LISP-CONS

A Mapping Database Service

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Agenda

- Brief Intro
- Design Considerations
- Brief Definitions
- How CONS Works
- What We've Learned
- Questions/Comments?

What is LISP?

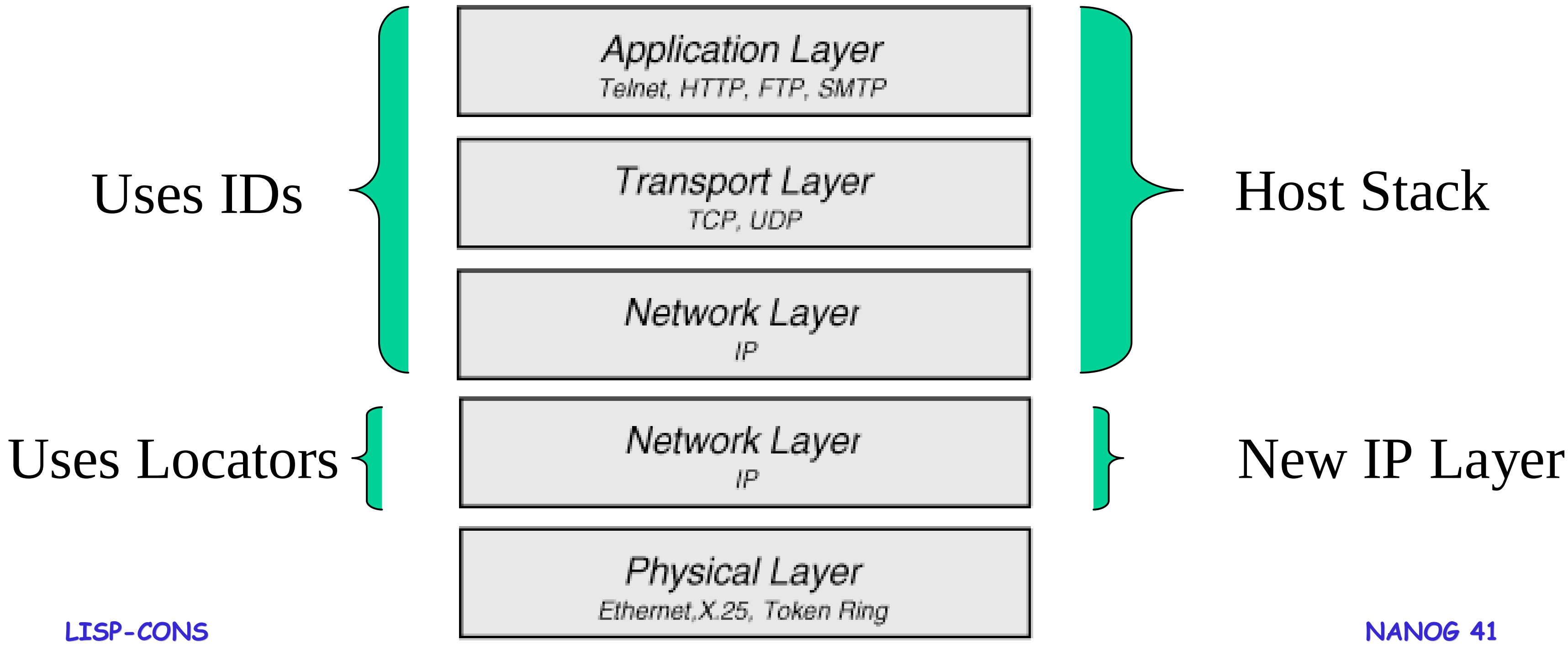
- Locator/ID Separation Protocol (LISP)
  - draft-farinacci-lisp-03.txt
- Creates two namespaces: IDs and Locators
- Why do this?
  - Improve site multihoming
  - Improve ISP Traffic Engineering
  - Reduce site renumbering costs
  - Reduce size of core routing tables
  - PI for all?
  - Some form of mobility?

Locator/ID Split?

- The idea here is that the IP address is overloaded
  - It encodes both location in the topology (locator) and the identity of the user of the address
- The locator role is used by the routing system
- The identity role is used by upper layer protocols
  - e.g., TCP pseudo-header
- Problem: Since we want locators to aggregate topologically, and since identifiers are usually allocated on organizational boundaries, it is difficult (impossible?) to get one number space to efficiently serve both purposes.
  - There are other issues as well, including
    - The expected lifetime of a name (don't want to reconfigure...)
    - Who has control over the name(s)?
    - ...

Locator/ID Split?

- One solution: split the functions -- This is at the heart of the Locator/ID split idea
  - So how might we achieve this?
- Architecturally, we might try to "Jack-up" the existing IP layer



Implementing a Locator/ID Split

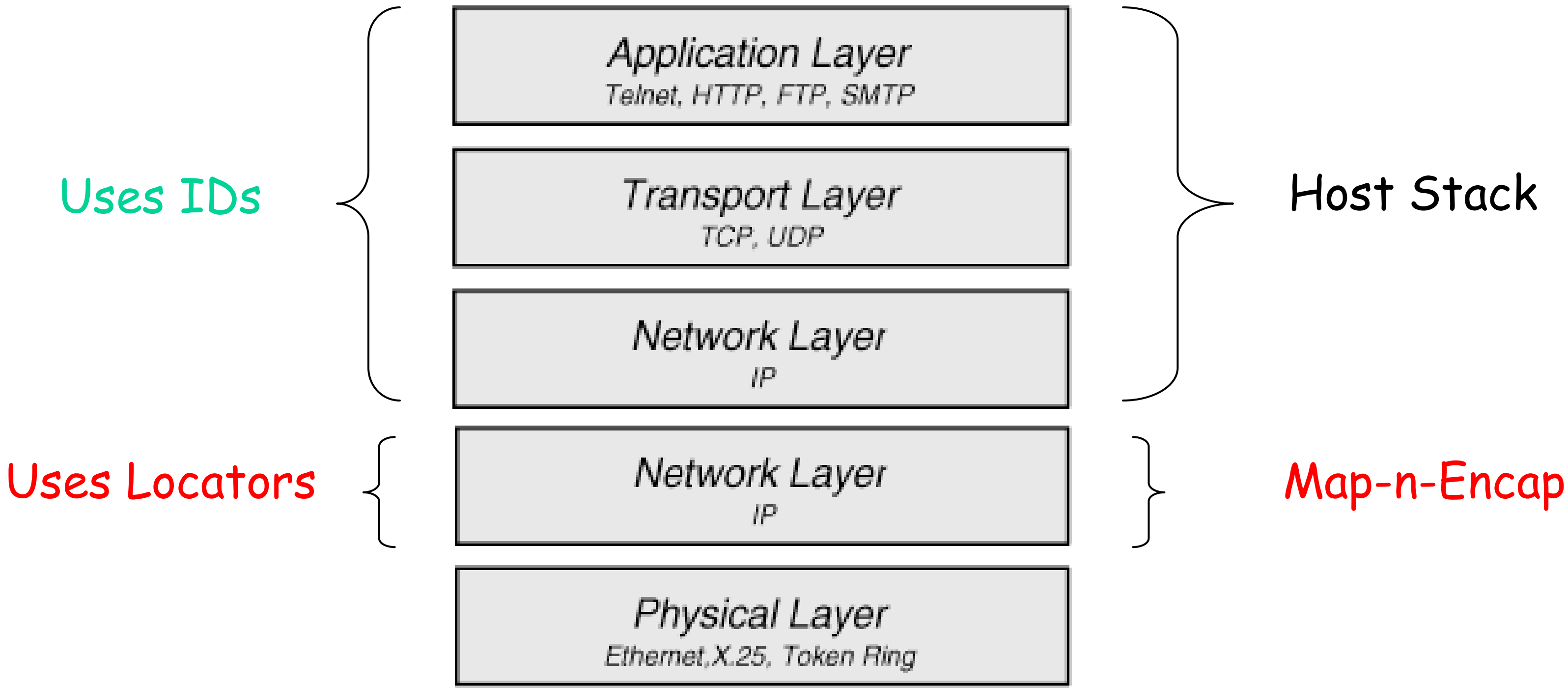
- There are two main ways to engineer a Loc/ID split
- Rewriting
  - If you have enough address space (e.g., IPv6), you could use the lower 64 bits as an identifier, and the upper 64 bits as a locator, and rewrite the locator at the border
  - This is the basis of O'Dell's 8+8/GSE scheme
    - Credit to Bob Smart and Dave Clark on this one too
- Map-n-Encap
  - You could also put another header on the packet, and make the inner header carry the IDs and the outer header carry the locators
    - LISP is an instance of this approach
    - Credit to Bob Hinden & Steve Deering on map-n-encap...

Loc/ID Split in practice

IPv6: $\underbrace{2001:0102:0304:0506}_{\text{Locator}}:\underbrace{1111:2222:3333:4444}_{\text{ID}}$

IPv4: $\underbrace{209.131.36.158}_{\text{Locator}}.\underbrace{10.0.0.1}_{\text{ID}}$

LISP is a Jack-Up



LISP Parts

- Data-plane
  - Design for encapsulation and tunnel router placement
  - Design for locator reachability
  - Data triggered mapping service
- Control-plane
  - Design for a scalable mapping service
  - This talk is about LISP Control-planes

LISP Variants

- LISP 1
  - Routable IDs over existing topology to probe for mapping reply
- LISP 1.5
  - Routable IDs over another topology to probe for mapping reply
- LISP 2
  - EIDs are not routable and mappings are in DNS
- LISP 3
  - EIDs are not routable, mappings obtained using new mechanisms (DHTs perhaps, LISP-CONS, NERD, APT)

Data-Plane Mapping

Control-Plane Mapping

Quick LISP Terms

- Endpoint Identifiers (EIDs)
  - IDs for host-use and only routeable in source and dest sites
  - Can be out of PA or PI address space
- Routing Locators (RLOCs)
  - Routable addresses out of PA address space
- Ingress Tunnel Router (ITR)
  - Device in source-site that prepends LISP header with RLOCs
- Egress Tunnel Router (ETR)
  - Device in destination-site that strips LISP header

LISP Control-Plane

- Build a large distributed mapping database service
- Scalability paramount to solution
- How to scale: `(state * rate)`
- If both factors large, we have a problem
  - `state` will be "large" ($O(10^{10})$ hosts)
  - Aggregate EIDs into EID-prefixes to reduce state
  - So `rate` must be small
  - Make mappings have "subscription time" frequency
    - i.e., we expect such mappings to change with low frequency
  - And no reachibility information in the mapping database

Some Questions for a LISP Control-Plane

- Where to put the mappings?
- How to find the mappings?
- Is it a push model?
- Is it a pull model?
- Do you use secondary storage?
- Do you use a cache?
- What about securing the mapping entries?
- What about protecting infrastructure from DOS-attacks?
- What about controlling packet loss and latency?

LISP Control-Plane

- "Push doesn't scale, caching doesn't scale, pick one"

LISP-CONS

- LISP-CONS is a hybrid approach
- Push EID-prefixes (but not mappings) at upper levels of hierarchy
- Pull from lower levels of hierarchy
- Mappings stored at lower-levels
  - Requests get to where the mappings are
  - Replies are returned
  - This is a crucial point as we'll see in a bit
- Getting to the lower-levels via pushing of EID-prefixes
- LISP-CONS is a mapping system for LISP 3.0

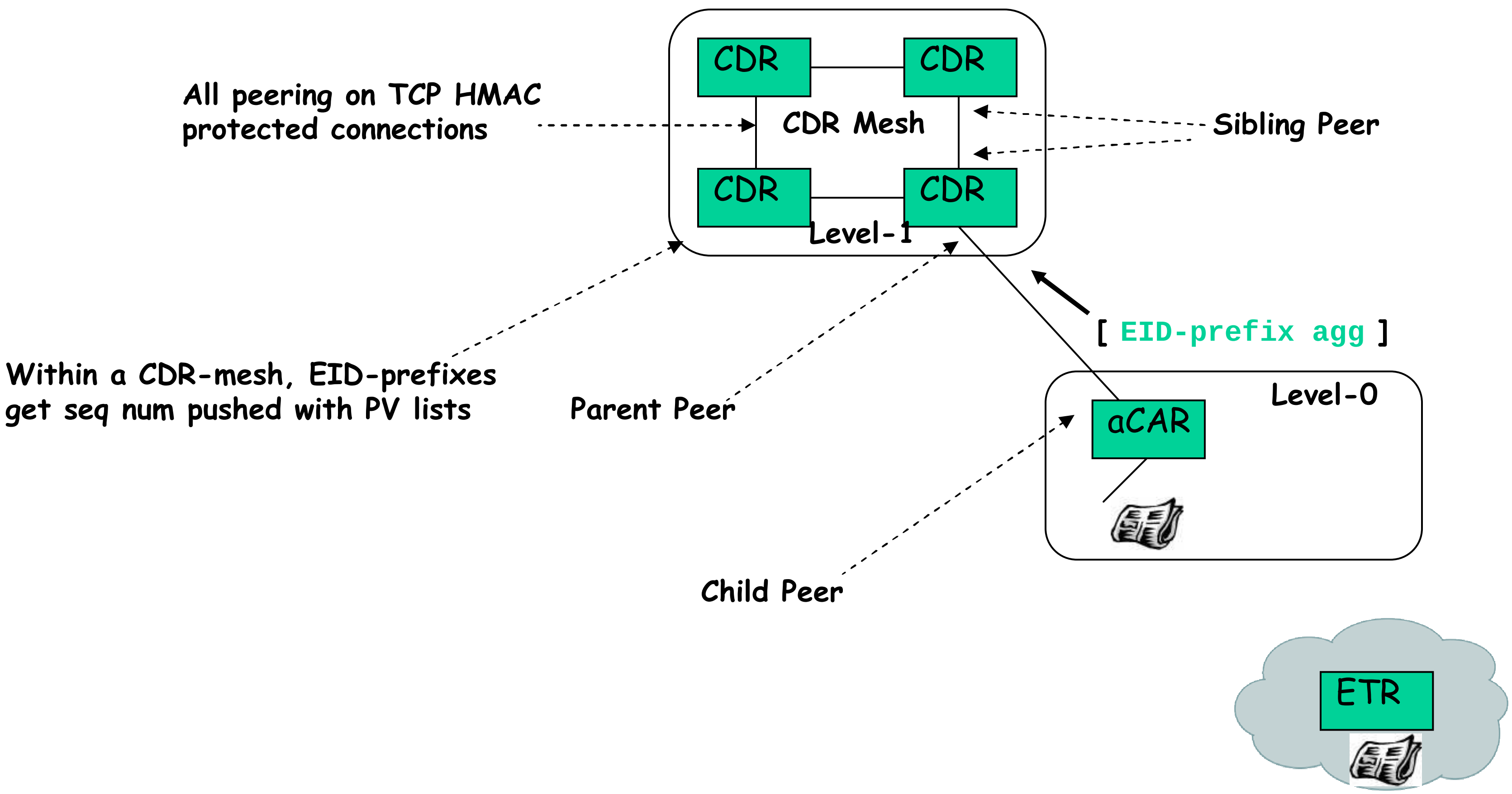
LISP-CONS

- We can get good EID-prefix aggregation
  - If hierarchy based on EID-prefix allocation and not topology
  - Then build a logical topology based on the EID-prefix allocation
- Map-Requests routed through logical hierarchy
  - Key is the EID
- Map-Reply returned to originator
  - With mapping record {EID-prefix, RLOC-set}

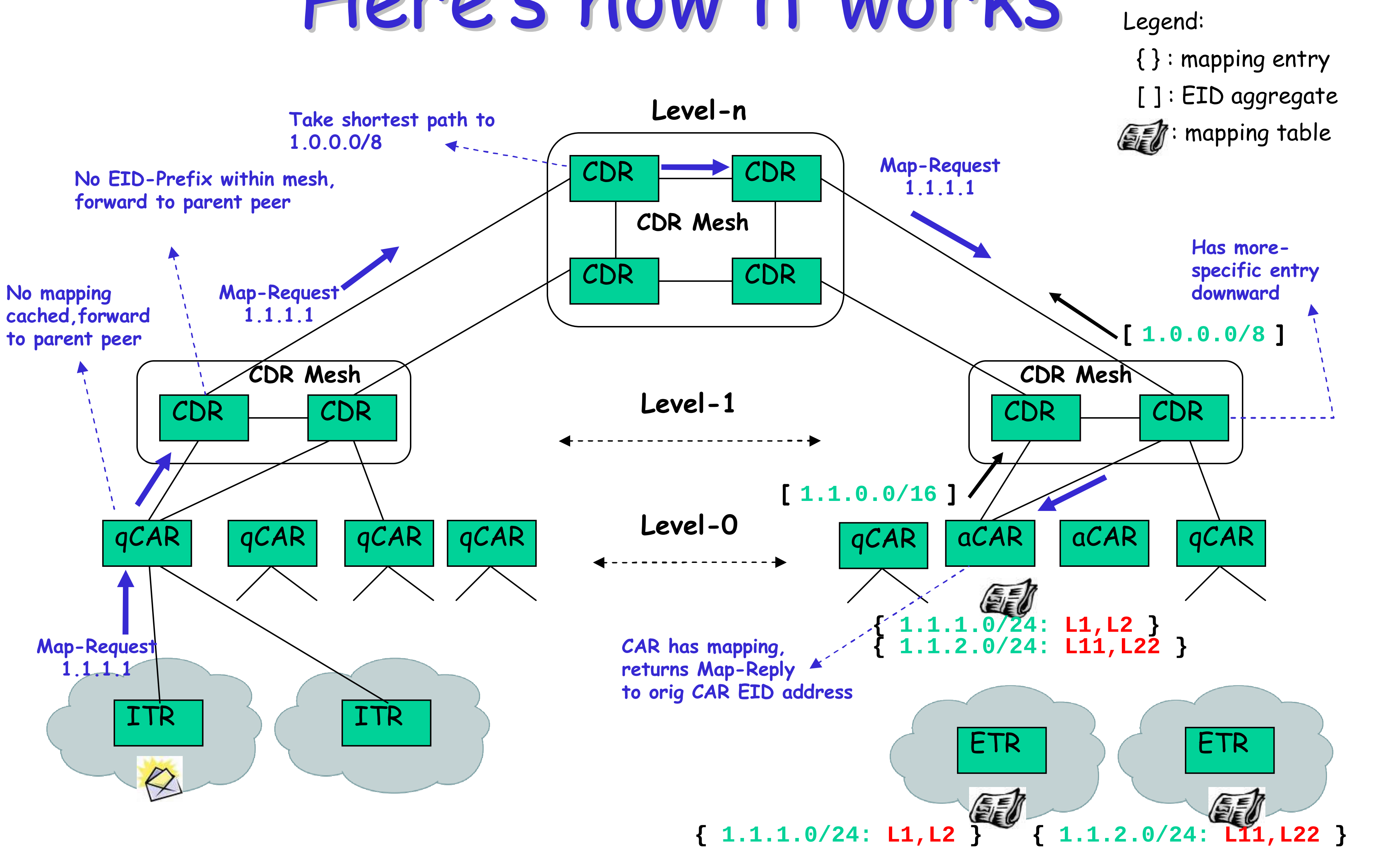
LISP-CONS Network Elements

- Content Access Routers (CARs)
  - Querying-CARs
    - Generate Map-Requests on behalf of ITRs
    - Returns answers to ITRs
  - Answering-CARs
    - Hold authoritative mappings at level-0 of hierarchy
    - Aggregate only EID-prefix upwards
    - Respond with Map-Replies
- Content Distribution Routers (CDRs)
  - Push around EID-prefixes with level-1 to n of hierarchy
  - Aggregate EID-prefix upwards
  - Advertise EID-prefixes in a mesh topology within level
  - Forward Map-Requests and Map-Replies

LISP-CONS -- Peering \\



Here's how it works



What We've Learned

- We wanted to optimize aggregatability of EID prefixes
  - That led to the design in which only EID prefixes were pushed around at the higher levels (but not the mappings themselves)
  - We were concerned about the rate*state product
- However, some SPs articulated another dimension
  - Latency
  - So you have to tradeoff rate, state, and latency
  - If you push, you wind up with the whole database in network elements (state)
  - If you pull, you incur latency
  - If you try to do mobility, you get lots of updates (rate)

What We've Learned

- Current thinking is that a different hybrid approach might be most feasible
- Push the whole mapping table around in the "CDR" level
- ITRs pull mappings from the "CAR" level
- This has a few nice properties:
  - You can get the whole mapping table
    - If you happen to want it
  - Latency is reduced because you don't have to traverse the whole hierarchy to retrieve the mappings

Drafts

- LISP
  - draft-farinacci-lisp-03.txt

- CONS
  - draft-meyer-lisp-cons-02.txt

Questions/Comments?

Thanks!