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Frequency-aware Reconstruction of Forwarding Tables in Name-based Routing

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Sketch of Proposal

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Goal

Feasibility Evaluation of name-based routing

- Hardware
 - Is storing routing information of 'names' to currently deployed routers possible?^[1]
- Network
 - How does the network topology change when the database is updated?^[2]
 - Is reconstructing the forwarding tables effective when objects have different access frequency?
 → **THIS WORK**

[1] Haesung Hwang, Shingo Ata, Masayuki Murata, "A Feasibility Evaluation on Name-based Routing," in Proceedings of the 5th IEEE International Workshop on IP Operations and Management (IPOM), pp.150-162, Venice, Italy, October 2009.
 [2] Haesung Hwang, Shingo Ata, Masayuki Murata, "The Impact of FQDN Database Updates on Name-based Routing Architecture," in Proceedings of the 5th IFIP/IEEE International Workshop on Broadband Convergence Networks (BCN), pp. 16-21, Osaka, Japan, April 2010.

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Name-based Routing

- FQDN (Fully Qualified Domain Name)
 - Hierarchical
 - Generalize to resource-based routing

```
XRI xri://authority/path?query#fragment
LSID urn:lsid:authority.org:namespace:object:revision
DOI prefix/suffix
<scheme name>:<hierarchical part>[?<query>][#<fragment>]
```

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System Architecture

- Location-aware virtual topology
 - Considers number of physical hops between routers
- Access frequency-aware virtual topology
 - Reconstruction of routing tables

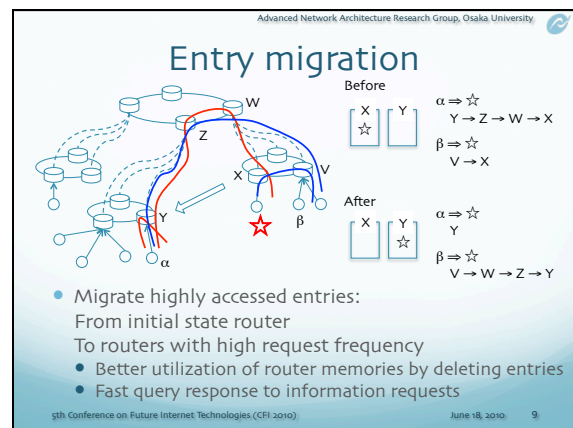
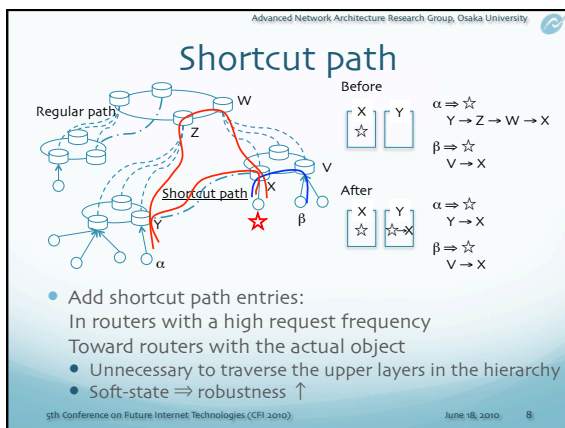
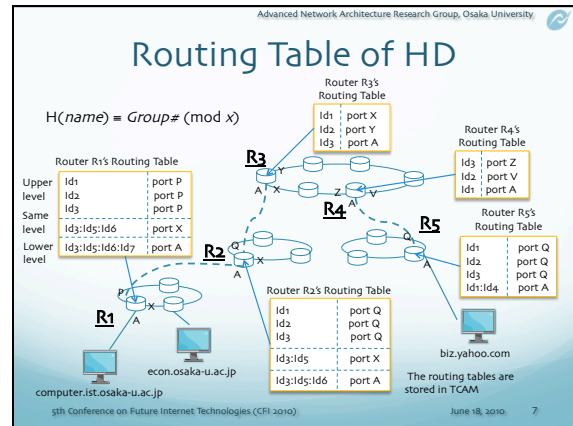
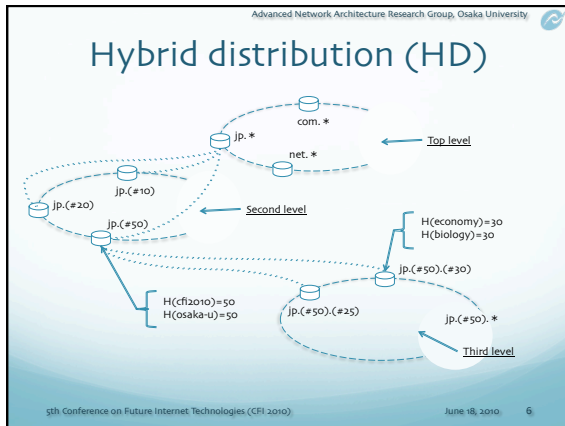
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Distributing Routing Info.

- FQDN - variable length, usually longer than IP address
 - distribute routing information to multiple routers
- Distribution Algorithms
 - Hierarchical Longest Alphabet Match (HLAM)
 - Inspired by longest prefix match
 - Takes full advantage of TCAM
 - Hybrid Distribution (HD)
 - Grouping by TLD + hashing function
 - Balanced distribution

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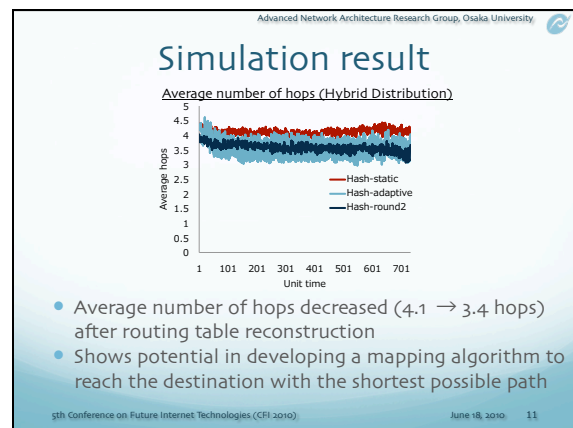
Simulation settings

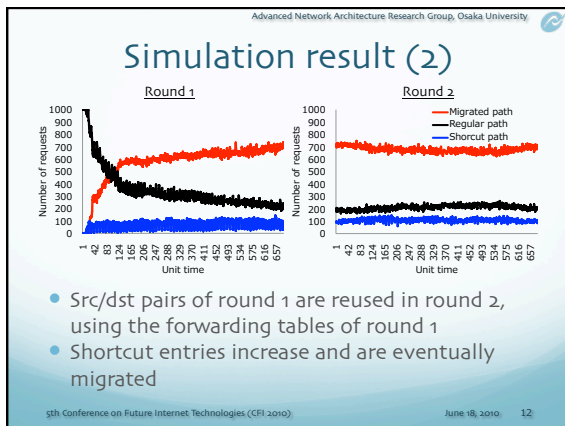
- Add shortcut entries \rightarrow Entry migration
- 1,000 communication/1 unit time (calculate number of hops between src-dst pair)
- FQDN: Acquired from ISC* (July 2009 database, approx. 700 million entries)
- Access frequency: Zipfian distribution
 - n^{th} most popular element occurs with a frequency of $1/n$ compared to that of the most popular element

* ISC (Internet Systems Consortium), available at <https://www.isc.org/index.pl?ops/ds/>

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Conclusion & Future Work

- Conclusion
 - A Post-IP routing technology expected in future Internet
 - A feasibility evaluation of name-based routing, as a first step of content-based routing
 - Evaluated the effect of reconstructing routing tables, reflecting the access frequency of search objects
- Future work
 - Mobile end nodes
 - Generalize name-based routing to resource-based routing (resource: name, category, type of a content....)

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Thank you!

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