NIST National Institute of Standards and Technology

INFORMATION TECHNOLOGY LABORATORY

# Enhanced Efficiency of Mapping Distribution Protocols in Scalable Routing and Addressing Architectures

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**July 2010**

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Acknowledgement: Thanks to Dino Farinacci, Lixia Zhang, Joel Halpern, and Robin Whittle for their helpful comments and suggestions.

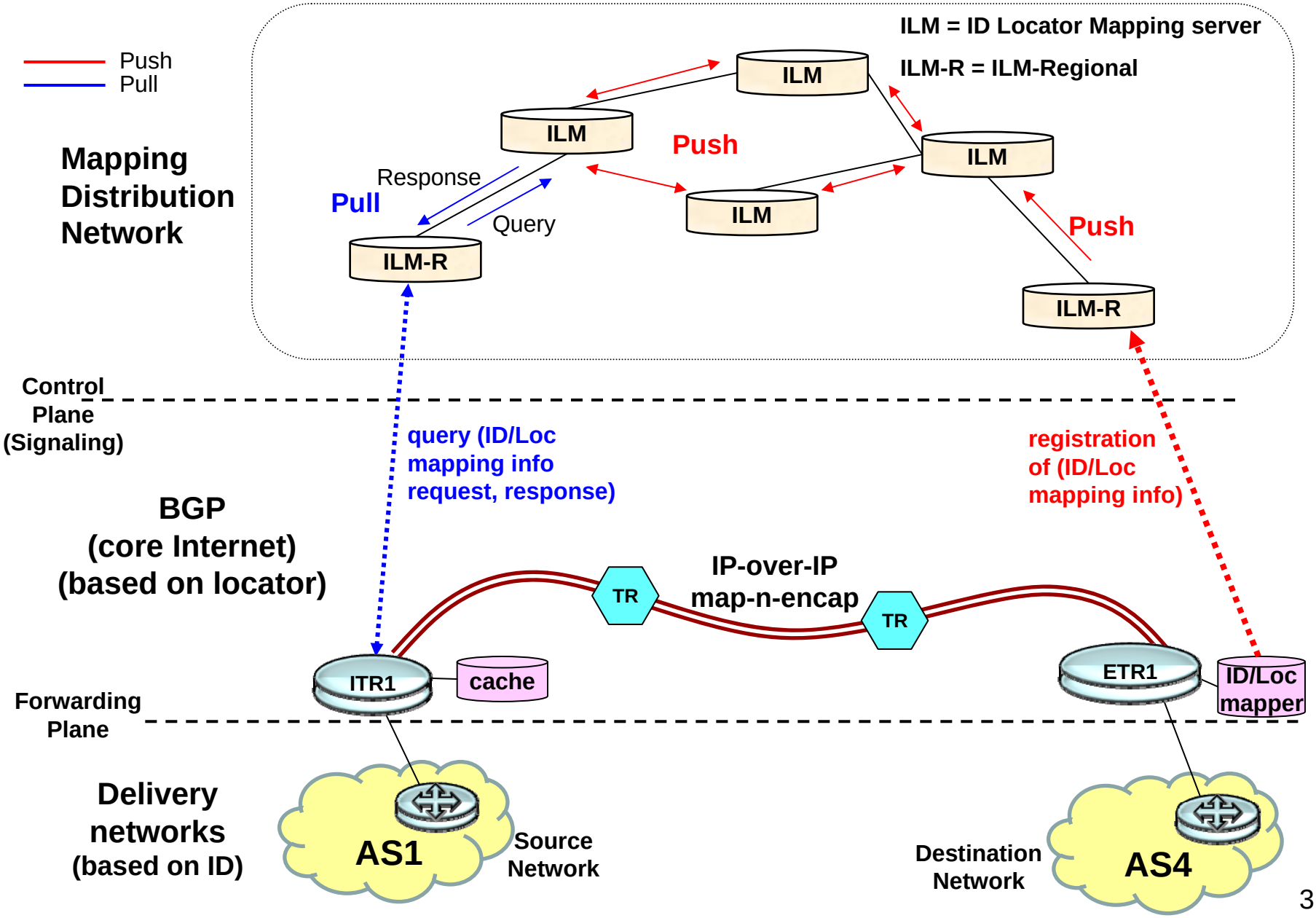
This research was supported by the Department of Homeland Security under the Secure Protocols for the Routing Infrastructure (SPRI) program and the NIST Information Technology Laboratory Cyber and Network Security Program.

# Background

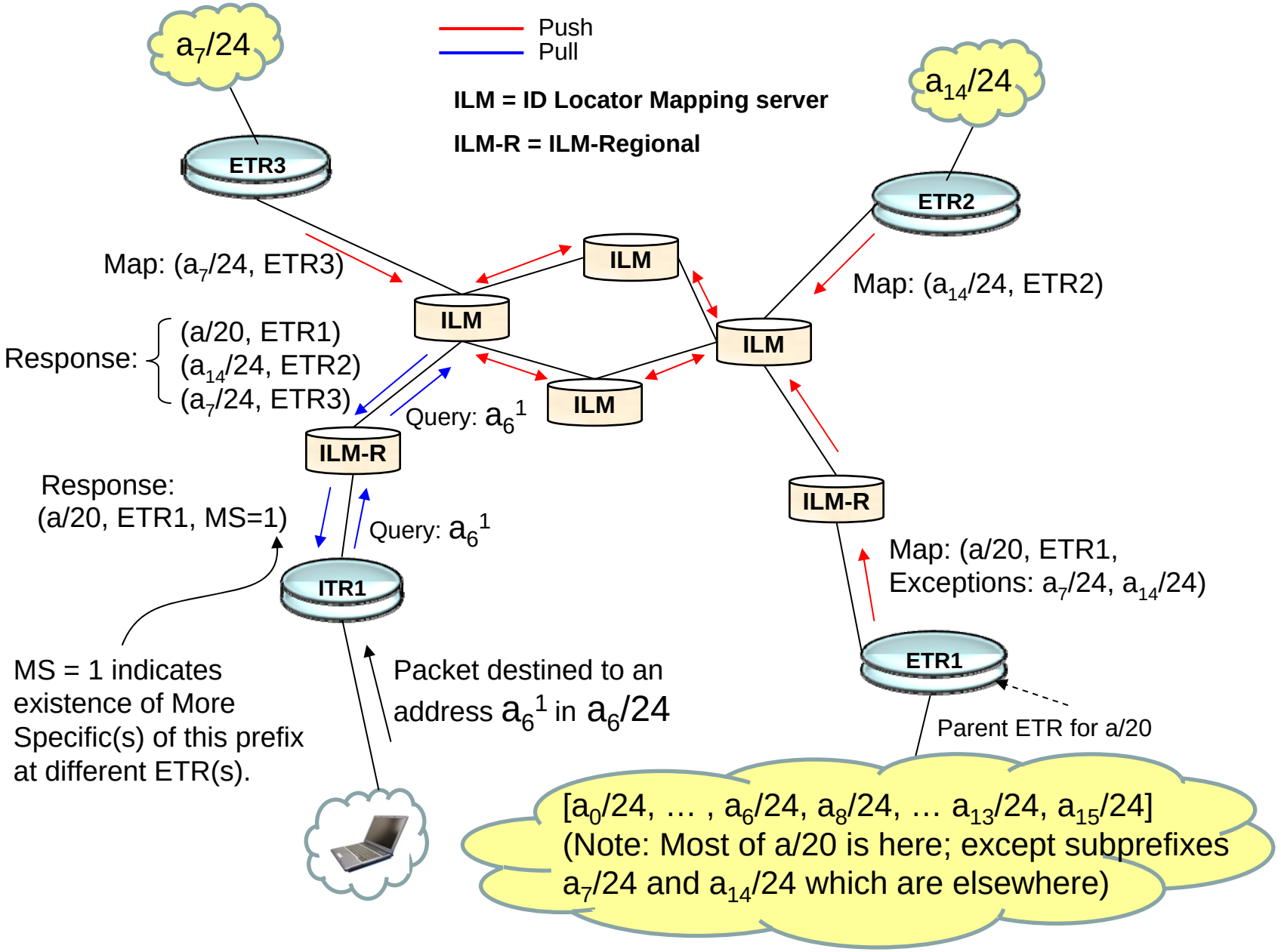
- This work was originally presented in RRG in July 2007 at the Dublin IETF Meeting.
- A revised version was presented at the IETF LISP WG meeting in March 2010. This current version reflects revisions based on feedback from that meeting.
- Slides 6, 8, 9, and 14-17 have new or significantly revised material.
- Detailed updated document is at:

http://www.antd.nist.gov/~ksriram/EEMDP_ICCCN2010.pdf

# Overview of Map and Encap Solution



# Managing Holes in Maps (Preview)



# Real-World Example: Hole in a PI Address

| | Announced in BGP-4: | |
|---|---|---|
| Aggregate | 129.6.0.0/17 | Origin: AS49 |
| More Specific | 129.6.112.0/24 | Origin: AS10886 |

| EID to Locator Mapping: | |
|---|---|
| EID: | ETR (equivalent) |
| 129.6.112.0/24 | ETR10886 |
| 129.6.113.0/24 | ETR49 |
| 129.6.114.0/23 | ETR49 |
| 129.6.116.0/22 | ETR49 |
| 129.6.120.0/21 | ETR49 |
| 129.6.96.0/20 | ETR49 |
| 129.6.64.0/19 | ETR49 |
| 129.6.0.0/18 | ETR49 |

# Proliferation of Map Entries

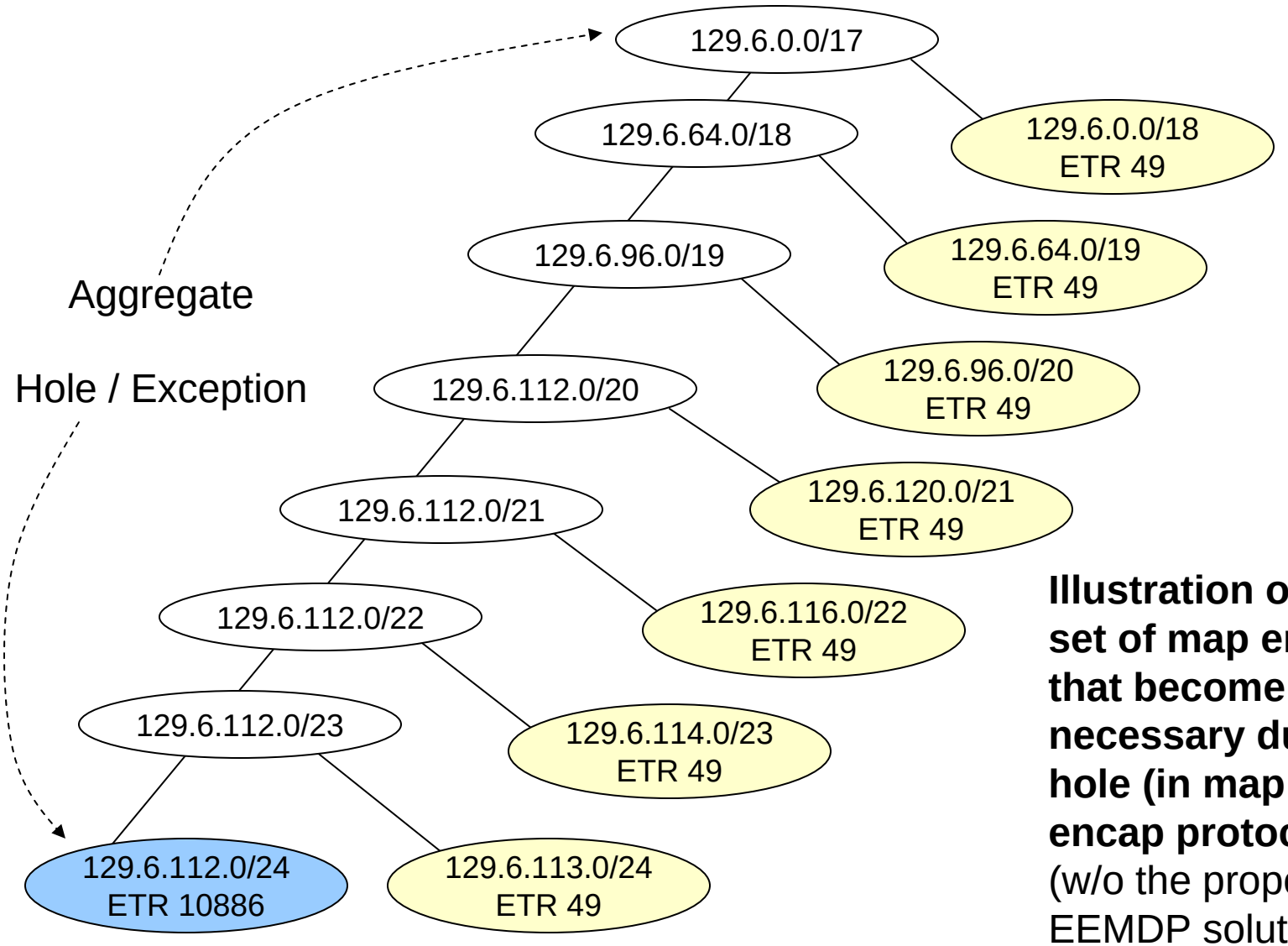
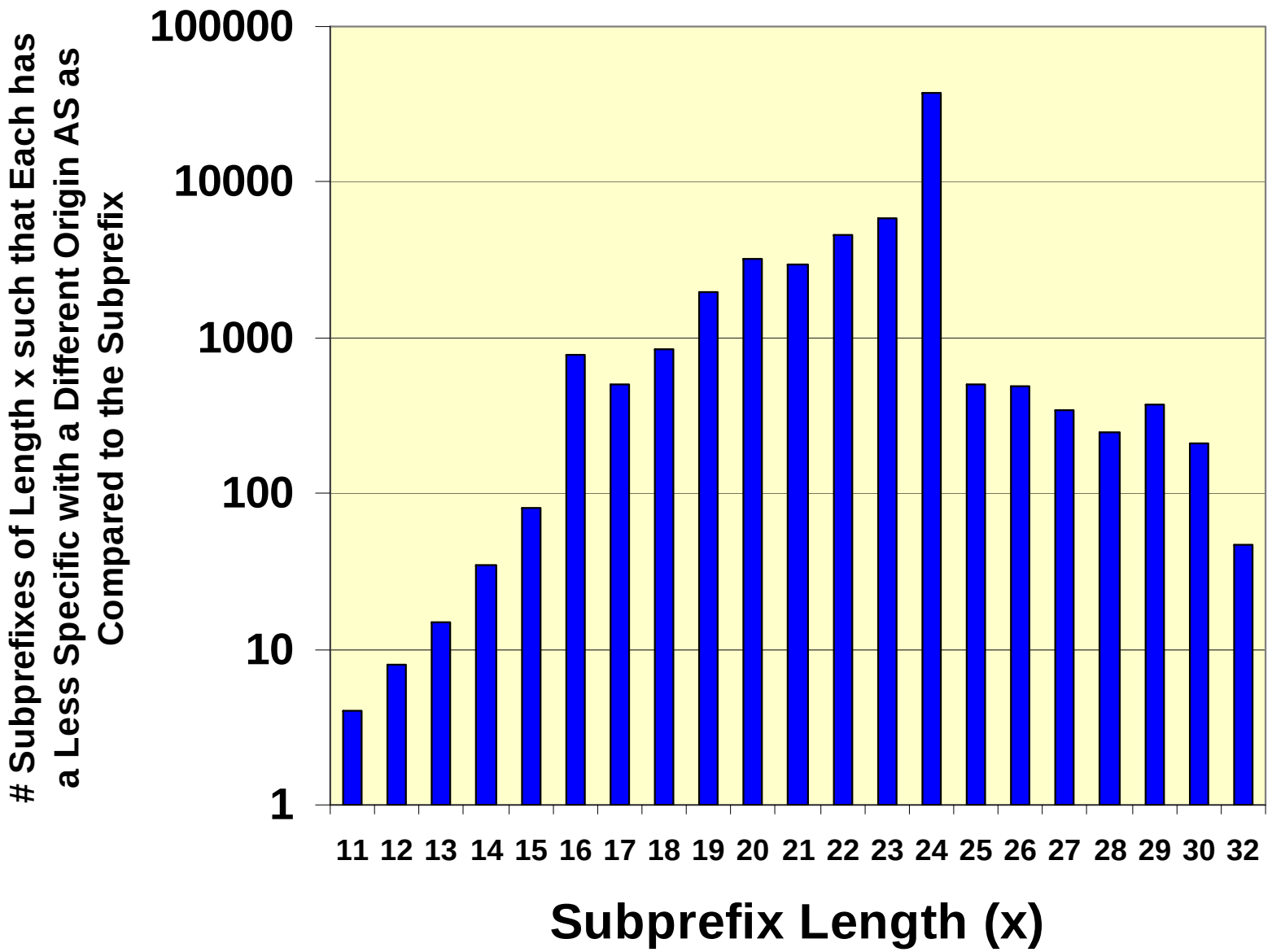



**Illustration of extra set of map entries that become necessary due to a hole (in map and encap protocols)** (w/o the proposed EEMDP solution)

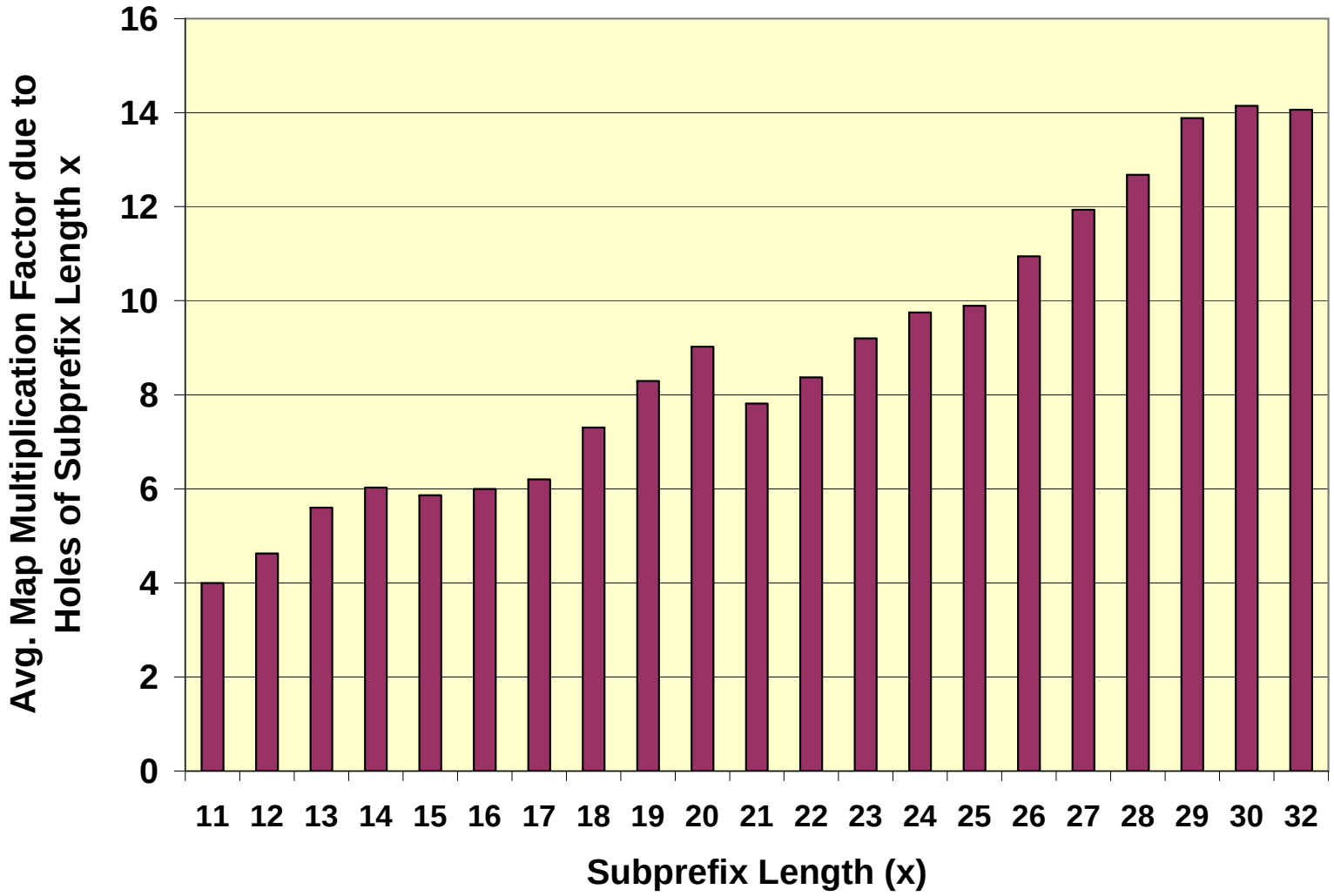
# Measurement of # Prefix Holes




Total # holes = 60988

Based on Routeviews RIBs trace data – Feb 2010

# Avg. Map Multiplication Factor Due to Holes

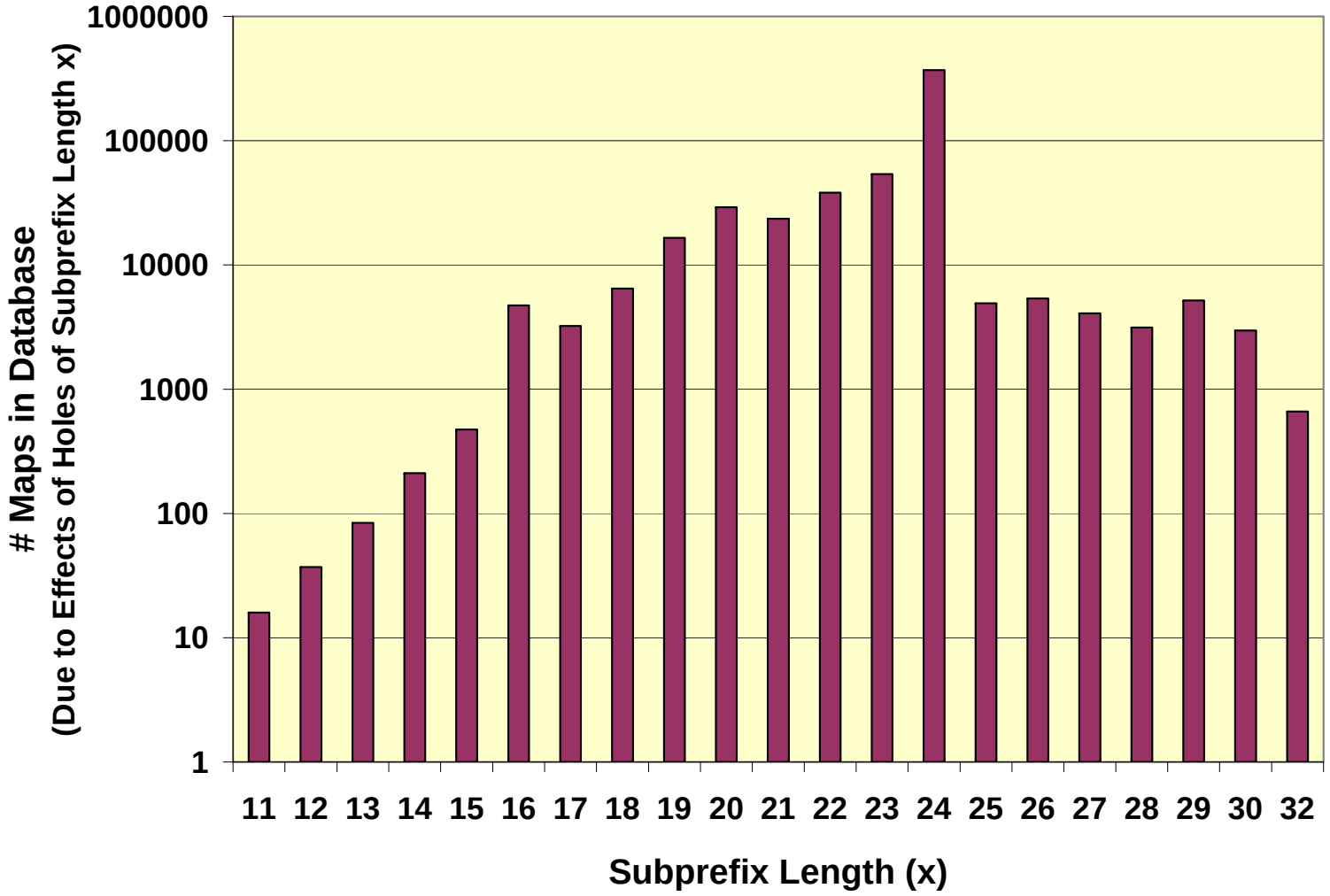



Overall avg. = 9.37

(w/o the proposed EEMDP solution)

Based on Routeviews RIBs trace data – Feb 2010

# Measurement of Proliferation of Maps



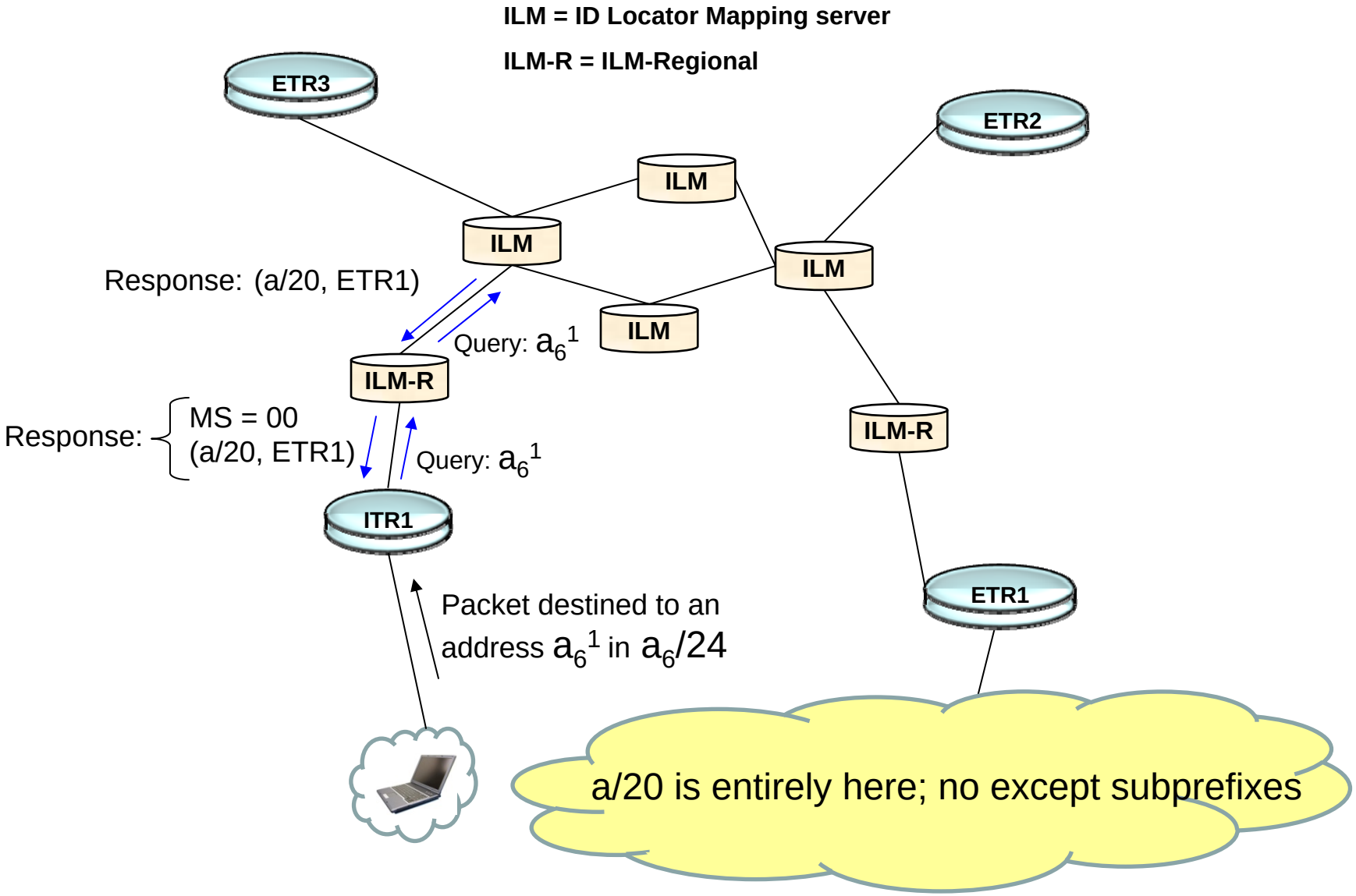

Total # Extra Maps in Database = 510508 (Approx.)

(w/o the proposed EEMDP solution)

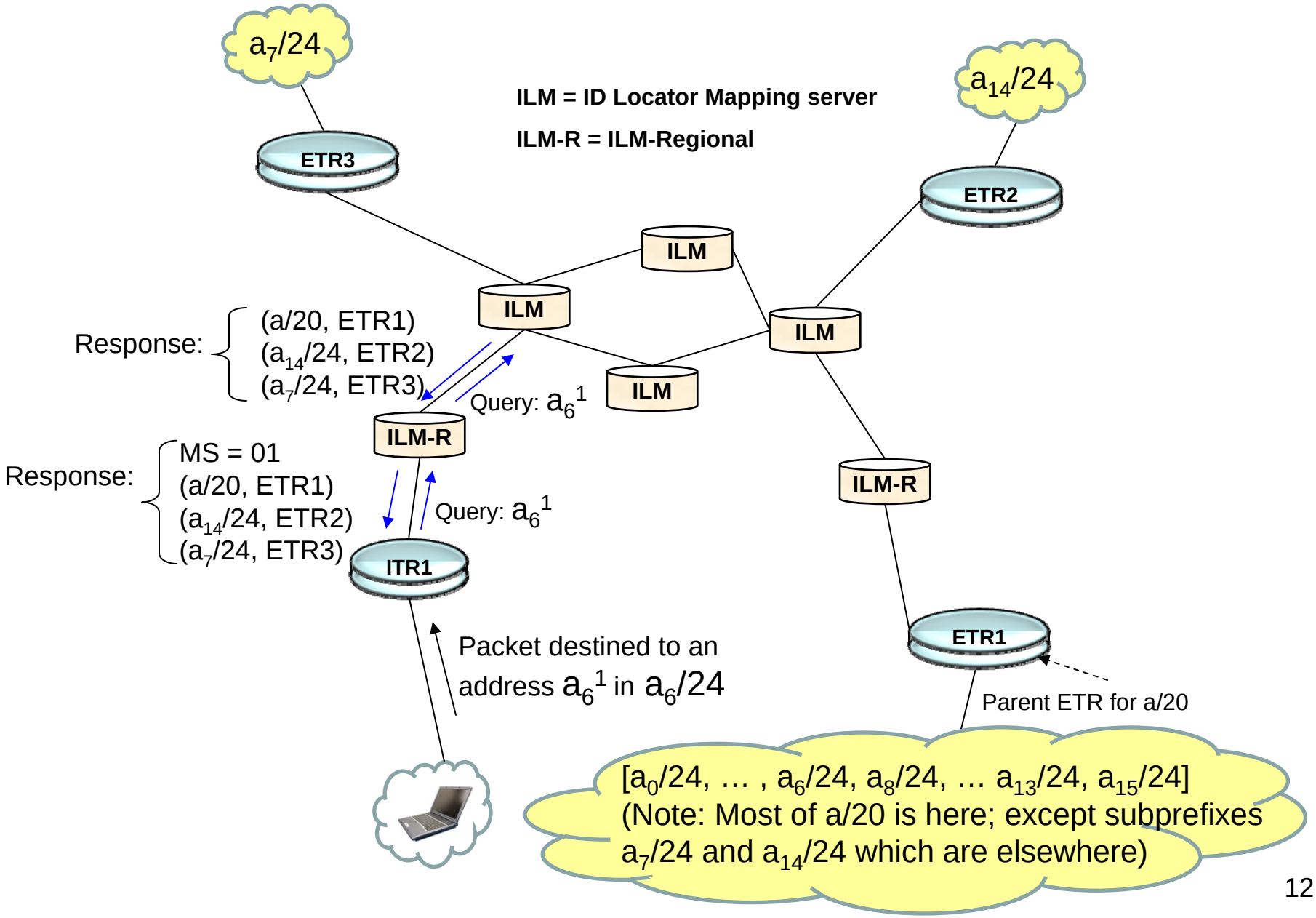
Based on Routeviews RIBs trace data – Feb 2010

# Details of the Proposed Algorithm: Enhanced Efficiency of Mapping Distribution Protocols (EEMDP)

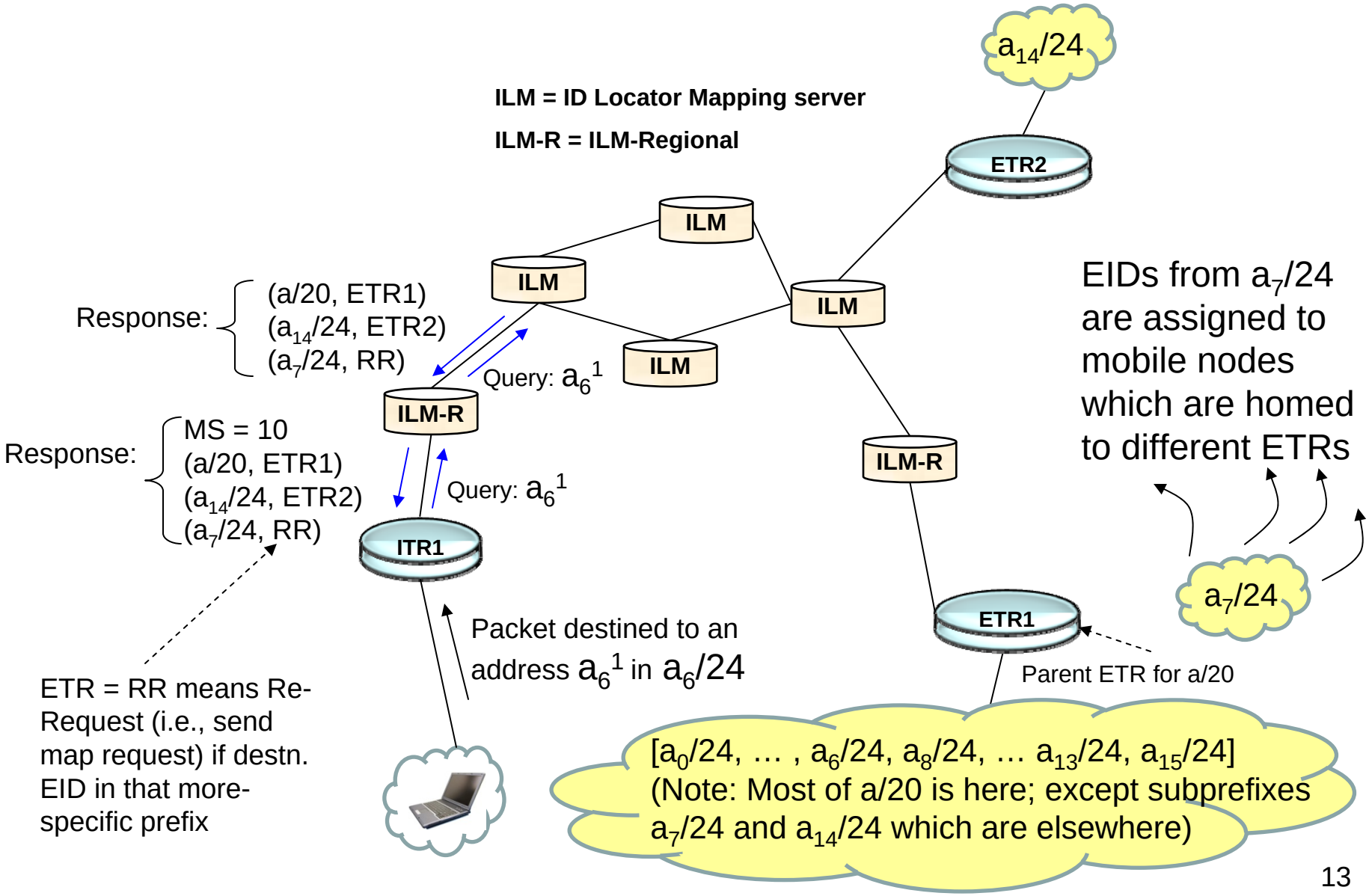
# Case 1: More-Specifics (Holes) Absent



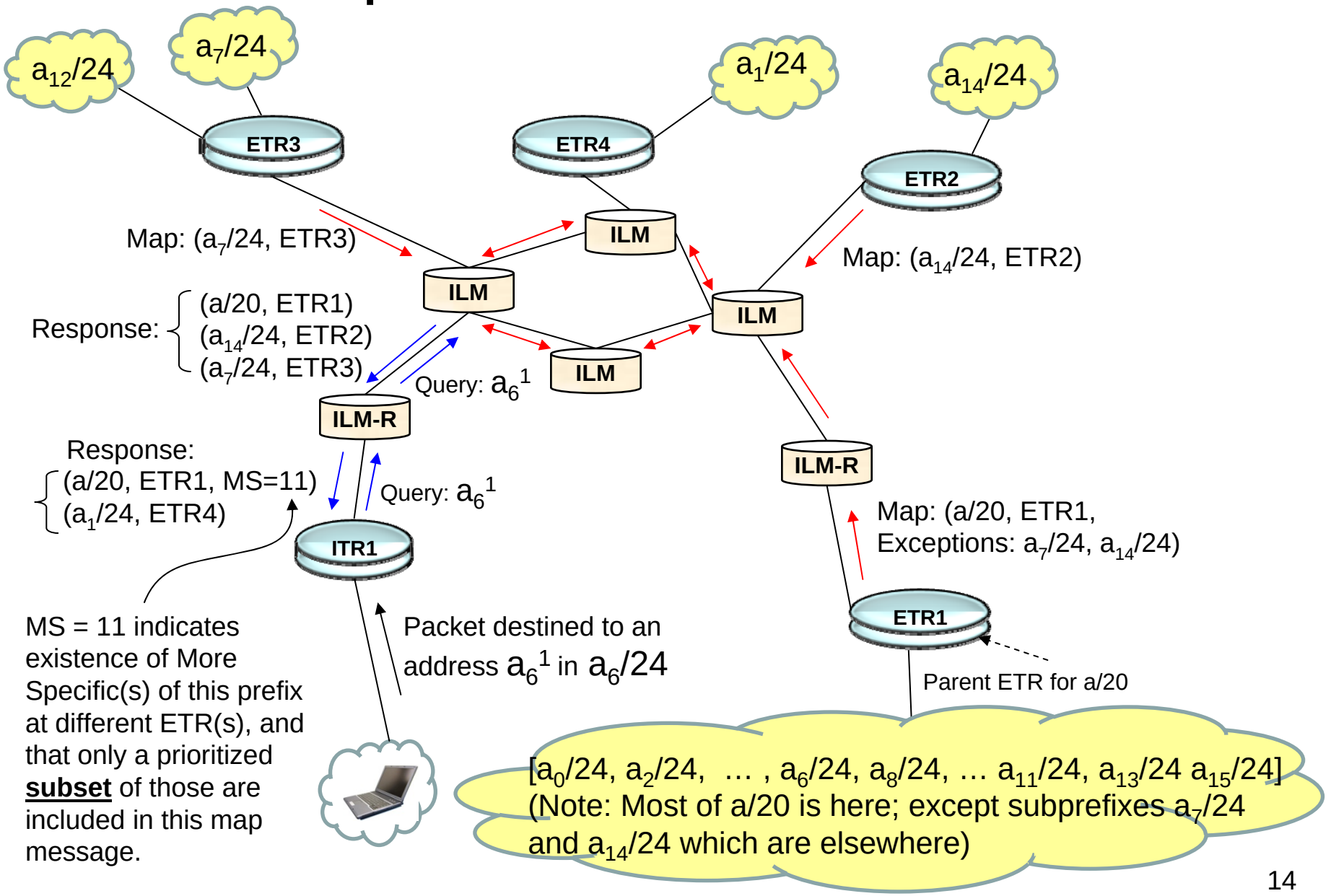
# Case 2: All More-Specifics Communicated



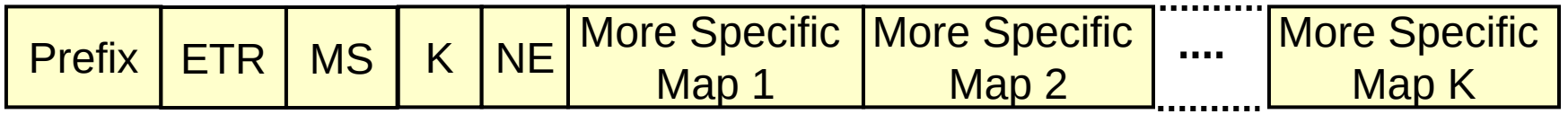
# Case 3: Exception More-Specific Communicated without ETR Info (Lots of Mobile Nodes)



# Case 4: Prioritized Subset of Maps for Exception More-Specifics Are Communicated



# Conceptual Format for the Enhanced Map Response




MS = More Specific indicator

K = # Maps to follow

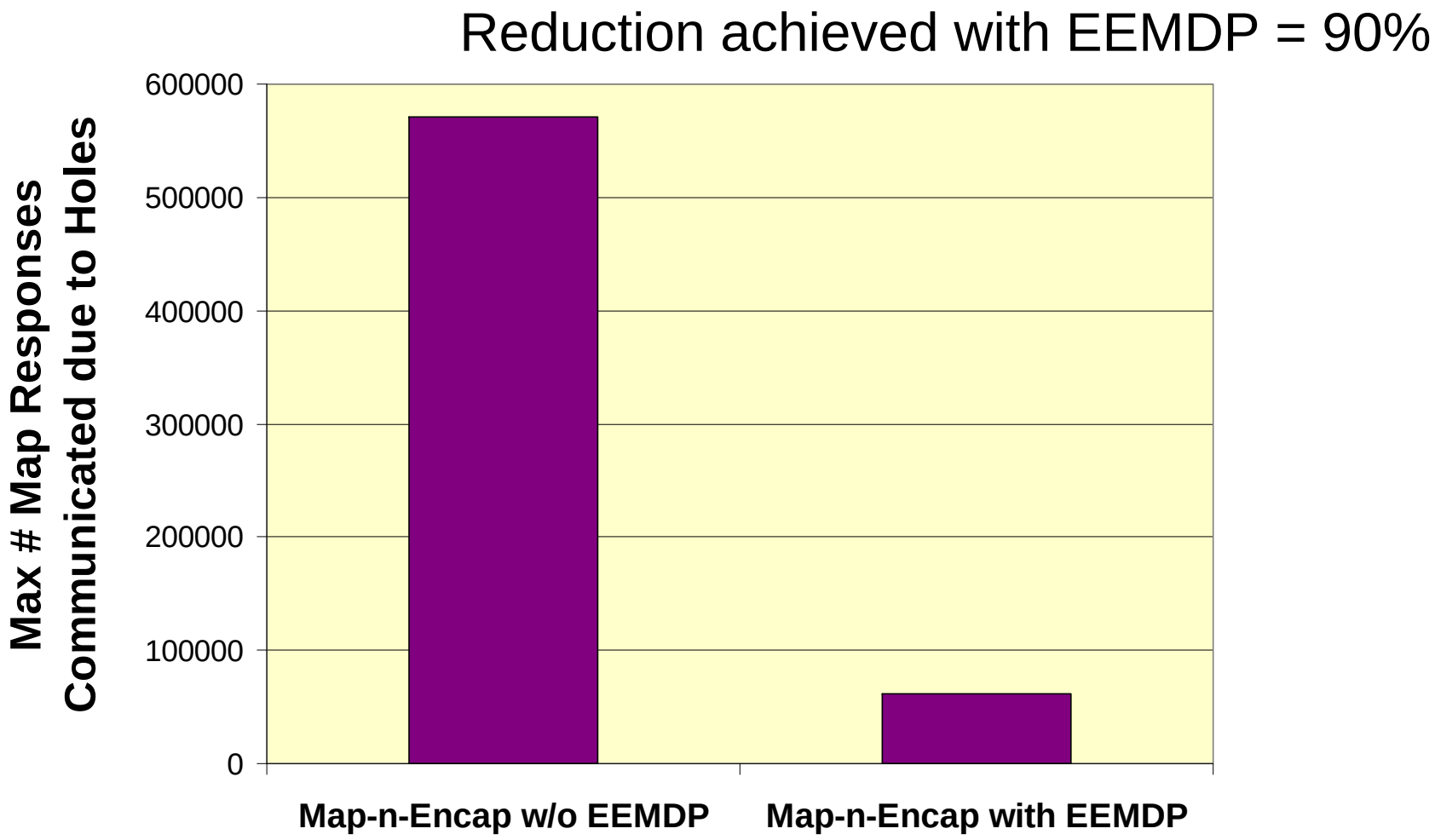
NE = Number of Exceptions ( NE ≥ K)

If for a more specific prefix, ETR = RR, it means ITR needs to query (Re-Request) for destination EID in that more-specific prefix

# Algorithm Description

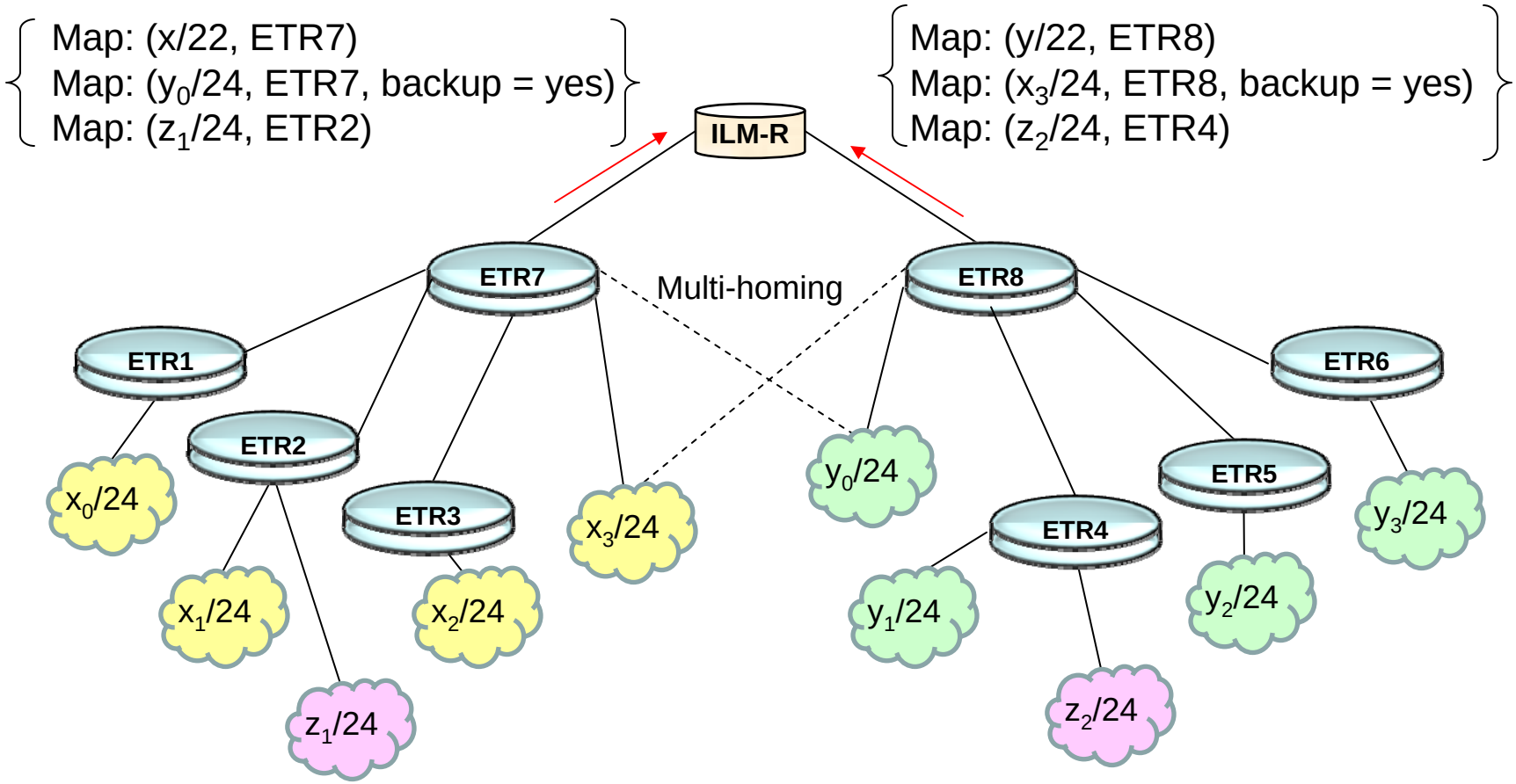
| More Specific Indicator (MS) | # Exception Maps Included (K) | Total # Exceptions (NE) | Interpretation |
|---|---|---|---|
| 00 | 0 | 0 | Map response has no exceptions. |
| 01 | *k* | $n_e = k$ | Map response has exceptions; All k map responses for the exception subnets are included. |
| 10 | *k* | $n_e = k$ | Map response has exceptions; All k map responses for the exception subnets are included but the ETR information for one or more specific subnets is “Re-request”; Subnets are further split into micro-subnets (e.g., mobile devices homed to different ETRs). |
| 11 | k ($k < n_e$) | $n_e$ | Map response has exceptions; # Exceptions exceeds threshold (H); Only a subset of exception maps is included; Maps for prioritized (frequently requested) subset of more specifics are included. |

# Comparison of Max # Map Responses Attributable to Holes w/o and with EEMDP




Based on Routeviews RIBs trace data – Feb 2010

# Endpoint ID Aggregation at ETRs



# Conclusions and Future Work

- Holes in ID-to-locator maps cause undesirable map proliferations
- Significant reduction in map entries and map query/response traffic load is possible with the proposed EEMDP scheme
- Substantial reduction in load on ITR's memory and processor
- More accurate quantification of benefits can be performed
- Also introduced the notion of a loose hierarchy of ETRs with the potential benefit of aggregation of their EID address spaces