

# HTTP Caching

The background of the slide features a photograph of the Alma Mater statue at the University of Illinois, which is a central figure in a long, flowing gown. The entire image is overlaid with a semi-transparent orange color, creating a monochromatic effect. The statue is positioned in the center-right of the frame, with its arms slightly outstretched. The background behind the statue consists of the intricate, bare branches of trees, which are also rendered in shades of orange.

**CS 240 - The University of Illinois**

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# Directory Permission Bits

Following up from lecture on Tuesday, what impact does directory read and execute bits have? Here's my experiment:

- Create two directories: `test-no-r` and `test-no-x`.
- Create one file in each directory, `hello.txt`.

```
$ ls -la
```

```
1 d-wx--x--x 2 waf waf 4096 Nov 3 11:20 test-no-r  
2 drw-r--r-- 2 waf waf 4096 Nov 3 11:20 test-no-x
```

```
$ ls test-no-r
```

```
ls: cannot open directory 'test-no-r': Permission denied
```

```
$ ls test-no-x
```

```
ls: cannot access 'test-no-x/hello.txt': Permission denied  
hello.txt
```

```
$ cat test-no-r/hello.txt
```

```
Hello world!
```

```
$ cat test-no-x/hello.txt
```

```
cat: test-no-x/hello.txt: Permission denied
```

# Directory Permission Bits

- **r** bit:
  
  
  
  
  
  
  
  
  
  
- **x** bit:

# Caching

A photograph of a statue of Alma Mater, likely at a university, surrounded by a crowd of people. The image is overlaid with a semi-transparent orange filter. The word "Caching" is written in large, white, sans-serif font across the center of the image. The statue is the central focus, with people gathered around it, some looking towards the camera and others looking towards the statue. The background shows trees and a building, all rendered in shades of orange.

Caching is critical across all parts of computer systems. We have already seen two forms of caching already:

1.

2.



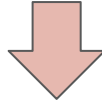


**ETag**



```
GET /lecture.jpg HTTP/1.1\r\n  
[...]
```

```
GET /lecture.jpg HTTP/1.1\r\n
[...]
```



```
HTTP/1.1 200 OK\r\n
Date: Wed, 03 Nov 2021 16:31:20 GMT\r\n
Last-Modified: Tue, 01 Sep 2020 17:07:47 GMT\r\n
ETag: "8073356a8280d61:0"\r\n
Content-Length: 25725\r\n
[...]
```

```
GET /lecture.jpg HTTP/1.1\r\n
If-None-Match: "8073356a8280d61:0"\r\n
[...]
```

```
GET /lecture.jpg HTTP/1.1\r\n
If-None-Match: "8073356a8280d61:0"\r\n
[...]
```



```
HTTP/1.1 304 Not Modified\r\n
[...]
```

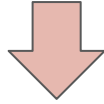
**Q:** If you visit a webpage 100 times a day, how many times would you need to check the ETag?

# Age-Based Cache Policy

The image features a central photograph of a crowd of people gathered around a statue of Alma Mater. The entire image is overlaid with a semi-transparent orange filter. The text 'Age-Based Cache Policy' is centered in white, bold, sans-serif font. The background shows a large group of people, some looking towards the camera and others towards the statue. The statue is a classical-style female figure in a long dress, standing on a pedestal. The text 'ALMA MATER' is visible on the base of the statue.



```
GET /lecture.jpg HTTP/1.1\r\n[...]
```



```
HTTP/1.1 200 OK\r\nCache-Control: public, max-age=31919000\r\nAge: 6745054\r\n[...]
```

```
HTTP/1.1 200 OK\r\n
Cache-Control: public, max-age=31919000\r\n
Age: 6745054\r\n
[...]
```

**Q:** If you visit a webpage 100 times a day, how many times would you need to request the cached file?

## **ETag Caching**

Best Used For:

Drawbacks:

## **Age-Based Caching**

Best Used For:

Drawbacks:

# Motivation for Caching

The image features a central scene of a crowd of people gathered around a statue of a woman in a long, flowing dress. The statue is positioned on a pedestal, and the crowd is seen from behind, looking towards the statue. The background consists of bare trees, suggesting a winter or late autumn setting. The entire image is overlaid with a semi-transparent orange filter. The text "Motivation for Caching" is centered in white, bold, sans-serif font.

| Usage Category | Cost                                |
|----------------|-------------------------------------|
| 0 GiB - 1 GiB  | \$0.00<br><i>First GiB is free!</i> |
| 1 GiB - 10 TiB | \$0.09 per GiB                      |

Suppose you're running a website that sends 100,000 HTTP packets /day where your average packet headers of 0.1 KiB and the content is 200 KiB.

1. How much bandwidth would be used in a 31-day month?

2. How much would that bandwidth cost on AWS?



**3.** You implement ETag caching and you find that your server has a cache-hit rate of 50%. How much bandwidth and money would you save?

4. You implement age-based caching and you find that your server has a cache-hit rate of 50%. How much bandwidth and money would you save?