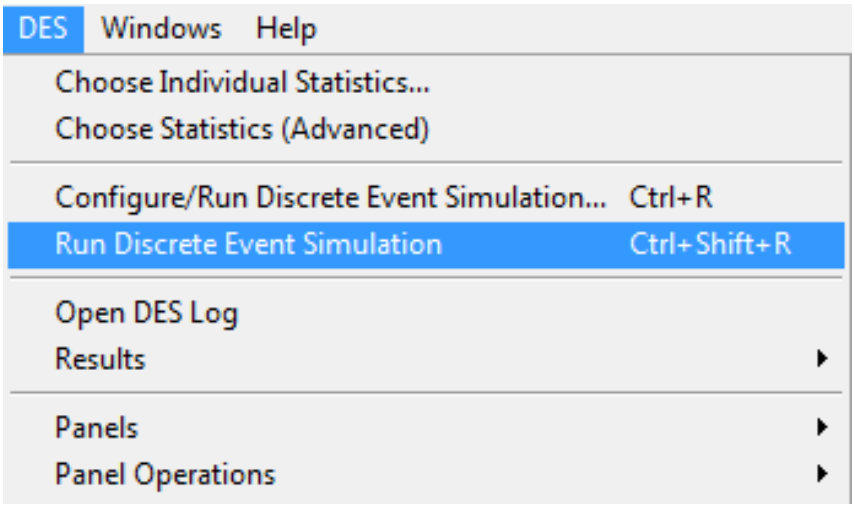
3.10. Aplicatie Modeler

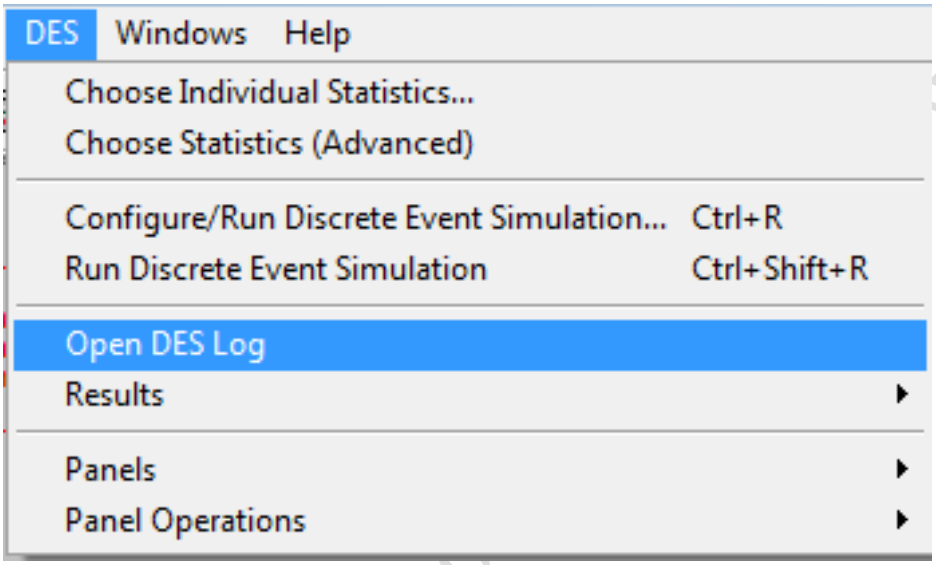
3.10.1. Standard Applications

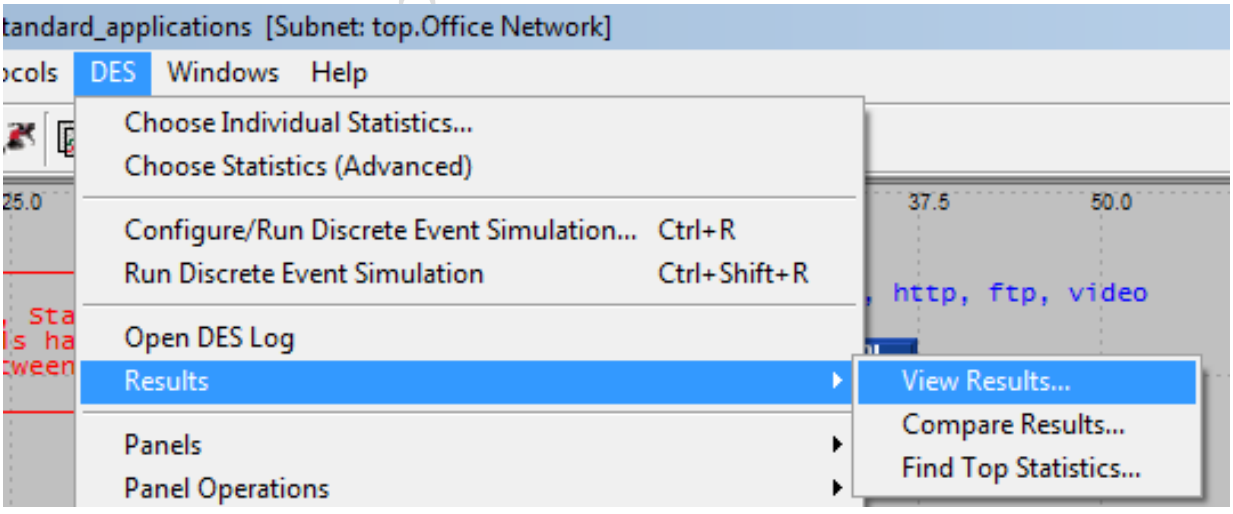
Riverbed ➔ example_networks/Application_Configuration_Example.project



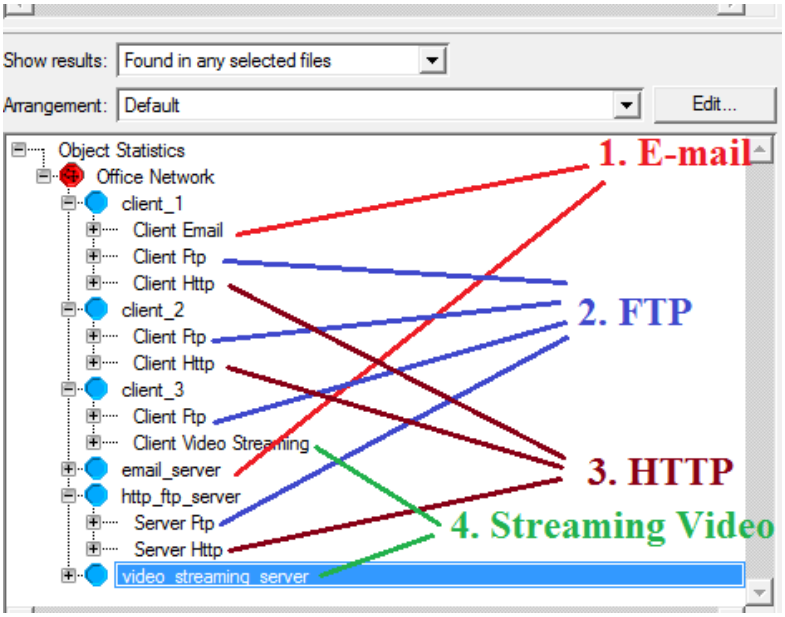



DES
Windows
Help
Choose Individual Statistics...
Choose Statistics (Advanced)
Configure/Run Discrete Event Simulation... Ctrl+R
Run Discrete Event Simulation Ctrl+Shift+R
Open DES Log
Results
Panels
Panel Operations

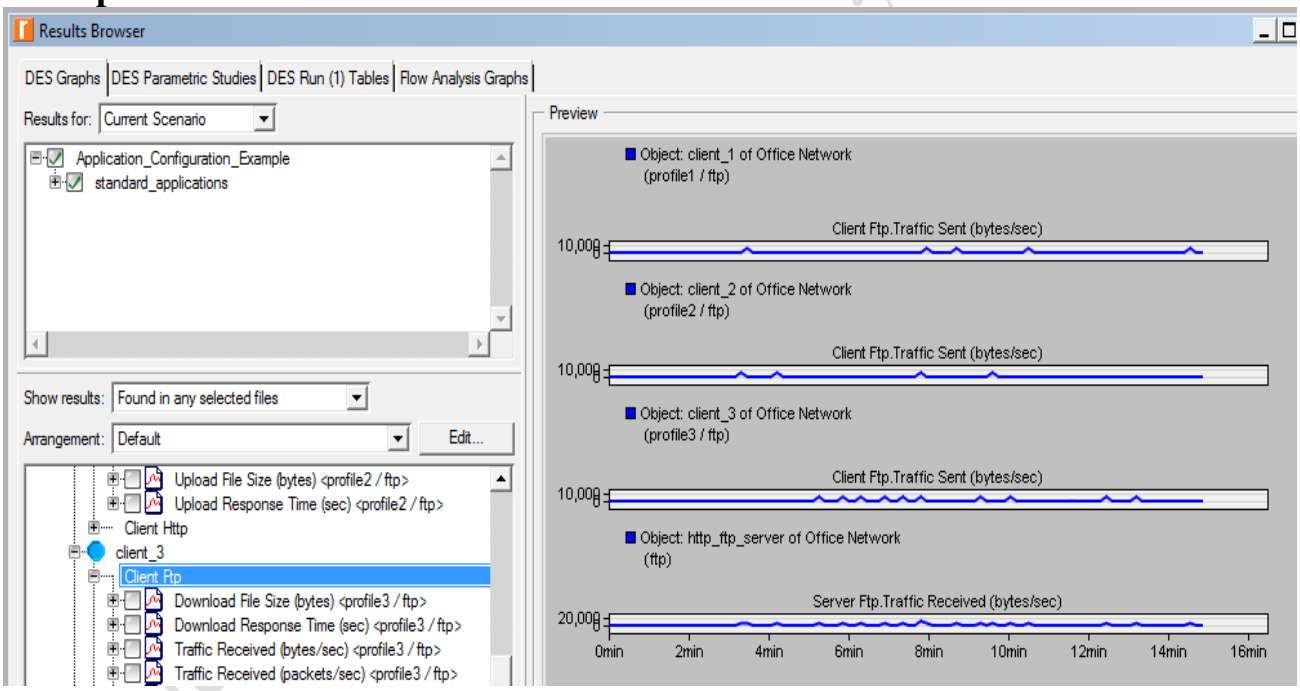

DES
Windows
Help
Choose Individual Statistics...
Choose Statistics (Advanced)
Configure/Run Discrete Event Simulation... Ctrl+R
Run Discrete Event Simulation Ctrl+Shift+R
Open DES Log
Results
Panels
Panel Operations


tandard_applications [Subnet: top.Office Network]
DES
Windows
Help
Choose Individual Statistics...
Choose Statistics (Advanced)
Configure/Run Discrete Event Simulation... Ctrl+R
Run Discrete Event Simulation Ctrl+Shift+R
Open DES Log
Results
Panels
Panel Operations
View Results...
Compare Results...
Find Top Statistics...
25.0
37.5
50.0
http, ftp, video

RESULTS:



Example:



3.10.2. Simularea traficului FTP intr-o retea si analiza throughput-ului

Solutie propusa: FTP_simulation.mp4

==========

Observatii TEMA!!!!!

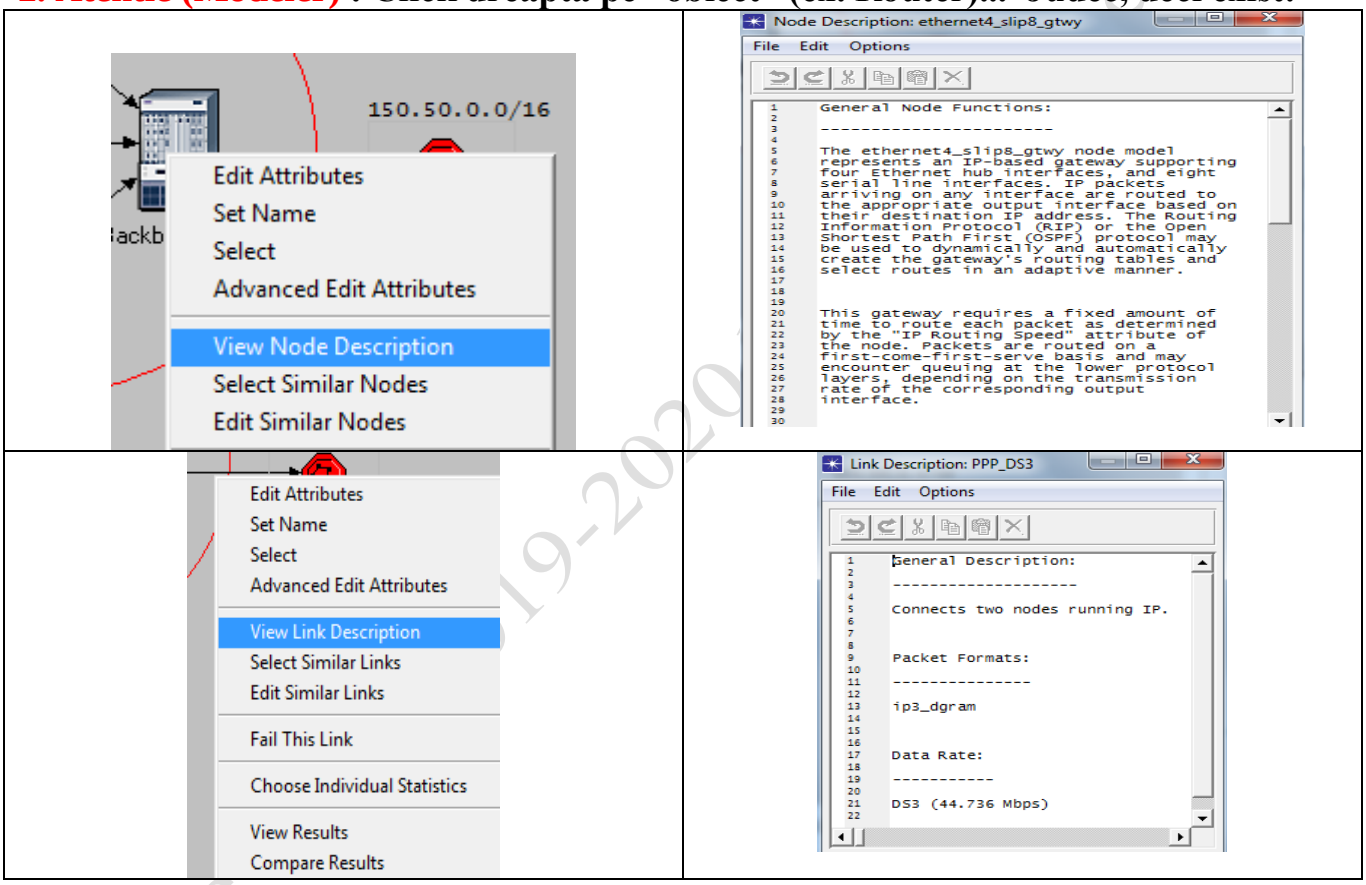
1. **Atentie (Modeler)** – Proiectul creat se salveaza implicit in:
   C:\Users\student(NUME user)\op_model\NUME_PROIECT

NUME_PROIECT ***contine proiectul modeler propriu-zis***

Varianta:

- In directorul **....\Studenti\Info3\Nume_Prenume** se creează directorul (**pentru punctul 3.3**) **\L11_3.3_Modeler_Nume_Prenume** folosind:
  - ***File → New → Folder***
- Se lansează în execuţie Modeler.
- Se selectează directorul în care vor fi plasate fişierele proiectului.
  - ***File → Model Files →Add Model Directory***
  - Se selectează directorul în care se va lucra (în acest director vor fi salvate fişierele proiectului curent)
  - Se arhiveaza **L11_3.3_Modeler_Nume_Prenume**

2. Atentie (Modeler) : Click dreapta pe "obiect" (ex. Router)..."Judec, deci exist!"



…..similar omnet++….. (http://www.omnetpp.org)

4. Tema:

- **Toate punctele din sectiunea 3 "partea practica"** se vor relua de catre cursanti, folosind etapele de lucru indicate. Rezultatele experimentale:
  - **L11_nume+prenume_java (folder) - contine subfolderele 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8 , fiecare subfolder cu fisierele .java, .bat, .png (Snipping Tool), insotite de un *readme.txt* pentru particularitati de rulare, conform prezentarilor facute.**
  - **L11_nume+prenume_Python (folder) - contine subfolderele A1, A2, A3, A4, A5, A6, fiecare subfolder cu fisierele .py, .png (Snipping Tool) si .doc(readme, observatii) pentru toate aplicatiile Python de la punctul 3.9.**

- **L11_nume_prenume_Modeler (folder) - contine subfoldere 3.10.1 si 3.10.2 fiexare cu proiectulcModeler + .png + .doc (comentarii, observatii) corespunzatoare punctului 3.10.**

se vor arhiva cu numele **L11_nume+prenume_info3.rar si** se va trimite prin e-mail la adresa **reteleccdsd@gmail.com** precizandu-se la **subject: L11_nume+prenume_info3**, pana pe data de **20 decembrie 2019 e.n., ora 8.00 a.m. (Atentie, gmail nu "prea vrea" .rar in .rar http://www.makeuseof.com/tag/4-ways-email-attachments-file-extension-blocked).**
VARIANTA pentru trimiterea arhivei: http://www.wetransfer.com

Cursantii sunt incurajati sa analizeze si sa comenteze rezultatele obtinute, studiind si materialele indicate in bibliografie si anexe. **(+ Recapitulare Laboratoarele 1+2+3+4+5+6+7+8+9+10)** (Pentru Modeler, varianta "programare" C++: **OMNeT++ Network Simulation Framework** http://www.omnetpp.org/;

Obs:

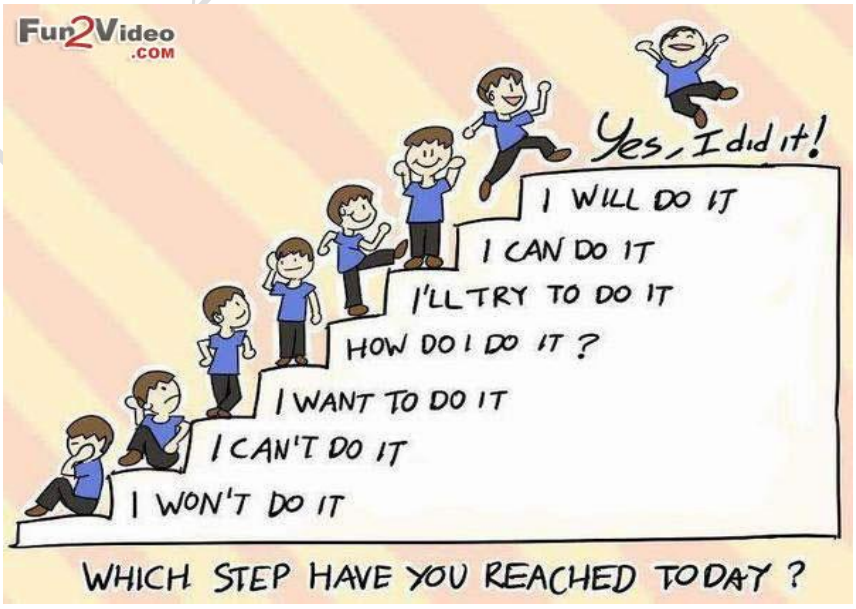
Punctaj maxim (Data trimiterii temei)			
<= 20.12. 2019	**24.12. 2019**	**28.12.2019**	**3.01.2020**
100 pct	**80 pct**	**60 pct**	**50 pct**

Obs: Participarea (activa!) la Curs si Laborator permite, prin cunostintele acumulate, obtinerea unor rezultate bune si f. bune, asa cum ni le dorim cu totii.

DE ANALIZAT readme-ul readme_mod_work_dir.pdf (si un numai!... de exemplu si **readme_lab_modeler.pdf) de la adresa http://www.cdsd.ro**

OBSERVATIE:

Cursantii sunt incurajati sa foloseasca materialele prezentate intr-un mod constructiv, astfel incat sa evalueze caracteristicile legaturilor fizice si ale dispozitivelor de retea folosite (click dreapta, view link/node description), a modelelor de retea precum si elementele de baza privind simularea sistemelor discrete de evenimente analizate; rezultatele obtinute grafic vor fi analizate si interpretate in contextul cerintelor formulate + **Modeler Tutorials**



Sursa: http://www.funnfun.in/wp-content/uploads/2013/06/steps-of-success-encouraging-quote.jpg

How to send an e-mail

http://lifehacker.com/5803366/how-to-send-an-email-with-an-attachment-for-beginners
https://support.google.com/mail/answer/6584?hl=en "As a security measure to prevent potential viruses, Gmail doesn't allow you to send or receive executable files (such as files ending in `.exe`)."
https://support.google.com/mail/answer/2480713?hl=en
http://fastupload.ro/free.php
http://www.computerica.ro/siteuri-transfer-fisiere-mari-upload/

Bibligrafie:

Lab_01, Lab_02, Lab_03, Lab_04, Lab_05, Lab_06, Lab_07, Lab_08, Lab_09, Lab_10, TL_01 etc, http://www.cdsd.ro/cursuri

http://support.microsoft.com/kb/140859
http://www.windowsreference.com/windows-2000/how-to-add-static-route-in-windows-xp2000vista/
http://www.comptechdoc.org/os/linux/usersguide/linux_ugrouting.html
http://linux-ip.net/html/ch-routing.html
http://www.3com.com/other/pdfs/infra/corpinfo/en_US/501302.pdf
http://www.microsoft.com/resources/documentation/windows/xp/all/proddocs/en-us/route.mspx?mfr=true

efg' Mathematics, http://www.efg2.com/Lab/Mathematics/CRC.htm
Java API, https://docs.oracle.com/javase/8/docs/api/
Java Tutorial, Writing Your Own Filtered Streams http://www.rgagnon.com/javadetails/java-0416.html

http://en.wikipedia.org/wiki/Cyclic_redundancy_check
http://www34.brinkster.com/dizzyk/crc32.asp
http://www.createwindow.com/programming/crc32/crcfile.htm
http://webnet77.com/cgi-bin/helpers/crc.pl
http://www.softpedia.com/get/Others/Miscellaneous/CRC32-Calculator.shtml
http://www.wikiera.net/EthernetCRC-readytouseexample.html
http://www.wireshark.org/docs/wsug_html_chunked/ChAdvChecksums.html

Modeler Tutorials

https://rpmapps.riverbed.com/ae/4dcgi/SIGNUP_NewUser
https://supportkb.riverbed.com/support/index?page=content&id=S24443
https://rpmapps.riverbed.com/ae/4dcgi/DOWNLOAD_HOME
https://rpmapps.riverbed.com/ae/4dcgi/REG_TransactionCode

- Install Riverved Modeler 17 5 Windows 10, 8 1, 8 and 7 (https://www.youtube.com/watch?v=TpenN2jYbHQ)
- Install Riverbed Modeler (https://www.youtube.com/watch?v=DQ3XhHYuFGA)
- How to activate riverbed modeler 17.5 (https://www.youtube.com/watch?v=h-ImeJMqiSA)
- How to solve invalid activation of Opnet Modeler 17.5 (https://www.youtube.com/watch?v=13ZBcXkW46s)
- Riverbed Modeler 17.5 Tutorial - Switched Lan (https://www.youtube.com/watch?v=XdebwQLrr0w)

- 6-Virtual LAN (VLAN) configuration in OPNET Riverbed (https://www.youtube.com/watch?v=Ajz7bVO5WJM)
- Riverbed Modeler Configuracion VLAN (https://www.youtube.com/watch?v=rP3jPMcyEFk)
- Ethernet (lab_04)
- Riverbed Opnet 17.5 Tutorial - The Ethernet network (https://www.youtube.com/watch?v=fS_J6ApFJtc)
- 6-Virtual LAN (VLAN) configuration in OPNET Riverbed (https://www.youtube.com/watch?v=Ajz7bVO5WJM)
- Riverbed Modeler Tutorial 3 Configuracion VLAN (https://www.youtube.com/watch?v=rP3jPMcyEFk)

Python (Lab1, Lab2)
Using Python on Windows - https://docs.python.org/3/using/windows.html
The Hitchhiker's Guide to Python - http://docs.python-guide.org/en/latest/intro/learning/
A Byte of Python - https://www.gitbook.com/book/swaroopch/byte-of-python/details
GUI Programming in Python - https://wiki.python.org/moin/GuiProgramming
https://winpython.github.io/ ; https://www.python.org/
https://social.technet.microsoft.com/wiki/contents/articles/910.windows-7-enabling-telnet-client.aspx
http://www.telnet.org/htm/places.htm
rainmaker.wunderground.com : weather via telnet!

https://docs.python.org/3/library/socket.html
18.1. socket — Low-level networking interface

Java Sockets
http://download.oracle.com/javase/tutorial/networking/sockets/
http://www.oracle.com/technetwork/java/socket-140484.html

Pyton Sockets
http://docs.python.org/howto/sockets.html

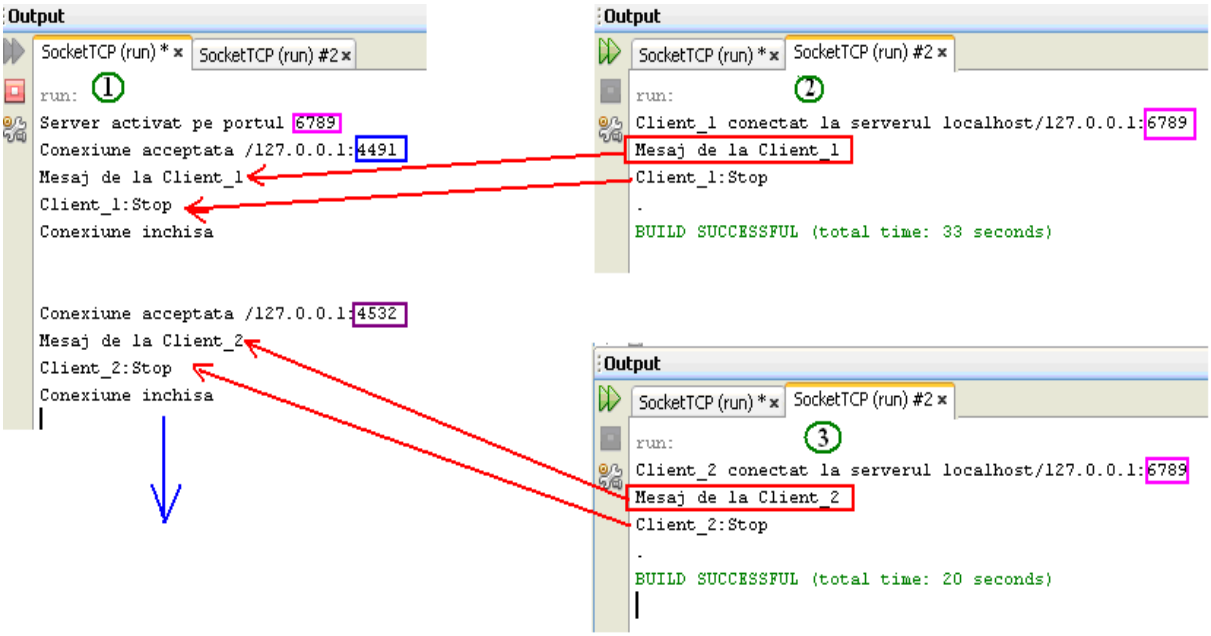
C++ Sockets
http://www.linuxhowtos.org/C_C++/socket.htm
http://cs.baylor.edu/~donahoo/practical/CSockets/winsock.html

PHP Sockets
http://www.php.net/manual/en/book.sockets.php

Perl Socket
http://www.devshed.com/c/a/Perl/Socket-Programming-in-PERL/

Ruby Sockets
http://en.wikibooks.org/wiki/Ruby_Programming/Reference/Objects/Socket
https://www6.software.ibm.com/developerworks/education/l-rubysocks/l-rubysocks-a4.pdf
http://www.tutorialspoint.com/ruby/ruby_socket_programming.htm
etc....

Anexa 1 - Exemplu comentariu



Anexa 2 – Instalare si rulare sever Apache

http://httpd.apache.org/download.cgi
http://httpd.apache.org/docs/2.4/

Apache http://httpd.apache.org/download.cgi - este cel mai popular server Web, fiind rezultatul unei initiative open-source. Este extrem de rapid, stabil si modular. Principalul scop al aplicatiei este acela de a asigura un server eficient, sigur si extensibil care sa furnizeze servicii HTTP in concordanta cu actualele standarde HHTP.
Competitori ai serverului Apache:

- Microsoft Internet Information Services (IIS) - http://www.iis.net/downloads
- Oracle iPlanet Web Server - http://www.oracle.com/technetwork/java/webtier/downloads/iplanet-webserver-525365.html

Apache este folosit de unele din cele mai mari situri din lume; exemplu: motorul de căutare folosit de Google foloseşte Google Web Server (GWS) http://code.google.com/webtoolkit/ - o versiune modificată de Apache; proiectele Wikimedia inclusiv Wikipedia rulează pe un server Apache.

Anexa 3

- **Create client-server application for web service in Java**
  https://www.codejava.net/java-ee/web-services/create-client-server-application-for-web-service-in-java
  https://docs.oracle.com/javaee/5/tutorial/doc/bnayn.html
- **Client-Side Web Programming**
  https://wiki.python.org/moin/WebClientProgramming
- **Simple HTTP server and client in Python**
  https://www.junian.net/2014/07/simple-http-server-and-client-in-python.html

Anexa 4: The Programming Process

1. Identify the Problem - **What** Are You Trying To Do?
    - Requirements
    - Specification
2. Design a Solution - **How** Is It Going To Be Done?
3. Write the Program - **Teaching** the Computer
    - Code
    - Compile
    - Debug
4. Check the Solution - **Testing** it Understands You