Content Centric Network

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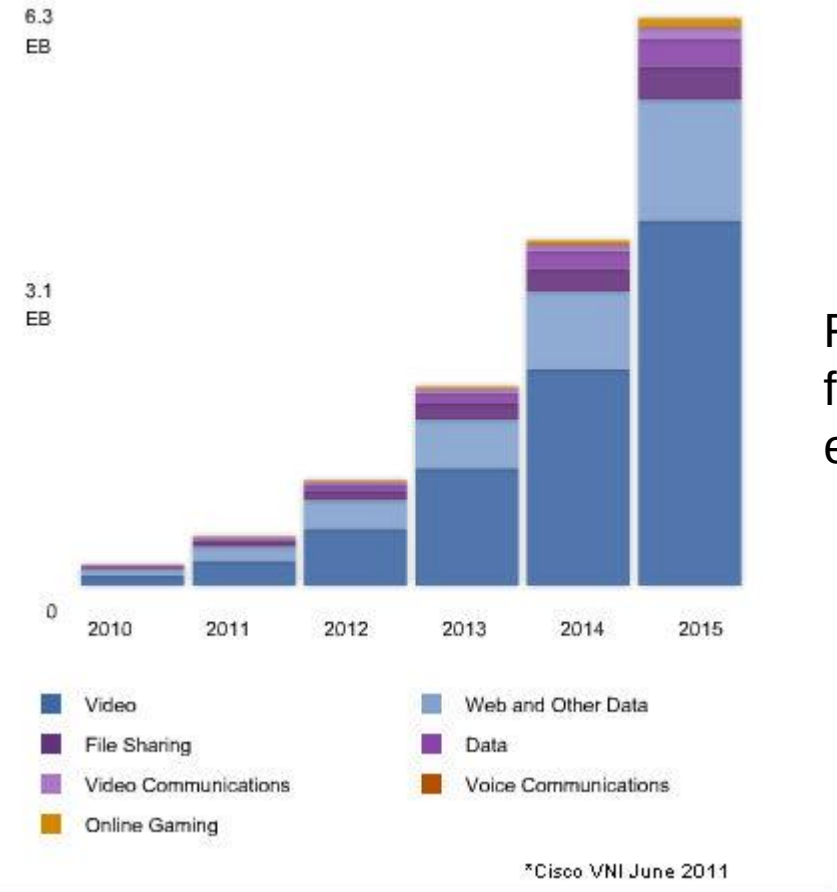
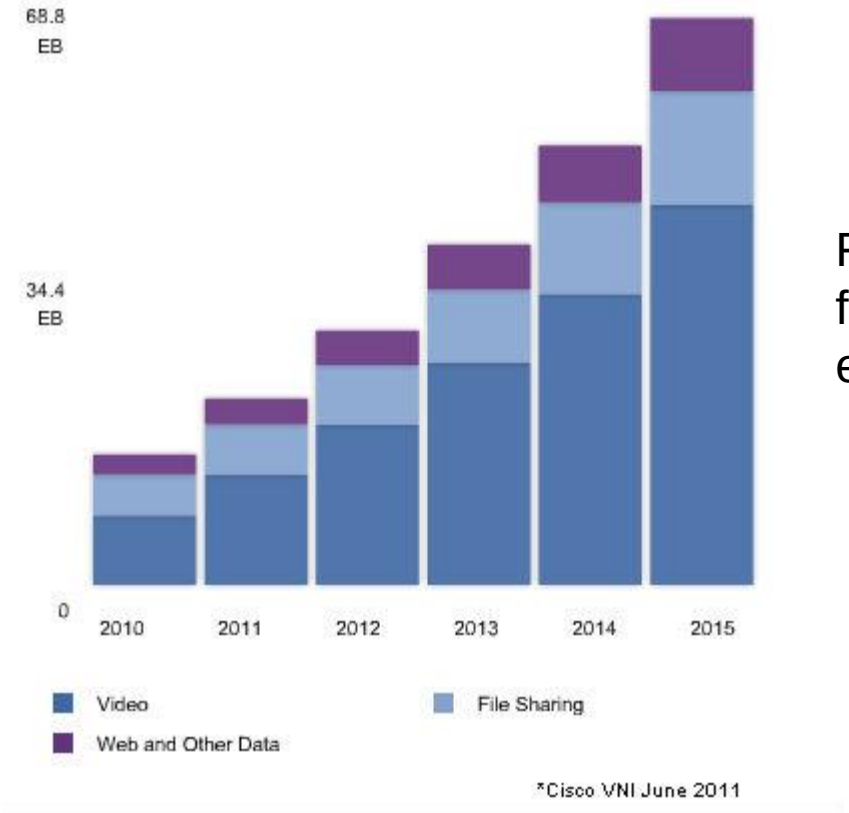
Materiale di Dirk Kutschner, Boerje Ohlman,

Mobile Data Traffic Prediction



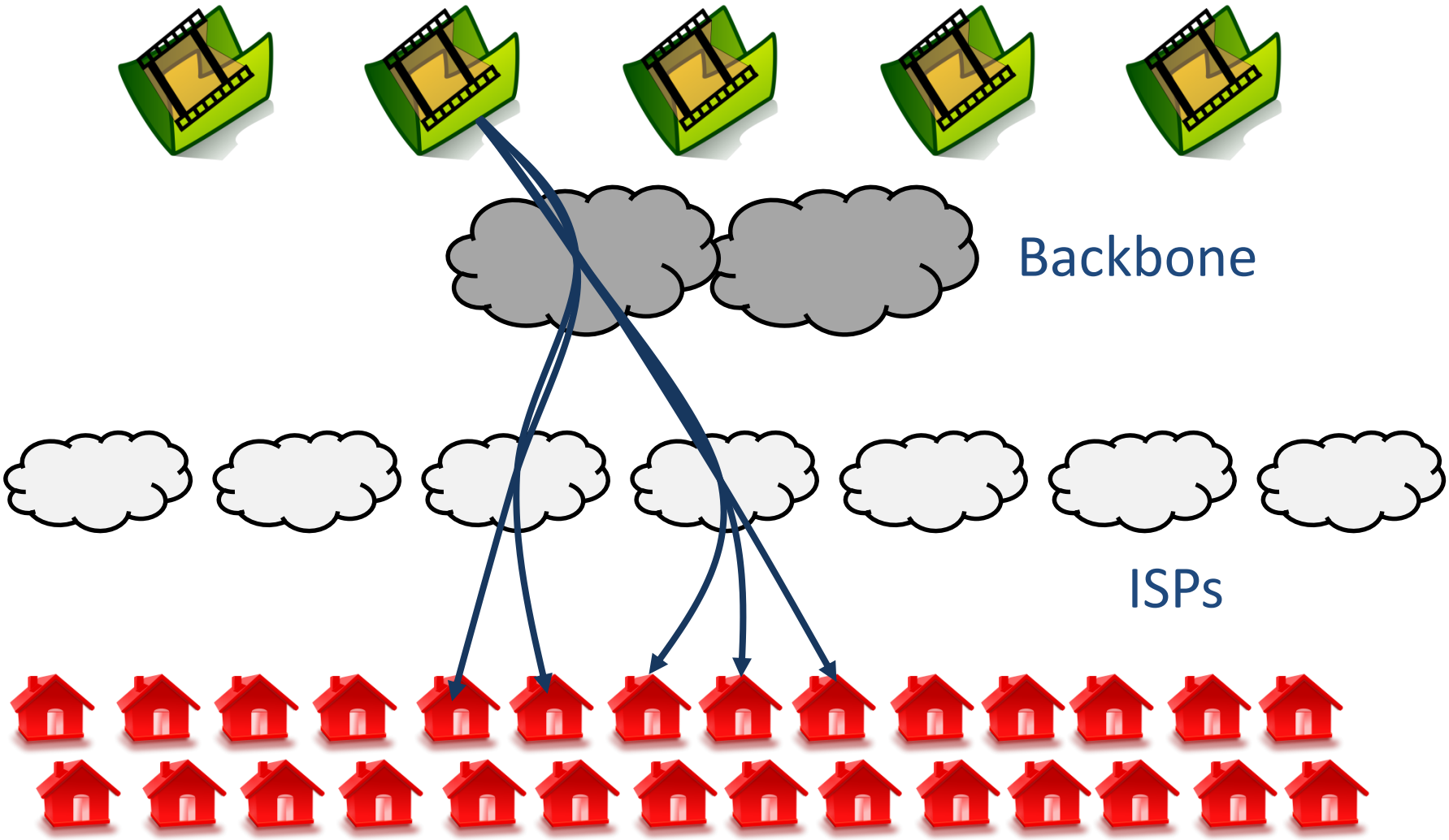
From 2010 to 2015: factor 26 increase expected

Video Data Traffic Prediction



From 2010 to 2015: factor 5 increase expected

Popular Conception:
Content Distribution Over the Internet Does Not Scale



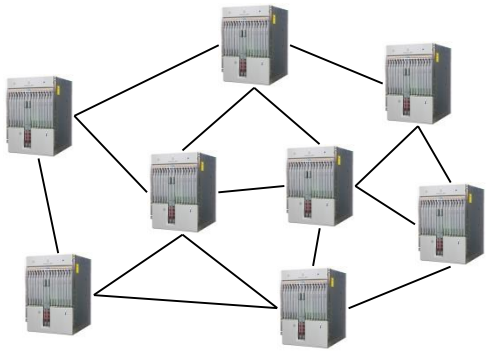
Problems with Today's Networks

- URLs and IP addresses are overloaded with locator and identifier functionality
  - Moving information = changing it's name => 404 file not found
- No consistent way to keep track of *identical copies*
  - No consistent *representation of information* (copy-independent)
- Information dissemination is inefficient
  - Can't benefit from existing copies (e.g. local copy on client)
  - No "anycast": e.g., get "*nearest*" copy
  - Problems like *Denial of Service, …*
- Can't trust a copy received from an untrusted node
  - Security is host-centric
  - Mainly based on securing channels (encryption) and trusting servers (authentication)

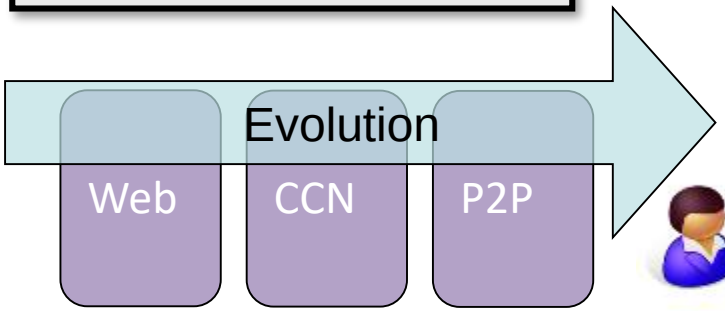
Content Centric Networking

Today's Internet

Focus on
nodes

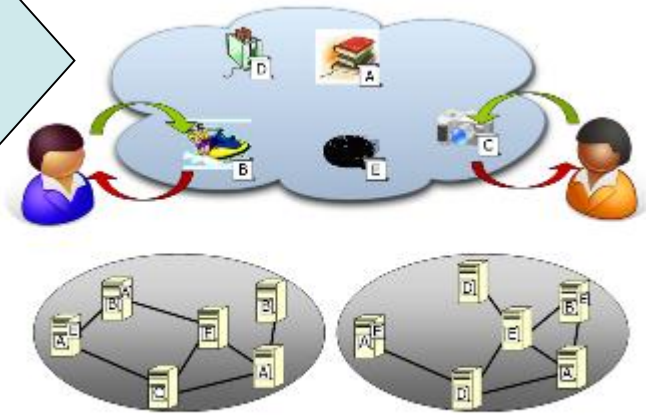


In today's Internet, accessing information is the dominating use case!



Information Centric Network

Focus on
information objects



- Considering important requirements
  - **Accessing named resources – not hosts**
  - **Scalable distribution through replication and caching**
  - **Good control of resolution/routing and access**
- With ubiquitous caching
  - But for all applications
  - And for all users and content/service providers

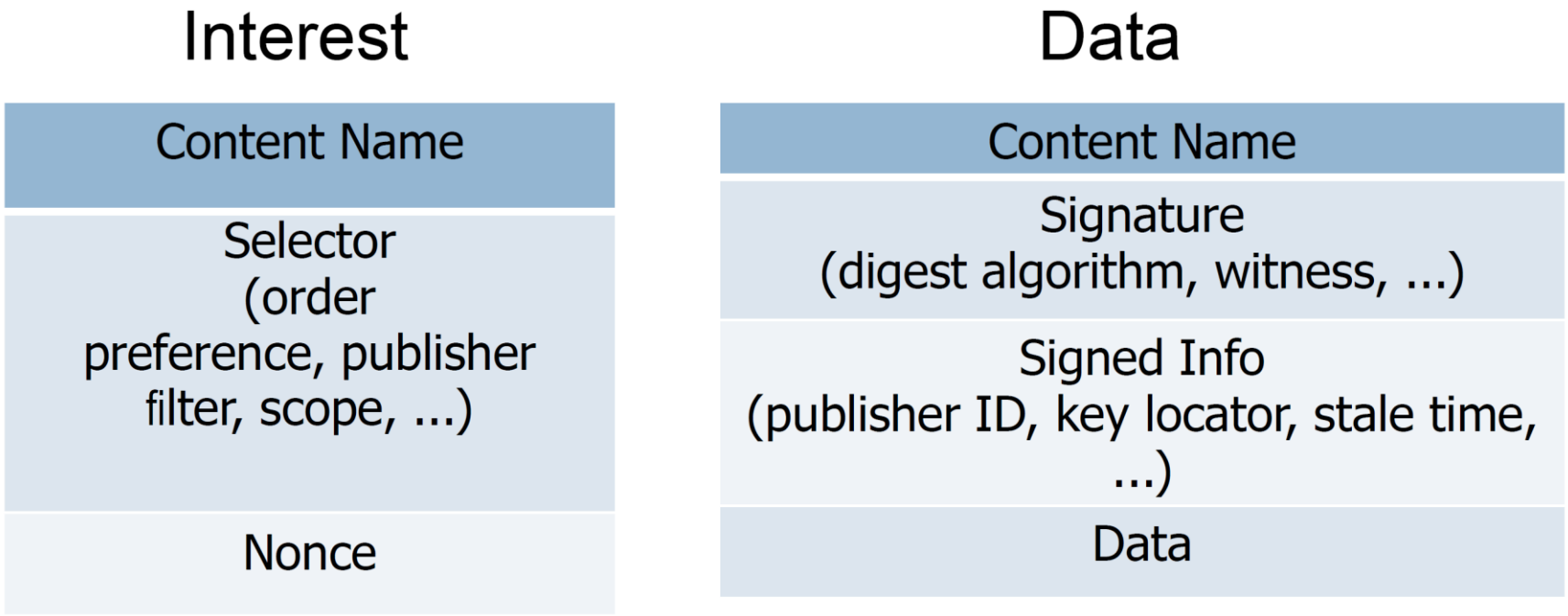
Why CCN Would be Useful

- Topic seems important – quite some interest
  - Content-distribution perspective
  - Internet evolution perspective

- A trending topic : one idea, many names
  - Content Centric Networking
  - Content Delivery Networking
  - Named Data Networking
  - Information Centric Networking
  - Data Oriented architecture

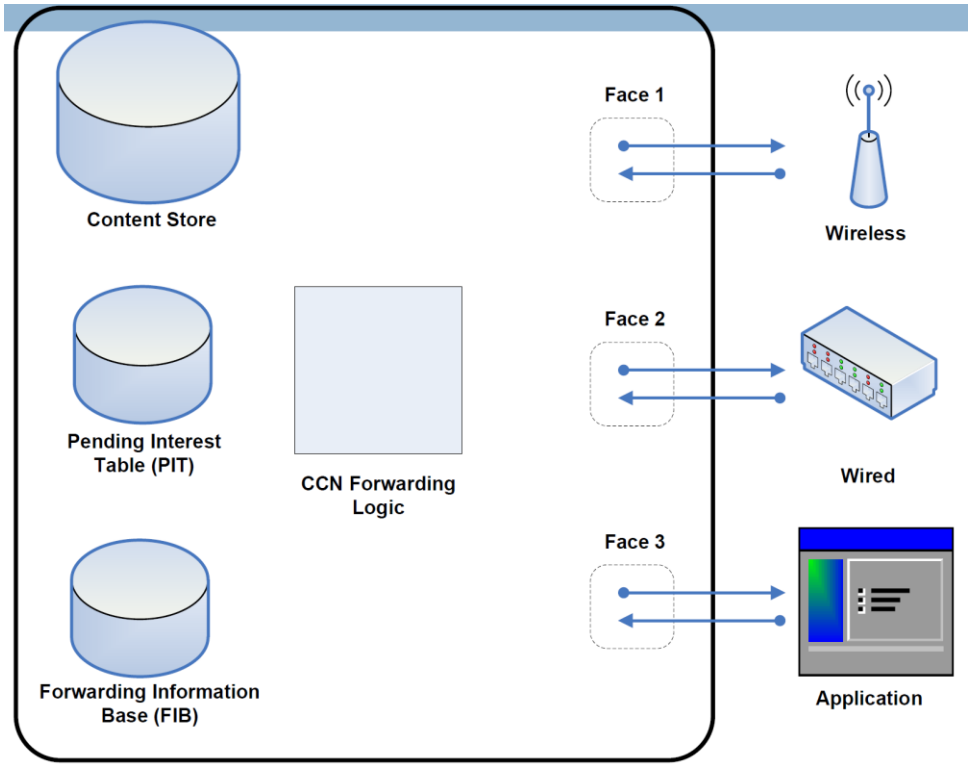
- Data is requested by name
  - `get '/parc.com/van/presentation.pdf'`
- Any node that hears the request and has a valid copy of the data can respond
- The returned data is signed, and secured, so its integrity & association with name can be validated (data centric security)
- `Here is '/parc.com/van/presentation.pdf/p1' <data>`

CCN Packets



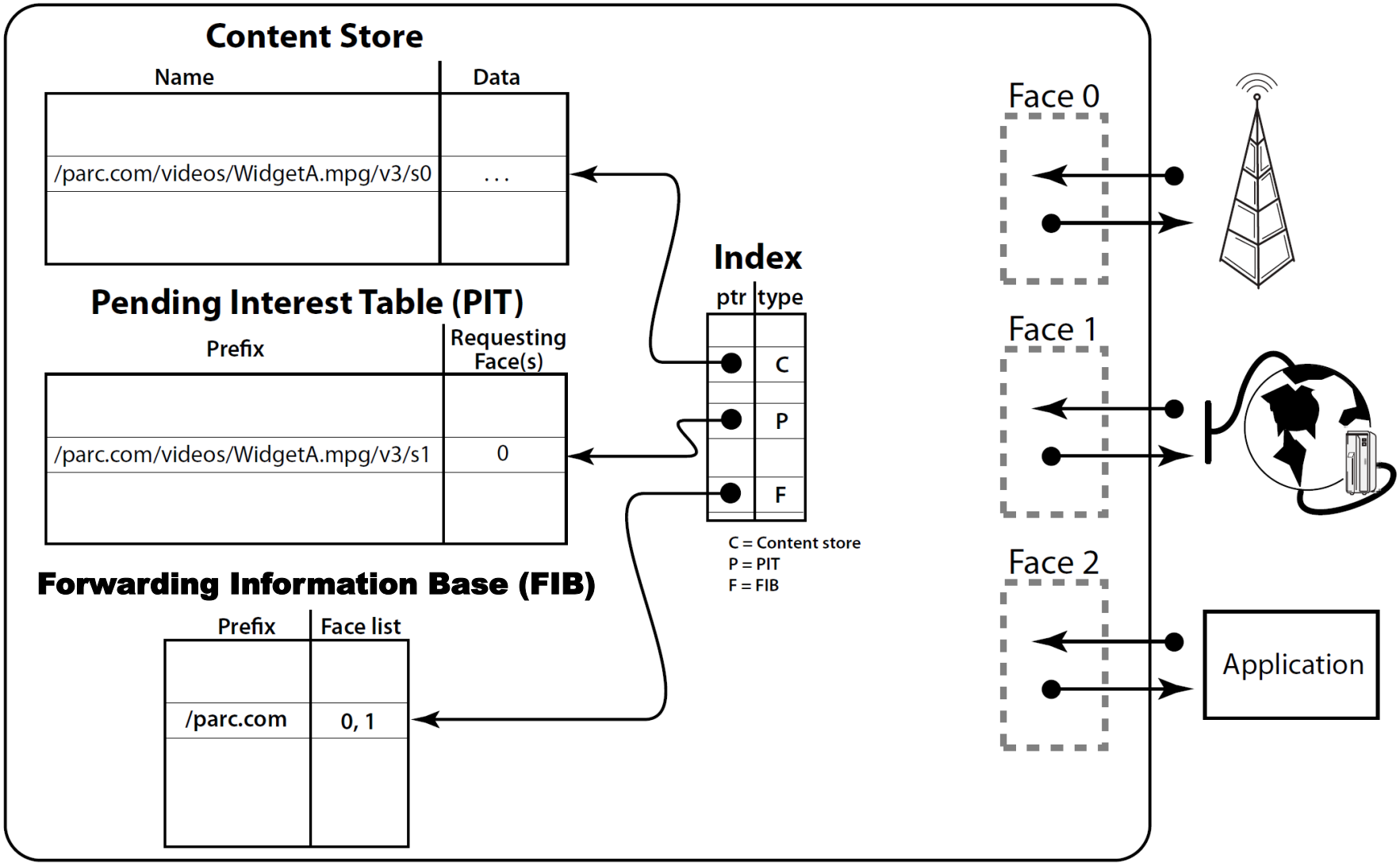
- There are just two CCN packet types - interest (similar to http “get”) and data (similar to http response).
- Both are encoded in an efficient binary XML

CCN Node Model

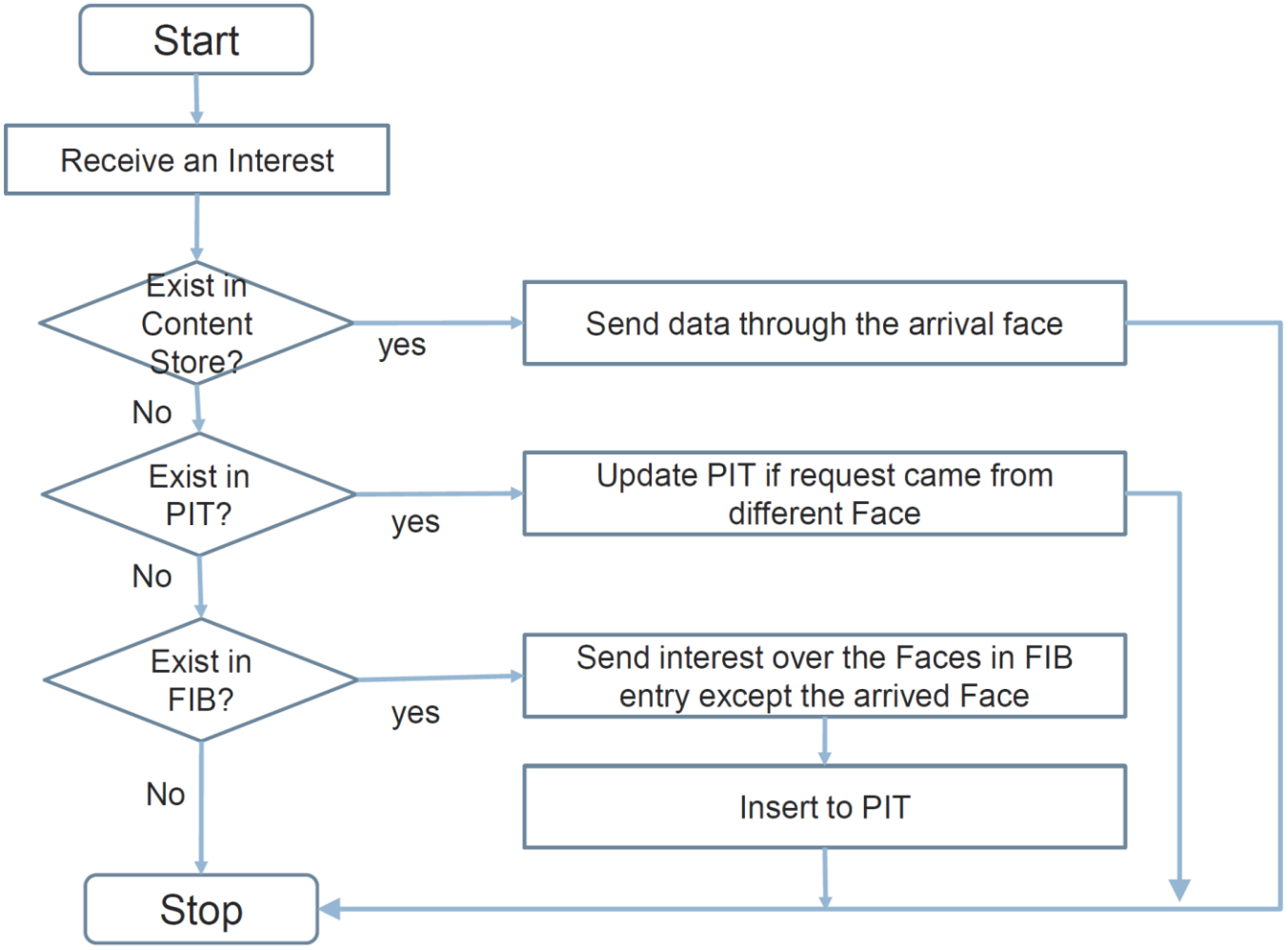


- Each CCN entity has 3 main data structures
  - Content Store, Pending Interest Table, Forwarding Information Base
- Uses multicast/broadcast
- Uses “longest prefix matching” lookup for content names

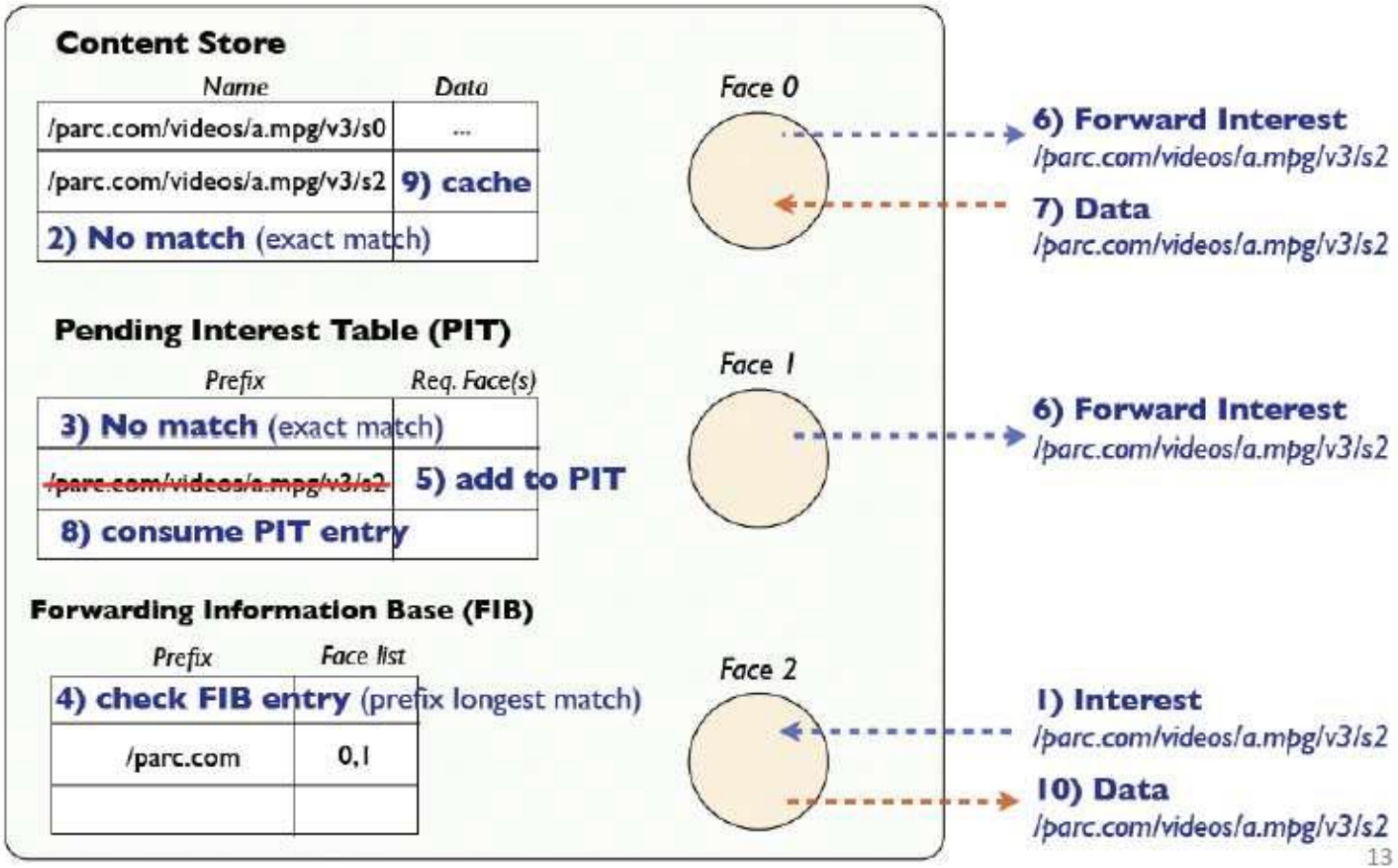
Interest Processing



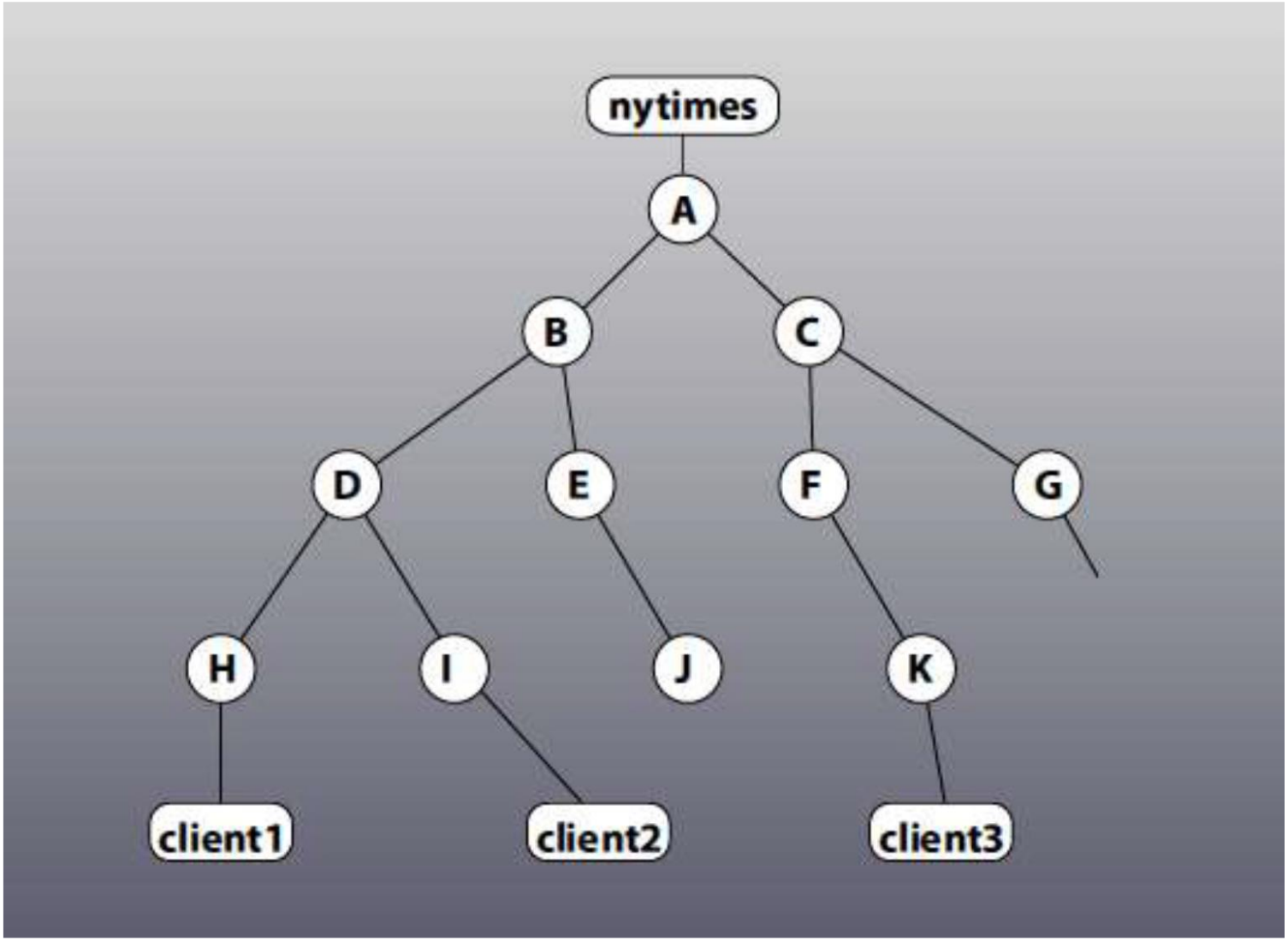
Interest Processing



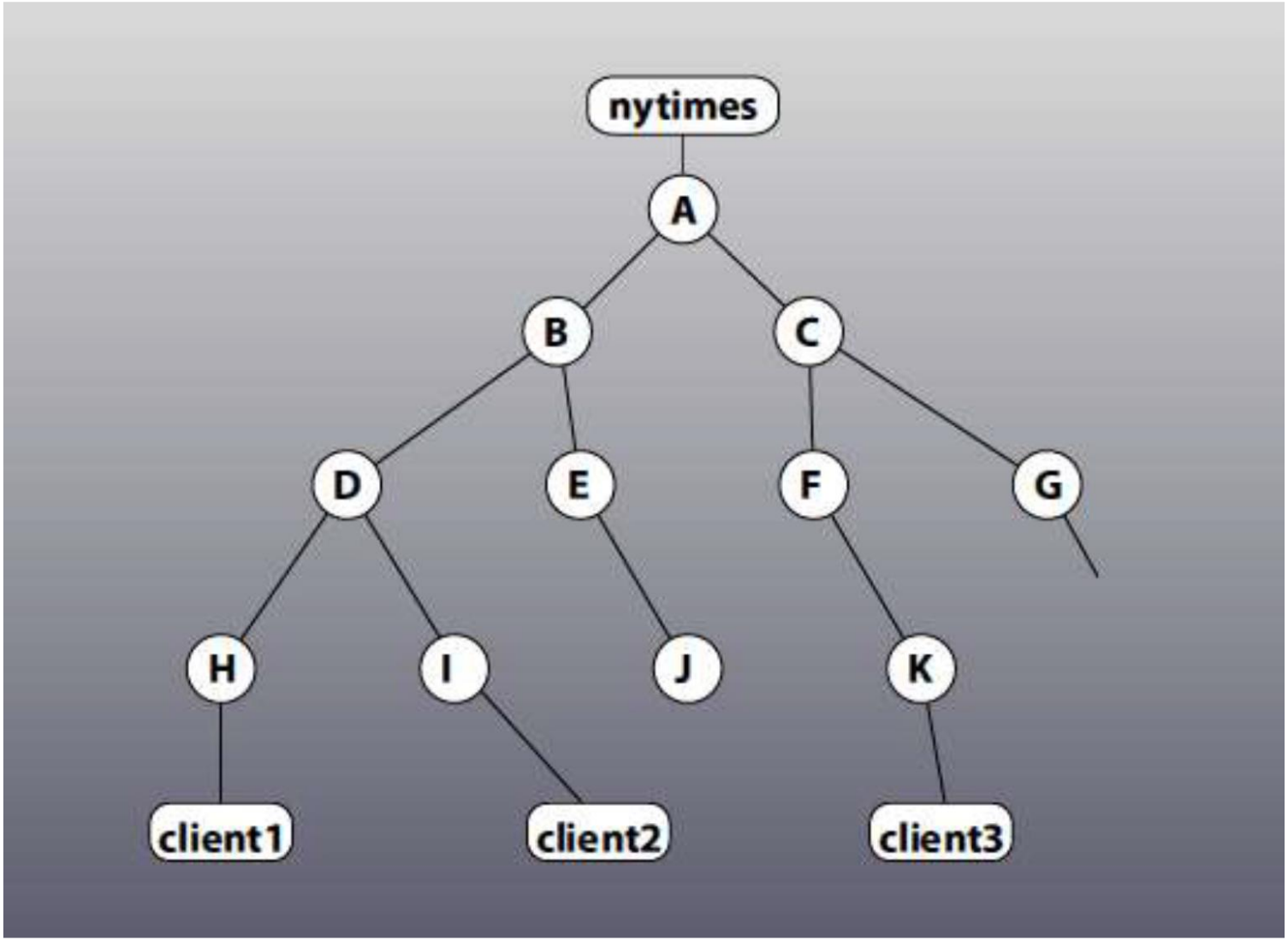
Interest processing



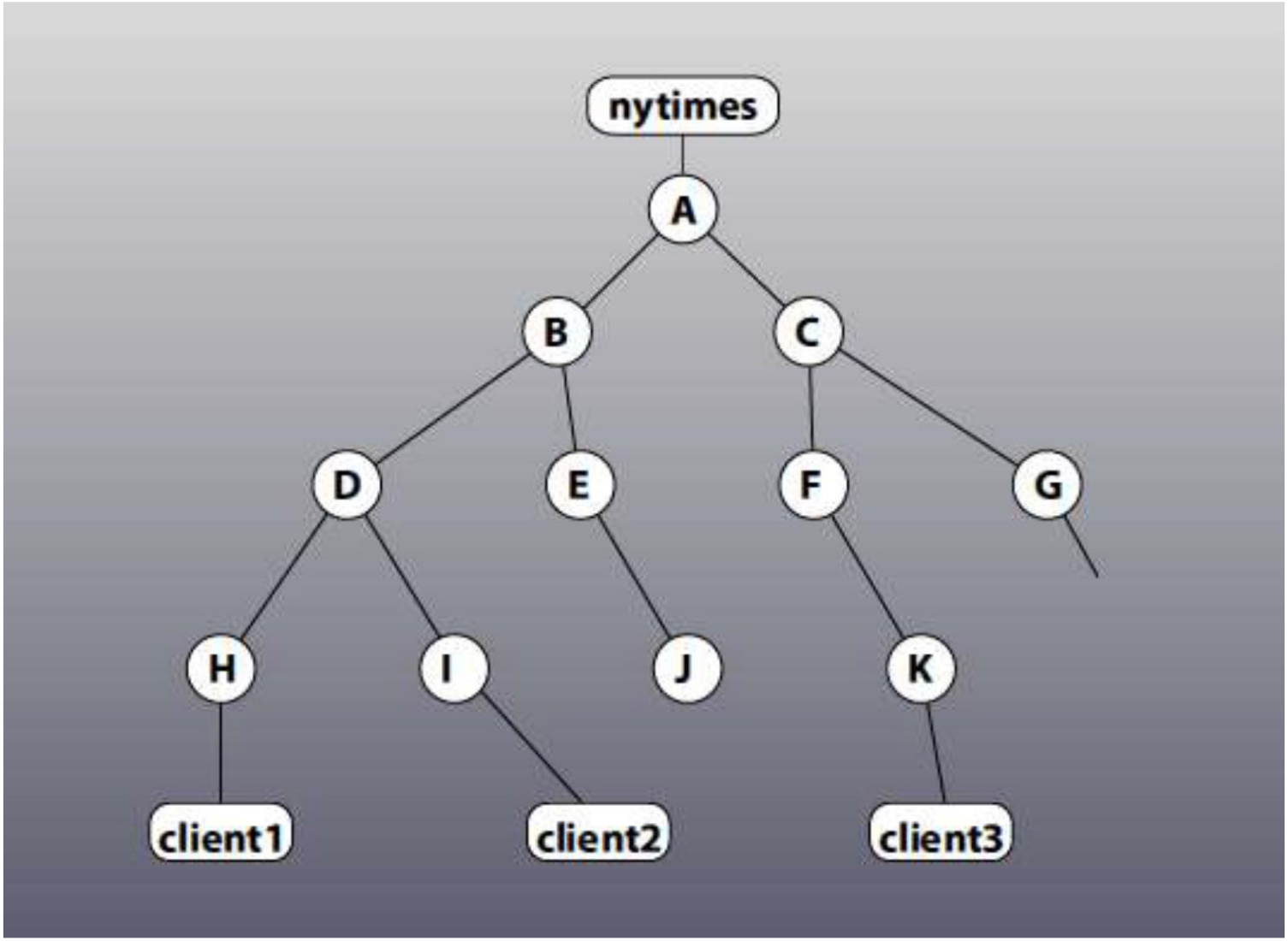
CCN operation



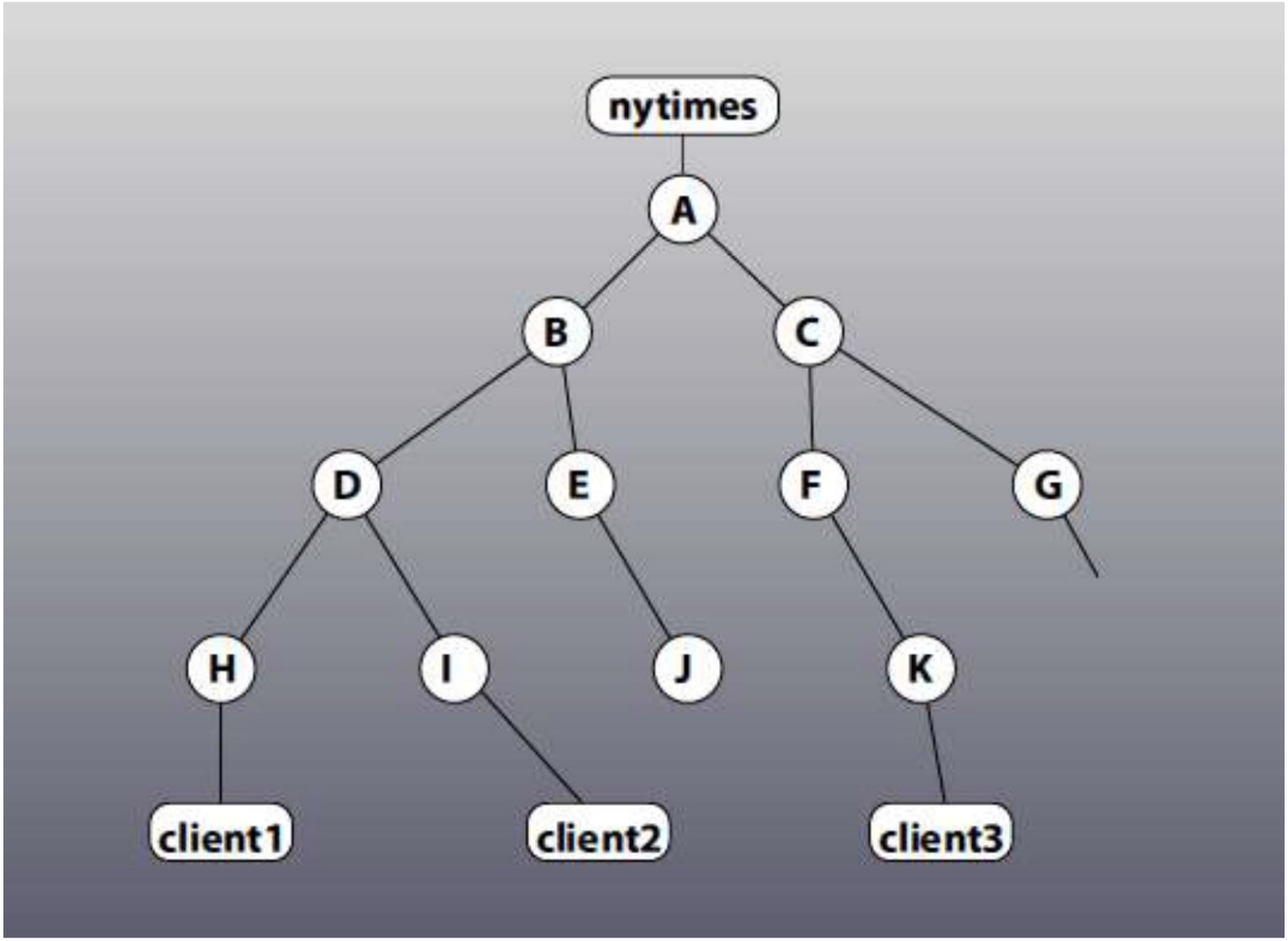
CCN operation



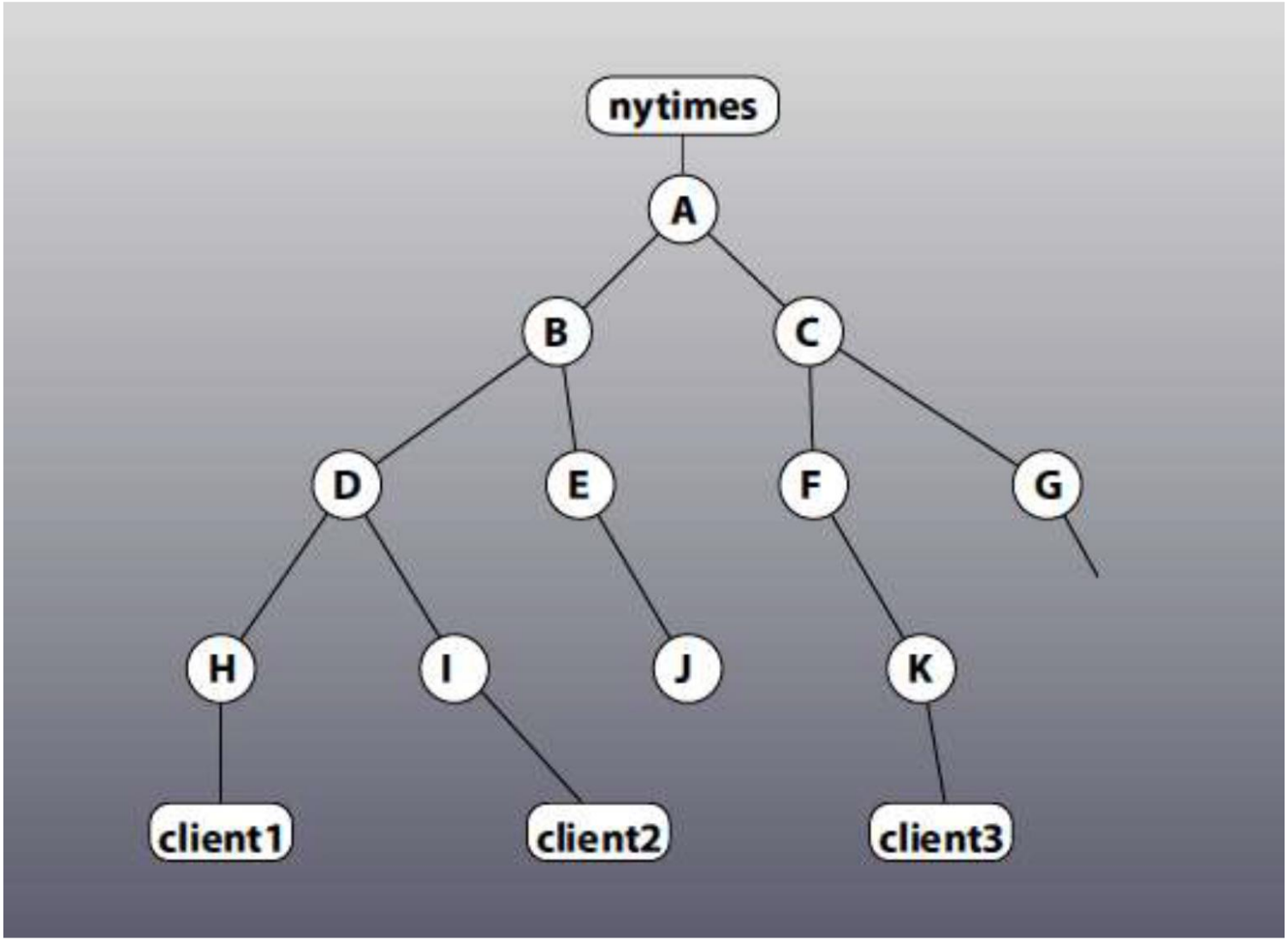
CCN operation



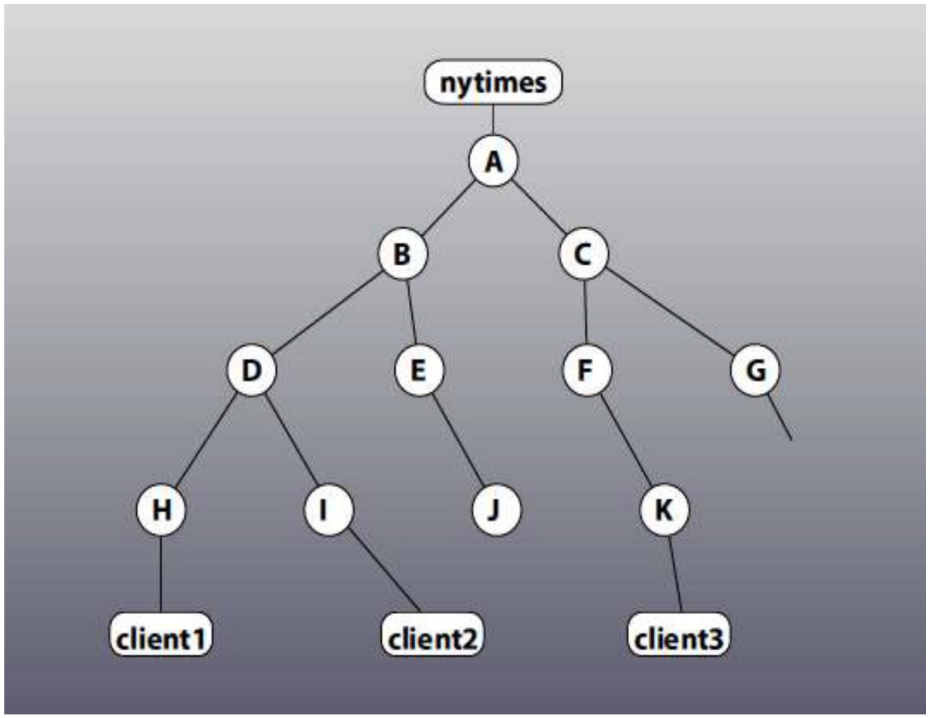
CCN operation



CCN operation

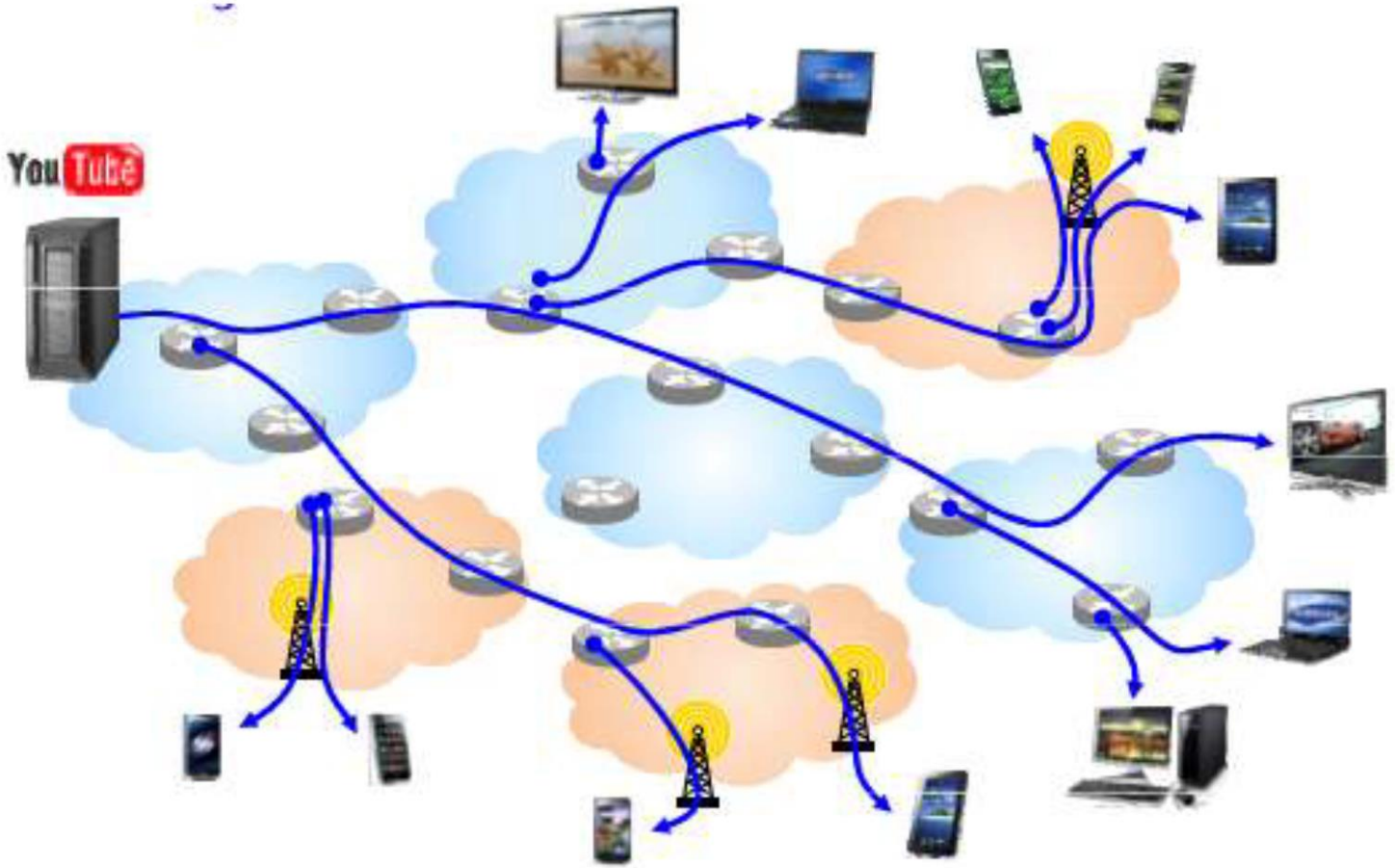


CCN operation



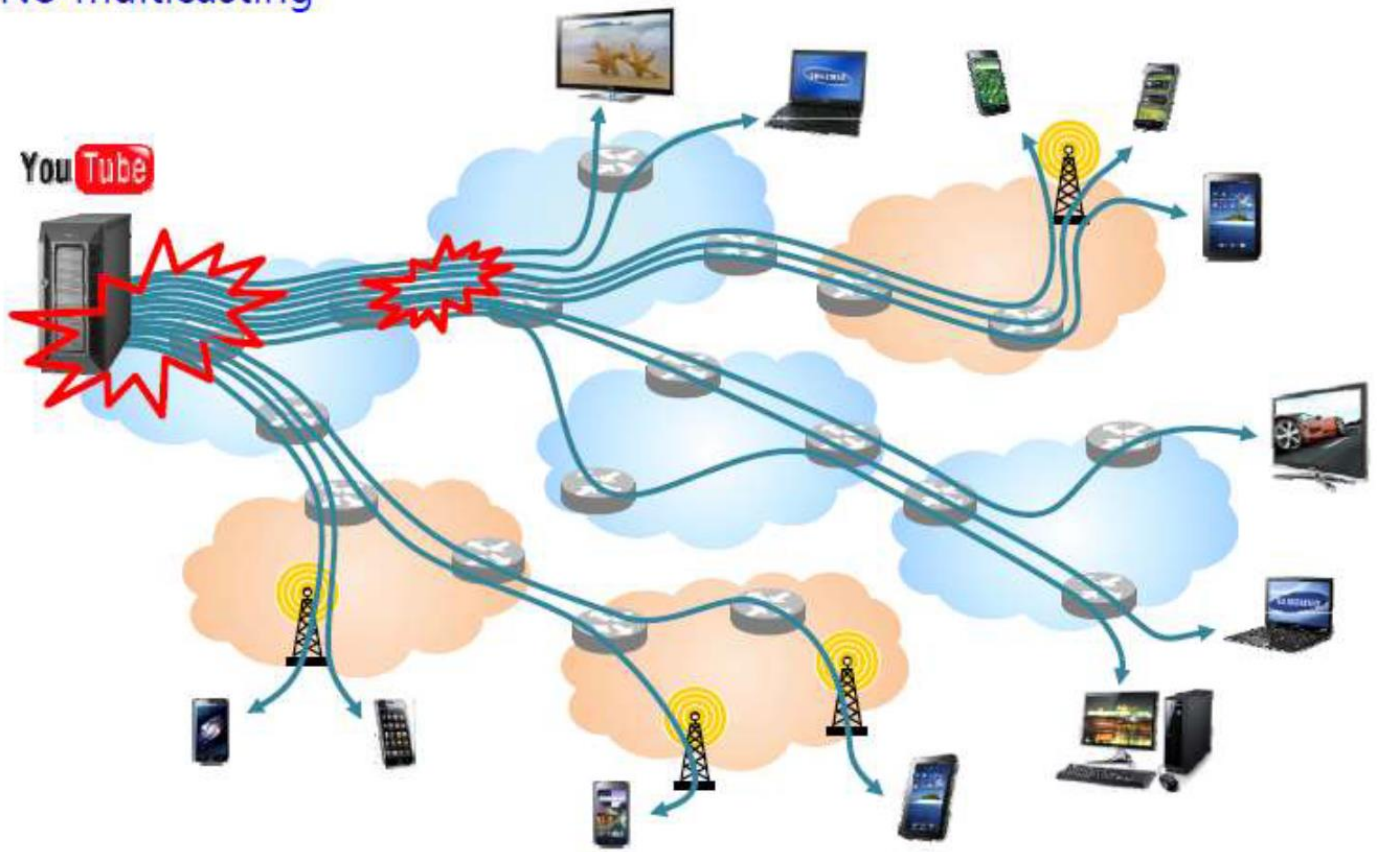
- Content goes only where there's interest.
- It takes at most one trip across any link.
- Average latency is minimized.
- Total bandwidth is minimized.
- There's no routing or control traffic associated with the replicas

CCN communication



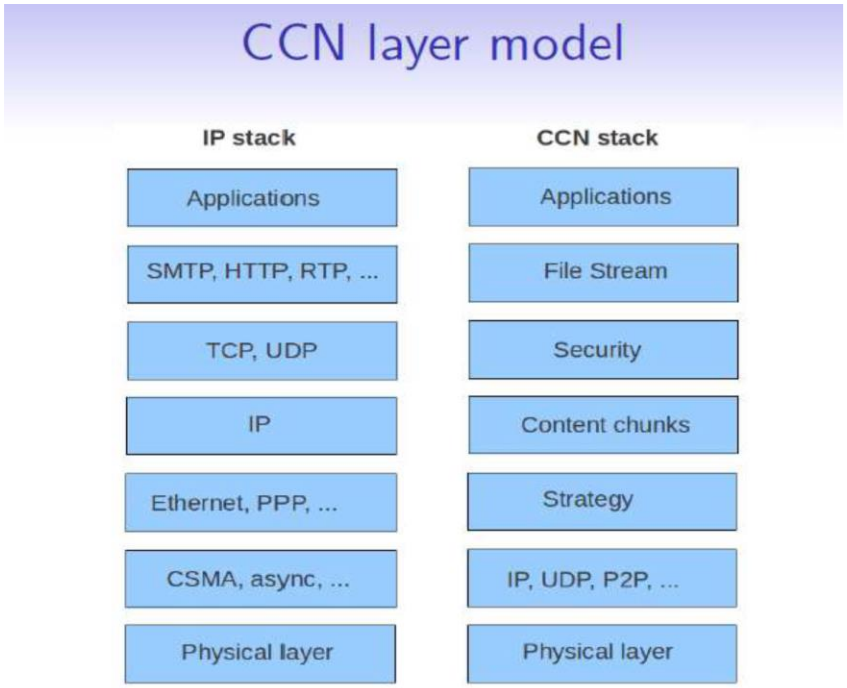
IP communication

- End host-to-end host communication
- Client/Server-based networking
- No multicasting



IP vs CCN protocol stacks

- Replace **packets** with **Data Objects or Interests**
- Replace **Addresses** with **Names of Objects**



Conclusion

- Content Centric Network
  - **uses “named content” as its central abstraction** rather than host identifiers
  - **retains the simplicity and scalability of IP**
  - offers **better security, delivery efficiency**
  - **designed to replace IP**, but **can be incrementally deployed** as an overlay