

Overview

- Similarly to DNS in IP architecture, DNS in NDN can be used as a distributed database to store various types of information.
- DNS in NDN can be utilized to
 - manage NDN namespace (i.e., provide an authoritative delegation of specific namespaces to specific organizations),
 - provide storage and lookup service for public key management similarly to DNSSEC and DANE
 - in many other solutions
- Design principles
 - DNS has been working well enough over last 25 years
 - Unless it is proven necessary, the existing DNS design should be kept intact, with minimal modification to adapt the system to communication primitives (Interest-Data) provided by Named Data Networking architecture

Use case: Interest forwarding scalability problem

- NDN is data-centric with names that are generally not tied to any provider
- Number of such names is almost innumerable
 - over 200 million 2nd-level DNS names
 - number of application names several orders of magnitude larger, if not infinite
 - assuming FIB-based Interest forwarding in NDN even with all aggregation possible using hierarchical names, it could be way too many names
- Forwarding alias in NDN is the same map'n'encap approach proposed many years back to scale IP routing
 - hint for NDN routers of a direction where the requested application data can be located
 - can be mapped from the data name using DNS system, the same way domain names are mapped to IP addresses

Scaling Interest forwarding with map'n'encap approach

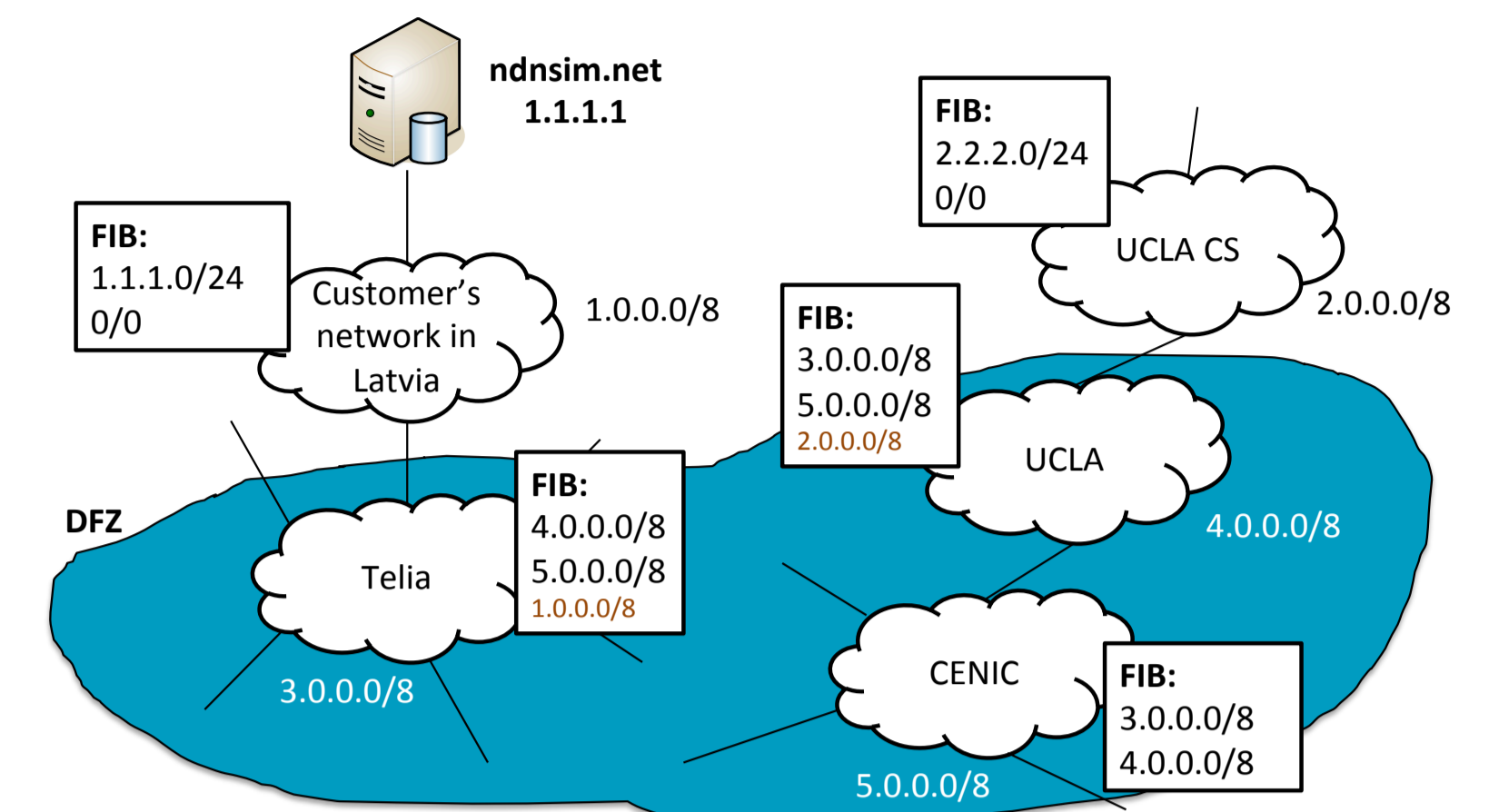
General map'n'encap idea

- Core of the Internet maintains default-free zone (DFZ)
 - every ISP (dedicated ISP's address) has a route in DFZ
- Customer networks
 - prefixes for all internal networks and servers
 - default route to DFZ
- When sending packets between customer networks
 - **map** destination address to ISP address
 - **encapsulate** original packet inside a new packet with ISP address

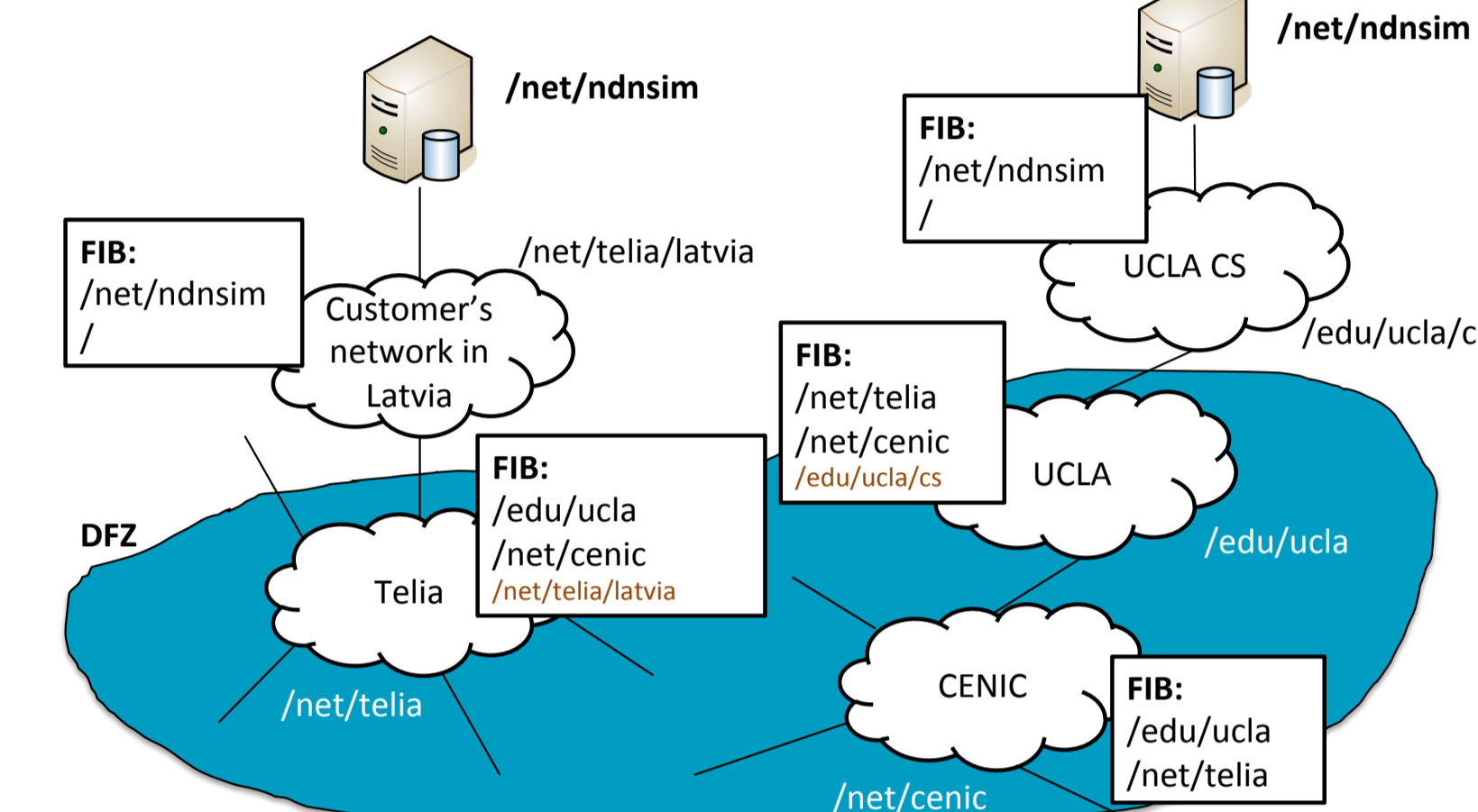
Applying map'n'encap in NDN

- All NDN names are applications names
 - small number of them are directly routable world-wide
 - most of them routable only inside ISP networks
- Globally routable names
 - scalable DFZ FIBs contain only top-level ISP and large content provider's names
 - /net/att
 - FIBs in ISPs may contain more specific location-dependent names
 - In ATT network, there could be /net/att/europe and /net/att/northamerica
- Routable only inside ISP networks
 - Example applications names:
 - /com/cnn/news/2013-01-14
 - /org/wikipedia/NDN
 - ISPs and content providers can forward Interests based on application names
 - In ATT: /com/cnn, /com/ndnsim, /org/wikipedia
 - In Google: /com/google/youtube

Example of IP map'n'encap: dual-homed ndnsim.net server



Example of NDN map'n'encap: dual-homed producer of /net/ndnsim prefix



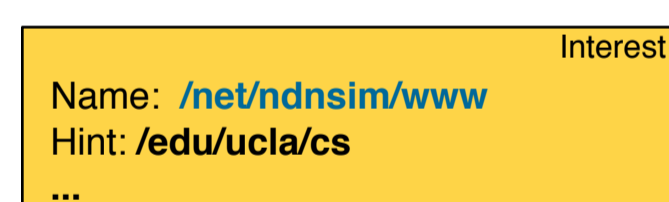
Encapsulating in NDN

Forwarding hint

- Carried in Interest packets
- Used by routers in forwarding, if content name is unknown



- Interest forwarded only if **/net/ndnsim/www** is known
- Discarded otherwise

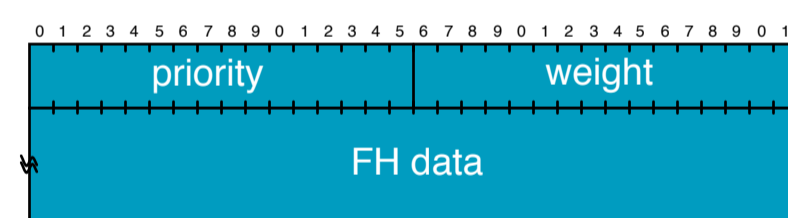


- Forwarded toward **/edu/ucla/cs** if **/net/ndnsim/www** is unknown

Mapping in NDN

NDN-DNS lookup

- Two types of queries
 - iterative queries by caching resolvers
 - recursive queries by end clients
- New record record (RR) type
 - mnemonic: FH
 - ID: 65429 (0xFF95)



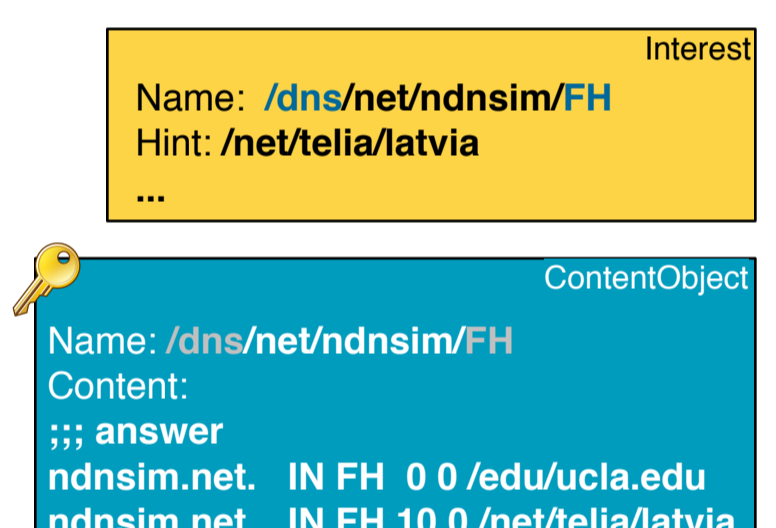
priority: the lower priority should be tried first
weight: probability of selection is proportional to the weight

FH data:
wire format: NDN name in cncb encoding
text format: URI-encoded NDN name

Naming for NDN-DNS queries

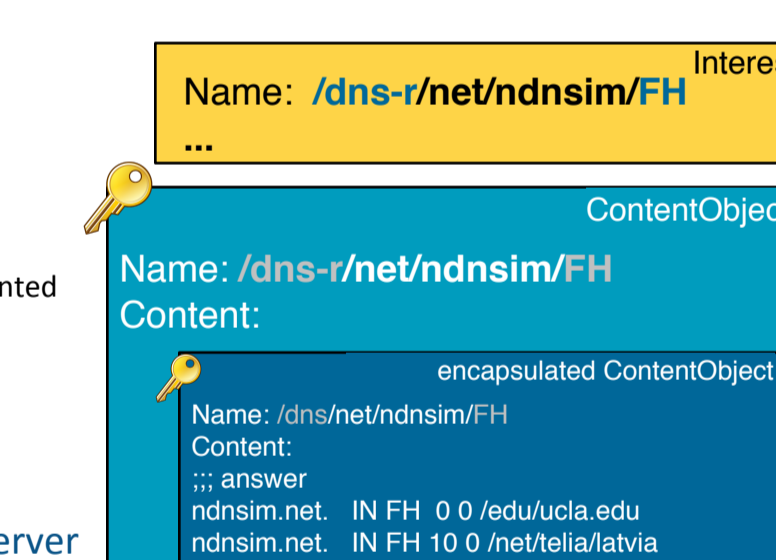
Iterative query

- Interest
 - Name: /dns/<domain_name>/<rr_type>
 - Forwarding Hint: /<DFZ-prefix>
- Data
 - Name: /dns/<domain_name>/<rr_type>
 - Signature: signature of the auth DNS server
 - Content: RFC1035 formatted RR packet



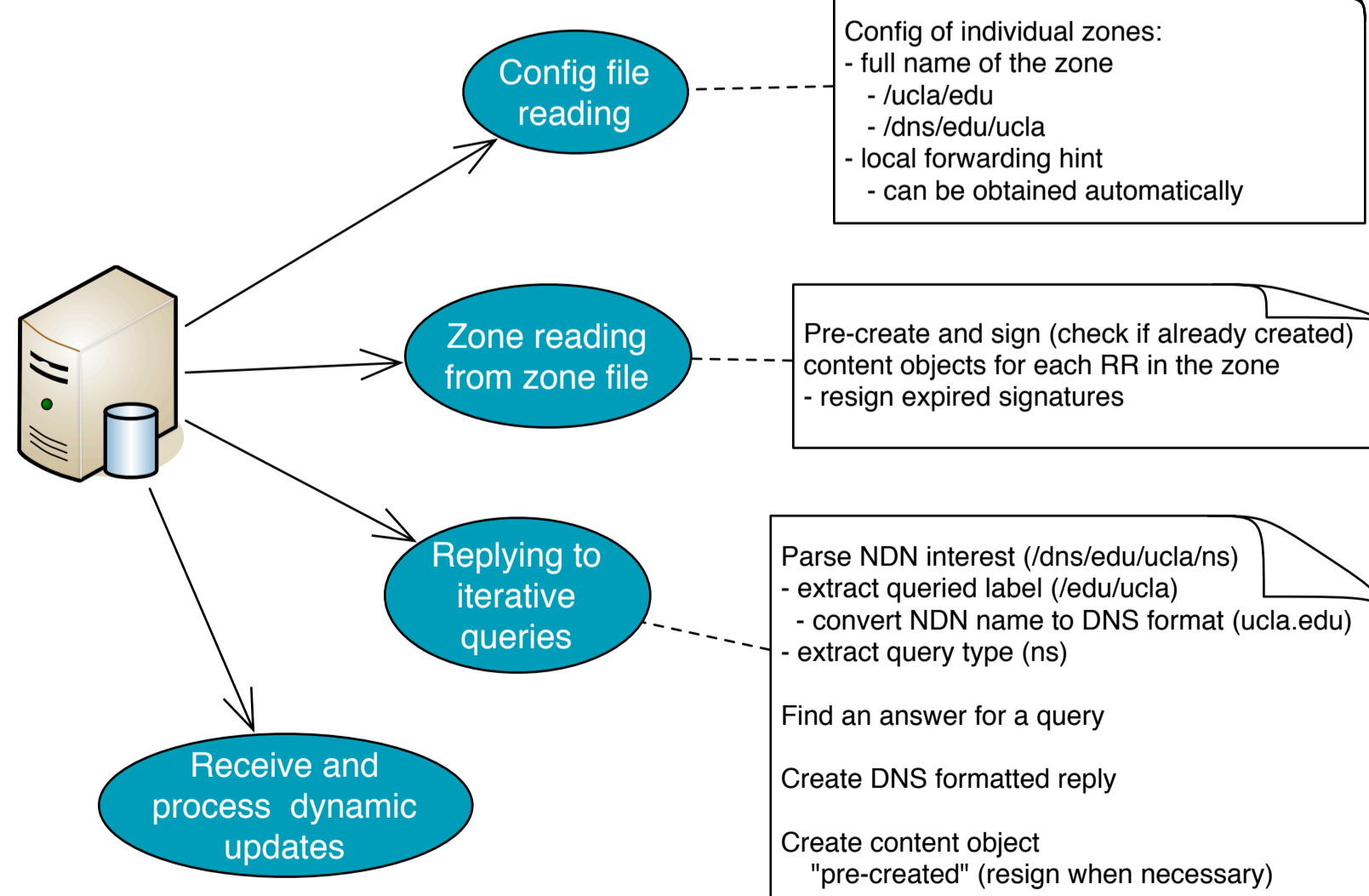
Recursive query

- Interest
 - Name: /<scope>/dns-r/<domain_name>/<rr_type>
 - Optional <scope> to select specific caching resolver, if wanted
- Data
 - Name: /<scope>/dns-r/<domain_name>/<rr_type>
 - Signature: signature of the caching resolver
 - Content: encapsulated data from the auth DNS server

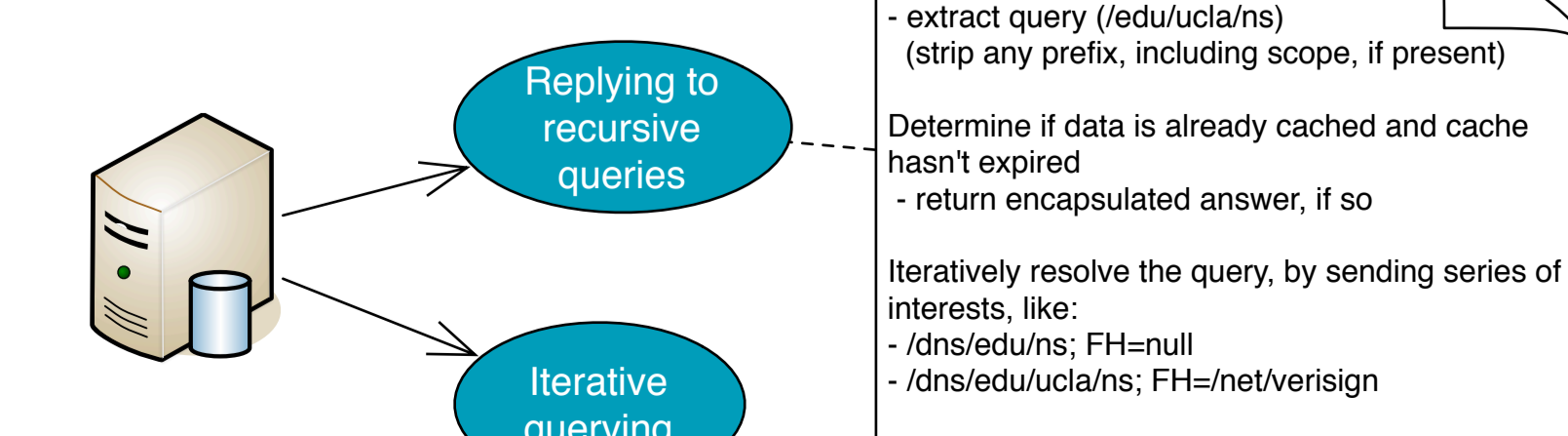


NDN-DNS server roles

Authoritative DNS server

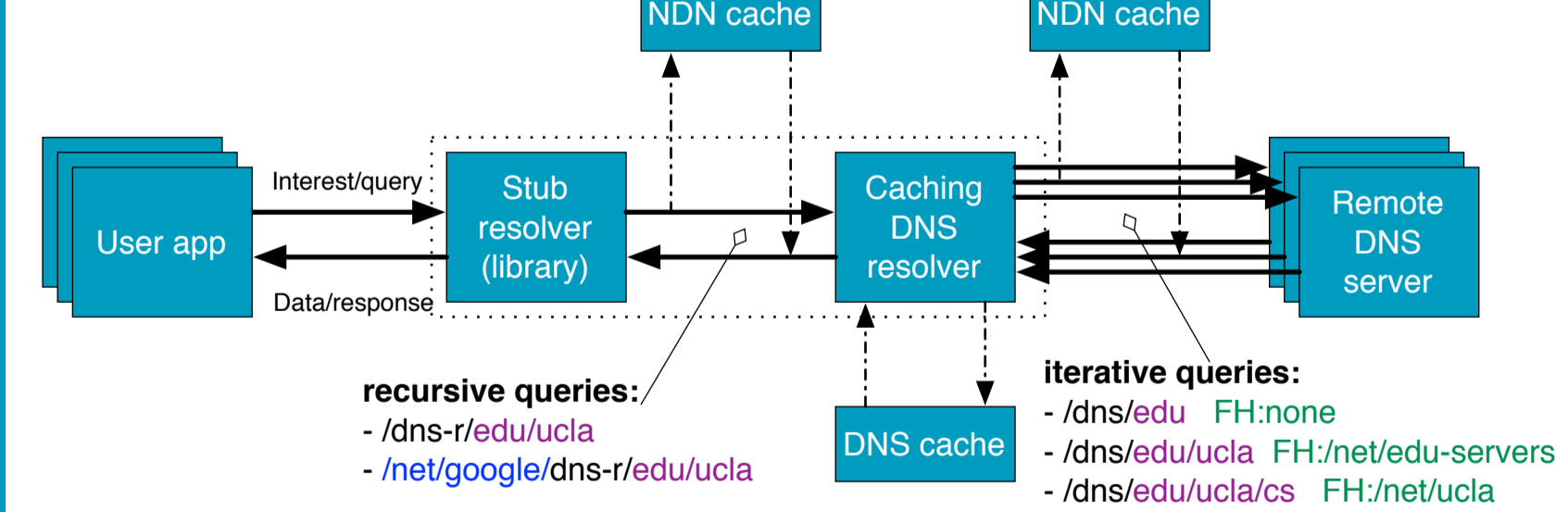


Caching/Recursive DNS server

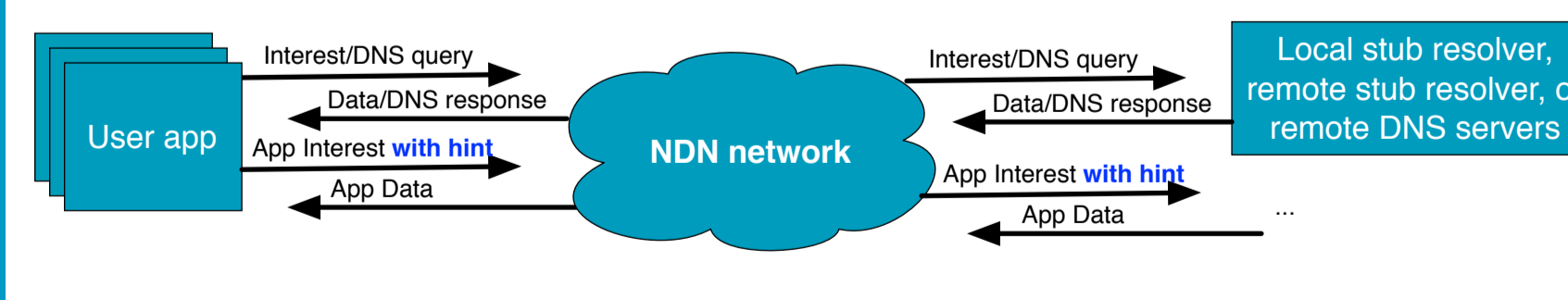


NDN-DNS lookup

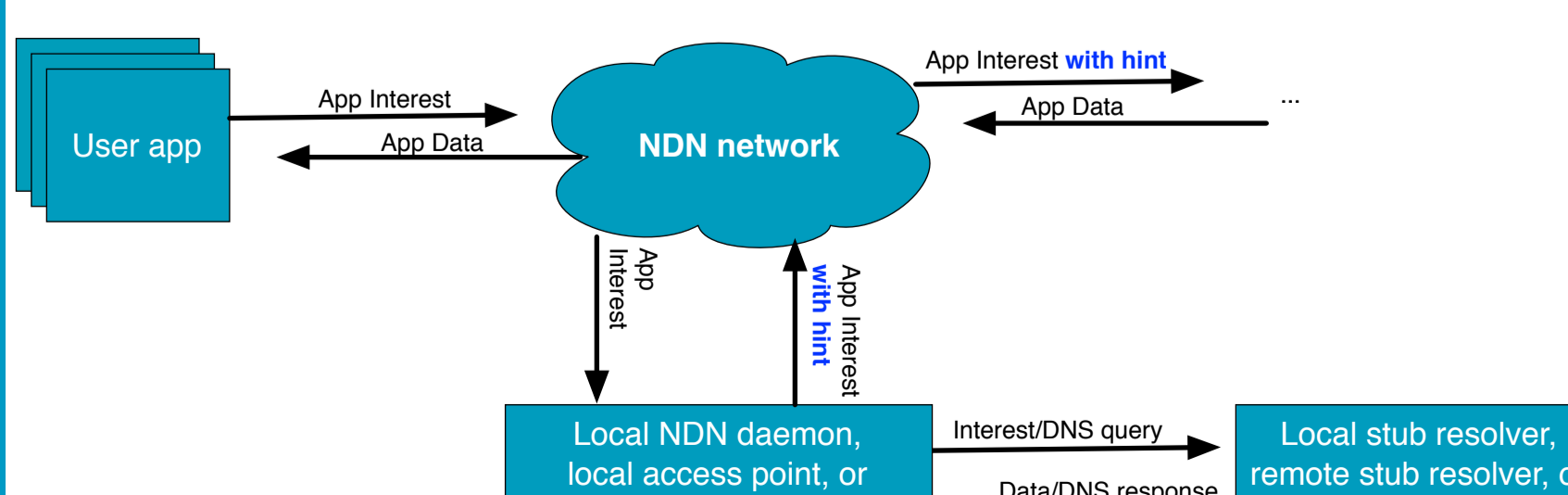
Overview



App-based lookup



Network-based lookup (possible only in NDN)



Example of NDN-DNS lookup for ndnsim.net

