Scaling on Cloud Infrastructure
Our GPA grade calculator has taken off and gone viral -- how do we scale our website for millions of users every day?

DNS - Domain Name Services
What we know:
- We know that TCP connects two remote hosts together through the internet via an IP address.
- However, most remote hosts we connect to do so via a domain name (“ex: cs.illinois.edu”).

DNS Resolution: The DNS root contains only 13 authoritative name servers/clusters for the entire Internet!

[Root Servers]:

[DNS Zones]:

DNS Records:
- Every DNS record is a set of key/value pairs that with a TTL (“Time to Live”) field.
- The record may be cached by intermediate servers for as long as the TTL is set (ex: 2 hours) before being updated.
- Notable keys in a DNS record:
  - “A” (Host, IPv4) Record:
  - “AAAA” (Host, IPv6) Record:
  - “CNAME” (Alias) Record:
  - “MX” (Mail Exchanger) Record:
**Optimization:** How do we use DNS to make our viral app better?

(1): Redundant Servers, Redundant Records

(2): Content Delivery Networks (CDNs)

[Overview]:

[Technical Implementation]:

[Advantages]:

[Disadvantages]:

**CDN as a Service:**

*Many offerings for CDN services available commercially:*

- AWS “Cloudflare”
- Google “Cloud CDN”
- Microsoft “Azure CDN”
- ...and others...

...and extremely cheap (Cloudflare pricing):

- Cost per HTTPS requests: $0.000001 /request
  \( \approx \$0.01 /10,000 \text{ requests} \)
- + $0.005 per path requested for invalidation.
- + standard bandwidth costs (~$0.085 /GB)

**Example:** 1,000,000 requests each receiving 100 KB of static data from the CDN, without any cache invalidations:

**Impact of CDN on Modern Apps:**

On many, many, many websites, you may arrive to the website to see a spinning loading circle:

- Website is delivered as “static” content, via the CDN.
- Data is separate from the webpage, may be static or dynamic.

Examples: