JOHNS HOPKINS
BLOOMBERG
SCHOOL of PUBLIC HEALTH

Summer Institute / HIT Series

Computer Systems and the Web/Databases

Hadi Kharrazi *MHI MD PhD*

kharrazi@jhu.edu

Johns Hopkins University

- *School of Public Health*
- *School of Medicine*

1.5 hrs / ~75 slides

Overview

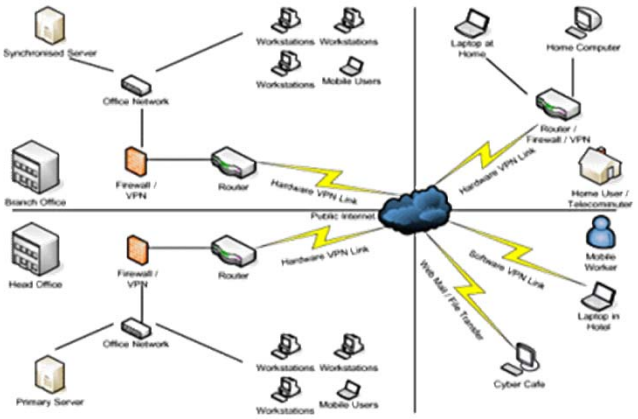
- Networking Overview
  - Network Topology
  - IP Address
  - Domain Name
  - Network Devices
- Web Server Technology Overview
  - Static Languages (e.g., HTML)
  - Server Side Languages (e.g., PHP)
  - Databases (e.g., MySQL)
  - Server Side Integration (HTML/PHP/MySQL)
- Database Overview
  - Relational Databases
  - MySQL GUI
  - SQL Language
- Resources
  - Books
  - Web

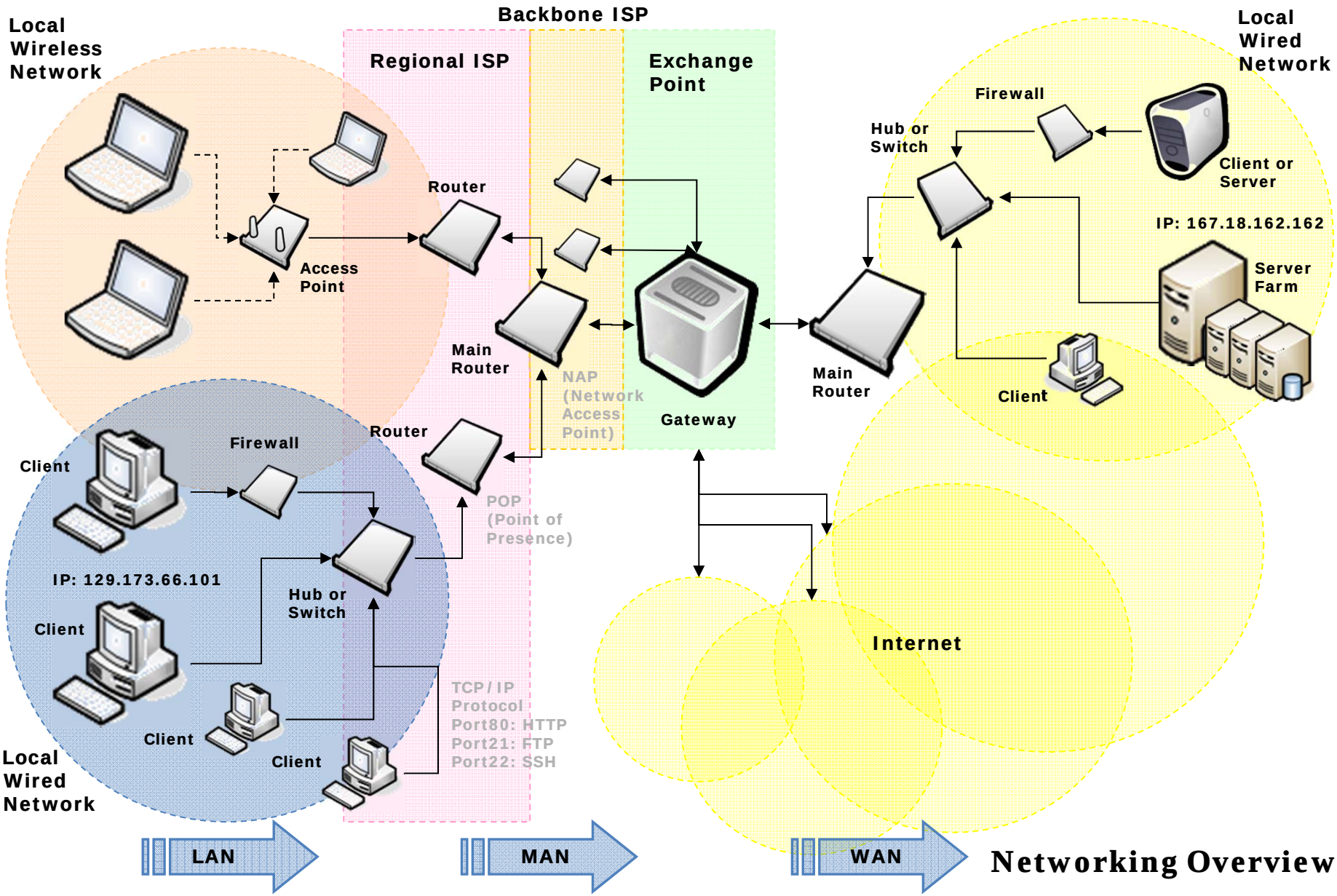
JOHNS HOPKINS
BLOOMBERG
SCHOOL of PUBLIC HEALTH

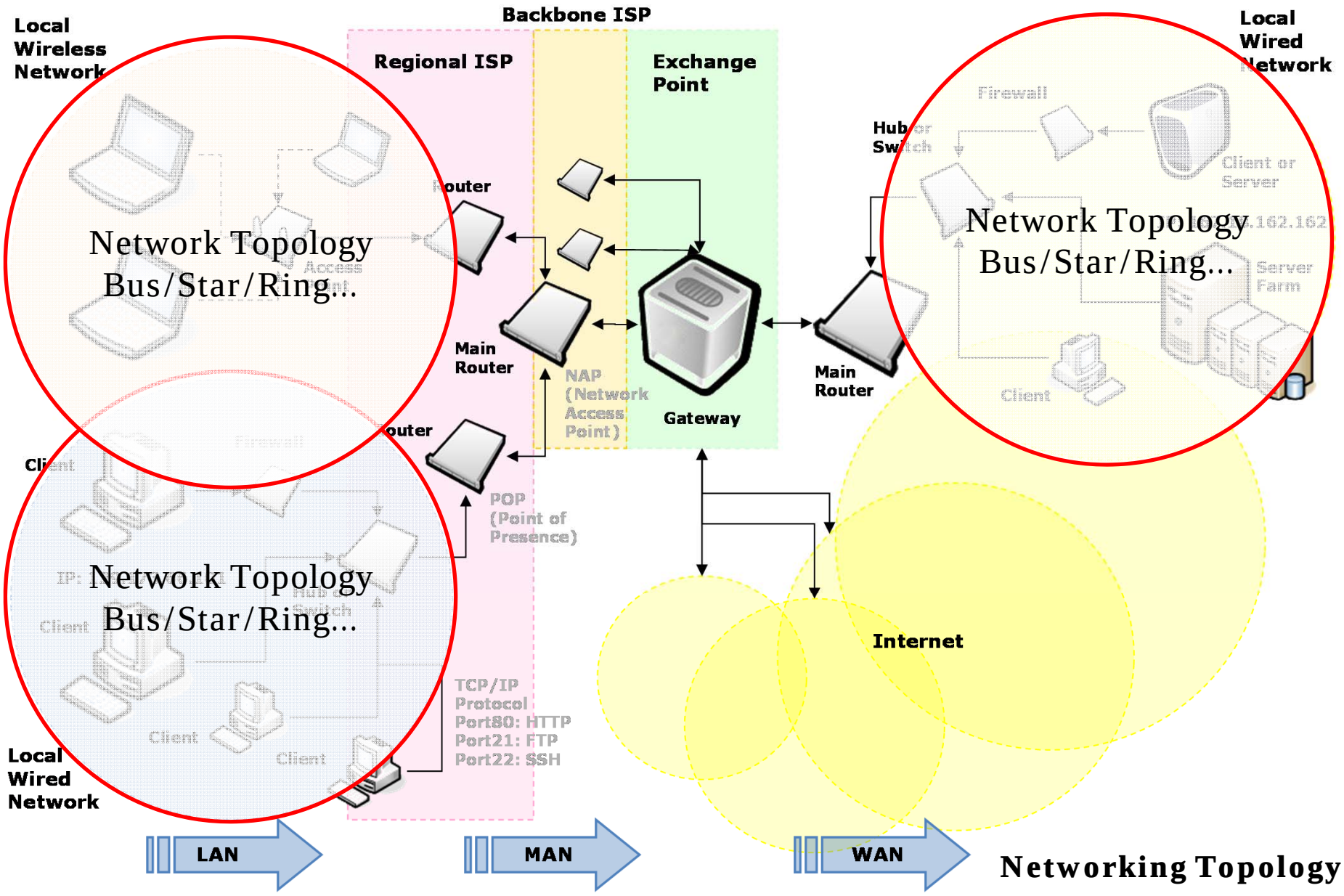
Networking Overview

Networking Overview

- Networking is the construction, design, and use of network, including the physical (cabling, hub, switch, router, bridge, gateway, backbone and etc.), the selection and use of telecommunication protocol and computer software for using and managing the network, and the establishment of operation policies and procedures related to the network.
- OSI (open systems interconnected) has 7 layers... physical to application layer!
- Common Terms: Client, Server, Network (LAN, MAN, WAN), Hub, Switch, Router, Gateway, Backbone, Bridge



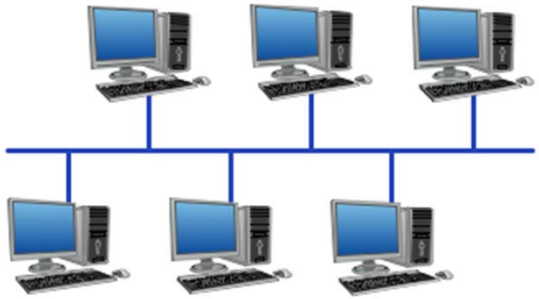

Local Wireless Network
Backbone ISP
Regional ISP
Exchange Point
Local Wired Network
Firewall
Hub or Switch
Client or Server
IP: 167.18.162.162
Server Farm
Router
Access Point
Main Router
NAP (Network Access Point)
Gateway
Main Router
Client
Router
Firewall
Client
POP (Point of Presence)
IP: 129.173.66.101
Hub or Switch
Client
Client
Client
TCP/IP Protocol
Port80: HTTP
Port21: FTP
Port22: SSH
Internet
Local Wired Network
LAN
MAN
WAN
Networking Overview


Backbone ISP
Local Wireless Network
Regional ISP
Exchange Point
Local Wired Network
Network Topology Bus/Star/Ring...
Router
Main Router
NAP (Network Access Point)
Gateway
Main Router
Firewall
Hub or Switch
Client or Server
Server Farm
Client
Router
POP (Point of Presence)
Network Topology Bus/Star/Ring...
Client
Client
Client
TCP/IP Protocol
Port80: HTTP
Port21: FTP
Port22: SSH
Internet
Local Wired Network
LAN
MAN
WAN
Networking Topology

Networking Overview → Topology (cont.)

- A network is a series of points or nodes interconnected by communication paths.
- General configurations of networks is called Topology of network.
- The most common topologies:
  - Bus
  - Star
  - Ring

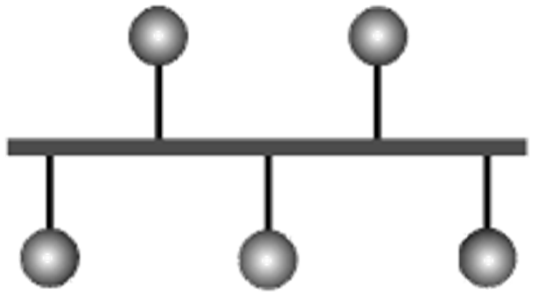
Fully Connected Network Topology



Common Bus Topology

Networking Overview → Topology (cont.)

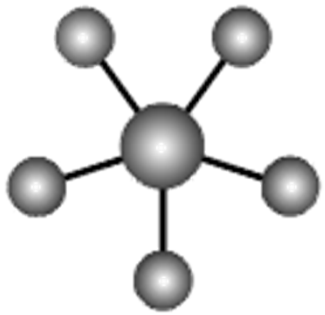
- **Bus topology**
  - All devices are attached to a line directly
  - All signals pass through each of the devices
  - Each device has a unique identity and can recognize those signals intended for it



Bus network

Networking Overview → Topology (cont.)

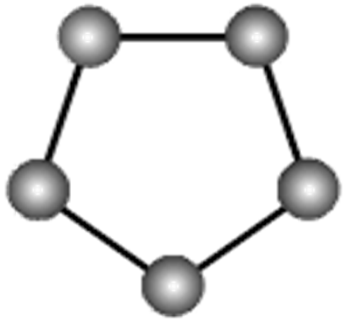
- **Star topology**
  - There is a central computer or server to which all the workstations are directly connected
  - Every workstation is indirectly connected to every other through the central computer



Star network

Networking Overview → Topology (cont.)

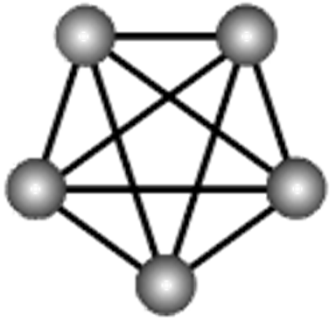
- **Ring topology**
  - The workstations are connected in a closed loop configuration
  - Adjacent pairs of workstations are directly connected
  - Other pairs of workstations are indirectly connected, the data passing through one or more intermediate nodes



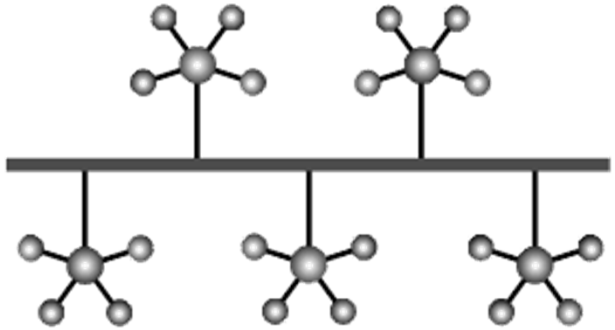
Ring network

Networking Overview → Topology (cont.)

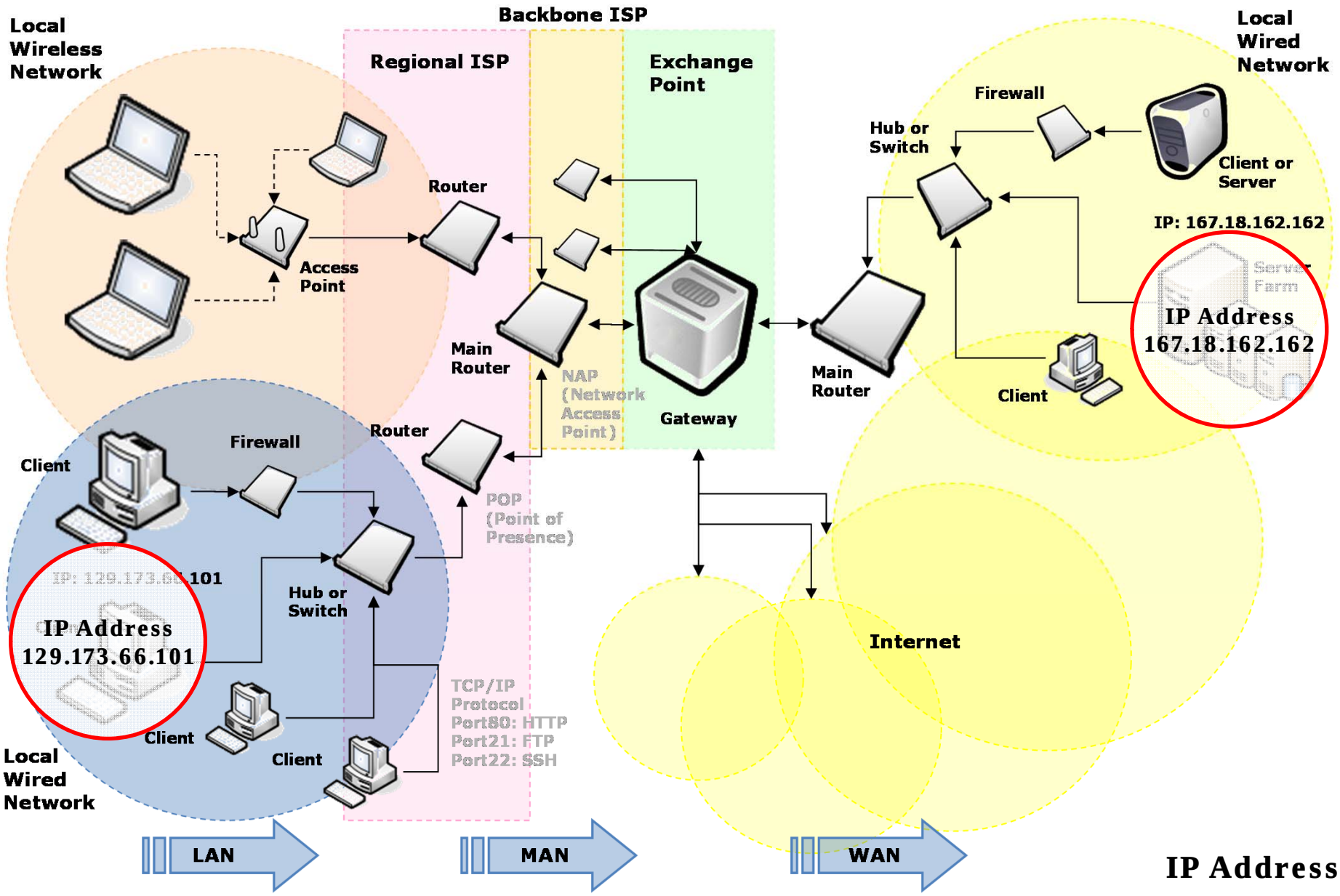
- **Hybrid topologies**
  - Mesh network: each workstation is connected directly to each of the others
  - Tree network: uses two or more star networks connected together. A tree network is a bus network of star networks



Mesh network



Tree network


Local Wireless Network
Backbone ISP
Regional ISP
Exchange Point
Local Wired Network
Firewall
Hub or Switch
Client or Server
IP: 167.18.162.162
Router
Access Point
Main Router
NAP (Network Access Point)
Gateway
Main Router
IP Address 167.18.162.162
Client
Router
Firewall
Client
POP (Point of Presence)
IP: 129.173.66.101
Hub or Switch
IP Address 129.173.66.101
Internet
TCP/IP Protocol
Port80: HTTP
Port21: FTP
Port22: SSH
Client
Client
Local Wired Network
LAN
MAN
WAN
IP Address

Networking Overview → IP Address (cont.)

IP Address

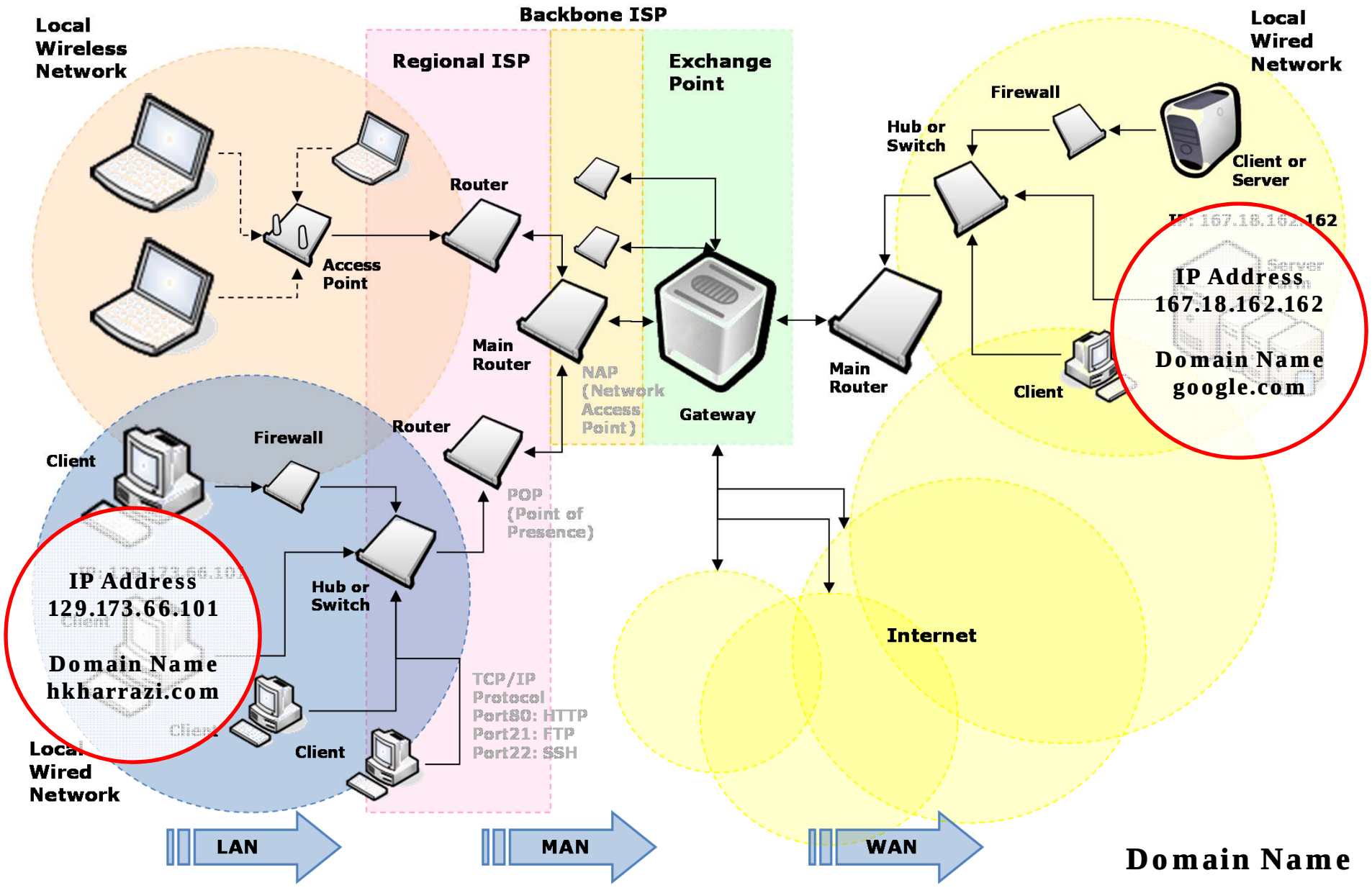
- Every machine on the Internet has a unique identifying number, called an IP Address.
- A typical IP address looks like this: 216.27.61.137
- To make it easier for humans to remember, IP addresses are normally expressed in decimal format as a "dotted decimal number" like the one above.
- Computers communicate in binary form: 216.27.61.137
- The same IP address in binary: 11011000.00011011.00111101.10001001

Networking Overview → IP Address (cont.)

- **IP Address**
  - The four numbers in an IP address are called octets, because they each have eight positions when viewed in binary form.
  - If you add all the positions together, you get 32, which is why IP addresses are considered 32-bit numbers.
  - Since each of the eight positions can have two different states (1 or 0) the total number of possible combinations per octet is 2^8 or 256. So each octet can contain any value between 0 and 255.
  - Combine the four octets and you get 2^32 or a possible 4,294,967,296 unique values!

Networking Overview → IP Address (cont.)

- **IP Address**
  - 32-bit addresses won't be enough for very much longer
  - IPv6, which uses 128-bit addresses, allowing a startlingly vast range of addresses: approximately 3.402824×10^{38}
  - more than enough to allow every atom in the universe a unique IP address.
  - a routing table will keep track of: network numbers, the next router to use to get to that network and the interface this next router is reachable through.


Local Wireless Network
Backbone ISP
Regional ISP
Exchange Point
Local Wired Network
Firewall
Hub or Switch
Client or Server
Router
Access Point
Main Router
NAP (Network Access Point)
Gateway
Main Router
IP Address 167.18.162.162
Domain Name google.com
Client
Router
Firewall
Client
POP (Point of Presence)
IP Address 129.173.66.101
Domain Name hkharrazi.com
Hub or Switch
Internet
TCP/IP Protocol
Port80: HTTP
Port21: FTP
Port22: SSH
Client
Local Wired Network
LAN
MAN
WAN
Domain Name

Networking Overview → Domain Name (cont.)

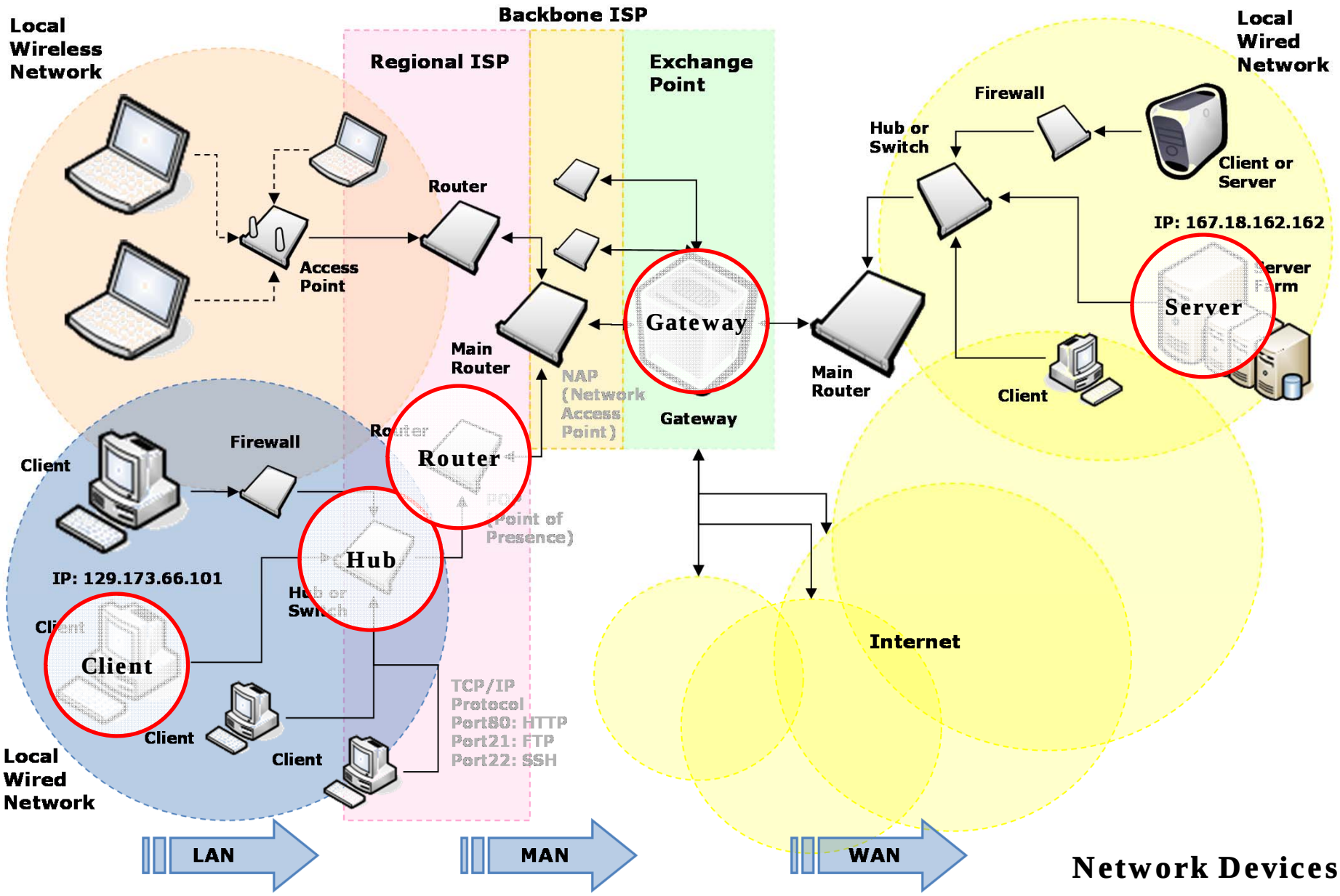
Domain Names

- Domain name servers, or DNS, are an incredibly important but completely hidden part of the Internet.
- The DNS system is a database, and no other database on the planet gets this many requests
- When you use the Web or send an e-mail message, you use a domain name to do it.
- the URL "http://www.jhu.edu" and e-mail address student@jhu.edu contain the domain name jhu.edu
- Every time you use a domain name, you use the Internet's domain name servers (DNS) to translate the human-readable domain name into the machine-readable IP address. Sounds simple!
- During a day of browsing and e-mailing, you might access the domain name servers hundreds of times!

Networking Overview → Domain Name (cont.)

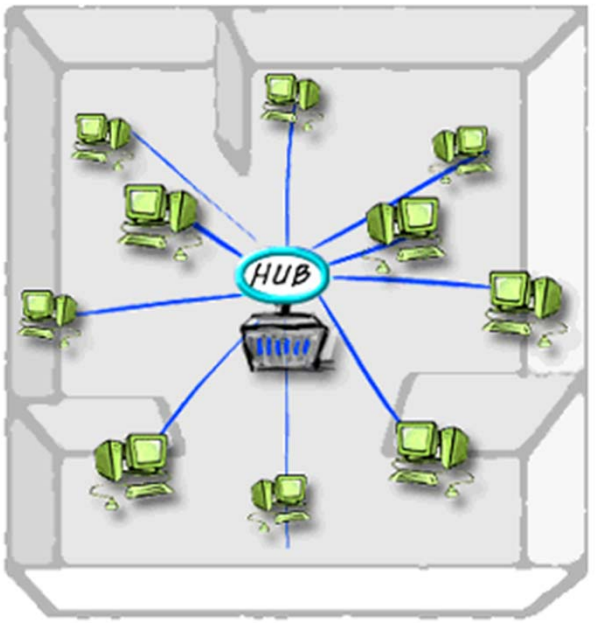
Domain Names

- The COM, EDU and UK portions of these domain names are called the top-level domain (TLD) or first-level domain.
- There are several hundred top-level domain names, including COM, EDU, GOV, MIL, NET, and ORG , as well as unique two-letter combinations for every country.
- Within every top-level domain there is a huge list of second-level domains. For example, in the COM first-level domain, you've got: Yahoo, Msn, Microsoft plus millions of others...
- Every name in the first top-level domain must be unique.


Local Wireless Network
Backbone ISP
Regional ISP
Exchange Point
Local Wired Network
Firewall
Hub or Switch
Client or Server
IP: 167.18.162.162
Server
Server Farm
Router
Access Point
Main Router
Gateway
NAP (Network Access Point)
Gateway
Main Router
Client
Firewall
Client
Router
POP (Point of Presence)
Hub
IP: 129.173.66.101
Hub or Switch
Client
Client
Client
Client
TCP/IP Protocol
Port80: HTTP
Port21: FTP
Port22: SSH
Internet
Local Wired Network
LAN
MAN
WAN
Network Devices

Networking Overview → Network Devices

- **Hub/Switch**
  - In data communications, a hub is a place of convergence where data arrives from one or more directions and is forwarded out in one or more other directions.
  - It is "dumb" system that broadcasts the packet to all directions.
  - A hub usually includes a switch of some kind.
  - The distinction seems to be that the hub is the place where data comes together and the switch is what determines how and where data is forwarded from the place where data comes together.



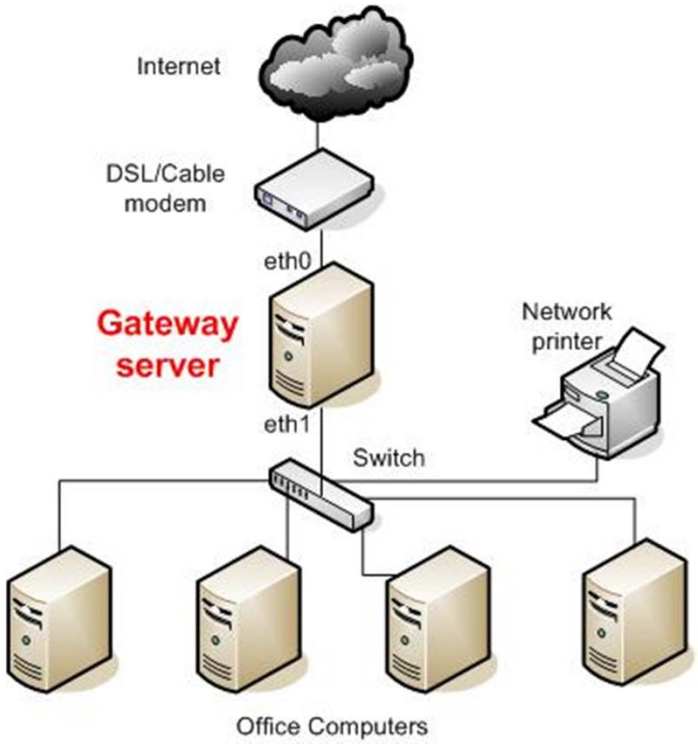
Networking Overview → Network Devices (cont.)

- **Router**
  - On the Internet, a router is a device or, in some cases, software in a computer, that determines the next network point to which a packet should be forwarded toward its destination.
  - The router is connected to at least two networks and decides which way to send each information packet.
  - A router is located at any gateway (where one network meets another), including each Internet point-of-Presence (POP).
  - A router maintains a table of the available routes along with distance/cost algorithms to determine the best route for a given packet
  - Typically, a packet may travel through a number of network points with routers before arriving at its destination.
  - Routing is a function of the Network layer in the TCP/IP protocol

Networking Overview → Network Devices

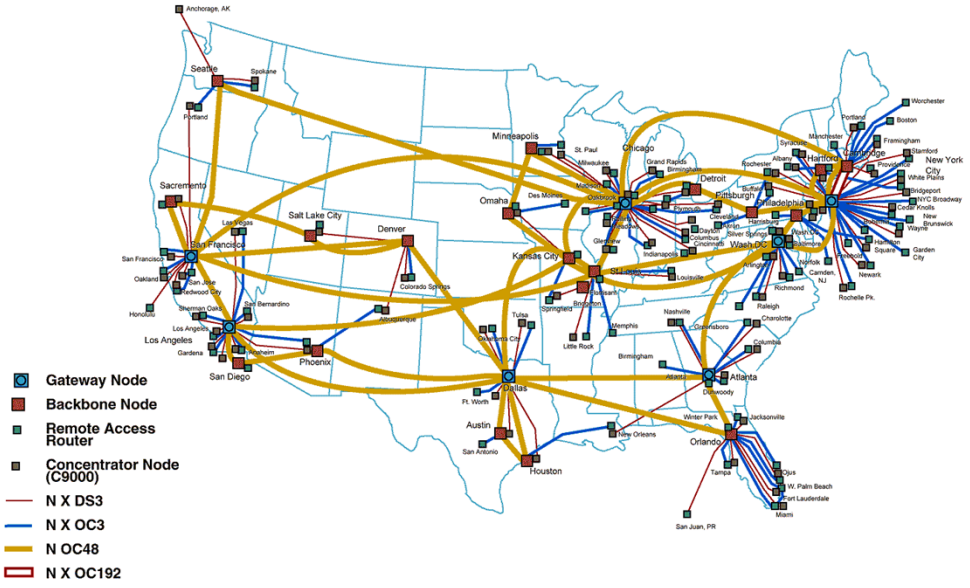
Gateway

- A network point that acts as an entrance to another network. On the Internet, a node or stopping point can be either a gateway node or a host (end-point) node.
- Both the computers of Internet users and the computers that serve pages to users are host nodes.
- The computers that control traffic within company's network or at local Internet Service Provider (ISP) are gateway nodes.



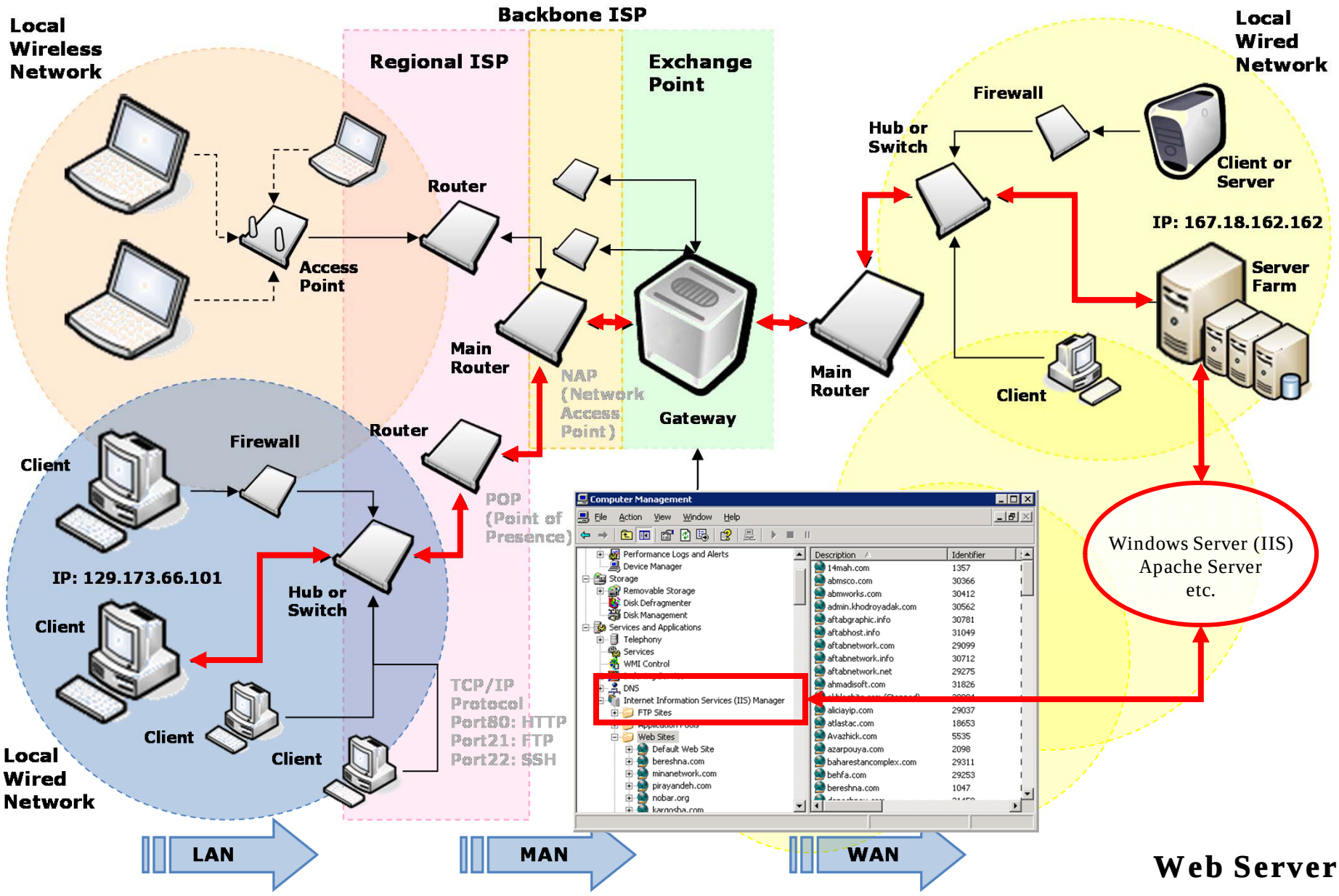
Networking Overview → Network Devices

- **Backbone**
  - A backbone is a larger transmission line that carries data gathered from smaller lines that interconnect with it.
  - On the Internet or other wide area networks, a backbone is a set of paths that local or regional networks connect to for long-distance interconnection.



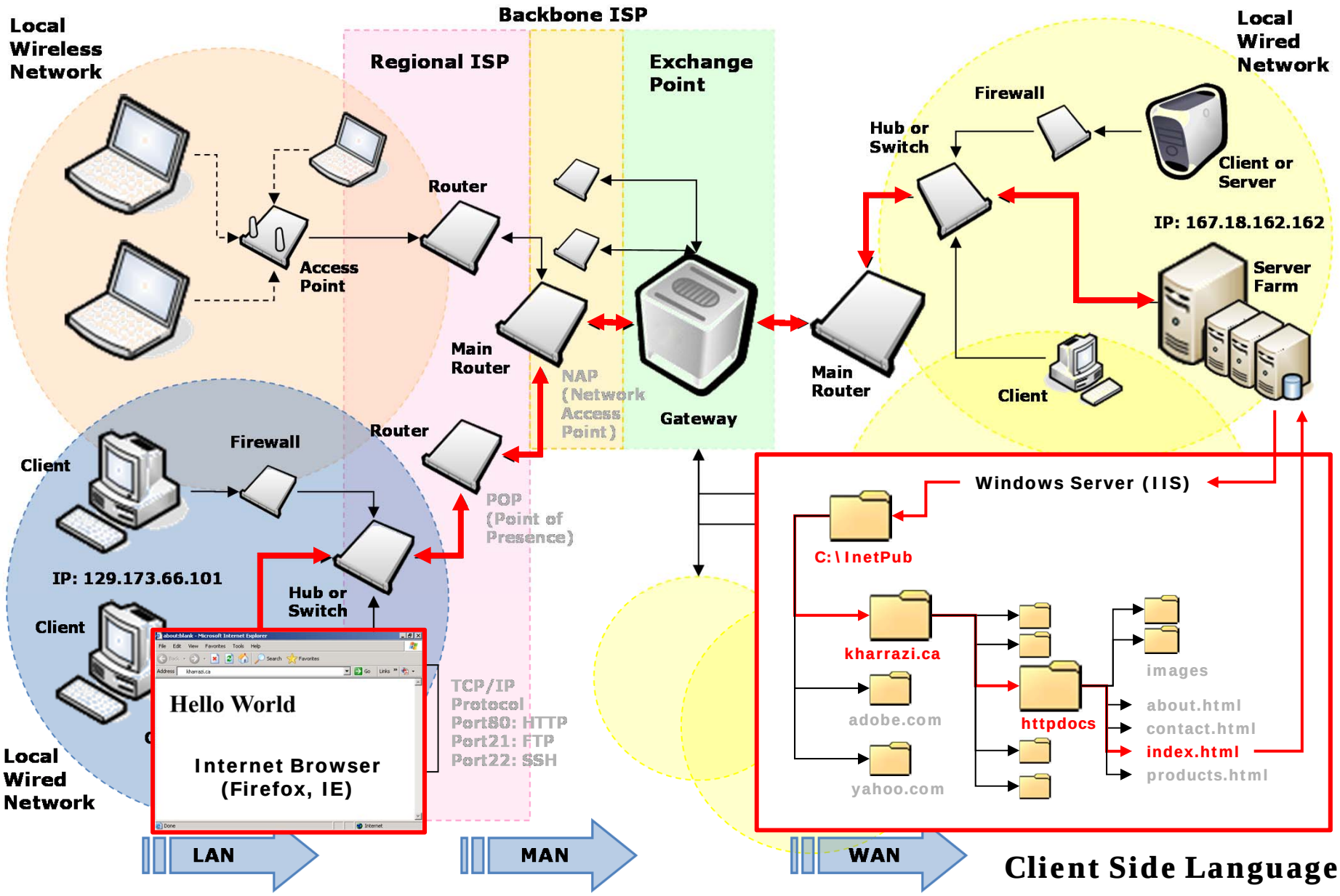
JOHNS HOPKINS
BLOOMBERG
SCHOOL of PUBLIC HEALTH

Web Server Technology Overview


Local Wireless Network
Backbone ISP
Regional ISP
Exchange Point
Local Wired Network
Firewall
Hub or Switch
Client or Server
IP: 167.18.162.162
Server Farm
Router
Access Point
Main Router
NAP (Network Access Point)
Gateway
Main Router
Client
Router
Firewall
Client
IP: 129.173.66.101
Hub or Switch
POP (Point of Presence)
Client
Client
Client
Local Wired Network
TCP/IP Protocol
Port80: HTTP
Port21: FTP
Port22: SSH
Computer Management
Windows Server (IIS)
Apache Server
etc.
LAN
MAN
WAN
Web Server

Web Server Overview

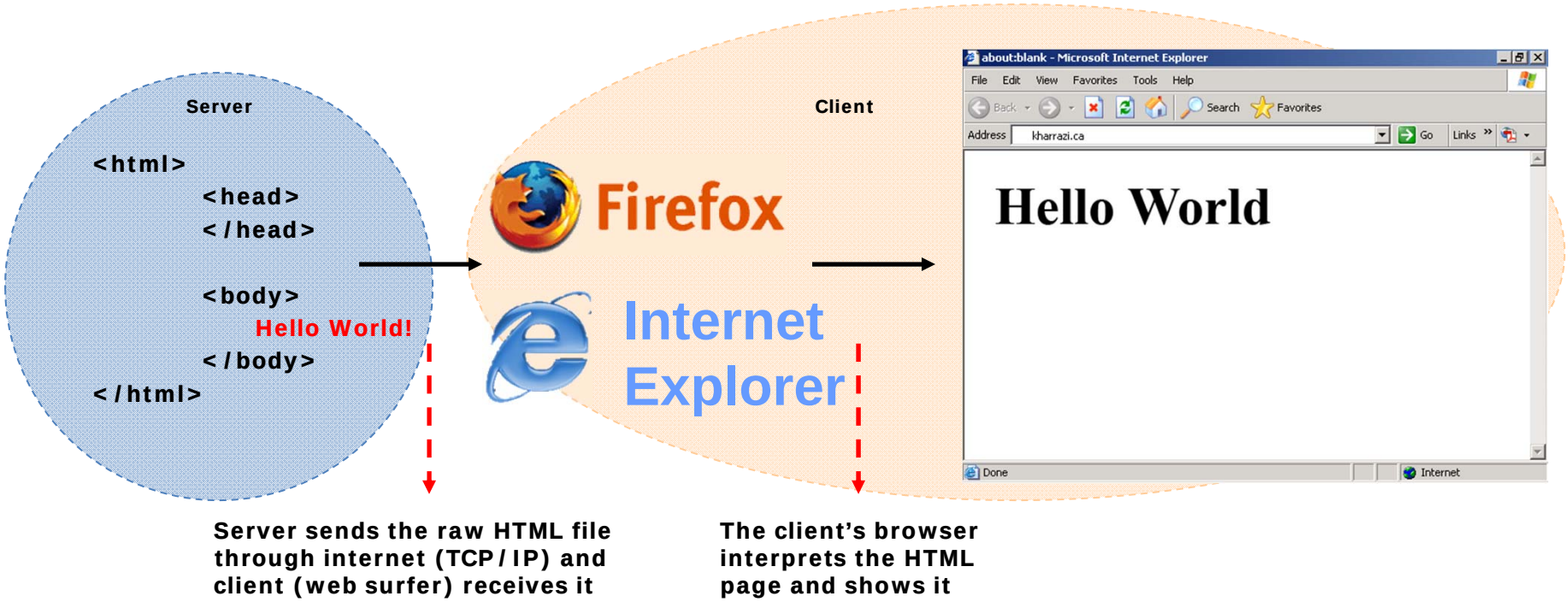
- The term web server can mean one of two things:
  - A computer responsible for serving web pages, mostly HTML documents, via the HTTP protocol to clients, mostly web browsers. Servers can have different Operating Systems such as Microsoft Windows, Mac OS, Linux, UNIX and FreeBSD.
  - A software program that is working as a daemon serving web documents such as Apache Server (Open Source) or Internet Information Server - IIS (Microsoft/Commercial).

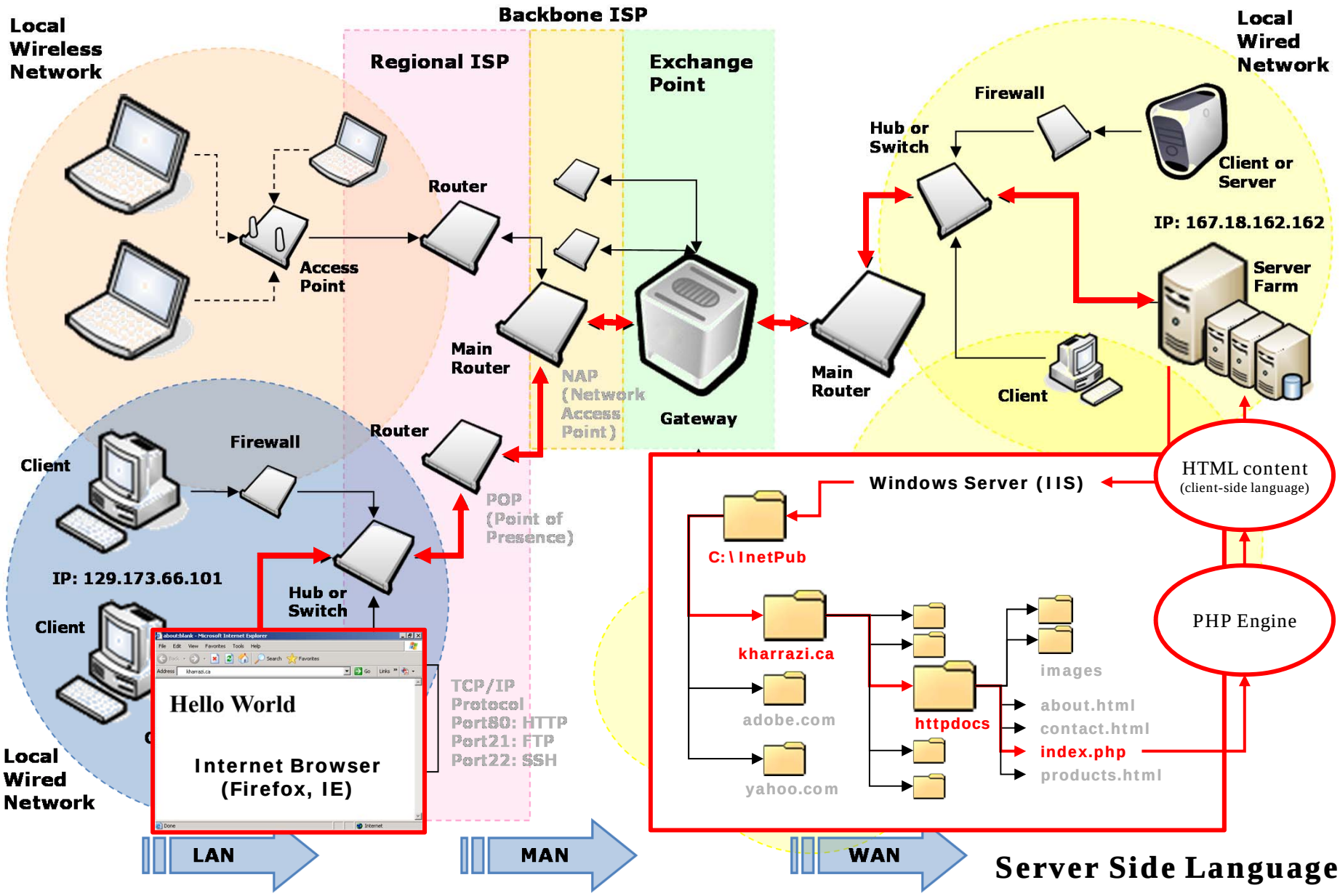

Local Wireless Network
Backbone ISP
Regional ISP
Exchange Point
Local Wired Network
Firewall
Hub or Switch
Client or Server
IP: 167.18.162.162
Server Farm
Router
Access Point
Main Router
NAP (Network Access Point)
Gateway
Main Router
Client
Router
Firewall
Client
POP (Point of Presence)
IP: 129.173.66.101
Hub or Switch
Client
Hello World
Internet Browser (Firefox, IE)
TCP/IP Protocol
Port80: HTTP
Port21: FTP
Port22: SSH
Local Wired Network
Windows Server (IIS)
C:\InetPub
kharrazi.ca
adobe.com
yahoo.com
images
httpdocs
about.html
contact.html
index.html
products.html
LAN
MAN
WAN
Client Side Language

Web Server Overview → Client Side Language (e.g., HTML)

- HTML (Hypertext Markup Language) is the document format language used on the World Wide Web. Web browsers (e.g., Firefox, Chrome, IE, Safari, Opera) read HTML and display the page.

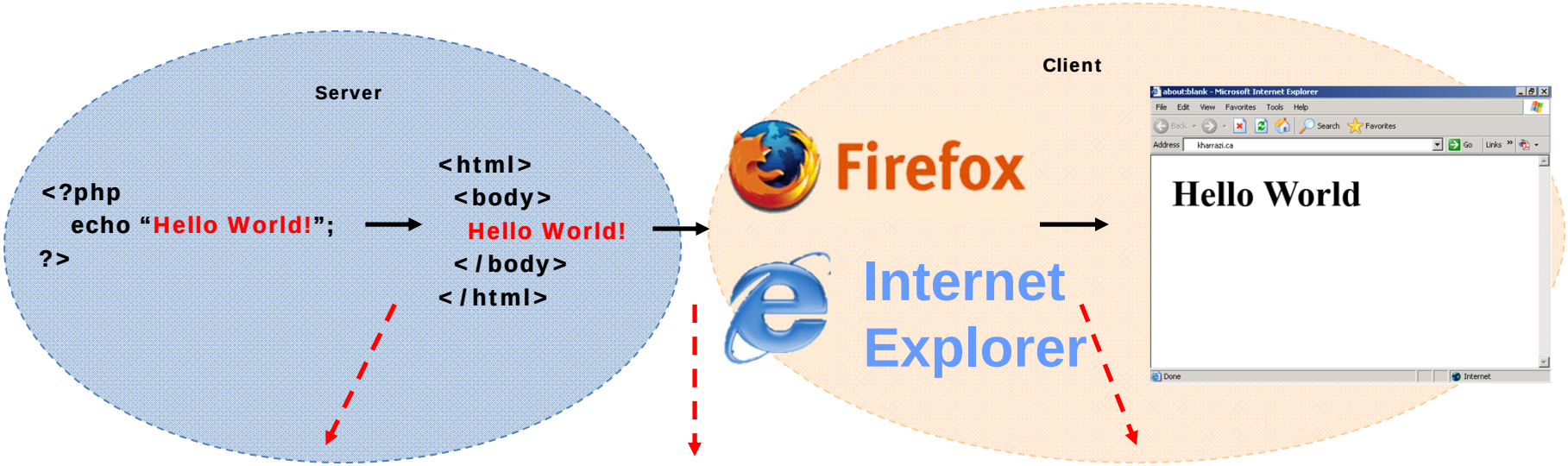
- Sample code (tags):

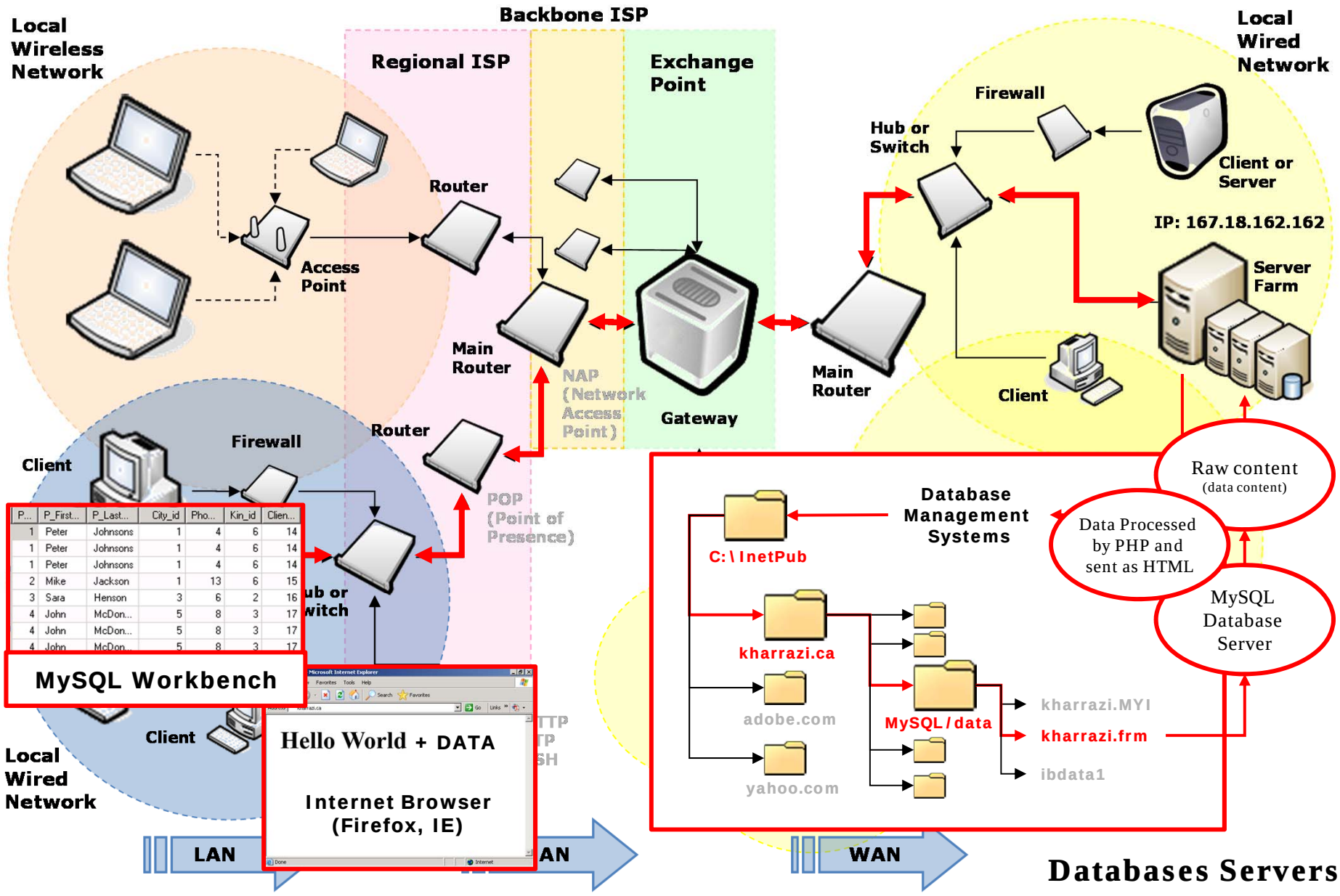



Local Wireless Network
Backbone ISP
Regional ISP
Exchange Point
Local Wired Network
Firewall
Hub or Switch
Client or Server
IP: 167.18.162.162
Server Farm
Router
Access Point
Main Router
NAP (Network Access Point)
Gateway
Main Router
Client
Router
Firewall
Client
IP: 129.173.66.101
Hub or Switch
Client
POP (Point of Presence)
Hello World
Internet Browser (Firefox, IE)
TCP/IP Protocol
Port80: HTTP
Port21: FTP
Port22: SSH
Local Wired Network
Windows Server (IIS)
HTML content (client-side language)
C:\InetPub
PHP Engine
kharrazi.ca
adobe.com
yahoo.com
httpdocs
images
about.html
contact.html
index.php
products.html
LAN
MAN
WAN
Server Side Language

Web Server Overview → Server Side Language (e.g., PHP)

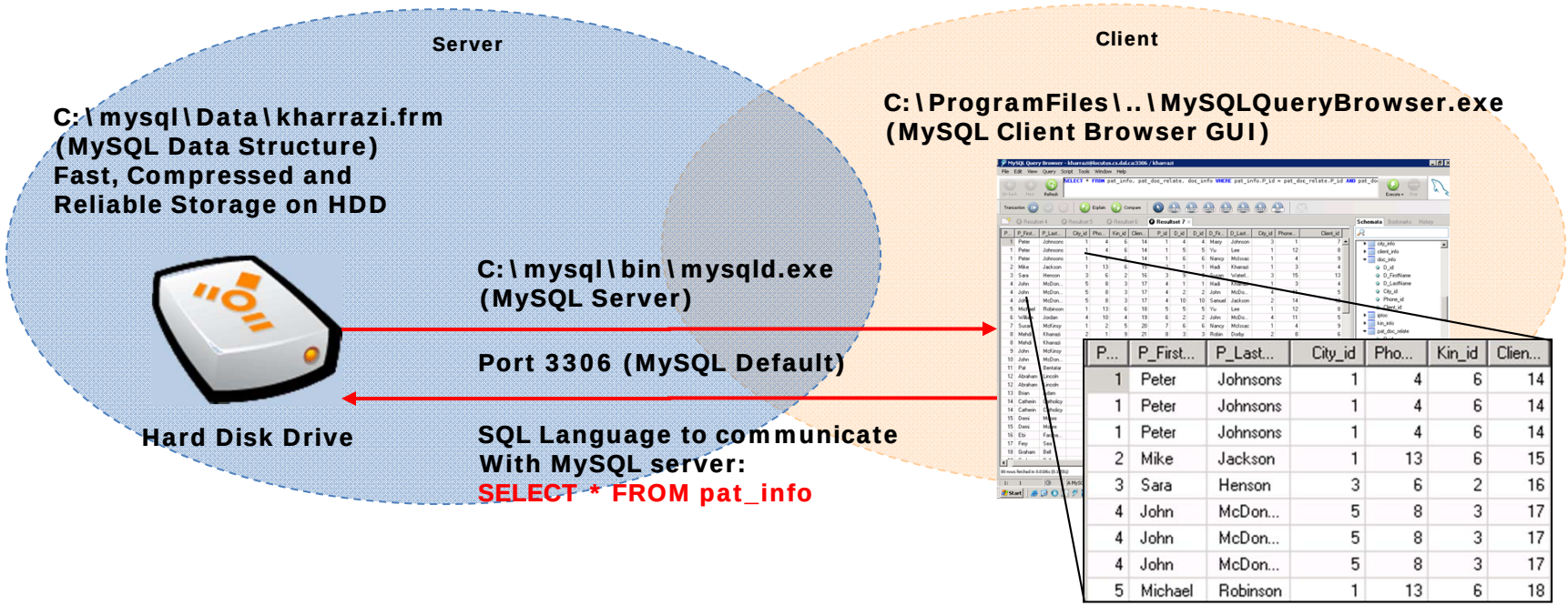
- PHP (Hypertext Preprocessor) is a server-side, cross-platform, HTML embedded scripting language that lets you create dynamic web pages. PHP-enabled web pages are treated just like regular HTML pages and you can create and edit them the same way you normally create regular HTML pages.




Local Wireless Network
Backbone ISP
Regional ISP
Exchange Point
Local Wired Network
Firewall
Hub or Switch
Client or Server
IP: 167.18.162.162
Server Farm
Router
Access Point
Main Router
NAP (Network Access Point)
Gateway
Main Router
Client
Router
Firewall
Client
POP (Point of Presence)
Raw content (data content)
Data Processed by PHP and sent as HTML
MySQL Database Server
Database Management Systems
C:\InetPub
kharrazi.ca
adobe.com
yahoo.com
MySQL/data
kharrazi.MYI
kharrazi.frm
ibdata1
MySQL Workbench
Hello World + DATA
Internet Browser (Firefox, IE)
Client
Local Wired Network
LAN
WAN
Databases Servers

Web Server Overview → Data Base Management System (e.g., MySQL)

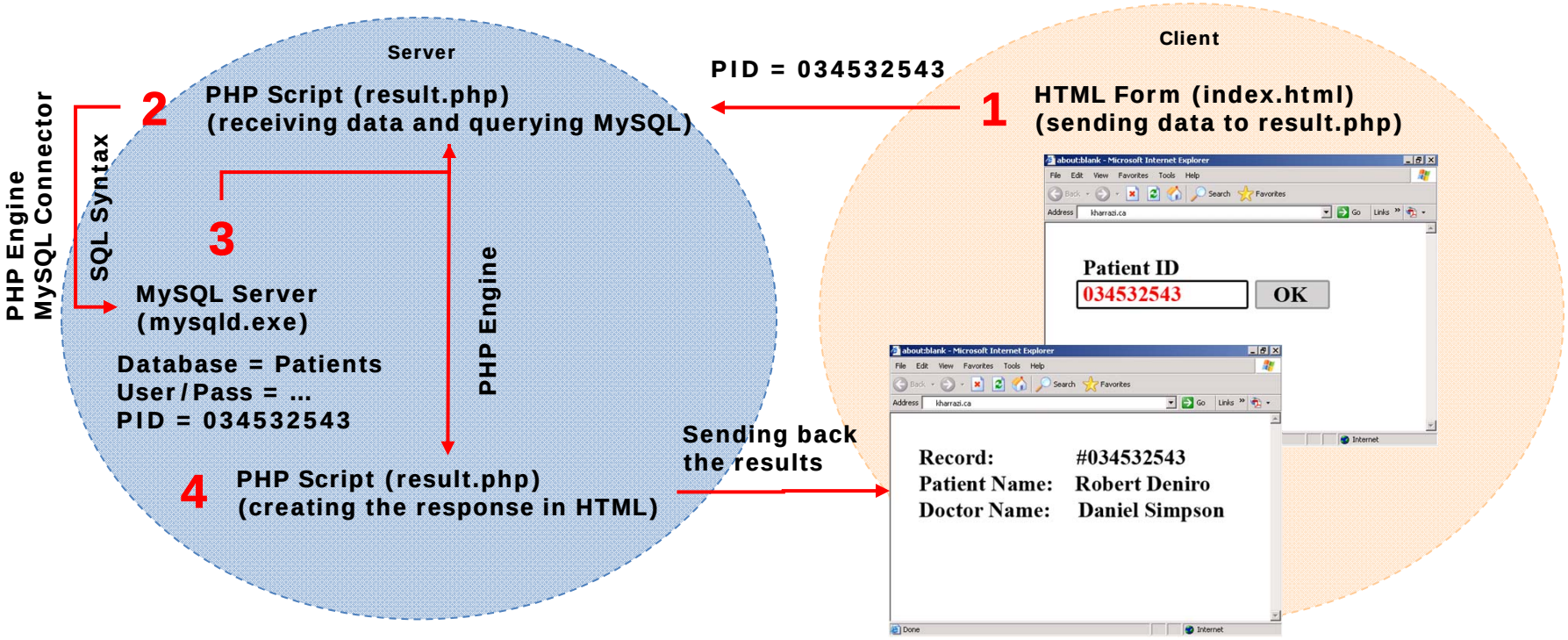
- MySQL is an open source relational database management system (RDBMS) that uses Structured Query Language (SQL), the most popular language for adding, accessing, and processing data in a database.



P...	P_First...	P_Last...	City_id	Pho...	Kin_id	Clien...
1	Peter	Johnsons	1	4	6	14
1	Peter	Johnsons	1	4	6	14
1	Peter	Johnsons	1	4	6	14
2	Mike	Jackson	1	13	6	15
3	Sara	Henson	3	6	2	16
4	John	McDon...	5	8	3	17
4	John	McDon...	5	8	3	17
4	John	McDon...	5	8	3	17
5	Michael	Robinson	1	13	6	18

Web Server Overview → HTML/PHP/MySQL Integration

- MySQL and PHP are integrated very well and therefore it is currently the most popular combination of a server side language and a database engine to work on web.



Web Server Overview → Applications

- **Windows Remote Desktop**
  - Manage Windows-based Servers
  - Setting (hostname, user/pass, default port 3389)
- **PuTTY**
  - Manage Linux-based Servers
  - Settings (hostname, user/pass, SSH 22, Tunneling 3306)
- **FileZilla**
  - Upload files directly to a remote server
  - FTP (plain FTP) or SFTP (Secure FTP under SSH)
  - Setting (hostname, user/pass, default port 21/22)
- **NotePad++**
  - Edit plain text files / code a program / highlight the code...
- **MySQL GUI Tools**
  - Connect to MySQL database engine

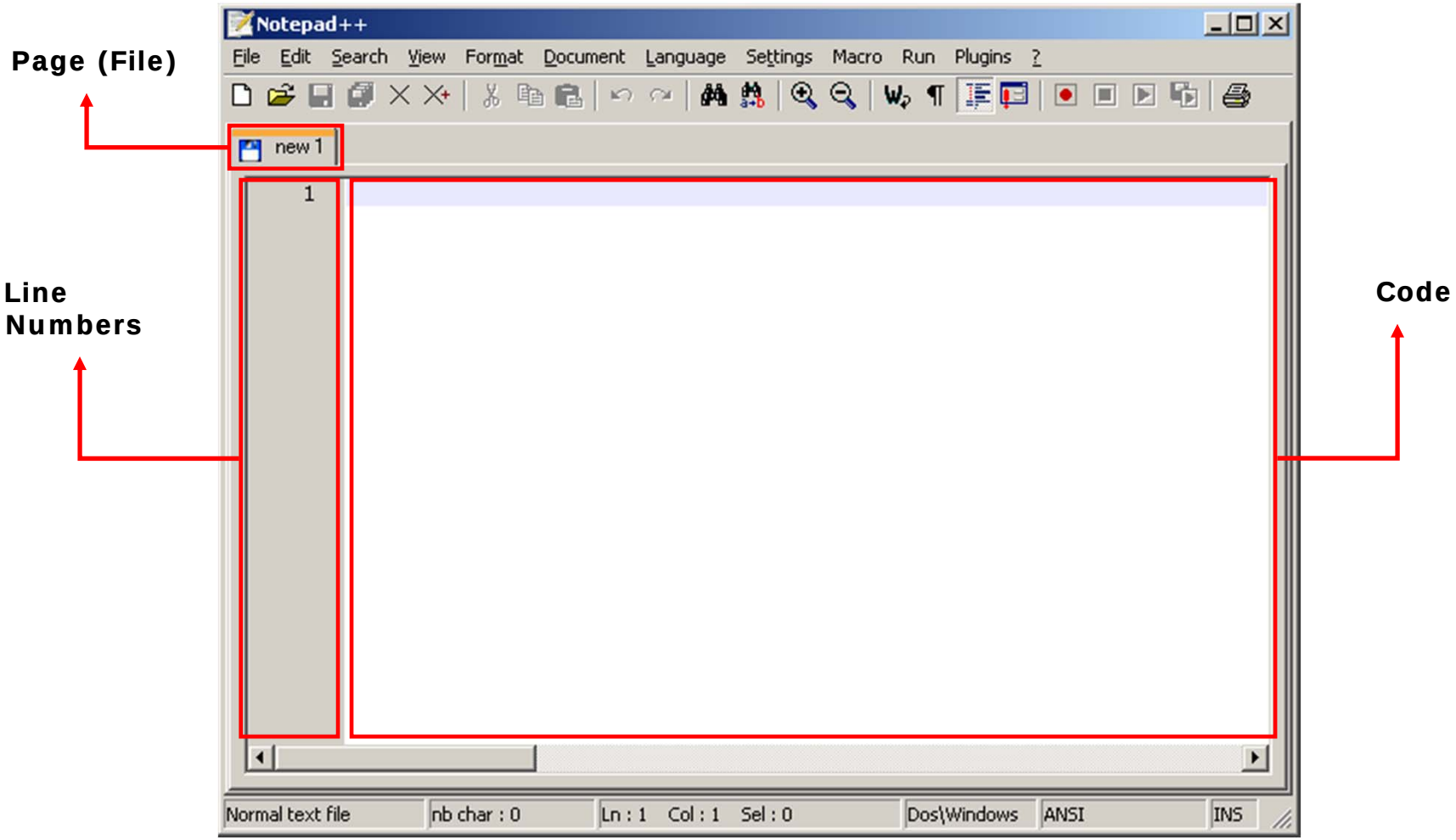
Web Server Overview → Applications (cont.) – NotePad++

- An IDE (integrated development environment) is an application or set of tools that allows a programmer to write, compile, edit, and in some cases test and debug within an integrated, interactive environment.

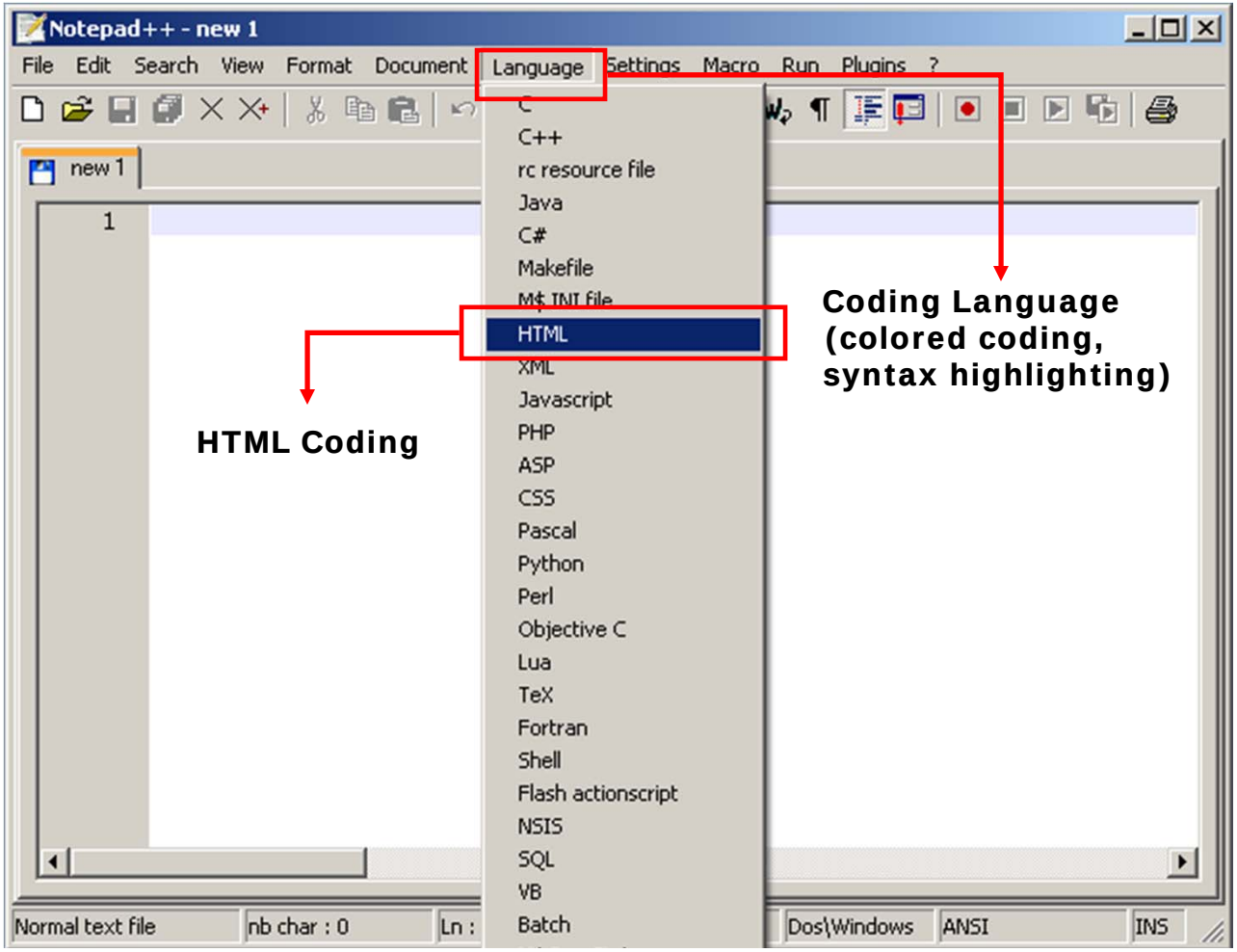
- NotePad++ is NOT a full feature IDE, but it is a simple and useful code editor which will help us writing codes in many languages such as HTML, PHP and etc. Some of the features for NotePad++ is:

  - Syntax Highlighting (Colored Coding)
  - Tabbed Navigation
  - Code Completion
  - Code Folding
  - Free (Open Source)

Web Server Overview → Applications (cont.) – NotePad++



Web Server Overview → Applications (cont.) – NotePad++

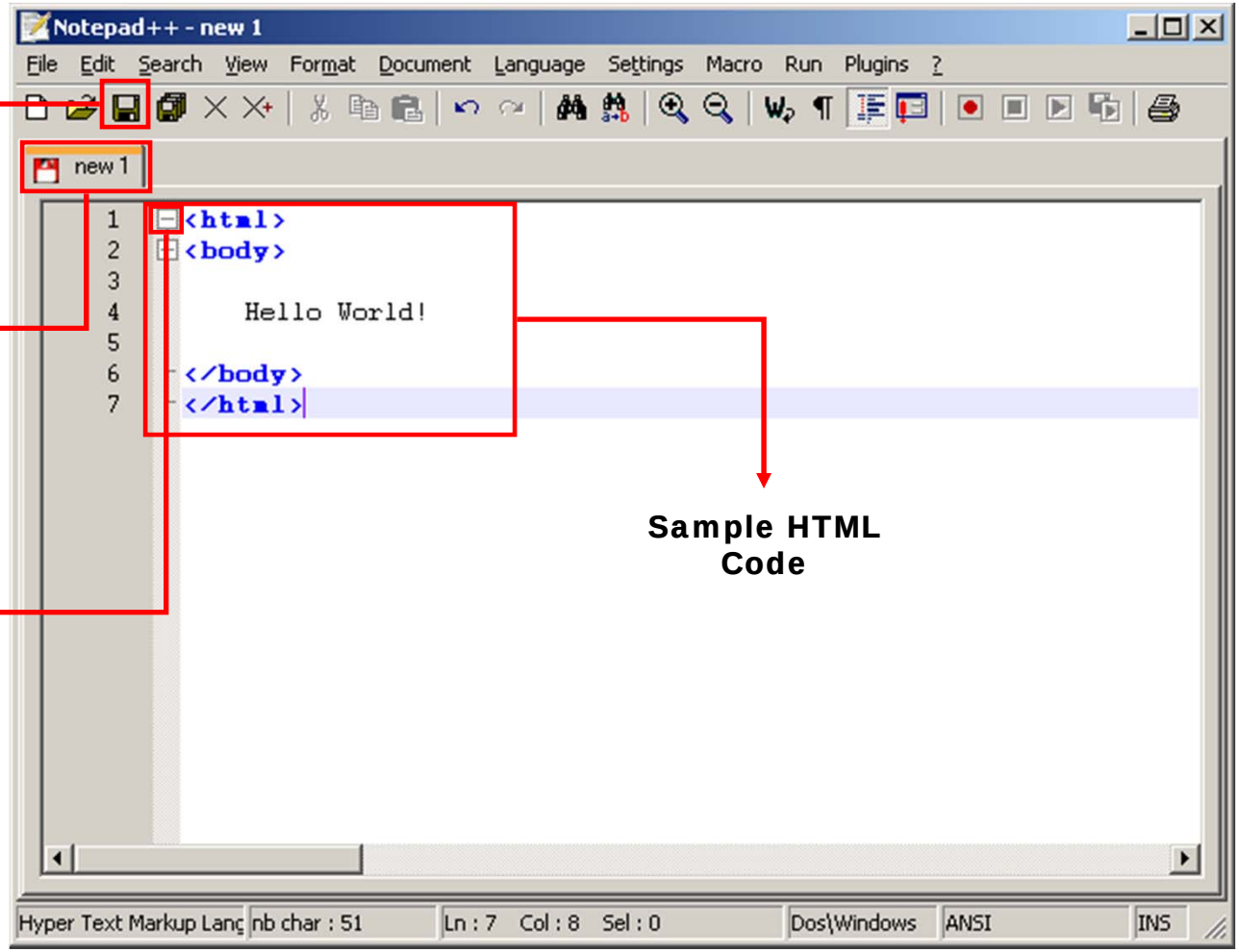


Web Server Overview → Applications (cont.) – NotePad++

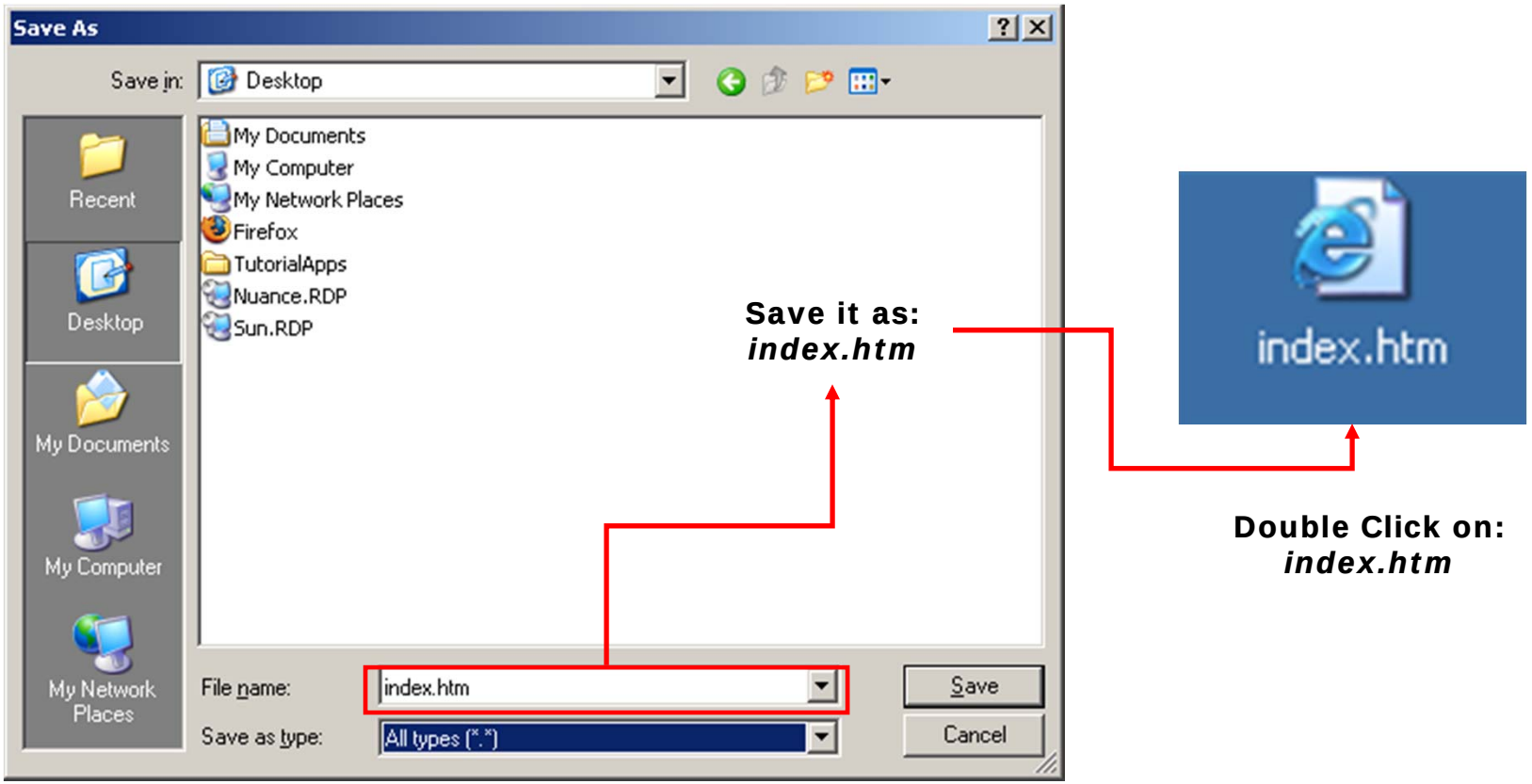
Sample HTML Code:

```
<html>
<body>

    Hello World!

</body>
</html>
```

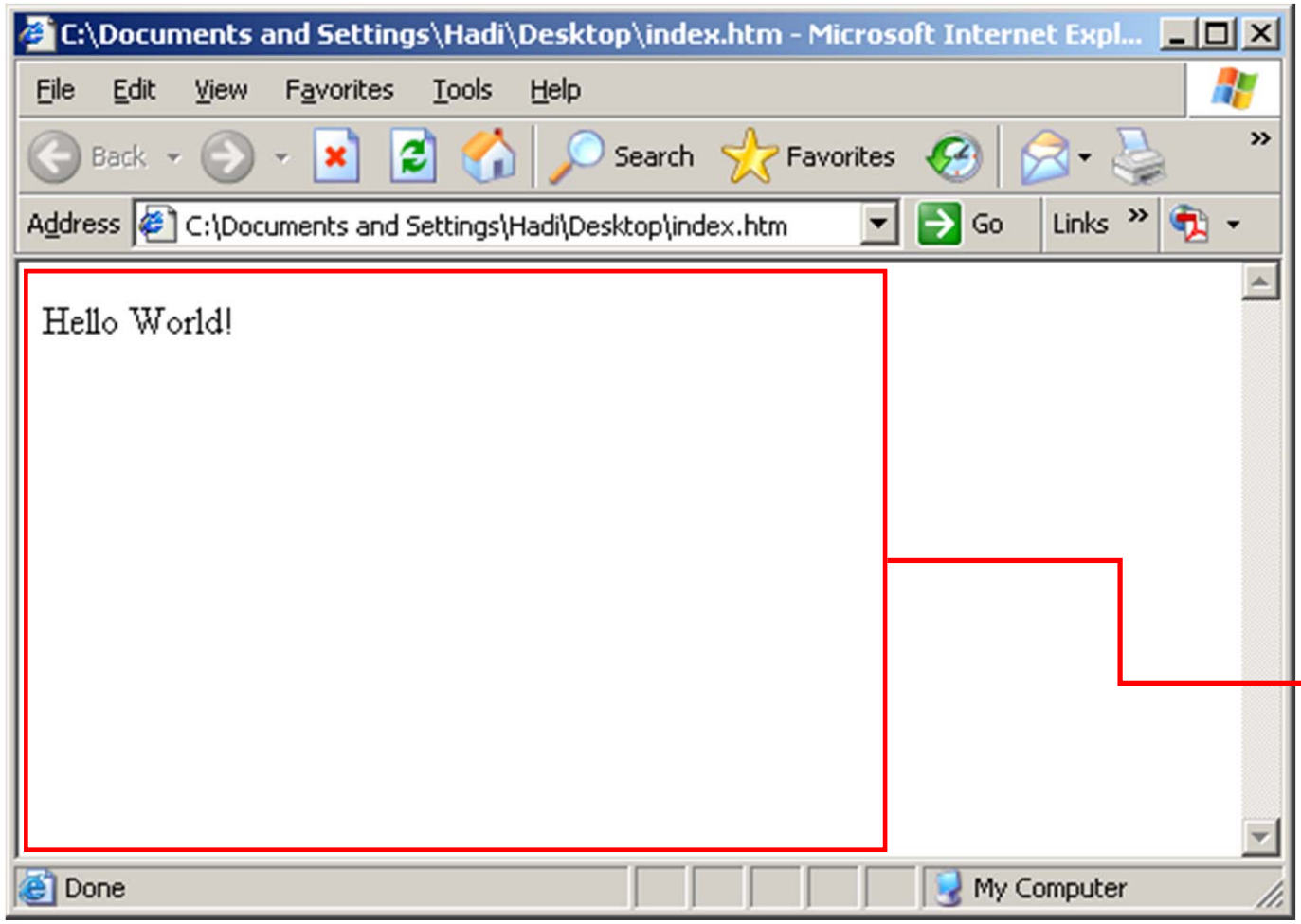
Web Server Overview → Applications (cont.) – NotePad++



Web Server Overview → Applications (cont.) – NotePad++

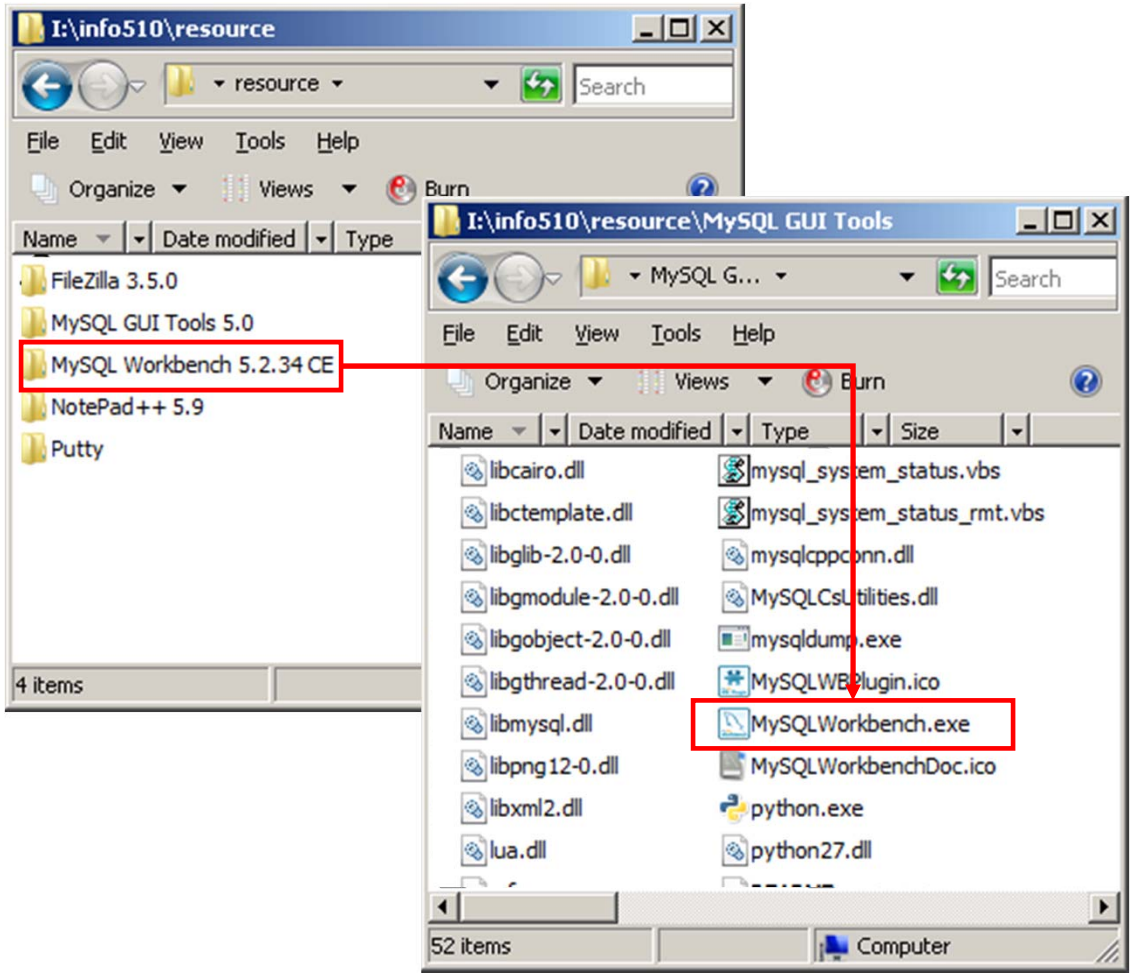


Web Server Overview → Applications (cont.) – NotePad++

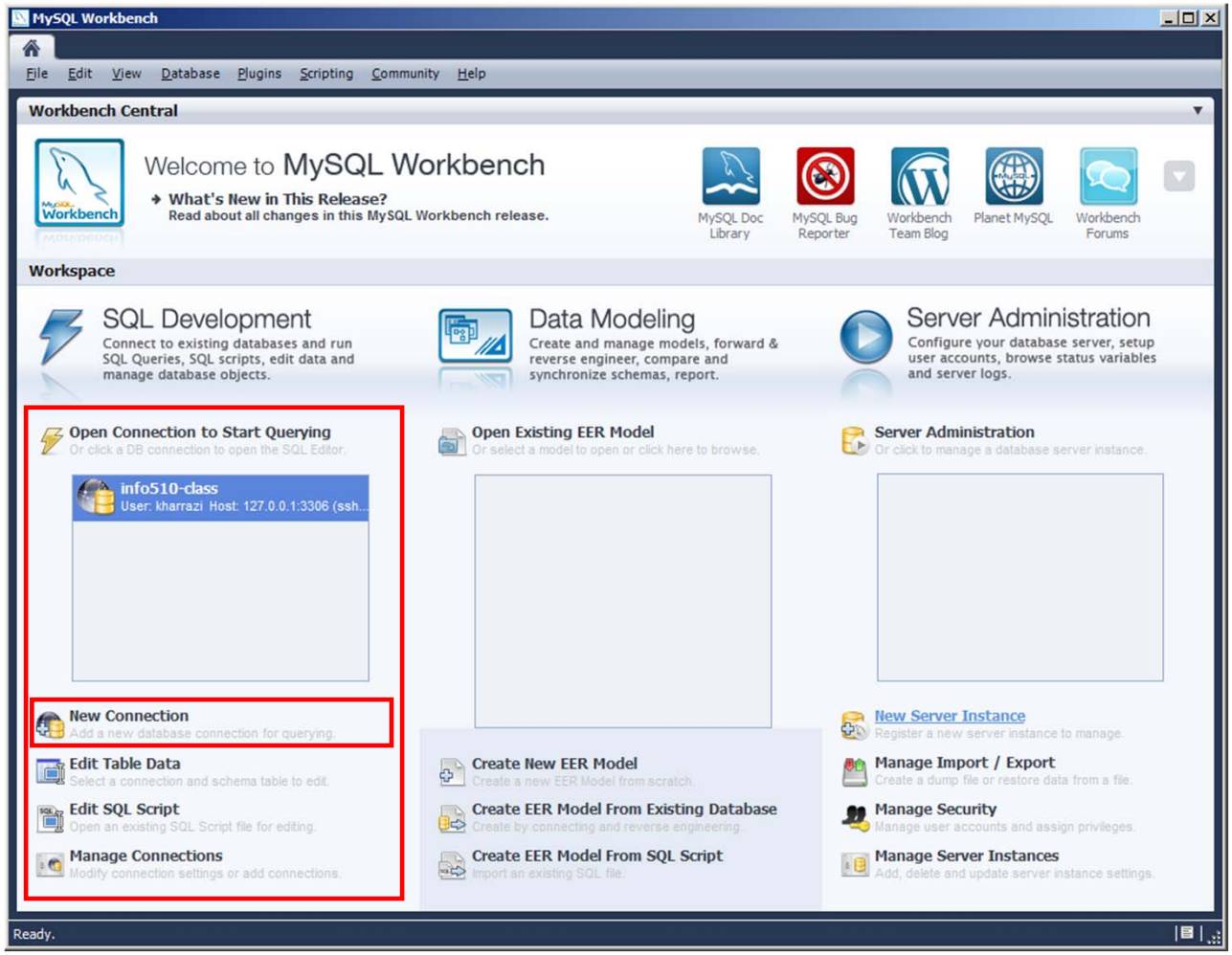


Internet Explorer or Mozila FireFox can translate (decode) your html file

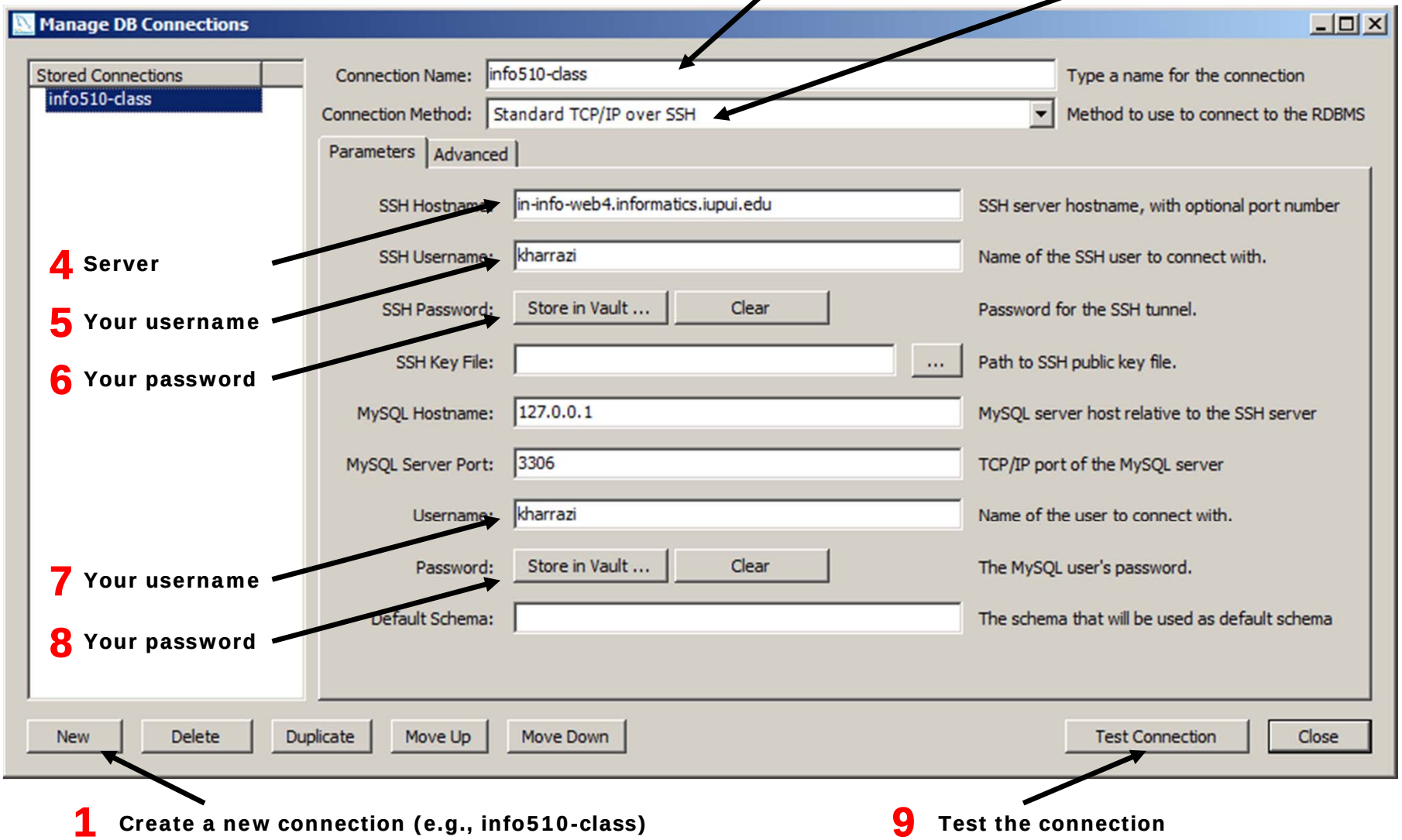
Web Server Overview → Applications (cont.) – MySQL Workbench



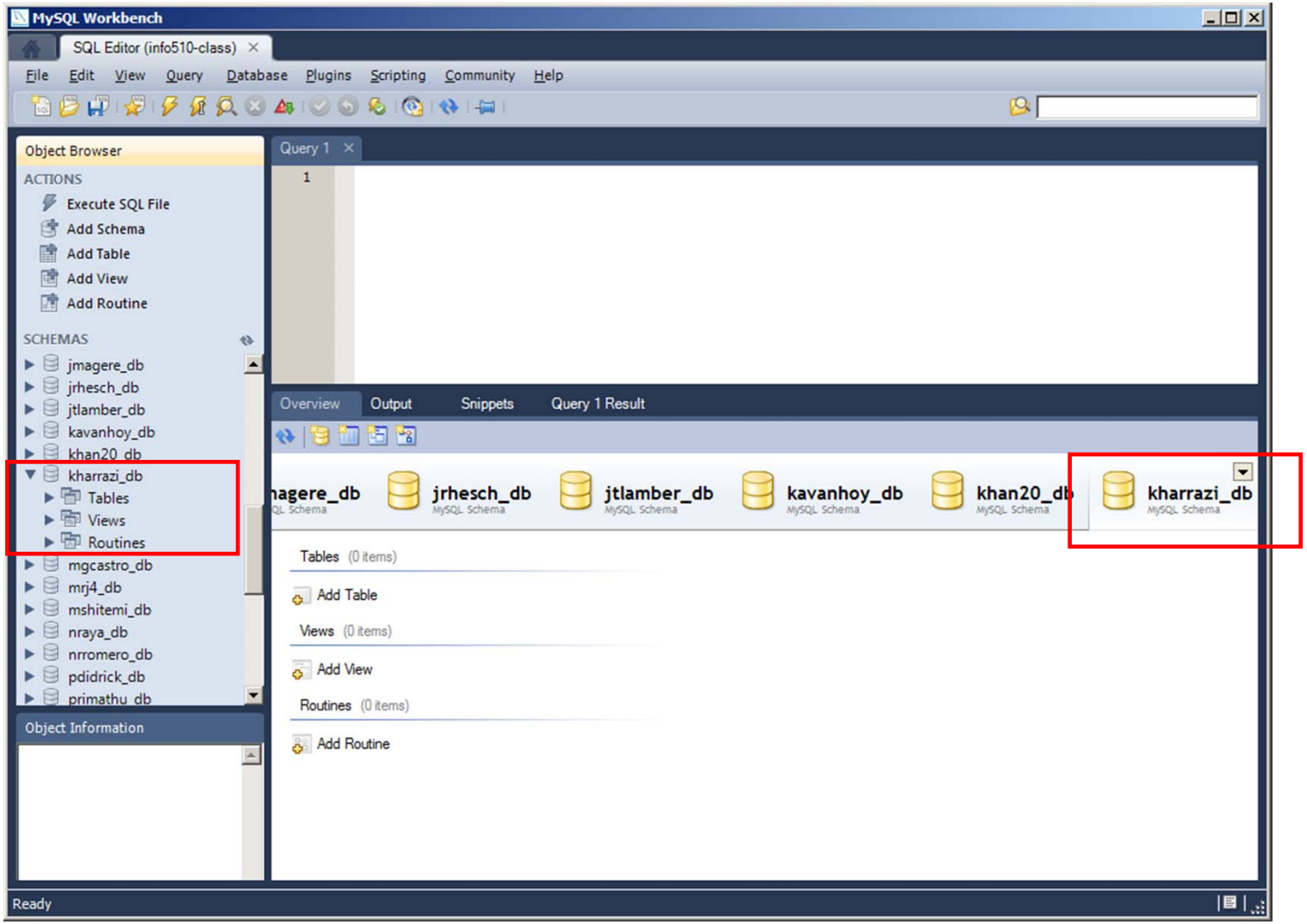
Web Server Overview → Applications (cont.) – MySQL Workbench



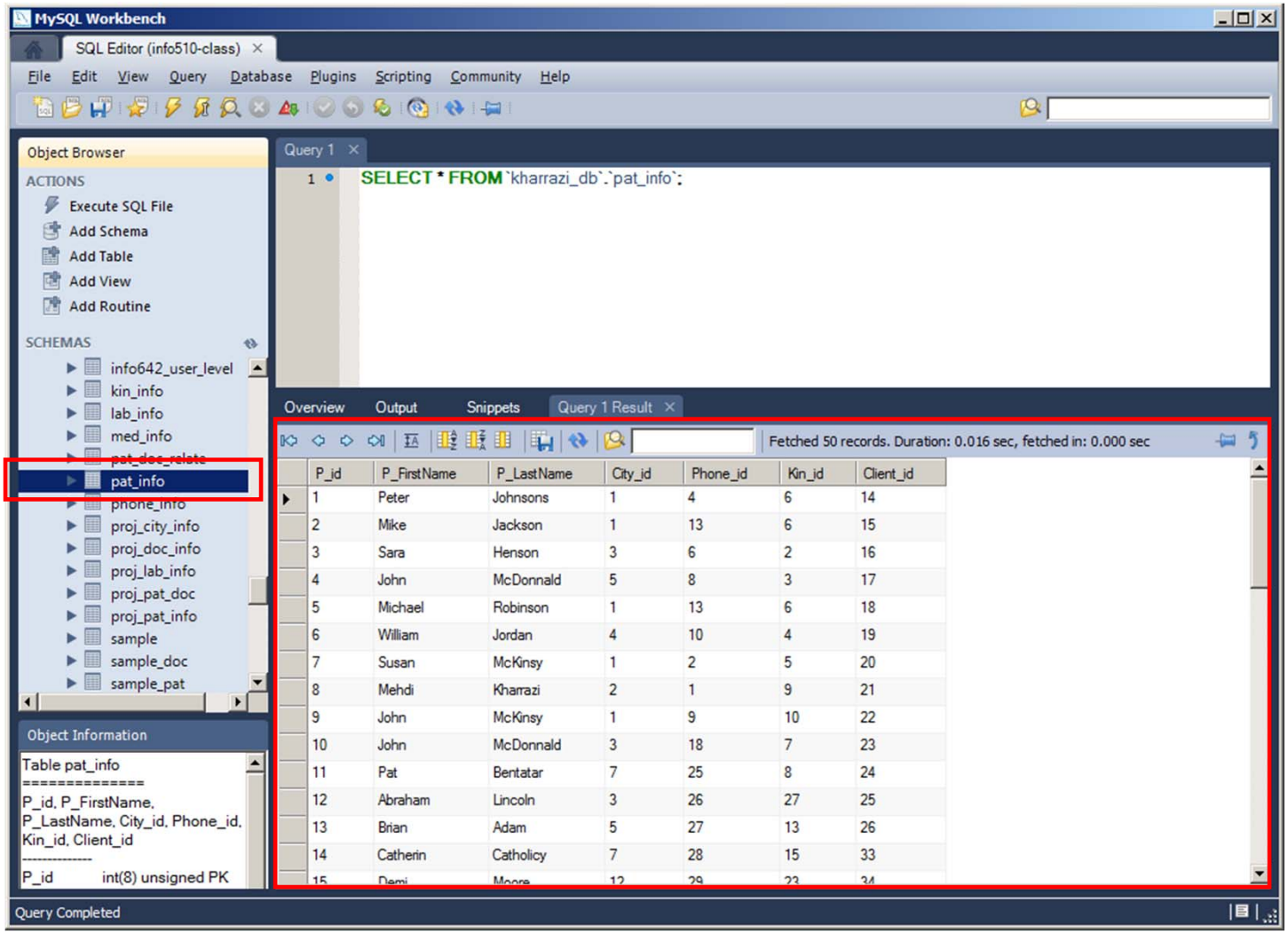
Web Server Overview → MySQL Workbench



Web Server Overview → Applications (cont.) – MySQL Workbench



Web Server Overview → Applications (cont.) – MySQL Workbench



JOHNS HOPKINS
BLOOMBERG
SCHOOL of PUBLIC HEALTH

Database Overview

Database Overview

- Different types of Database structures (Hierarchical, Relational, Temporal) are based on the way they store the data on Hard Disk Drive and how they read from the stored data.

- Famous Relational Databases: Oracle, MS SQL (Microsoft), DB2 (IBM), MySQL, mSQL, Postgre SQL and etc.

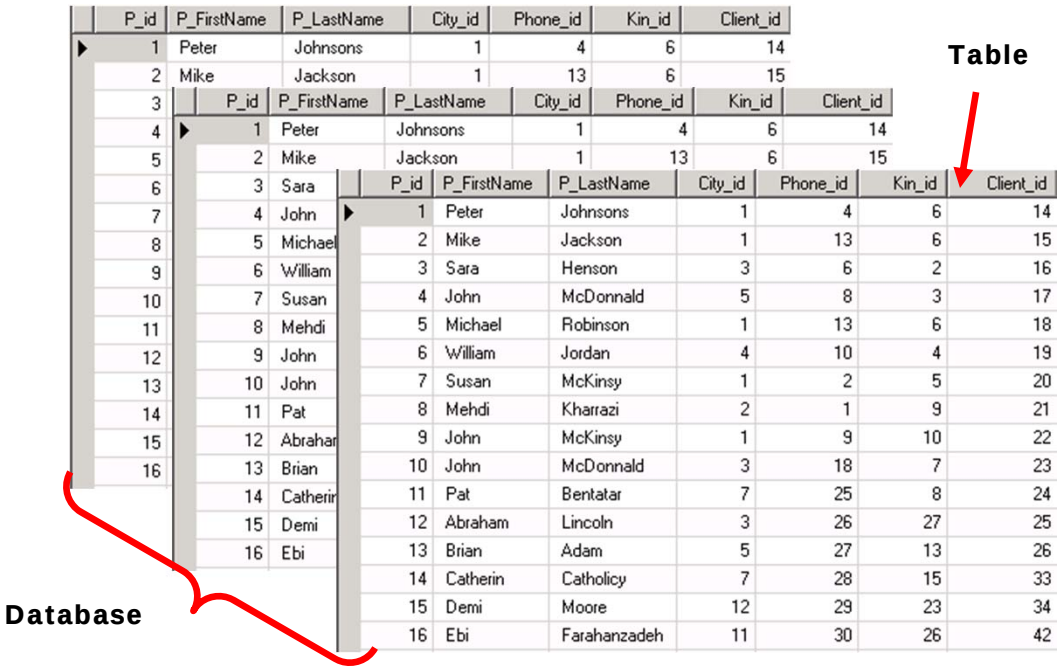
- MySQL is an open source relational database management system (RDBMS) that uses Structured Query Language (SQL), the most popular language for adding, accessing, and processing data in a database.

Database Overview → Relational Databases

- RDBMS (Relational Database Management System)
- RDBMSs can provide faster access to data than flat files.
- RDBMSs can be easily queried (SQL Language) to extract sets of data that fit certain criteria.
- RDBMSs have built-in mechanisms for dealing with concurrent access so that you as a programmer don't have to worry about it.
- RDBMSs have built-in privilege systems.

Database Overview → Relational Databases (cont.)

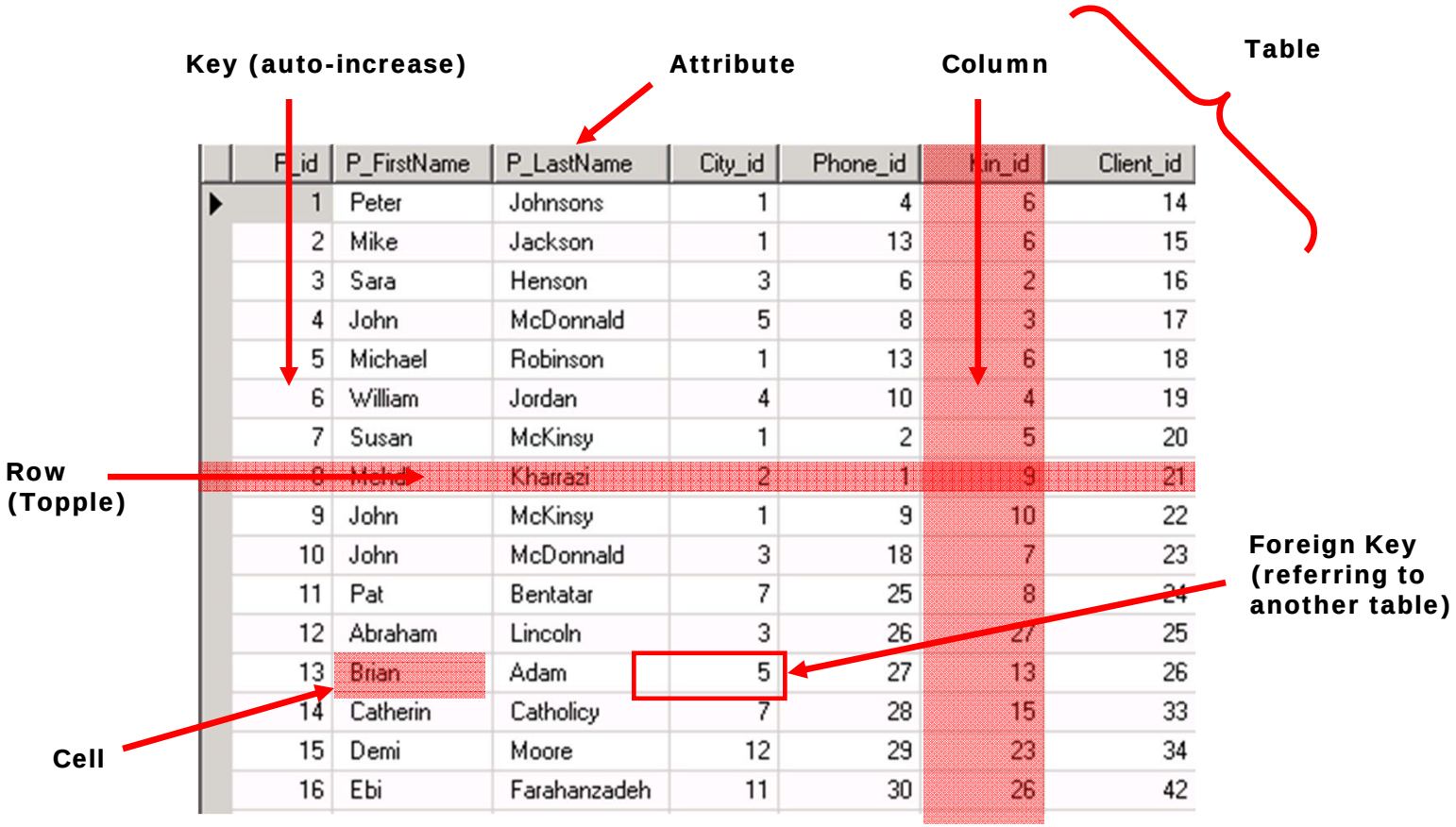
- Relational databases are made up of relations, more commonly called tables.
- A table is exactly what it sounds like a table of data. If you've used an electronic spreadsheet (Excel), you've already used a relational table.
- A database usually consists of several tables.
- MySQL can handle thousands of databases.



P_id	P_FirstName	P_LastName	City_id	Phone_id	Kin_id	Client_id
1	Peter	Johnsons	1	4	6	14
2	Mike	Jackson	1	13	6	15
3	Sara	Henson	3	6	2	16
4	John	McDonnald	5	8	3	17
5	Michael	Robinson	1	13	6	18
6	William	Jordan	4	10	4	19
7	Susan	McKinsy	1	2	5	20
8	Mehdi	Kharrazi	2	1	9	21
9	John	McKinsy	1	9	10	22
10	John	McDonnald	3	18	7	23
11	Pat	Bentatar	7	25	8	24
12	Abraham	Lincoln	3	26	27	25
13	Brian	Adam	5	27	13	26
14	Catherin	Catholicy	7	28	15	33
15	Demi	Moore	12	29	23	34
16	Ebi	Farahanzadeh	11	30	26	42

Database Overview → Relational Databases (cont.)

- Elements of the relational database table:



P_id	P_FirstName	P_LastName	City_id	Phone_id	Kin_id	Client_id
1	Peter	Johnsons	1	4	6	14
2	Mike	Jackson	1	13	6	15
3	Sara	Henson	3	6	2	16
4	John	McDonnald	5	8	3	17
5	Michael	Robinson	1	13	6	18
6	William	Jordan	4	10	4	19
7	Susan	McKinsy	1	2	5	20
8	Mehdi	Kharrazi	2	1	9	21
9	John	McKinsy	1	9	10	22
10	John	McDonnald	3	18	7	23
11	Pat	Bentatar	7	25	8	24
12	Abraham	Lincoln	3	26	27	25
13	Brian	Adam	5	27	13	26
14	Catherin	Catholicy	7	28	15	33
15	Demi	Moore	12	29	23	34
16	Ebi	Farahanzadeh	11	30	26	42

Database Overview → Relational Databases (cont.)

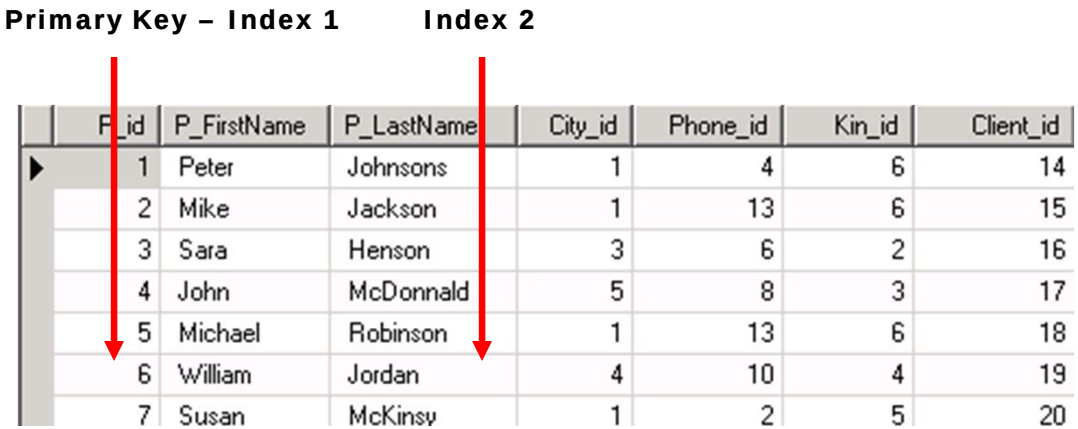
- **Keys**
- Keys are special fields
- Keys are defined on table creation
- Keys tie tables together
- Keys are unique: no two records have same value of the key
- Primary key: Unique and links two tables → e.g. SSN number
- Only one primary key per table

Key (auto-increase)

P_id	P_FirstName	P_LastName	City_id	Phone_id	Kin_id	Client_id
1	Peter	Johnsons	1	4	6	14
2	Mike	Jackson	1	13	6	15
3	Sara	Henson	3	6	2	16
4	John	McDonnald	5	8	3	17
5	Michael	Robinson	1	13	6	18
6	William	Jordan	4	10	4	19
7	Susan	McKinsy	1	2	5	20

Database Overview → Relational Databases (cont.)

- **Indexes**
  - Similar to the index of a book
  - MySQL automatically creates an index for each primary key
  - Indexes make it a lot faster to retrieve results
  - User can define additional indexes



P_id	P_FirstName	P_LastName	City_id	Phone_id	Kin_id	Client_id
1	Peter	Johnsons	1	4	6	14
2	Mike	Jackson	1	13	6	15
3	Sara	Henson	3	6	2	16
4	John	McDonnald	5	8	3	17
5	Michael	Robinson	1	13	6	18
6	William	Jordan	4	10	4	19
7	Susan	McKinsy	1	2	5	20

Database Overview → Relational Databases (cont.)

- Internal Key (1 to 1 relationship):

city_id	city_name	province_name
1	Halifax	Nova Scotia
2	Vancouver	British Columbia
3	Tonronto	Ontario
4	Montreal	Quebec
5	Saskatoon	Saskatchewan
6	Winnipeg	Manitoba
7	Calgary	Alberta
8	Los Angeles	California
9	Boston	Massachusetts

Table: City_information (ONE-ONE)

Database Overview → Relational Databases (cont.)

- Foreign Key (1 to Many relationship):

P_id	P_FirstName	P_LastName	City_id	Phone_id	Kin_id	Client_id
1	Peter	Johnsons	1	4	6	14
2	Mike	Jackson	1	13	6	15
3	Sara	Henson	3	6	2	16
4	John	McDonnald	5	8	3	17
5	Michael	Robinson	1	13	6	18
6	William	Jordan				19
7	Susan	McKinsy				20
8	Mehdi	Kharrazi				21
9	John	McKinsy				22
10	John	McDonnald				23
11	Pat	Bentatar	7	25	8	24
12	Abraham	Lincoln	3	26	27	25
13	Brian	Adam	5	27	13	26
14	Catherin	Catholicy	7	28	15	33
15	Demi	Moore	12	29	23	34
16	Ebi	Farahanzadeh	11	30	26	42

Foreign Key (referring to another table)

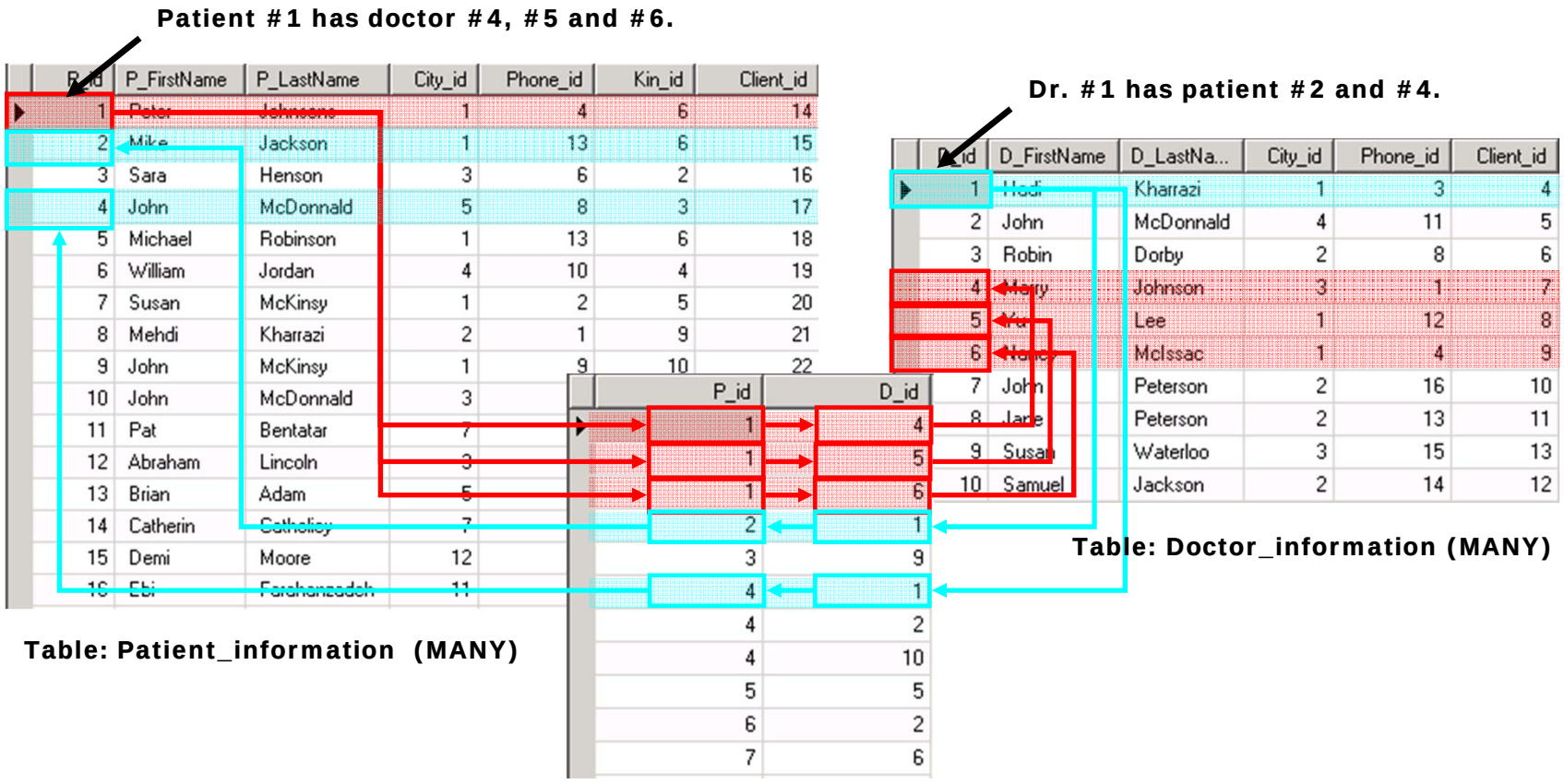
Table: Patient_information (MANY)

City_id	City_Name
1	Halifax
2	Vancouer
3	Toronto
4	Montreal
5	Quebec
6	Winnipig
7	Calgary
8	Sydney
9	New York
10	Los Angeles
11	Chicago
12	Boston

Table: City_information (ONE)

Database Overview → Relational Databases (cont.)

- Foreign Key (Many to Many relationship):



P_id	P_FirstName	P_LastName	City_id	Phone_id	Kin_id	Client_id
1	Peter	Johnsons	1	4	6	14
2	Mike	Jackson	1	13	6	15
3	Sara	Henson	3	6	2	16
4	John	McDonnald	5	8	3	17
5	Michael	Robinson	1	13	6	18
6	William	Jordan	4	10	4	19
7	Susan	McKinsy	1	2	5	20
8	Mehdi	Kharrazi	2	1	9	21
9	John	McKinsy	1	9	10	22
10	John	McDonnald	3			
11	Pat	Bentatar	7			
12	Abraham	Lincoln	3			
13	Brian	Adam	5			
14	Catherin	Catholicy	7			
15	Demi	Moore	12			
16	Ebi	Farahanzadeh	11			

D_id	D_FirstName	D_LastNa...	City_id	Phone_id	Client_id
1	Hadi	Kharrazi	1	3	4
2	John	McDonnald	4	11	5
3	Robin	Dorby	2	8	6
4	Mary	Johnson	3	1	7
5	Ali	Lee	1	12	8
6	Hans	McIssac	1	4	9
7	John	Peterson	2	16	10
8	Jane	Peterson	2	13	11
9	Susan	Waterloo	3	15	13
10	Samuel	Jackson	2	14	12

P_id	D_id
1	4
1	5
1	6
2	1
3	9
4	1
4	2
4	10
5	5
6	2
7	6

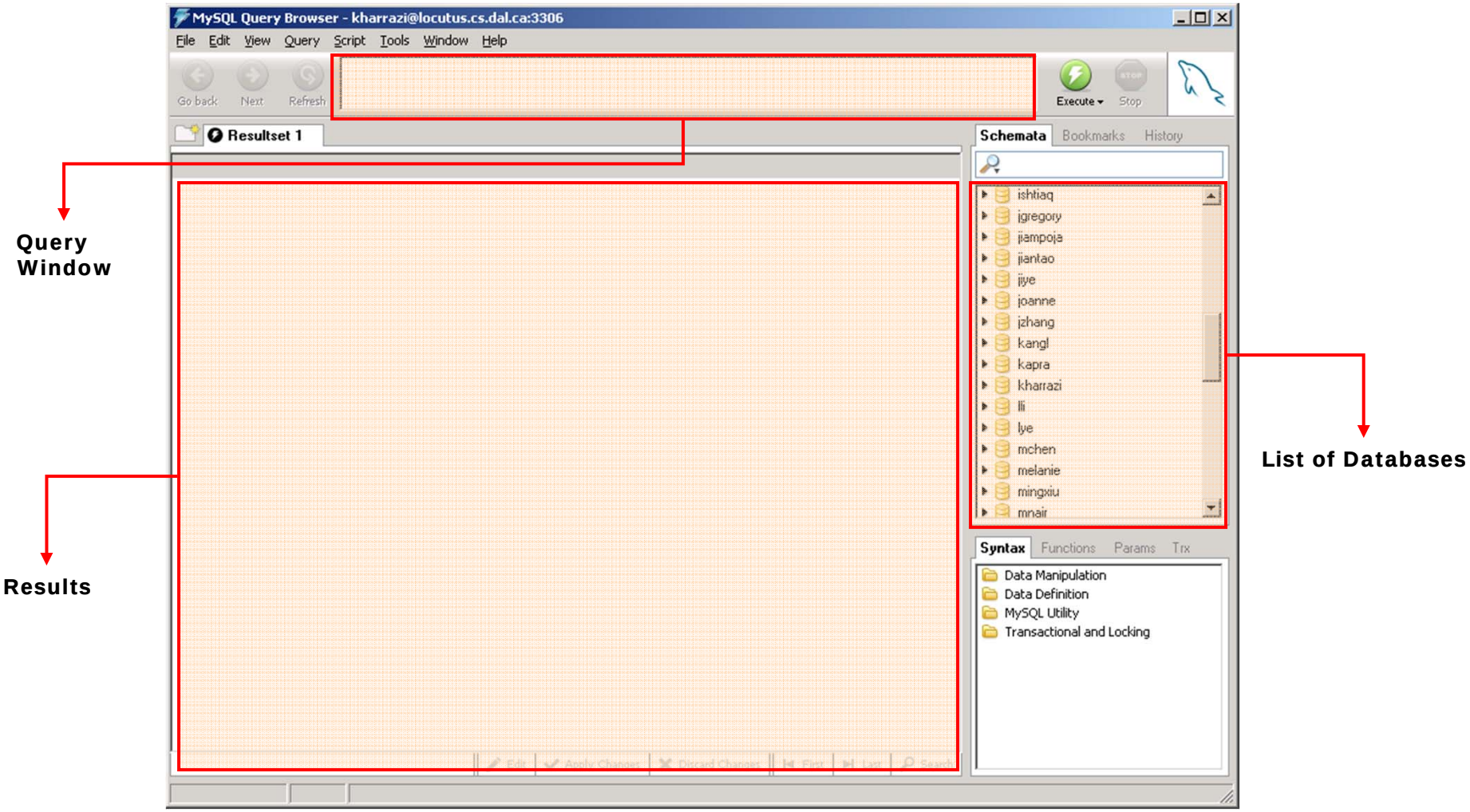
Database Overview → Relational Databases (cont.)

Database Normalization

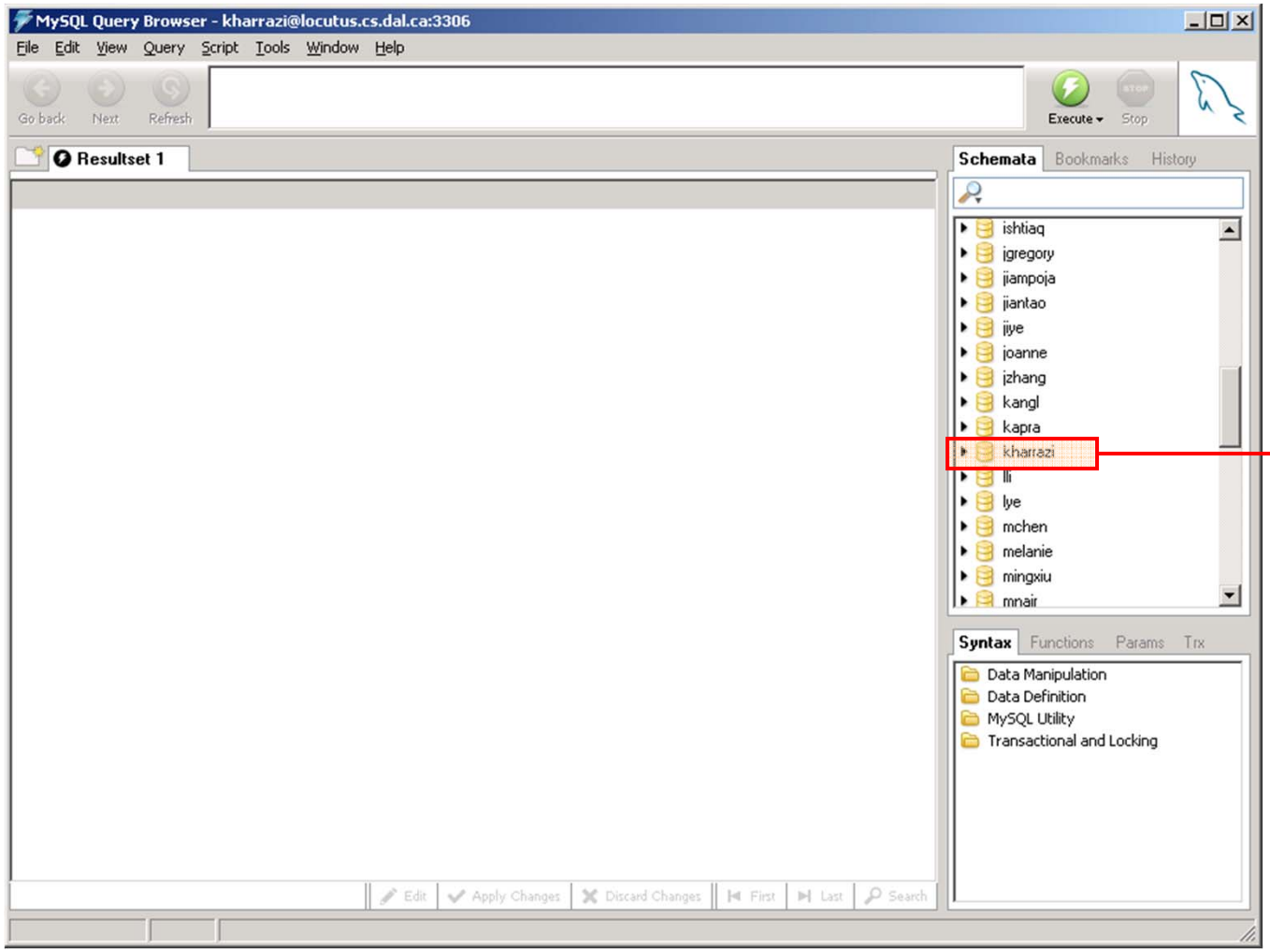
- In the field of relational database design, normalization is a systematic way of ensuring that a database structure is suitable for general-purpose querying and free of certain undesirable characteristics — insertion, update, and deletion anomalies — that could lead to a loss of data integrity
- Atomic data → smallest piece of data that can't or shouldn't be divided. The decision to consider a piece of information as atomic or not depends on the context and decision of the database designer:
  - Pizza delivery: order_id, address (includes house_number and street_name)
  - Real estate agent: mls_id, house_number, street_name

    (Real estate agent may want to know the houses on sale on one street)g

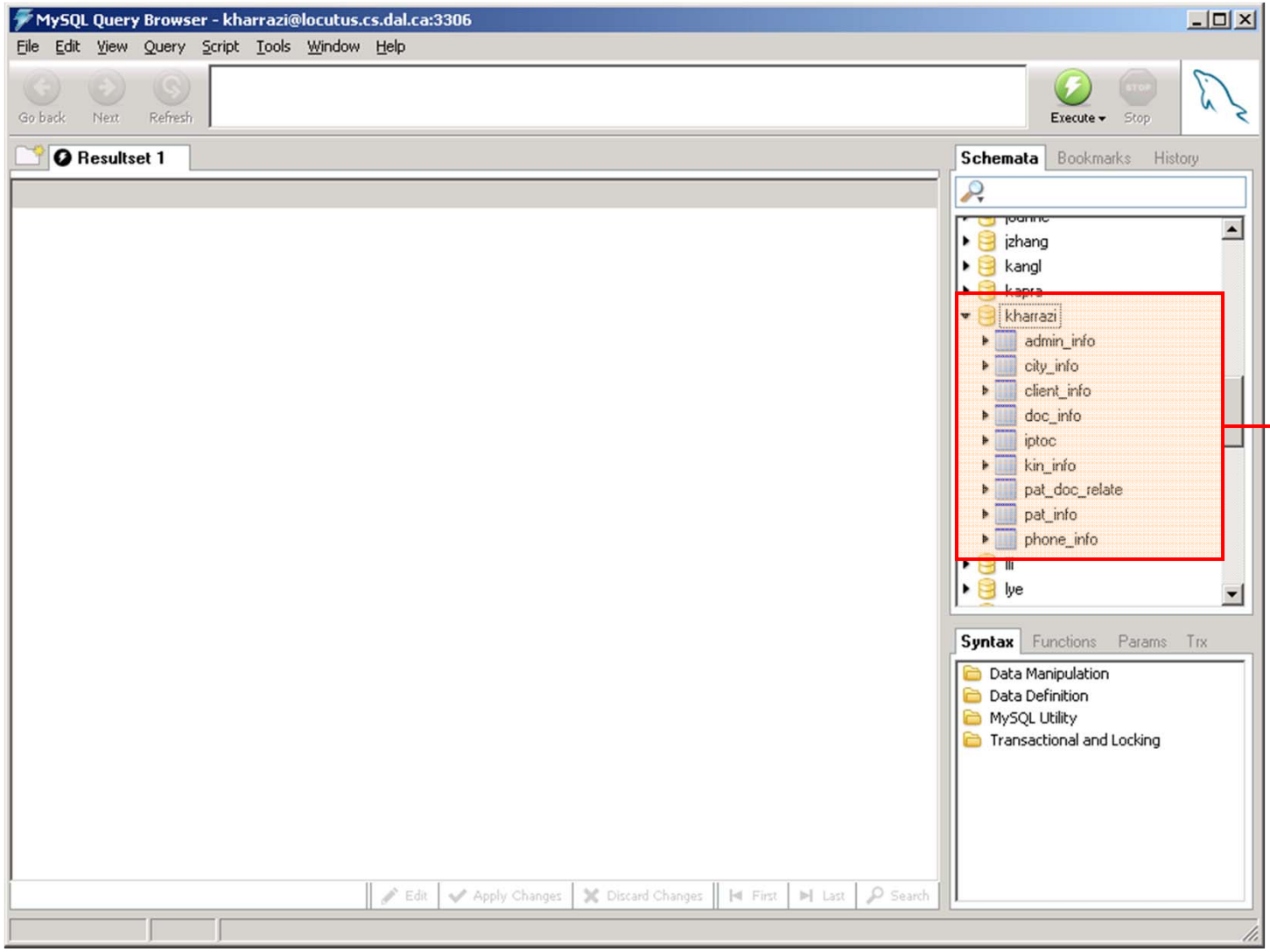
Database Overview → MySQL GUI (cont.) (Browsing)



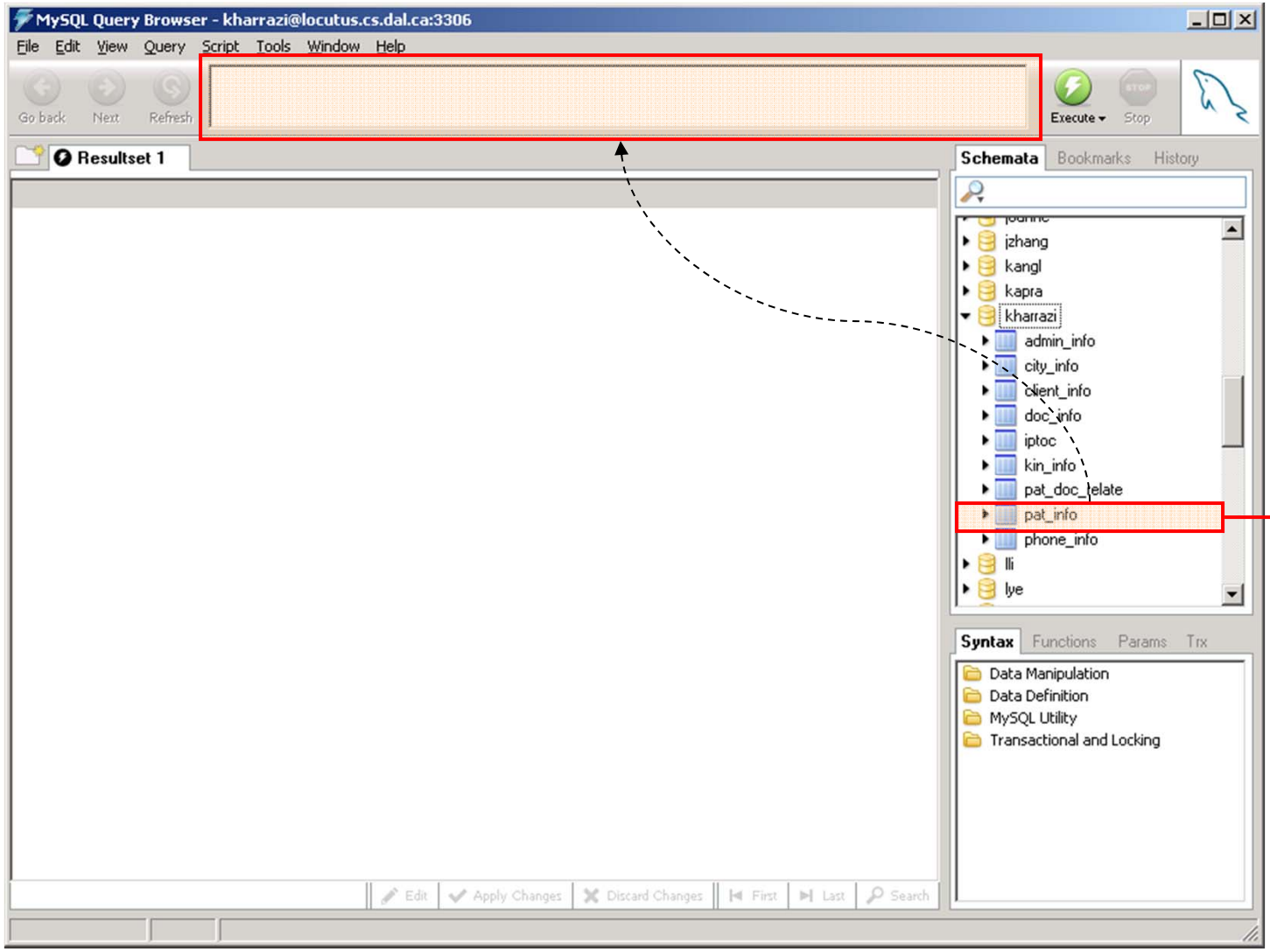
Database Overview → MySQL GUI (cont.) (Fetching Database)



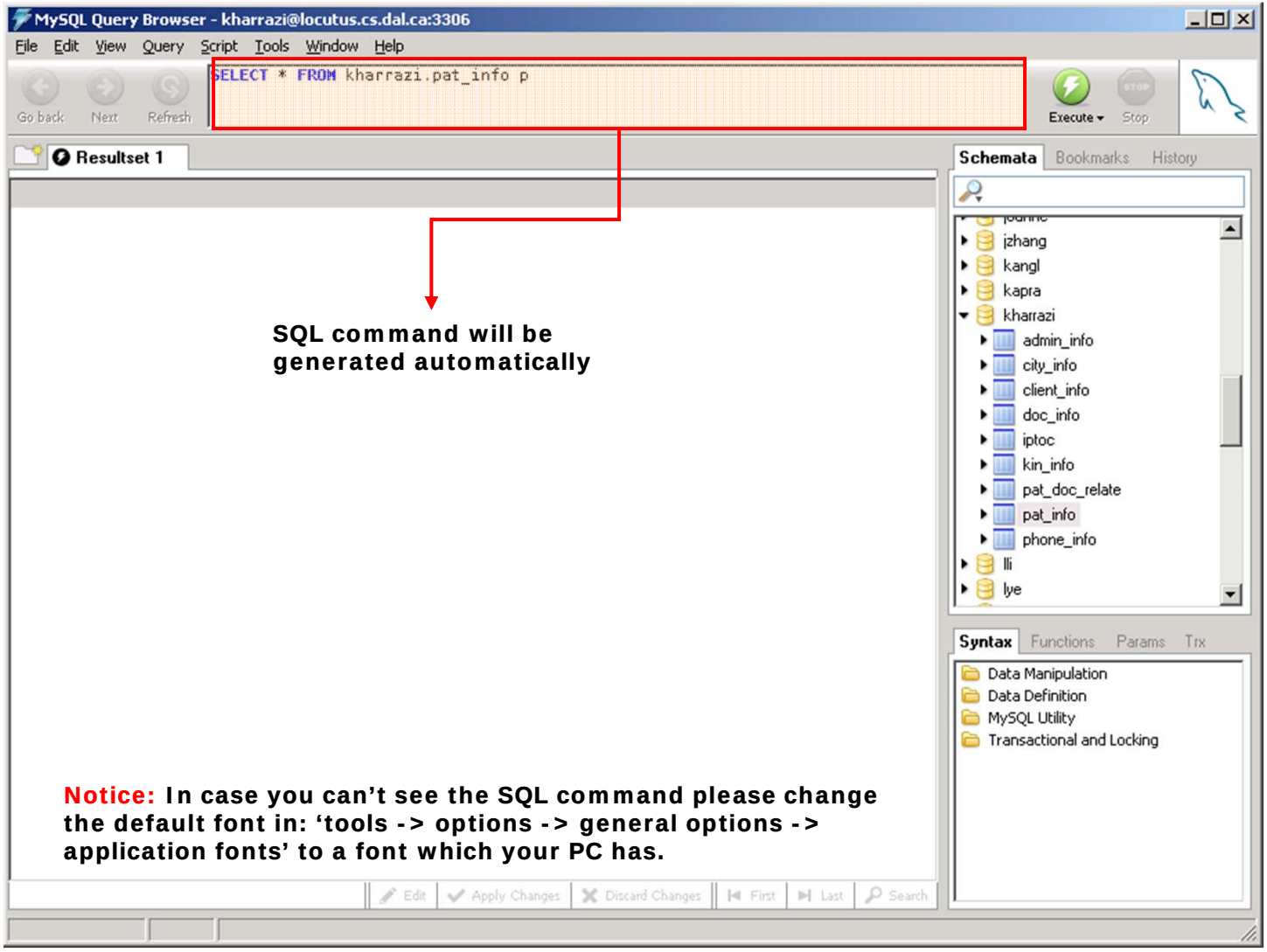
Database Overview → MySQL GUI (cont.) (Fetching Database)



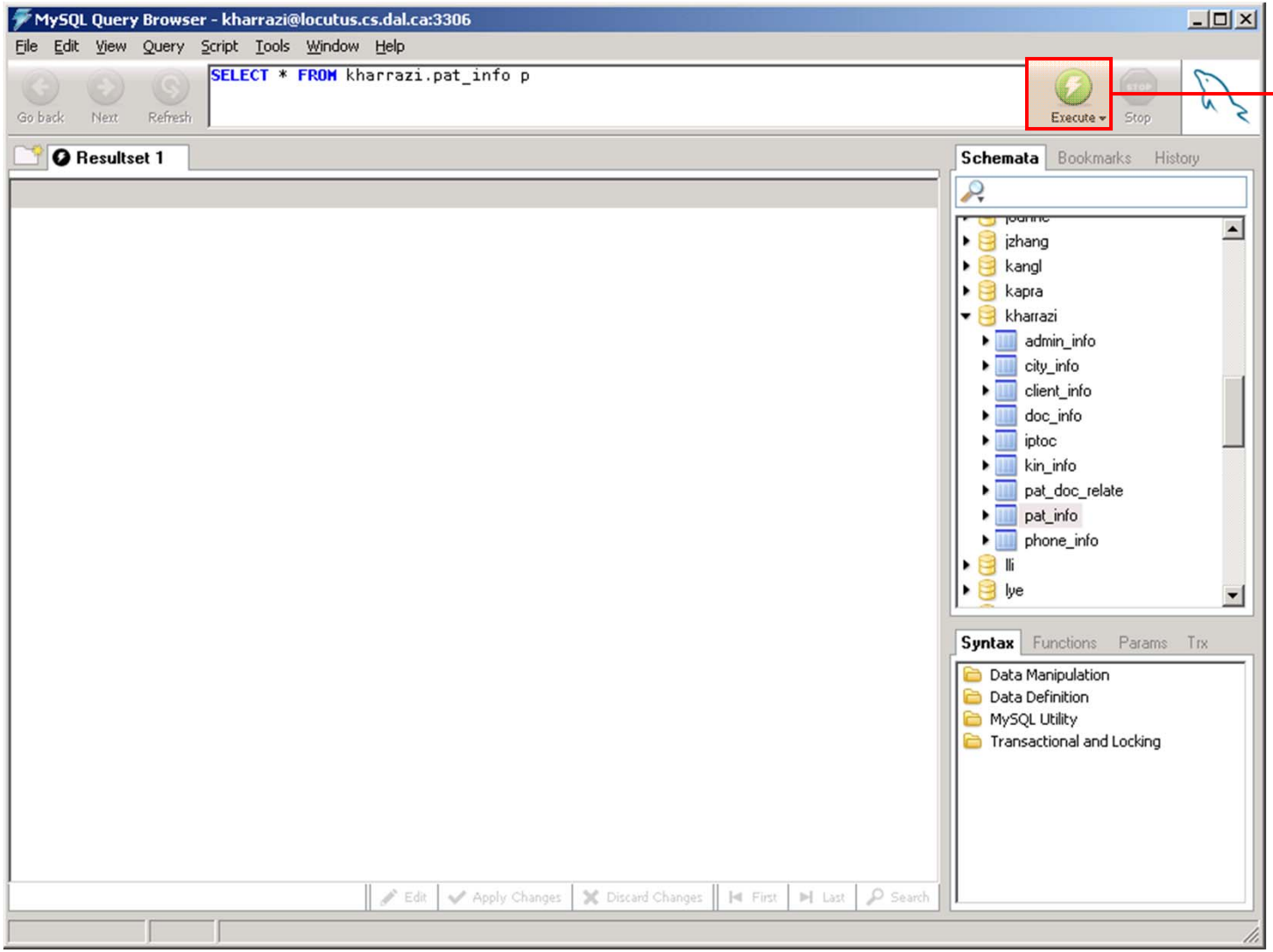
Database Overview → MySQL GUI (cont.) (Querying a Table)



Database Overview → MySQL GUI (cont.) (Querying a Table)

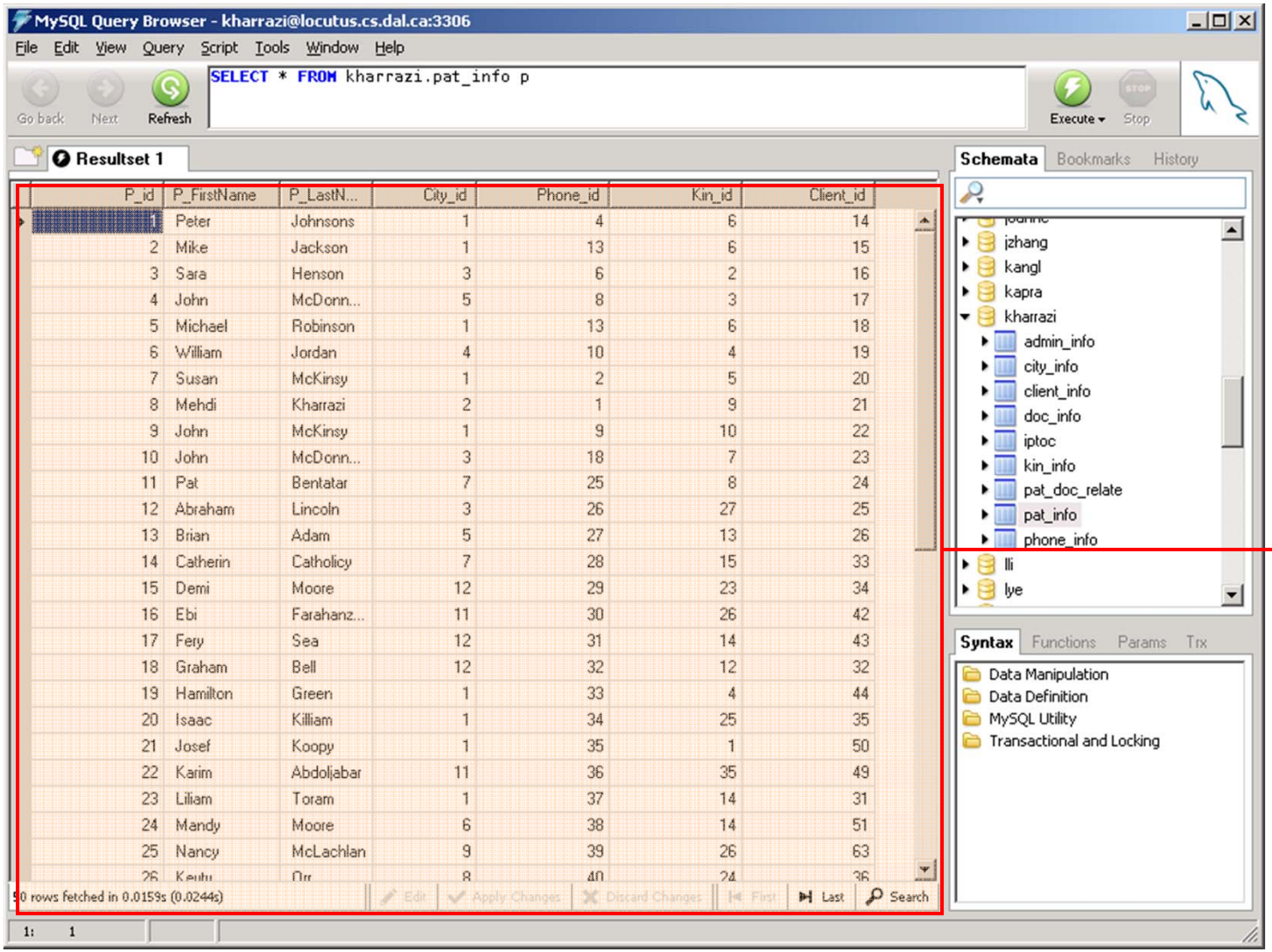


Database Overview → MySQL GUI (cont.) (Querying a Table)



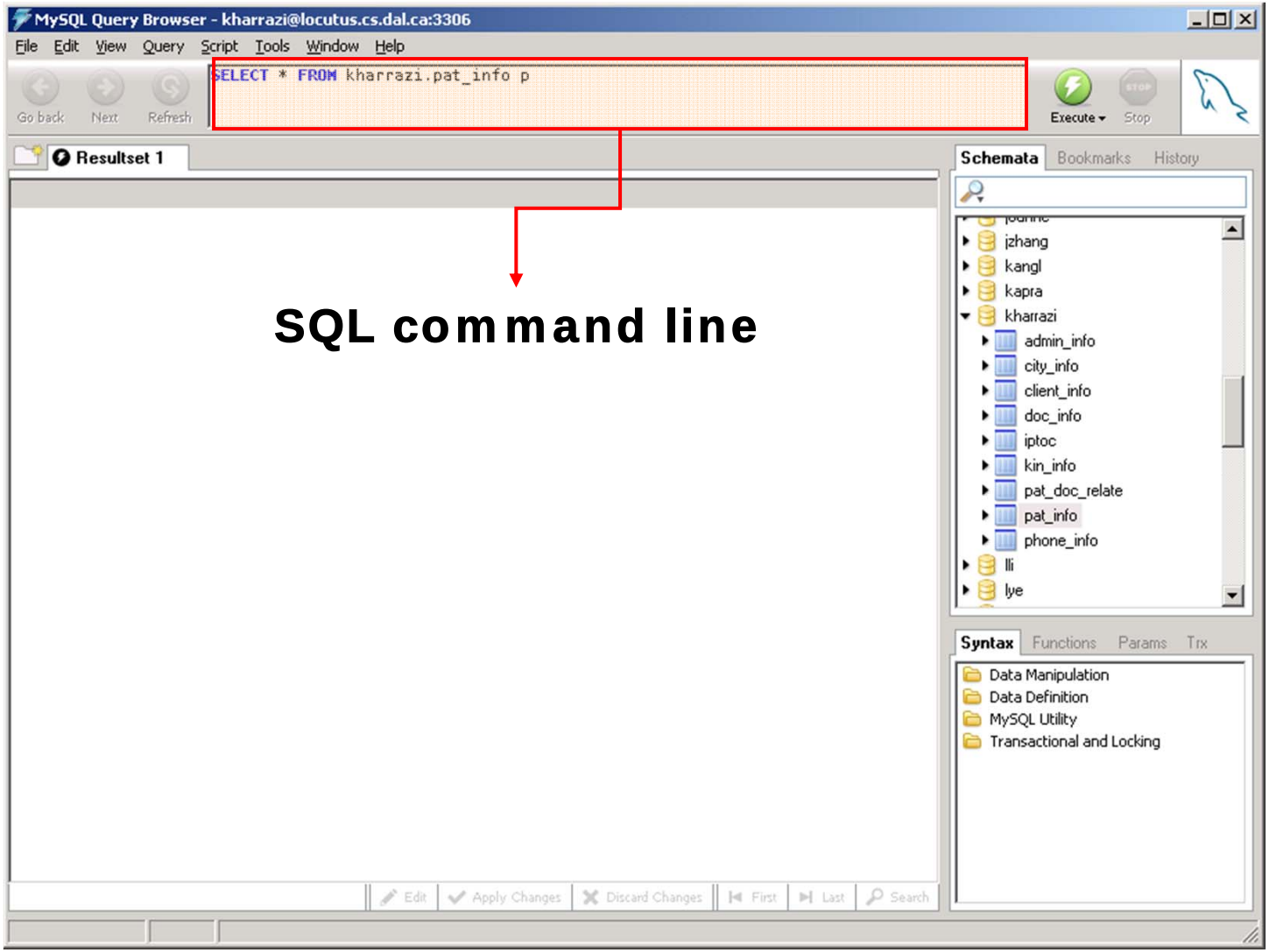
Click on Execute

Database Overview → MySQL GUI (cont.) (Querying a Table)



P_id	P_FirstName	P_LastN...	City_id	Phone_id	Kin_id	Client_id
1	Peter	Johnsons	1	4	6	14
2	Mike	Jackson	1	13	6	15
3	Sara	Henson	3	6	2	16
4	John	McDonn...	5	8	3	17
5	Michael	Robinson	1	13	6	18
6	William	Jordan	4	10	4	19
7	Susan	McKinsy	1	2	5	20
8	Mehdi	Kharrazi	2	1	9	21
9	John	McKinsy	1	9	10	22
10	John	McDonn...	3	18	7	23
11	Pat	Bentatar	7	25	8	24
12	Abraham	Lincoln	3	26	27	25
13	Brian	Adam	5	27	13	26
14	Catherin	Catholicy	7	28	15	33
15	Demi	Moore	12	29	23	34
16	Ebi	Farahanz...	11	30	26	42
17	Fery	Sea	12	31	14	43
18	Graham	Bell	12	32	12	32
19	Hamilton	Green	1	33	4	44
20	Isaac	Killiam	1	34	25	35
21	Josef	Koopy	1	35	1	50
22	Karim	Abdoljabar	11	36	35	49
23	Liliam	Toram	1	37	14	31
24	Mandy	Moore	6	38	14	51
25	Nancy	McLachlan	9	39	26	63

Database Overview → MySQL GUI (cont.) (Querying a Table)



Database Overview → SQL Language

- SQL is a standard computer language for accessing and manipulating databases.

- What is SQL?
  - SQL stands for **Structured Query Language**
  - SQL allows you to **access** a database
  - SQL is an **ANSI** standard computer language
  - SQL can **execute queries** against a database
  - SQL can **retrieve** data from a database
  - SQL can **insert** new records in a database
  - SQL can **delete** records from a database
  - SQL can **update** records in a database
  - SQL is **easy** to learn

Database Overview → SQL Language (cont.)

- SQL is an ANSI (American National Standards Institute) standard computer language for accessing and manipulating database systems.

- SQL statements are used to retrieve and update data in a database. SQL works with database programs like **MS Access, DB2, Informix, MS SQL Server, Oracle, Sybase, etc**.

- Unfortunately, there are many different versions of the SQL language, but to be in compliance with the ANSI standard, they must support the same **major keywords** in a similar manner (such as SELECT, UPDATE, DELETE, INSERT, WHERE, and others).

Database Overview → SQL Language (cont.)

- SQL Data Manipulation Language (**DML**):
  - SELECT - extracts data from a database table
  - UPDATE - updates data in a database table
  - DELETE - deletes data from a database table
  - INSERT INTO - inserts new data into a database table

- SQL Data Definition Language (**DDL**):
  - CREATE TABLE - creates a new database table
  - ALTER TABLE - alters (changes) a database table
  - DROP TABLE - deletes a database table
  - CREATE INDEX - creates an index (search key)
  - DROP INDEX - deletes an index

Database Overview → SQL Language (cont.)

SQL in a Nutshell

1. SQL Introduction
2. SQL: **SELECT** Statement
3. SQL: **WHERE** (BETWEEN/LIKE/LIMIT) Clause
4. SQL: **AND** & **OR**
5. SQL: **IN**
6. SQL: **ORDER BY** Clause
7. SQL: **INSERT INTO** Statement
8. SQL: **UPDATE/SET** Statement
9. SQL: **DELETE** Statement
10. SQL: *Joining and Keys (Inner Join)*
11. SQL: **LEFT JOIN/ON** *(Outer Join)*
12. SQL: **GROUP BY** & **HAVING**
13. SQL: **FUNCTIONS**
14. SQL: **CREATE** Database, Table, and Index
15. SQL: **DROP** Index, Table and Database
16. SQL: **ALTER** Table

Database Overview → SQL Language (cont.) → SELECT Statement

- The **SELECT** statement is used to select data from a table. The tabular result is stored in a result table.

- Syntax:

```
SELECT column_name(s) FROM table_name
```

- Examples:

SELECT * FROM pat_info

SELECT P_FirstName FROM pat_info

SELECT P_FirstName, P_LastName FROM pat_info

SELECT DISTINCT city_id FROM pat_info

Database Overview → SQL Language → WHERE Statement

- To conditionally select data from a table, a **WHERE** clause can be added to the SELECT statement.

- Syntax:

```
SELECT column FROM table
WHERE column operator value
```

- Examples:

```
SELECT * FROM pat_info WHERE P_FirstName='Mike'
SELECT * FROM pat_info WHERE P_id<6
SELECT * FROM pat_info WHERE P_id<6 LIMIT 2
SELECT * FROM pat_info WHERE P_id BETWEEN 6 AND 9
SELECT * FROM pat_info WHERE P_FirstName LIKE 'h%'
```

Database Overview → SQL Language → AND/OR/IN Clause

- **AND & OR** join two or more conditions in a WHERE clause. The AND operator displays a row if ALL conditions listed are true. The OR operator displays a row if ANY of the conditions listed are true.

- Syntax:

```
SELECT column FROM table WHERE column operator value
 AND column operator value OR column operator value
```

- Examples:

```
SELECT * FROM pat_info WHERE P_id>6 AND City_id=4

SELECT * FROM pat_info WHERE City_id=3 OR City_id=4

SELECT * FROM pat_info WHERE P_FirstName
IN ('Sara', 'Uve', 'John')
```

Database Overview → SQL Language → ORDER BY Clause

- The **ORDER BY** clause is used to sort the rows.
- Syntax:

```
SELECT column FROM table ORDERED BY column DESC/ASC
```

- Examples:

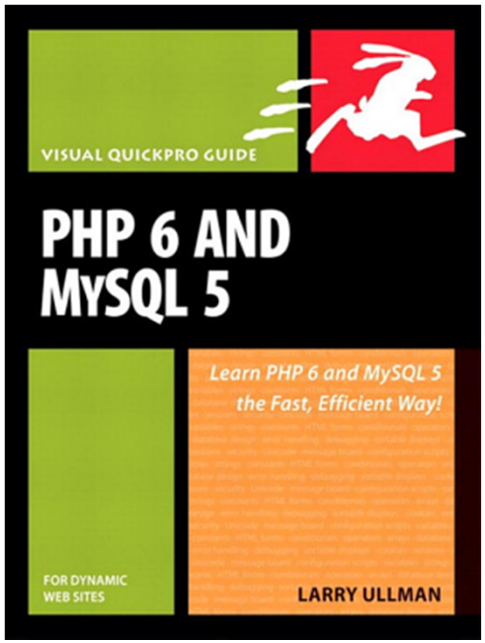
SELECT * FROM pat_info ORDER BY P_FirstName

SELECT * FROM pat_info ORDER BY P_FirstName DESC

JOHNS HOPKINS BLOOMBERG SCHOOL of PUBLIC HEALTH

Additional Resources

Resources – Books



Title	PHP 6 and MySQL 5 for Dynamic Web Sites: Visual QuickPro Guide
Authors	Larry Ullman
Year	2009
Hardcover	Yes
Publisher	Pearson Education
Language	English
ISBN	9780321617422

Resources – Web

- **Reference Website**:
  - HTML: www.w3.org
  - PHP: www.php.net
  - MySQL: www.mysql.com
  - Apache Webserver: httpd.apache.org
- **Educational**:
  - www.w3schools.com
  - www.lynda.com
  - www.codecademy.com
  - www.khanacademy.org/computing/computer-programming

Summary

- Networking Overview
  - Network Topology
  - IP Address
  - Domain Name
  - Network Devices
- Web Server Technology Overview
  - Static Languages (e.g., HTML)
  - Server Side Languages (e.g., PHP)
  - Databases (e.g., MySQL)
  - Server Side Integration (HTML/PHP/MySQL)
- Database Overview
  - Relational Databases
  - MySQL GUI
  - SQL Language
- Resources
  - Books
  - Web