

CS 925

Lecture 18

HTTP Streaming

Tuesday, April 2, 2024

HTTP Streaming

▶ HTTP Segmented Delivery

- Enables rate adaptation on segment boundaries
- Enables near-real-time streaming given a near-real-time delay of at least one segment duration

▶ Deterministic and auditable delivery quality

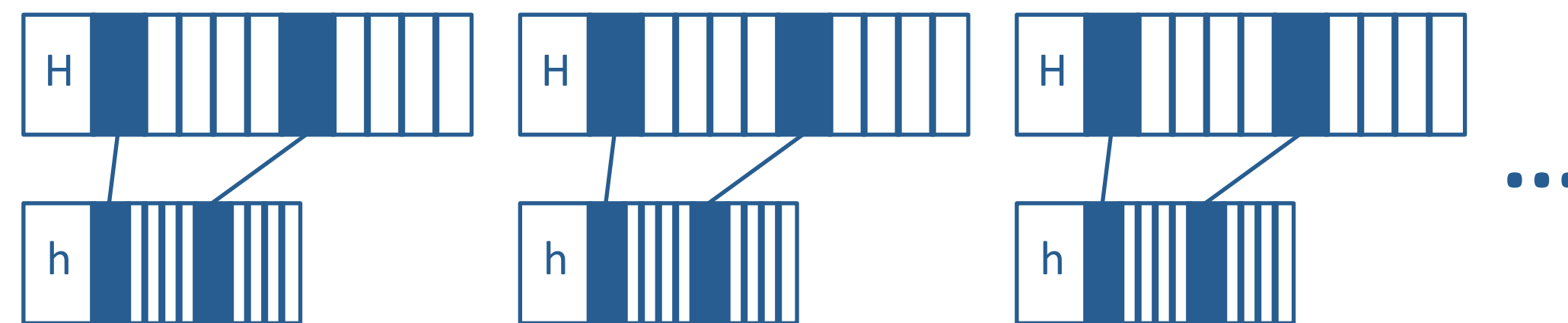
- Either plays or doesn't - no quality degradation

▶ Content Delivery Networks (CDN)

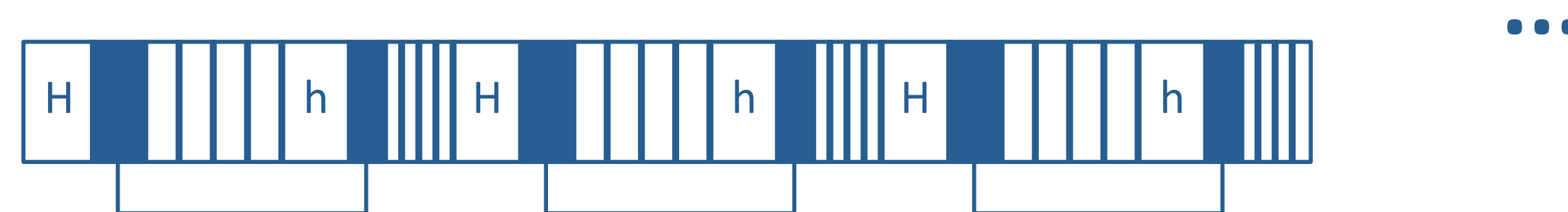
- Allows for using the existing HTTP-optimized delivery infrastructures provided by CDNs

HTTP Streaming

- ▶ Apple HTTP Live Streaming (HLS)
 - Per-bitrate segmented files



- ▶ Microsoft Silverlight Smooth Streaming (deprecated)
 - HTTP *Range Requests* into single monolithic file



MPEG DASH

- ▶ **Dynamic Adaptive Streaming over HTTP**
- ▶ an adaptive bitrate streaming (...that isn't Apple)
- ▶ Media Presentation Description (MPD)
 - URL, resolution, bit rate
 - XML
 - Media Presentation
 - Period
 - Adaptation set
 - Representation
 - Segment

Adaptive Streaming

- ▶ Adaptive Bitrate Streaming (ABR)
- ▶ Network conditions observed:
 - client-side: measured bandwidth, buffer occupancy
 - server-side ?
- ▶ Delivered rate adjusted:
 - client: segments with best possible rate requested
 - server-side, network ?

Basic ABR Methods

▶ Throughput-based

- the throughput of the next segment download will be similar to that of the past segments
- startup behavior: optimistic vs pessimistic initial guess

▶ Buffer-based

- the fewer segments in the buffer the lower the rate of the requested segment
- startup behavior: aggressive buffer fill vs aggressive high rate

▶ Combined...

Content Delivery Networks

▶ **Observation:**

- small subset of content is requested by a large subset of clients (e.g., just released episode of a popular show, static logo of a popular website, a breaking-news article). Popular content can be replicated and widely distributed to servers close to users.
- ▶ Domain name resolution (DNS) provides a mechanism through which user requests are pointed to the nearest server that holds the content.
- ▶ The resulting mechanism is called Content Delivery Networks (CDN). There are many commercial CDN providers

Video content delivery

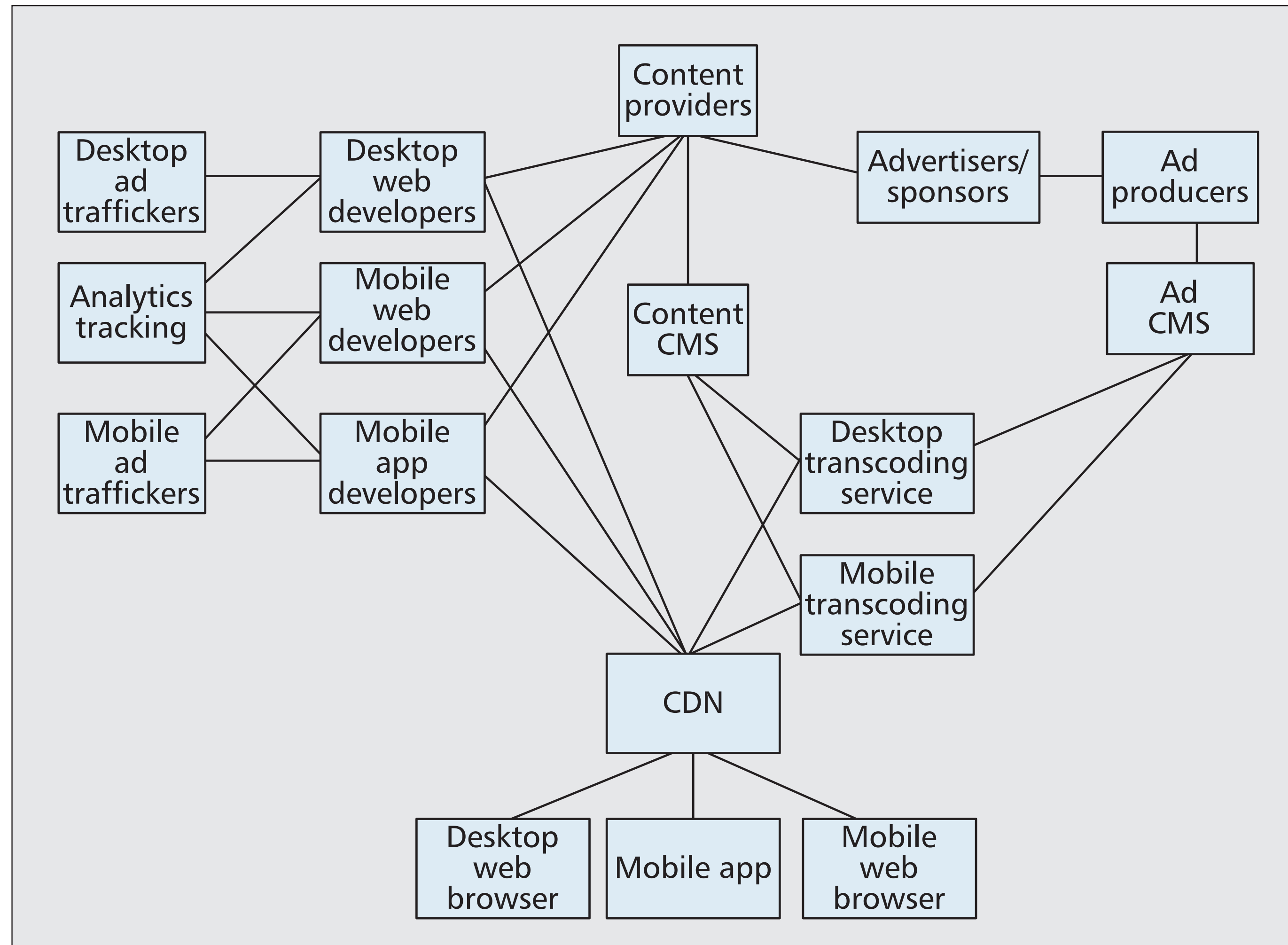


Figure 1. Video delivery ecosystem.

Mobile video delivery

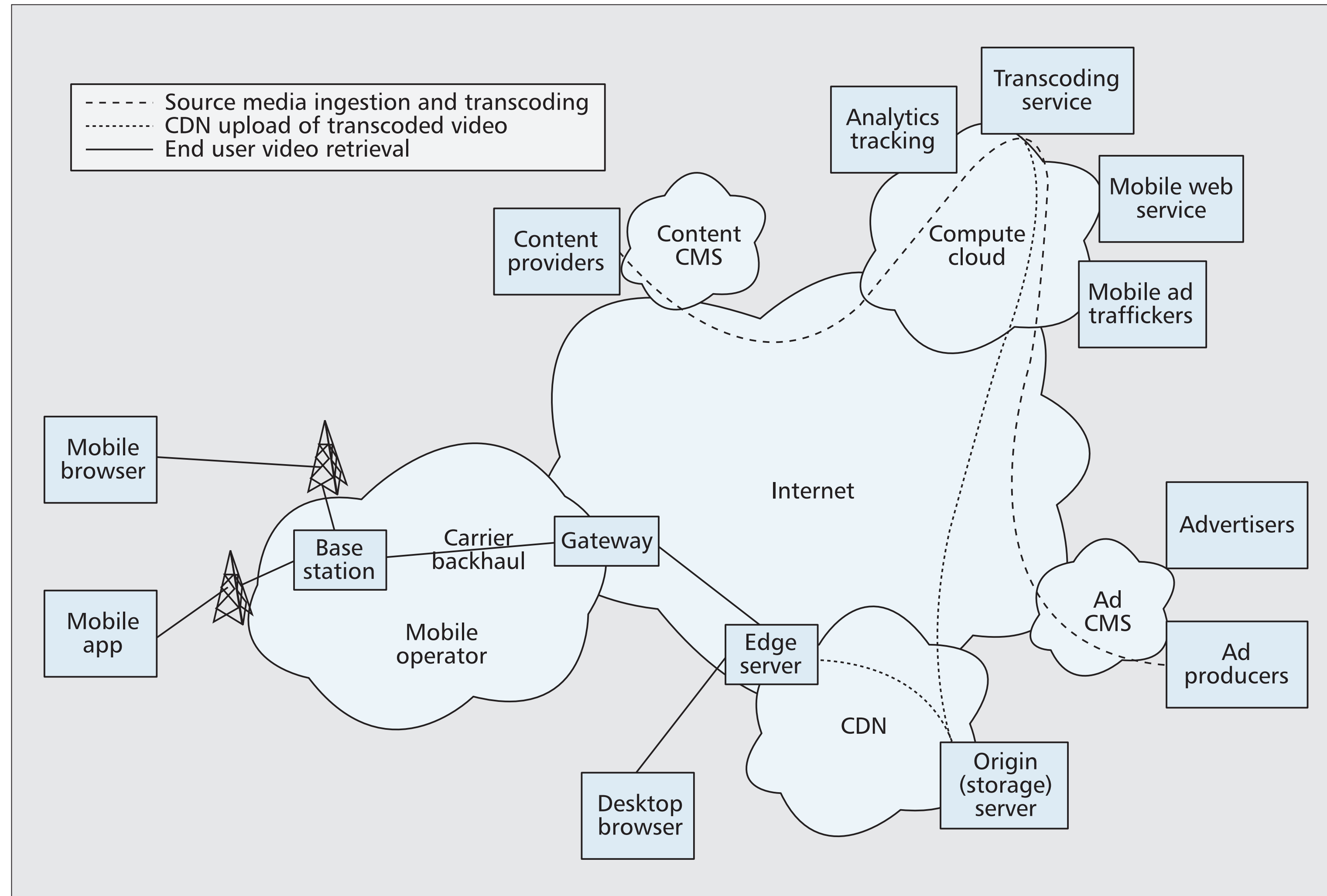
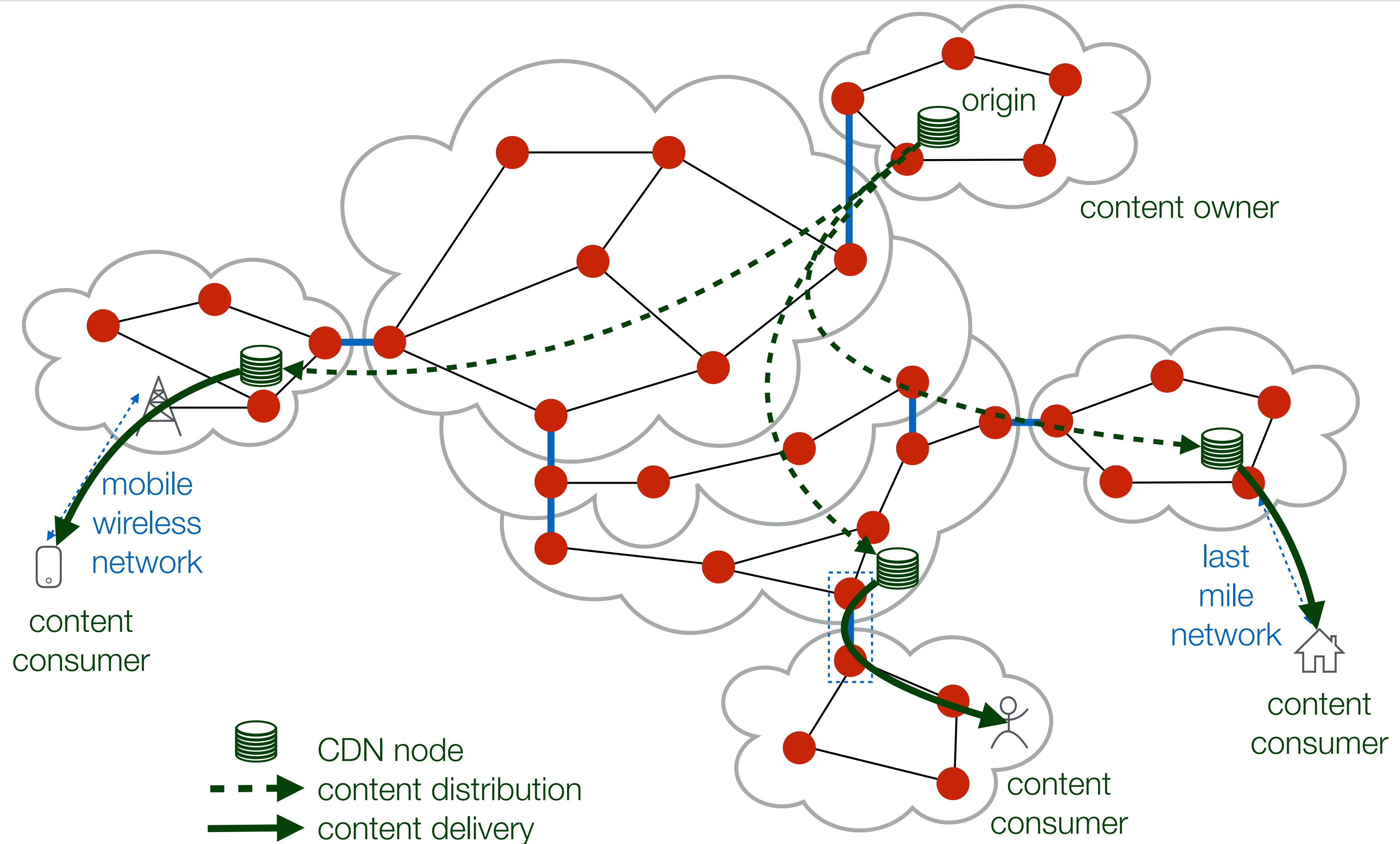


Figure 2. Mobile video delivery network.

Content Delivery Networks



Content Delivery Networks

- ▶ Many solutions exist to reduce protocol latency, however, they cannot solve all problems, the **inherent propagation latency** of the network will always be an issue.
- ▶ In order to address this issue, we must **reduce the distance** between the server providing the information and the client requesting it.
- ▶ **Approach:** move the server closer to the client

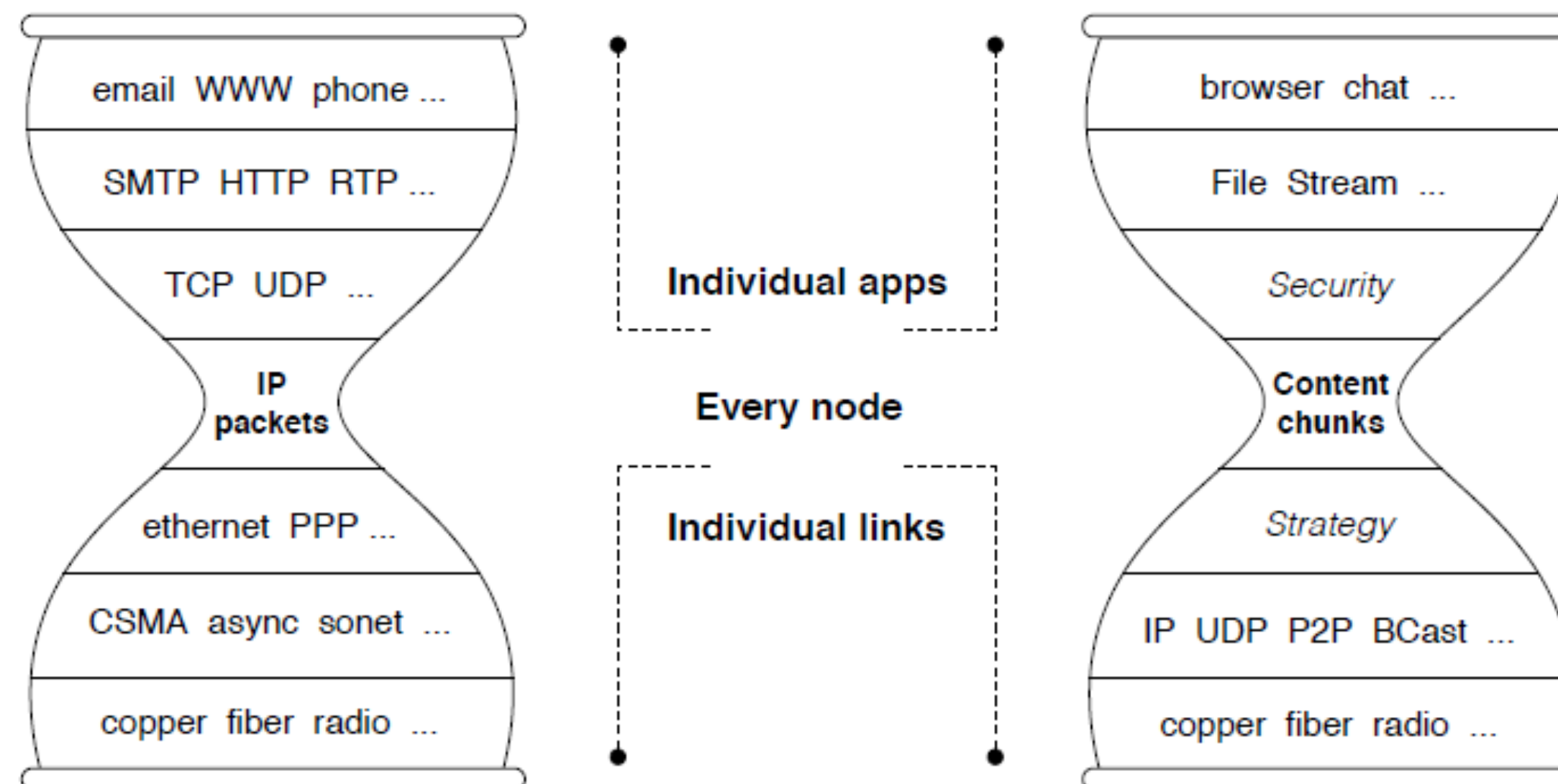
Information Centric ~~Content Delivery~~ Networks

- ▶ Many solutions exist to reduce protocol latency, however, they cannot solve all problems, the **inherent propagation latency** of the network will always be an issue.
- ▶ In order to address this issue, we must **reduce the distance** between the server providing the information and the client requesting it.
- ▶ **Approach:** move the ~~server~~ closer to the client



Information Centric Networks

- ▶ One idea, many names:
 - **ICN** Information Centric Networks (IRTF ICNRRG)
 - **CCN** Content-Centric Networking (PARC)
 - **NDN** Named Data Networking
 - ...



Information Centric Networks

- ▶ The concept of a CDN can be further developed to a system where the **content identifier**, rather than its location (URL), **is used to retrieve it**.
- ▶ Separating content from its location allows so called **Information Centric Networks** (ICNs) to make demand-driven decisions on:
 - **creating copies** of the content, and
 - the **locations** of the copies that minimize the access latency for the users