UNIT 8 · SESSION 9

The Internet, the Web and DNS

Six weeks ago you published a page to an address with your group's name in it. Today you find out what that address is, who answers for it, and how.

2ND SEMESTER · SCHOOL YEAR 2026-2027

Introduction to Computing · Prof. Ryan V. Labrador

Saturday, 10 October 2026 · 2-hour lecture

TODAY

Two hours, four parts

Part 1	**Internet is not the Web**	Two different things. Most people use the words as one.
Part 2	**Addresses**	IP addresses, IPv4 and IPv6, and why your phone's address is not yours
Part 3	**DNS, properly**	The system that turns your group's name into a number. The core of today.
Part 4	**URLs, HTTP, browsers**	Reading an address, what the padlock means, how a browser works
After	**Laboratory**	You trace YOUR OWN subdomain, from name to number to file

Part 3 is the largest part of the session, and this afternoon's lab is the best one of the semester. Save your energy for both.

LEARNING OBJECTIVES

By the end of today you will be able to…

1. Explain the difference between the Internet and the World Wide Web.
2. Describe what clients and servers do, and which one your phone is.
3. Read an IPv4 address, and say why IPv6 had to be invented.
4. Trace a DNS lookup through resolver, root, TLD and authoritative server.
5. Name what A, AAAA, CNAME, MX, NS and TXT records are for.
6. Say exactly what the padlock in the address bar does and does not prove.

PART 1

The Internet is not the Web

One is a network of networks. The other is one of the things that runs on it. People say them interchangeably; they are not interchangeable.

THE DISTINCTION

Roads and the vehicles on them

The Internet

- The global network of interconnected networks.
- Cables, fibre, radio, satellites, routers.
- Older — the network came first.
- Carries many different services, not just web pages.
- Analogy: the road system.

The World Wide Web

- A service that RUNS ON the internet.
- Pages, links, HTTP, browsers.
- Invented later, on top of what already existed.
- One of several things the internet carries.
- Analogy: the buses that use the roads.

Turn off the Web tomorrow and the internet still works. Turn off the internet and nothing works at all.

NOT JUST PAGES

Other things the internet carries

Email

Its own set of rules, decades older than the web. When you use webmail in a browser, that browser is a front door onto a system that is not the web.

Messaging and calls

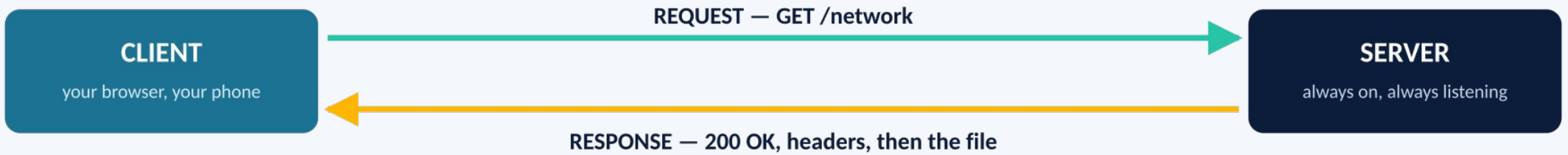
Messenger, Viber, Zoom, online games. They use the internet directly. No page is ever drawn.

DNS itself

The service we spend the middle of today on runs on the internet and is not part of the web at all. It has to work before any page can load.

Your phone uses the internet all day without opening a browser once. That is the difference, in your own pocket.

Clients and servers



The client always starts the conversation. The server never speaks first.

Client	**Asks**	Your phone, your browser, the lab PC. It starts the conversation and waits for a reply.
Server	**Answers**	A machine that is always on, always listening, waiting to be asked. Your group's site lives on one.
Request	**What you send**	'Give me the file at this path.' A few hundred bytes. Usually smaller than the reply.
Response	**What comes back**	A status, some headers, and the file. Then the connection can be reused or closed.

'Server' is a role, not a size. An old desktop under a desk is a server if things ask it for something and it answers.

PART 2

Addresses

Every device that speaks on the internet has a number. Names are for people; the network only ever uses numbers.

Four numbers, each 0 to 255

THE ADDRESS	WHAT IT IS	WHERE YOU MEET IT
`192.168.1.1`	Very likely your home router	Type it into a browser at home
`192.168.x.x`	A private address, inside a LAN	Almost every home and office
`8.8.8.8`	A public DNS resolver	You will type this yourself this afternoon
`127.0.0.1`	This machine. 'Localhost'.	Always means the computer you are on
`255.255.255.0`	Not an address — a subnet mask	It says which part is the network

Each of the four numbers is one byte. Four bytes, 32 bits, about 4.3 billion possible addresses in total.

RUNNING OUT

IPv4 and IPv6

IPv4

- 32 bits. About 4.3 billion addresses.
- Written as four decimal numbers: 203.0.113.42
- Designed when a few thousand machines existed.
- There are more phones on earth than IPv4 addresses.
- Kept alive by sharing addresses between many devices.

IPv6

- 128 bits. A 39-digit number of addresses.
- Written in hexadecimal: 2001:0db8::1
- Enough for every device, forever, realistically.
- Hex again — eight groups of four hex digits.
- Adoption is slow because IPv4 still mostly works.

IPv6 is not faster. It is bigger. That is the entire reason it exists.

TWO ADDRESSES

The one your device has, and the one the world sees

Private	**Inside your LAN**	192.168.x.x, 10.x.x.x, 172.16-31.x.x. Reused in millions of buildings at once. Not routable on the internet.
Public	**Your router's address**	One address shared by everyone in the building. This is what a website records when you visit.
The translation	**NAT**	Your router rewrites the addresses on the way out and remembers who asked, so replies come back to the right device.
Why it matters	**Attribution**	A site sees the building, not the person. That is a data privacy point, and it is Unit 10 in two weeks.

Run ipconfig this afternoon and you will see a private address. Search 'what is my IP' and you will see a different one. Both are correct.

PART 3

DNS

The Domain Name System. Nobody types 203.0.113.42. This is the machinery that lets you type a name instead — and this afternoon you will watch it work on your own address.

THE PROBLEM

Machines use numbers. People do not.

The need	**Names to numbers**	You type a name. The network needs an IP address. Something must translate, in a few milliseconds, billions of times a day.
Not a phonebook	**It is distributed**	There is no single list anywhere. No organisation holds a copy of every name on the internet.
Delegation	**Each level answers for the level below**	The root knows who runs .net. Whoever runs .net knows who answers for rmlsystems.net. That chain is the design.
Why it survives	**No single point of failure**	Nothing can be switched off to take the whole system down. That was deliberate, and it has held for forty years.

DNS is the largest distributed database ever built, and it exists because names are easier to remember than numbers.

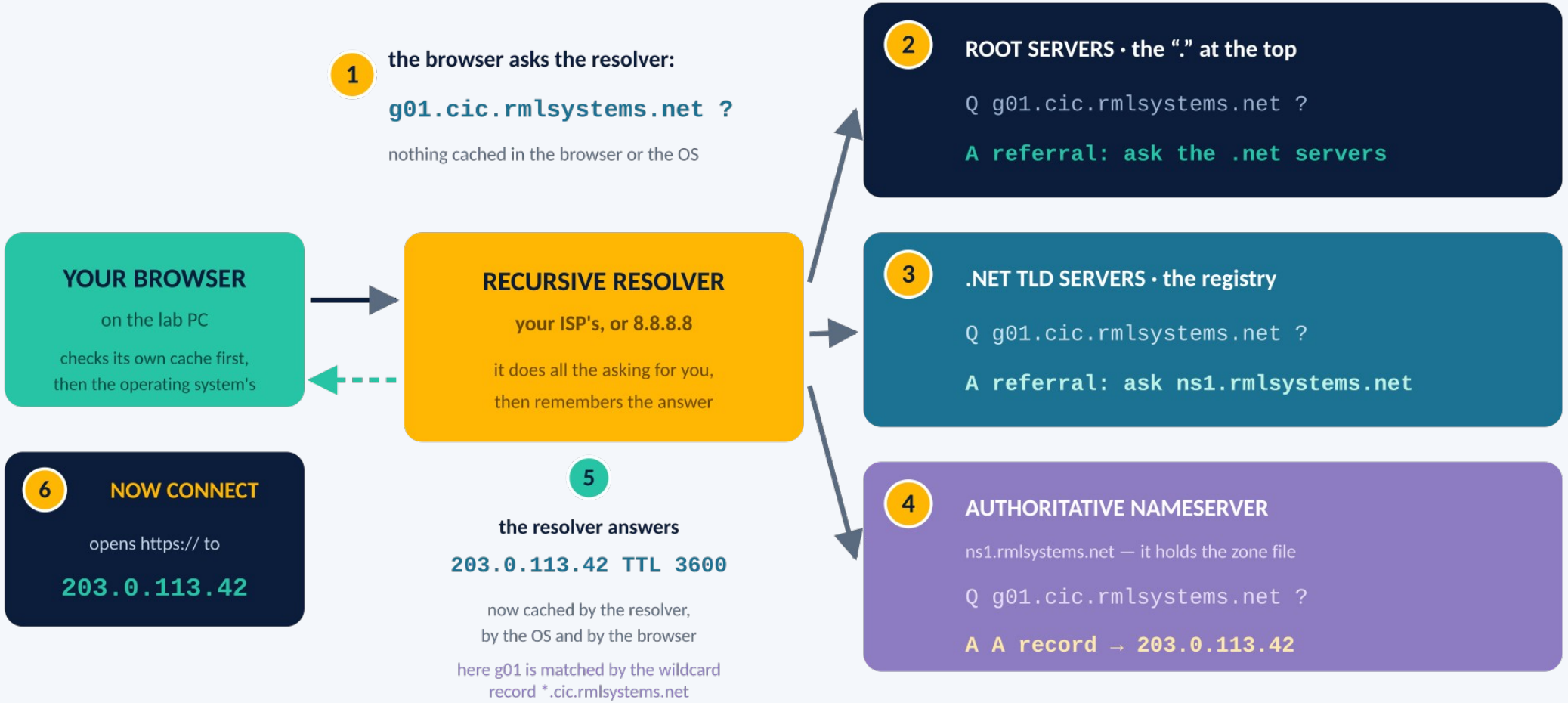
WHO IS INVOLVED

Four players in every lookup

Resolver	**Does the work for you**	Your ISP's, or a public one like 8.8.8.8. It asks everybody else and keeps the answers for a while.
Root servers	**Know the top level**	Thirteen named addresses, A to M, served worldwide. They do not know your site — they know who runs .net.
TLD servers	**Know one top-level domain**	.net, .com, .ph, .gov.ph. They know which nameservers are responsible for rmlsystems.net.
Authoritative	**The final answer**	The nameservers for rmlsystems.net. They hold the actual records — including yours.

Only the authoritative server truly knows. Everyone else is either pointing onwards or repeating something they were told earlier.

One lookup, six steps, four players



Steps 2, 3 and 4 are asked by the RESOLVER, never by your PC. Root and TLD only point onwards — only the authoritative server truly knows.

STEP BY STEP

Looking up g01.cic.rmlsystems.net

#	WHO ASKS	WHO THEY ASK	WHAT COMES BACK
1	Your browser	The operating system, then its cache	Nothing yet — not seen recently
2	Your PC	The resolver (e.g. 8.8.8.8)	Nothing cached — it will go and find out
3	Resolver	A root server	Ask the .net servers. Here they are.
4	Resolver	A .net TLD server	Ask the nameservers for rmlsystems.net.
5	Resolver	The authoritative server	The A record. Here is the IP address.
6	Resolver	— answers your PC —	The IP, plus how long it may be kept

Six steps, and it normally finishes in well under a tenth of a second. Then it is cached, and the next person pays almost nothing.

The record types you will meet

TYPE	MAPS	PLAIN ENGLISH	YOU WILL QUERY THIS TODAY
A	name to IPv4	Where this name lives	Yes — yours
AAAA	name to IPv6	Same, but the newer addresses	Yes
CNAME	name to another name	This name is an alias for that one	Yes
MX	domain to mail servers	Send email for this domain here	Yes
NS	domain to nameservers	These servers are authoritative	Yes — the key one
TXT	name to free text	Notes, proofs of ownership, anti-spam rules	Yes

A record is just a line in a file: a name, a type, a value, and how long you may remember it.

READ IT BACKWARDS

Your own address, taken apart

g01.cic.rmlsystems.net

READ THIS ORDER	THE LABEL	WHAT IT IS	WHO CONTROLS IT
1st — rightmost	net	Top-level domain	The .net registry
2nd	rmlsystems	The registered domain	Your instructor, who pays for it
3rd	cic	A subdomain — this course	Your instructor
4th — leftmost	g01	A subdomain — your group	Your instructor, on your behalf

DNS names are read RIGHT TO LEFT, from the most general to the most specific. Everything to the left is a subdivision of what is on its right.

ONE LINE

How ten groups got ten addresses

```
*.cic.rmlsystems.net      A      the server's IP address
```

The star	**Means anything**	Any name ending in .cic.rmlsystems.net that has no record of its own matches this one line.
The consequence	**Ten sites, one record**	g01 through g10 all resolve, and nobody had to add ten separate entries.
The surprise	**So does g99**	A group that does not exist still resolves — because the wildcard answers for it. Try it this afternoon.
The lesson	**Resolving is not existing**	A name having an IP address does not mean anything is served there. Those are two different questions.

Ten students. One line in a file. That is what delegation buys you.

REMEMBERING

Caching and TTL

TTL

Time To Live, in seconds. Every answer carries one. It says how long anybody may keep this answer before asking again.

Layers of cache

The browser, the operating system, the resolver. Three places an answer might come from before anyone asks a real server.

Why changes lag

Change a record and old answers stay in caches until their TTL runs out. This is why 'it works for me' and 'it is down' are both true.

ipconfig /flushdns empties your machine's cache. It cannot empty anybody else's — which is why waiting is often the only fix.

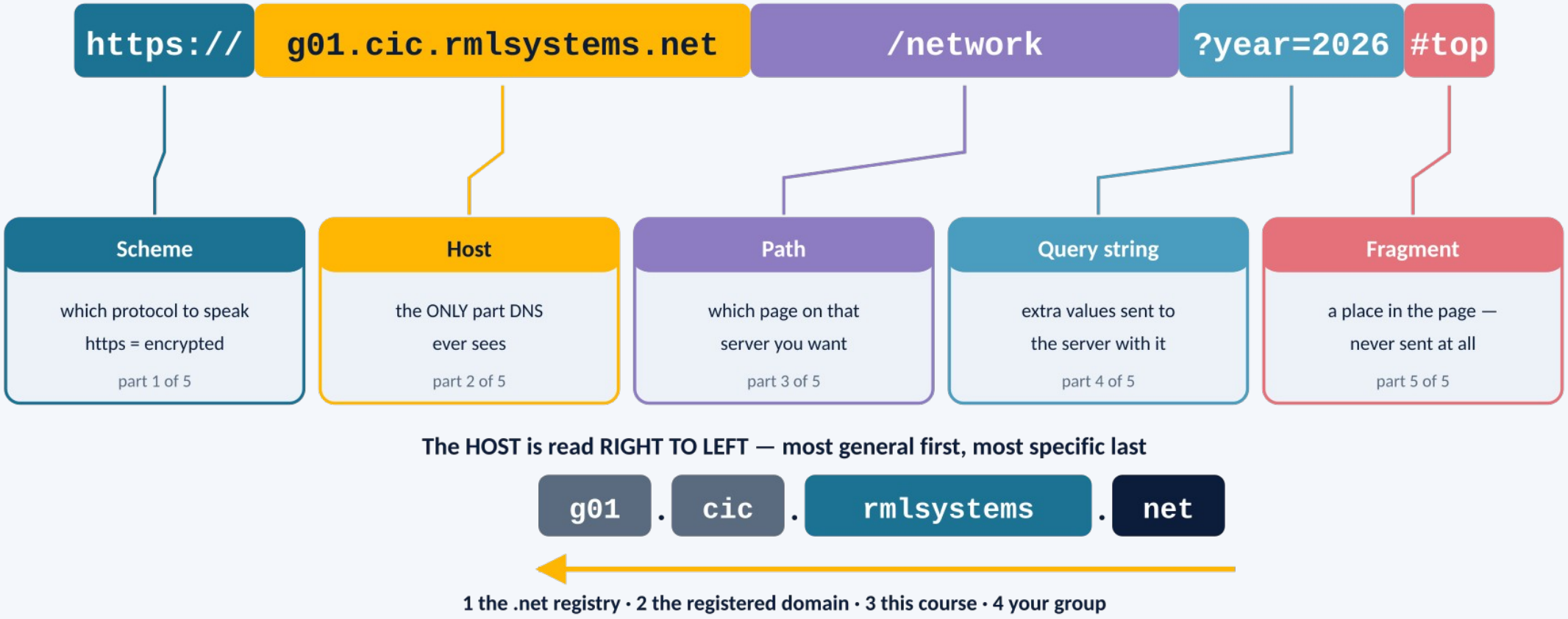
PART 4

URLs, HTTP and the browser

Now that the name has become a number, what actually gets asked for — and what the padlock does and does not promise.

ANATOMY

Every part of an address, labelled



Cover the diagram and ask the room which part DNS actually uses. It is the amber one, and only the amber one.

Every part of a URL

`https://g01.cic.rmlsystems.net/network?year=2026#top`

PART	WHAT IT IS	WHAT IT DOES
https	Scheme	Which protocol to speak. https means encrypted.
g01.cic.rmlsystems.net	Host	The name DNS turns into an IP address.
/network	Path	Which page on that server you are asking for. On your own site it is a route you wrote.
?year=2026	Query string	Extra values sent to the server with the request.
#top	Fragment	A place in the page. Never sent to the server at all.

The host is the only part DNS ever sees. Everything after the first single slash is the server's business, not the network's.

HTTP: asking, and the numbers that come back

CODE	NAME	WHAT IT REALLY MEANS	WHOSE PROBLEM
200	OK	Here is the file you asked for.	Nobody's
301	Moved permanently	It lives somewhere else now. Go there.	Handled for you
403	Forbidden	It exists. You are not allowed it.	Permissions
404	Not found	No such file at that path on this server.	Usually a typo
500	Internal server error	The server broke while trying to answer.	The server's
503	Service unavailable	The server is up but cannot cope right now.	The server's

A 404 proves the server answered. A name that does not resolve at all never gets that far — you see a different error entirely.

What the padlock proves — and what it does not

It DOES prove

- Traffic between you and the site is encrypted.
- Nobody on the Wi-Fi can read what you send.
- Nobody can quietly alter the page on the way.
- The certificate matches the name in the address bar.
- That is all. Genuinely, that is the whole list.

It does NOT prove

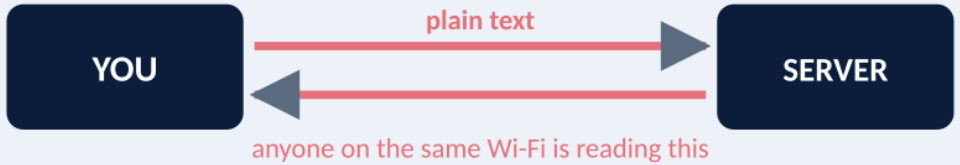
- That the site is honest.
- That the company behind it exists.
- That your data is safe once it arrives.
- That the name is the one you meant to type.
- Certificates are free. Criminals have padlocks too.

A padlock on gcash-verify-login.xyz is a real padlock on a real fake site. Encryption protects the road, not the destination.

SIDE BY SIDE

What the encryption actually covers

HTTP · port 80 · no padlock

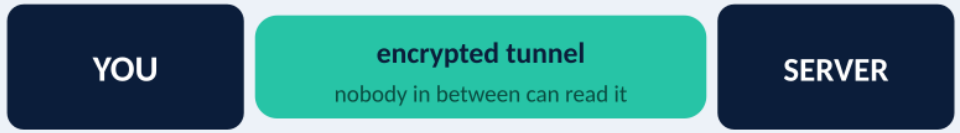


Visible to anyone in between:

- the full address and page you asked for
- everything the page contains
- the username and password you typed
- and they can silently alter the page

Nothing at all is protected.

HTTPS · port 443 · TLS encrypted



HIDDEN

the path you asked for

the page's content

form data and passwords

cookies and sessions

STILL VISIBLE

the server's IP address

the hostname you asked for

how much data, and when

that you visited at all

Encryption protects the road. It says nothing about the destination.

The amber column is the honest part. HTTPS hides what you did on the site — it does not hide that you went there.

BEHIND ONE CLICK

What a browser actually does

	1	**Resolves the name**	Asks DNS for an IP address, checking its own cache and the operating system's first.
	2	**Opens a connection**	To that IP, on port 443 for https or port 80 for http. Sets up encryption if needed.
	3	**Sends a request**	A few lines of text: the method, the path, and who is asking.
	4	**Receives and parses**	Status code, headers, then the HTML. It reads the HTML and finds what else it needs.
	5	**Fetches everything else**	Stylesheets, scripts, images — each one often another request, sometimes to other names entirely.
	6	**Draws the page**	Lays everything out and renders it. All of this, normally, in under a second.

How a search engine works

Crawl

Automated programs follow links from page to page, endlessly, fetching what they find. Your group site can be crawled — it is a public page on a public name.

Index

Every word found is stored against the pages it appeared on. Searching does not search the web. It searches this index.

Rank

Deciding which of a million matching pages to show first. The ranking rules are secret, constantly changed, and worth enormous sums of money.

A search engine never searches the internet. It searches a copy it made earlier — which is why brand-new pages take time to appear.

HOLD ON TO THIS

Five things from today

One	Internet, then Web	The network came first. The Web is one service running on it.
Two	Names are for people	The network only uses numbers. DNS is the translation layer, and nothing loads without it.
Three	Delegation, not a list	Root points to TLD, TLD points to authoritative. No single machine holds everything.
Four	Resolving is not existing	A name can have an IP address with nothing served there at all.
Five	The padlock protects the road	Not the destination. Encryption says nothing about honesty.

Next Saturday: cybersecurity. Malware, phishing, passwords, and the scams currently running in this province.

AFTER THE BREAK

The best lab of the semester

Yours	**Your own subdomain**	Every command you run today points at the address with your group's name in it.
Trace	**Name to number**	nslookup, step by step, from your machine out to the authoritative server.
Records	**A, NS, MX, CNAME, TXT**	You will read real records out of a real zone, not an example in a book.
Prove	**Number back to file**	Follow the IP to the server and back to the page you wrote in week three.
Publish	**/dns**	Everything you found becomes the sixth page on your own site.

For six weeks that address has been a thing you typed. This afternoon it becomes a thing you understand.

PROGRAMMING LAB ACTIVITY

This afternoon

A lookup table, which is all DNS is

What you are building today

Together	**The group page**	A /dns page: the names you looked up this afternoon and the addresses they gave, as a dictionary, with a look-up that answers a miss politely instead of crashing.
On your own	**Your own version — this is the marked one**	Your own five most-visited sites, with the address each resolved to on the machine in front of you.
To match	**Your page.html twin**	The same thing again, typed out by hand as HTML.

WHERE IT GOES LIVE

`gNN.cic.rmlsystems.net/dns`	`gNN.cic.rmlsystems.net/<yourfolder>/`	`gNN.cic.rmlsystems.net/<yourfolder>/page.html`

Eight identical pages is eight zeros. Your version has to be yours — your data, your words.

NEW THIS WEEK

The Python you have not used before

`table = {"cic": "58.71.69.30"}`

a dictionary — a name, and what it points at

`table["cic"]`

look one up

`table.get(x, "not found")`

look one up without crashing

`for name, address in table.items():`

walk the whole table

at the shell

```
table = {
    "rmlsystems.net": "58.71.69.30",
    "cic.rmlsystems.net": "58.71.69.30",
}

for name, address in table.items():
    print(name, "->", address)

print(table.get("nowhere.net", "not in our table"))
```

It prints: rmlsystems.net -> 58.71.69.30 ... not in our table

TWENTY POINTS

How this is marked

6	**It runs**	Your address loads and there is no traceback on it.
6	**It does this week's thing**	A real dictionary of addresses you measured, and .get() for the misses.
4	**It is yours**	Your own five sites, and your own not-found sentence.
2	**The twin matches**	page.html shows the same thing, by hand.
2	**Worksheet complete**	Including the AI sentence and the twin count.

DUE Sunday 11 October, 11:59pm · the full guide is at labs.cic.rmlsystems.net/guides/

Nobody typed your address in.

There is no master list with your group on it. There is one record, in one zone file, on one server, that a chain of other servers knows how to reach. This afternoon you follow that chain yourself, from your own keyboard.

Questions?