



NTNU

| Kunnskap for en bedre verden

Teknostart Day 1

How does the Internet work?

Stanislav (Stas) Lange



Frokost for 1. klasse-ladies

Nå på onsdag kl. 8:00 – 9:00

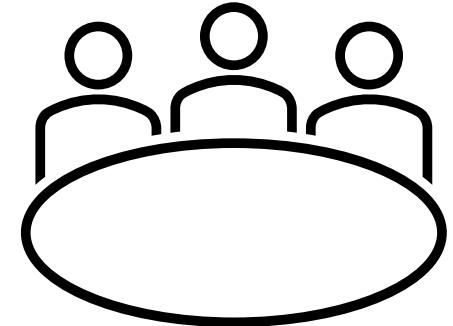
Elektro-kantina (her i El-bygget)

Bli med! 😊

Innsjekk

Hva?

- Uformell, ved starten av dagen
- Mulighet til å dele noe med de andre i gruppen om hvordan du har det (feks. jeg er litt nervøs, spent på dagen, trøtt, ...)



Hvordan?

- Si gjerne også hvem du er, hvor du kommer fra
- Fortell kort noe om hvordan du har det? Hvordan har starten på dagen vært?
- 2-3 min. per person

Utsjekk

Hva?

- Uformell kort avslutning etter dagens siste arbeidsøkt

Hvordan?

- Si kort noe om hvordan du har opplevd dagen
- Feks. hva synes du var interessant / gøy / kjedelig? Evt. hva skal du gjøre etterpå?
- 2-3 min. per person

Hvorfor?

- Bli kjent med de andre i gruppen / klassen
- Bidrar til åpenhet og til at gruppemedlemmene kan få forståelse for hva de andre tenker / opplever, ...
- Gir en mulighet til å ta vare på hverandre
- Viktig for samarbeidet at man også blir litt kjent, har fokus på det sosiale
- Innsjekk/utsjekk hver dag denne uken ;)

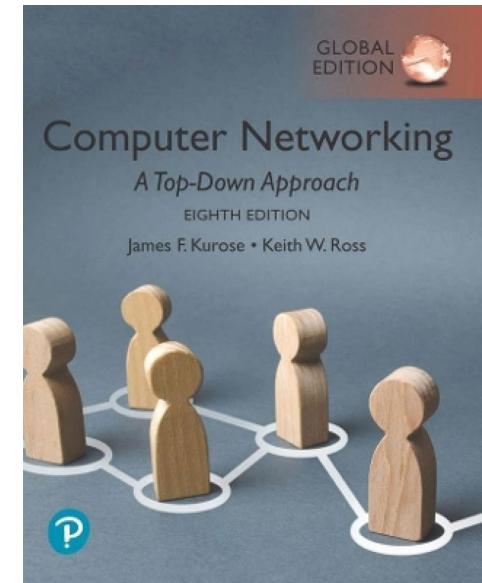
Overview

Next semesters TTM4200, TTM4180, ...				Go Deeper
Weeks 35-37 Networking	Weeks 39-41 Ethical Hacking	Weeks 43-46 IoT	Apply Knowledge in Context	Build Foundation
 Days 1, 2 The Internet, Encryption	Days 3, 4 Net. Reliability, HTML	Week 34 Linux CLI		

Book Recommendation

Used in several units of TTM4175 and multiple courses

Title: Computer Networking: A Top-Down Approach
Author: James F. Kurose, Keith W. Ross
Publisher: Pearson
Date: 2021
Edition: 8th edition, Global edition.



Goals for Today



Get a broad sense of how the Internet works

Internet structure and components
Addressing and address resolution
Protocols and packets
See and use some basic tools



Use case: what happens when we access a web page?

[Home](#) > [News](#) > [Security](#) > Norway says Ivanti's Endpoint vulnerability in Ivanti's Endpoint by 12 ministries in the country.

Aftenposten

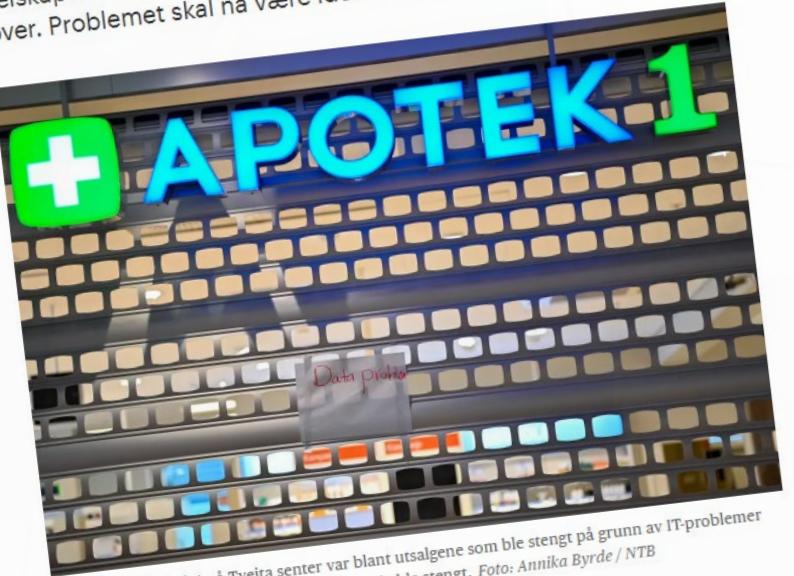
Norway says Ivanti ze

By Sergiu Gatlan



Alvorlig IT-trøbbel over hele verden: - Den største IT-kollapsen i historien

Alvorlige IT-problemer rammer mange store internasjonale selskaper. Blant annet flyplasser, banker og nettsider verden over. Problemene skal nå være identifisert og løst.



Butikken til Apotek 1 på Tveita senter var blant utsalgene som ble stengt på grunn av IT-problemer fredag. Apotek 1 har 460 utsalg i Norge, og alle ble stengt. Foto: Annika Byrde / NTB

Preben Brækstad Journalist
Anne Lindholm Journalist
Joakim Midtbø Viland Journalist
Ida Kristin Ronning Journalist

Publisert: 19.07.2024 08:39 | Oppdatert: 19.07.2024 17:16

- Attractive t
- Understand to build and improve robust systems

The New York Times

Gone in Minutes, Out for Hours: Outage Shakes Facebook

When apps used by billions of people worldwide blinked out, businesses were disrupted, businesses were cut off from customers, some Facebook employees were locked out, and

ENGLISH AKTUELT LEDIGE STILLINGER KONTAKT VARSEL NSM OM HENDELSER

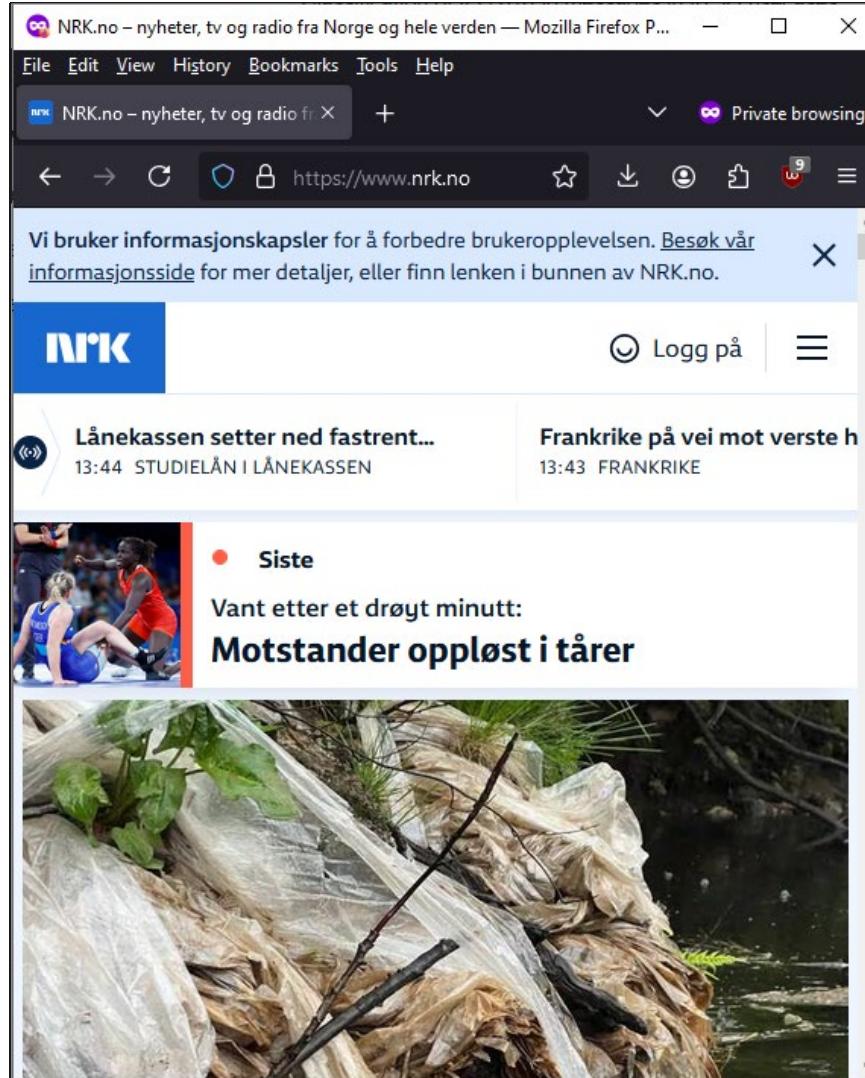
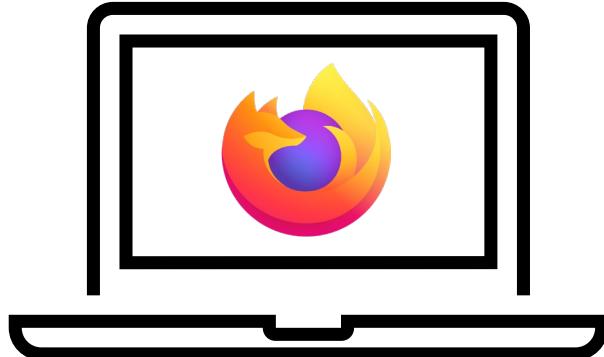
MENY

arhet i Ivanti Endpoint (MobileIron Core)

Oppdatert: 25.07.2023

1. juli 2023 informerte Nasjonal Departementenes sikkerhets- og serviceorganisasjon gssårbarhet som ble benyttet til å utføre et Departementenes sikkerhets- og serviceorganisasjon (DSS).

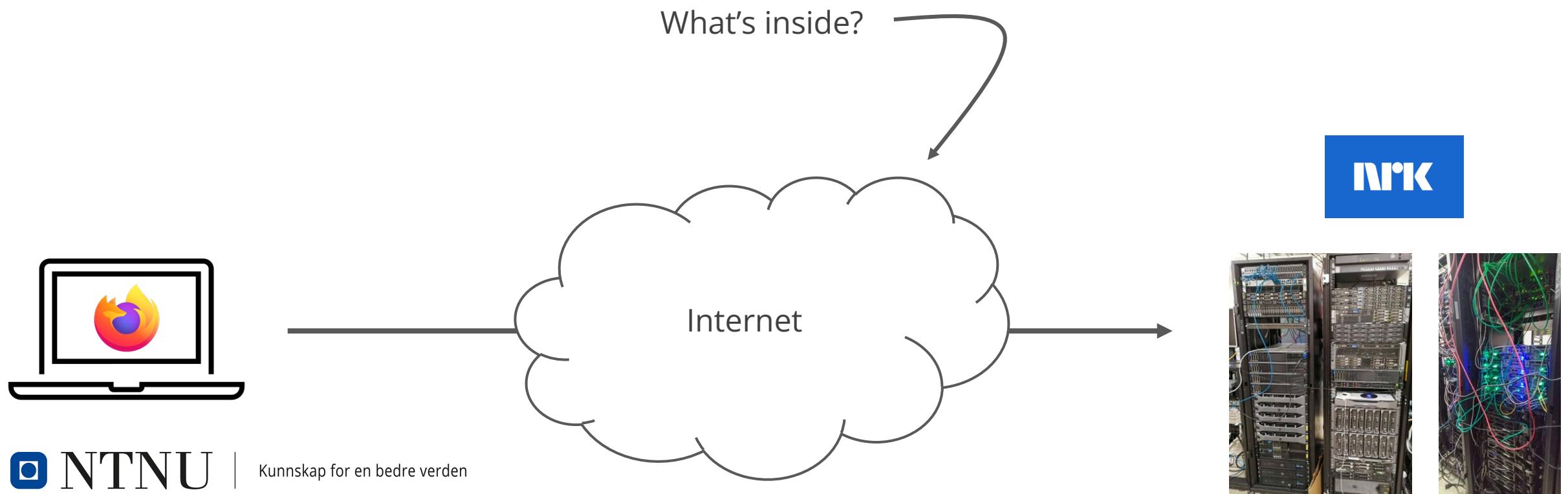
Let's Visit a Website



- Open a new tab
- Type in address
- Press enter
- Page appears

A lot of things
happen behind
the scenes here!

High-Level View

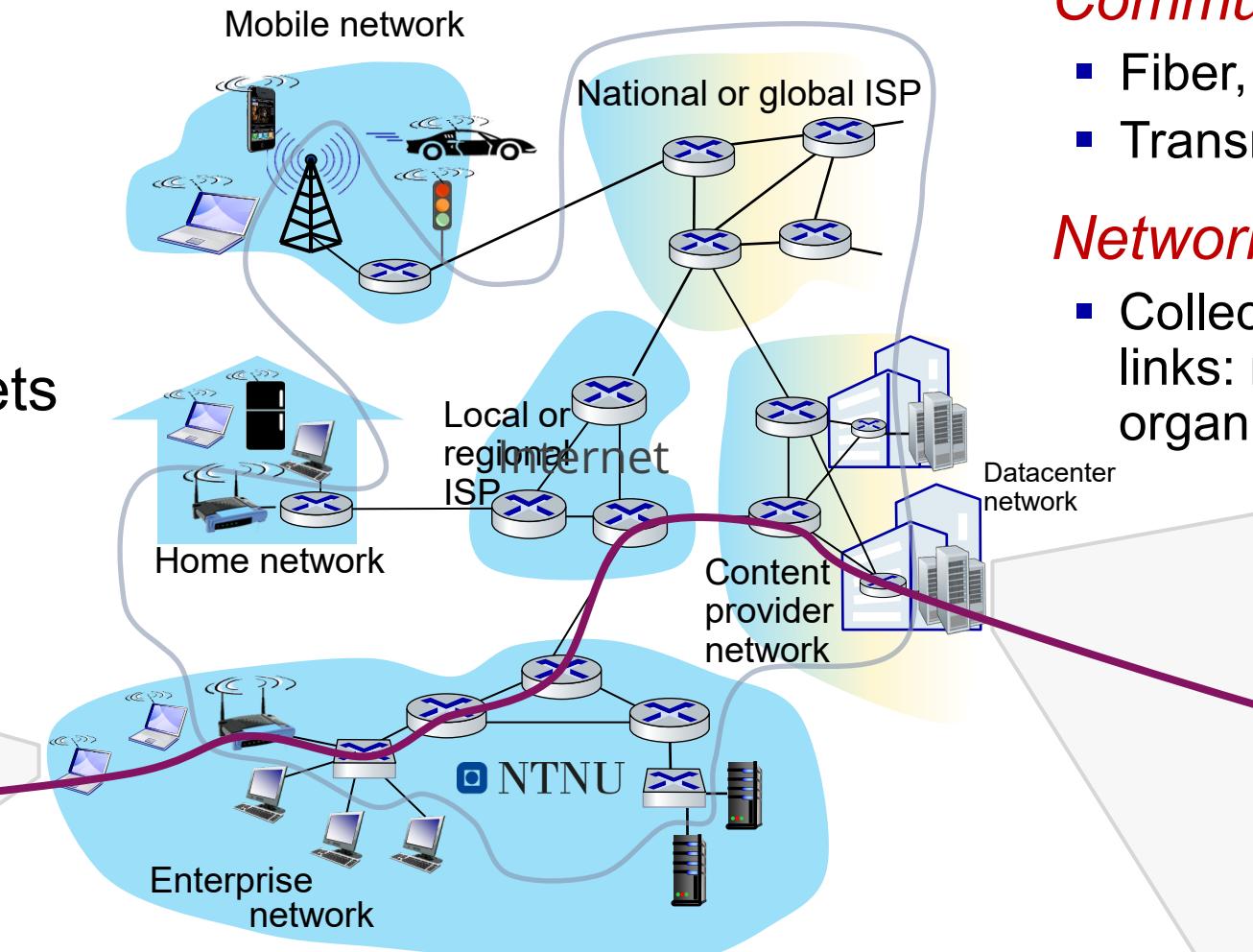
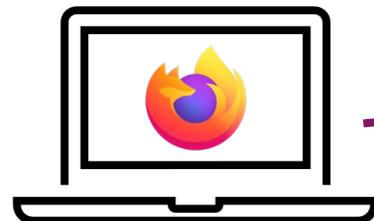


Internet Structure and Components

Billions of connected computing **devices**

- **Hosts** = end systems
- Running network **apps**

Packet switches and routers forward packets (= chunks of data)



Communication links

- Fiber, copper, radio, satellite
- Transmission rate: *bandwidth*

Networks

- Collection of devices, routers, links: managed by an organization

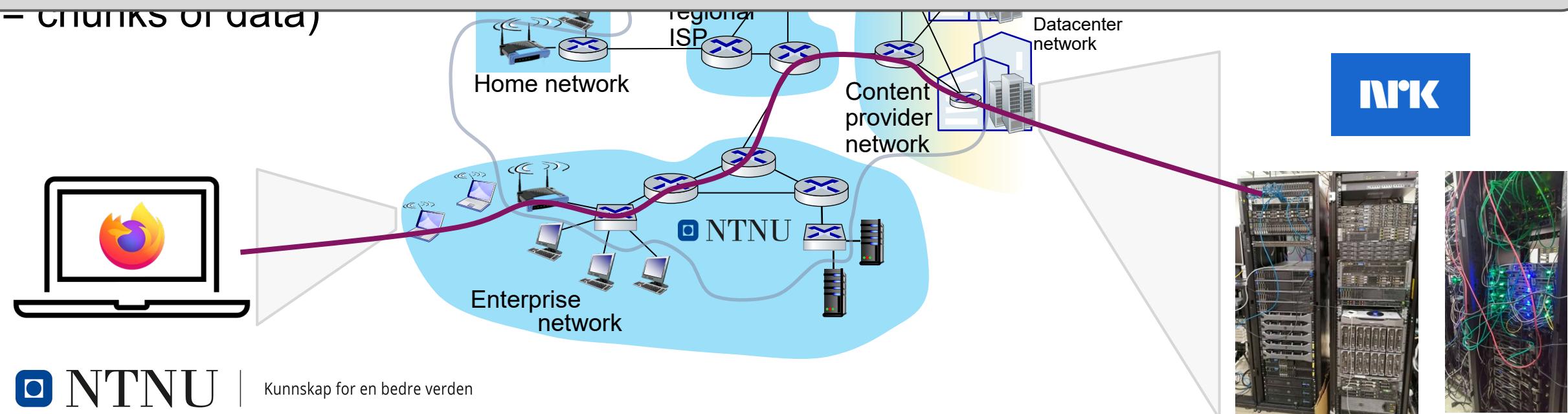


Internet Structure and Components

The Internet is a **network of networks** with many different devices, applications, and stakeholders

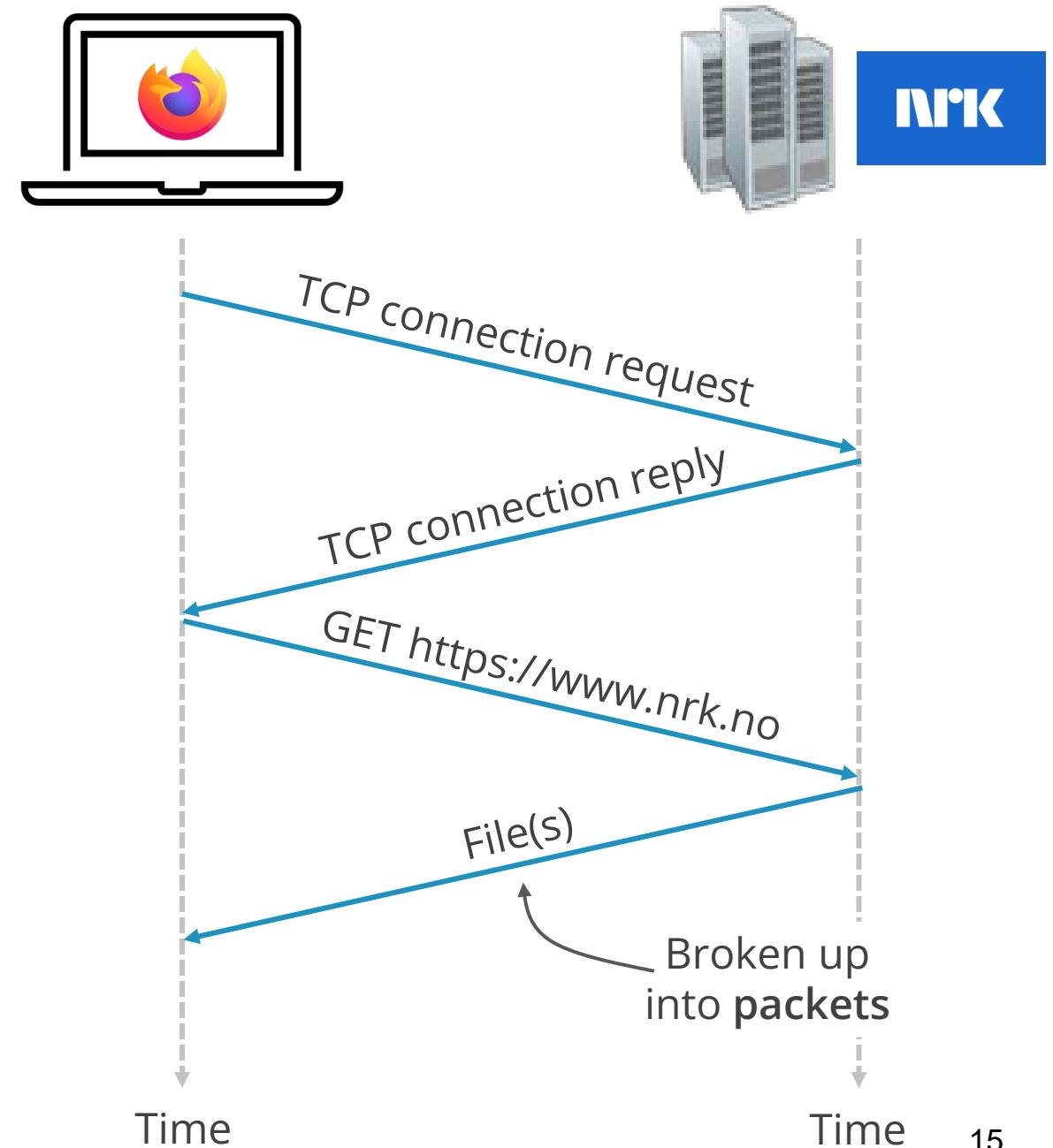
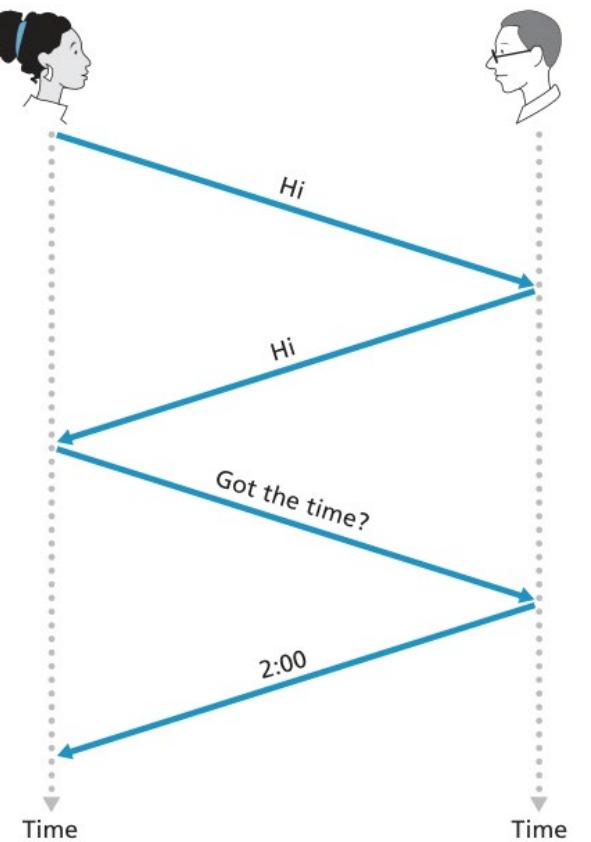
- How to exchange data in such diverse contexts?
 - Protocols
 - Addressing schemes

(- chunks of data)



Protocols

- Rules and format of information exchange



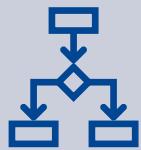
Internet Protocol (IP) Addressing



What is an IP address?



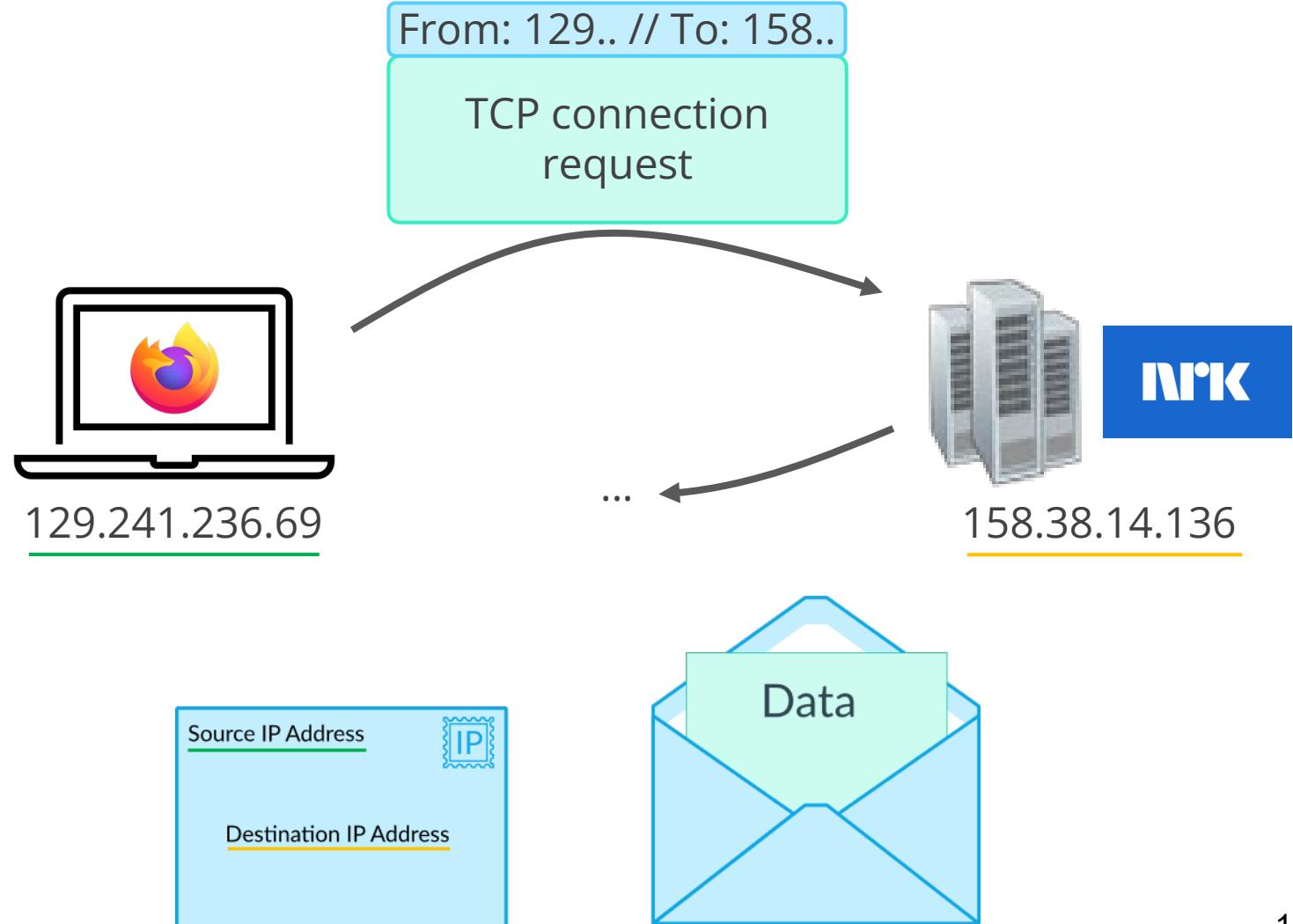
What does an IP address look like?



What types of IP addresses are there?

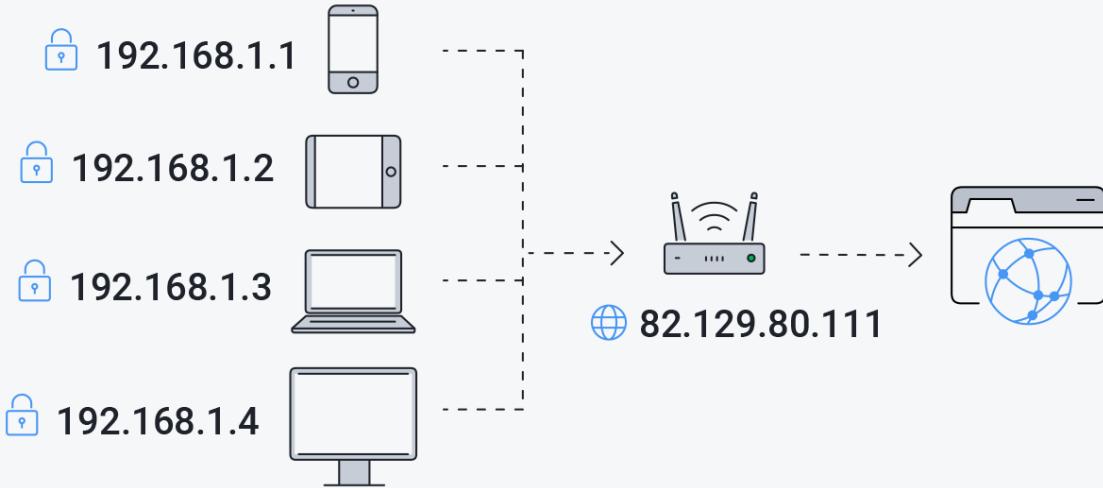
Internet Protocol (IP) Addressing

- Each Internet-facing device has a **globally unique** IP address



IP Address Types

Private (local) vs Public IP Addresses



IPv4 vs IPv6 Addresses

- v4: 32 bits in 4 blocks of 8 bits
 - Example: 158.38.14.136
 - ~4.3 billion unique addresses
- v6: 128 bits in 8 blocks of 16 bits
 - Example: fe80:0000:0000:0000:0215:5dff:fecc:5381
 - $\sim 3.4 \cdot 10^{38}$ unique addresses

IPv4 Address Structure

- 32 bits, four octets of 8 bits = 1 Byte each

More details on
binary \leftrightarrow decimal
conversion in week 35

158	.	38	.	14	.	136
10011110	.	00100110	.	00001110	.	10001000



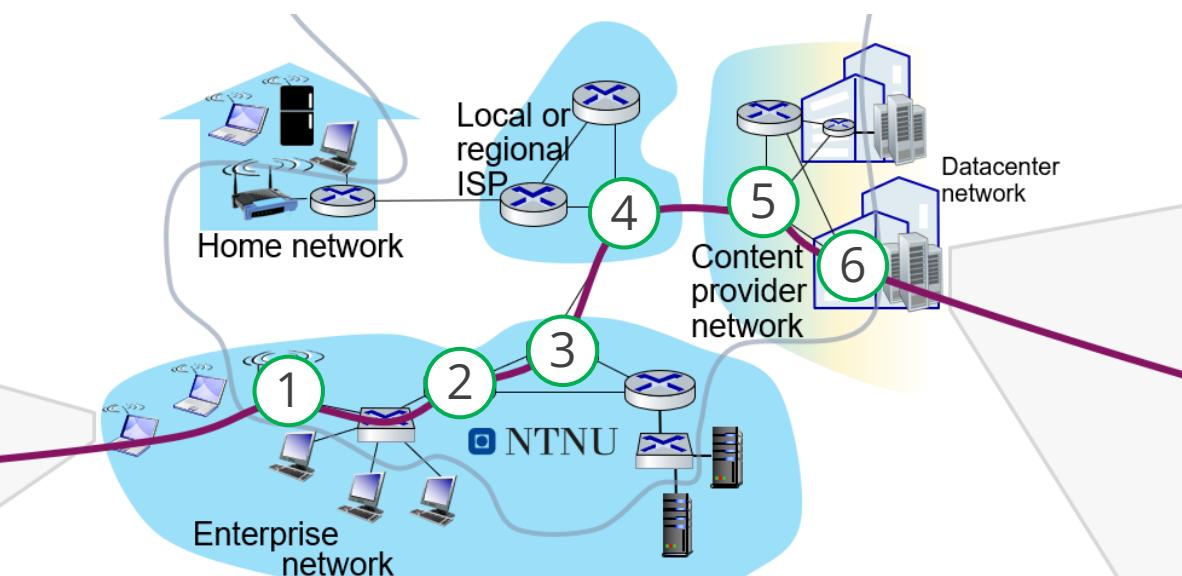
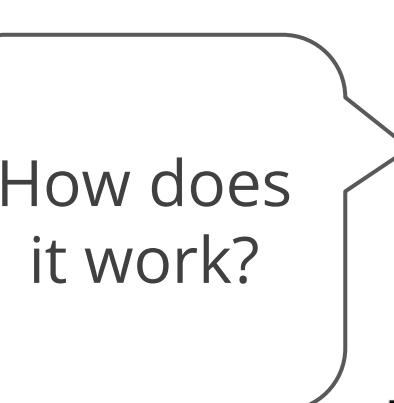
$$(1 \cdot 2^7 + 0 \cdot 2^6 + 0 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0 = 158)$$

- Range 0.0.0.0 – 255.255.255.255

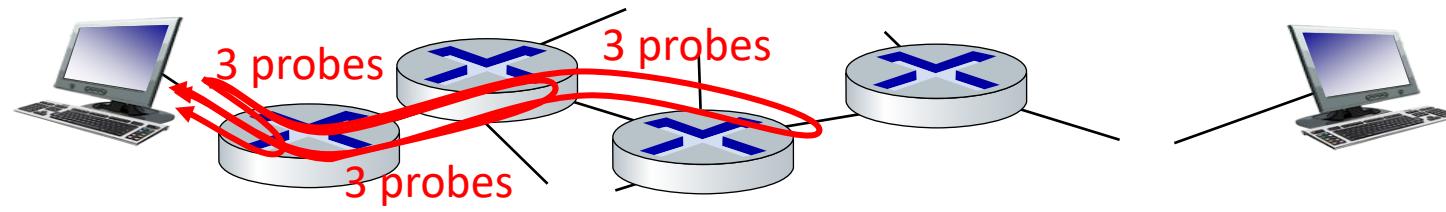
Traceroute

- Find out what way packets take to a destination
- Try it out!
 - On your machine: `traceroute nrk.no` or `tracert nrk.no`
 - Online: <https://s.ntnu.no/traceroute-map>

[> how to open a terminal]



Traceroute



IPv4 Address Structure

- 32 bits, four octets of 8 bits = 1 Byte each

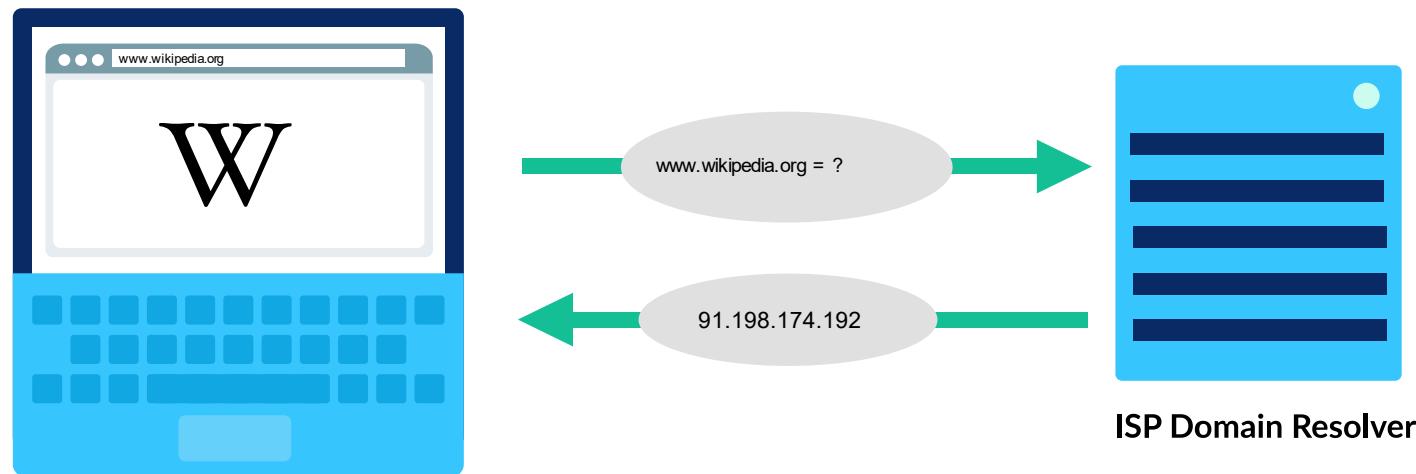
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- Range 0.0.0.0 – 255.255.255.255
- But: how do we know where <https://www.nrk.no> is at?
 - ➔ Address resolution using the Domain Name System (DNS)

Domain Name System (DNS)

- Maps between easier-to-remember names and IPs
- **Distributed database with trillions of daily requests**
 - Performance, scalability, and security challenges!



Hands-on – IP and DNS

- Checking one's own IP address
 - Private: ipconfig / ip / ifconfig
 - Public: <https://www.showmyip.com/>
- Resolving IP address of a remote target
 - Operating system tools: host, dig, nslookup
 - Online tools: <https://www.nslookup.io/>

Hands-on – IP and DNS



Find your private IP address and compare with your team members / other teams. Do you notice a pattern?



Find your public IP address and do the same



When using your local DNS tools, which name server is used?
Who owns it?



Try different DNS servers at nslookup.io – do you notice something when comparing the results for large services like netflix.com?

Demo: WiFi Access Point

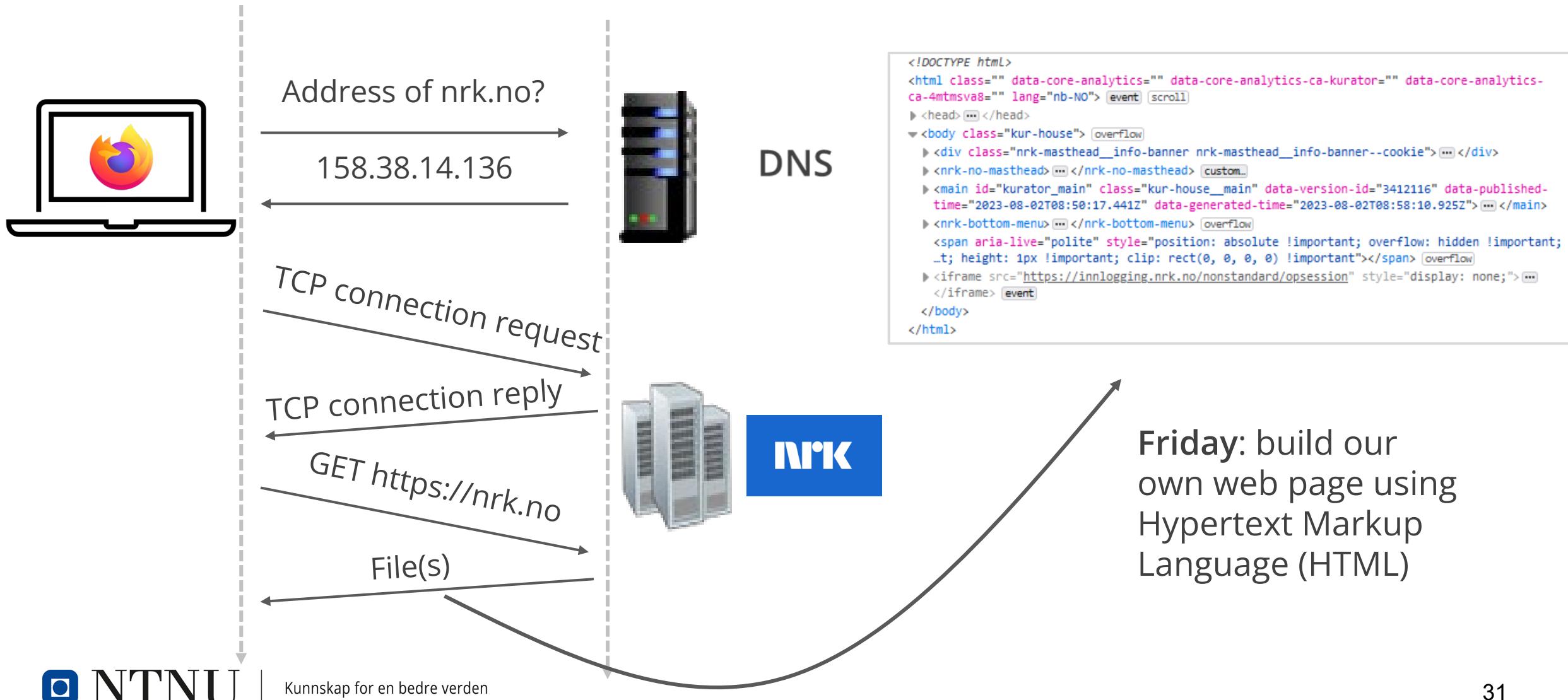
- Connect to network teknostart-wifi, password: teknostart24



- Provides IP address, DNS, Internet access
- Can monitor / redirect / alter / block traffic
- Inspection of traffic using Wireshark → Week 35



Summary and Outlook



Utsjekk

Hva?

- Uformell kort avslutning etter dagens siste arbeidsøkt

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