Scalability Analysis of the TurfNet Architecture

Jordi Pujol, Stefan Schmid, Lars Eggert,
Marcus Brunner and Jürgen Quittek
NEC Network Labs, Heidelberg, Germany

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Outline

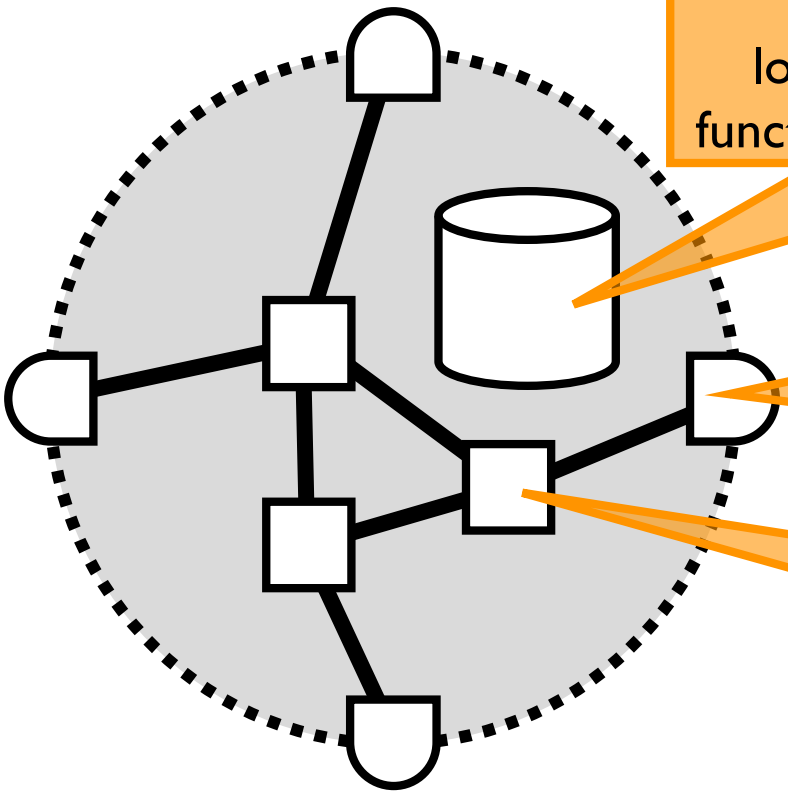
- TurfNet overview
- Internet-derived model
- scalability analysis
- future work
- conclusion

TurfNet Highlights

- next-generation Internet architecture
- dynamic federation of independent, composable network domains
- identity/locator split with global identities
- inherent multihoming and mobility
- implicit, hierarchical interdomain routing

Towards Autonomous Network Domains. Stefan Schmid, Lars Eggert, Marcus Brunner and Jürgen Quittek. Proc. *8th IEEE Global Internet Symposium*, Miami, FL, USA, March 17-18, 2005.

Turf Components

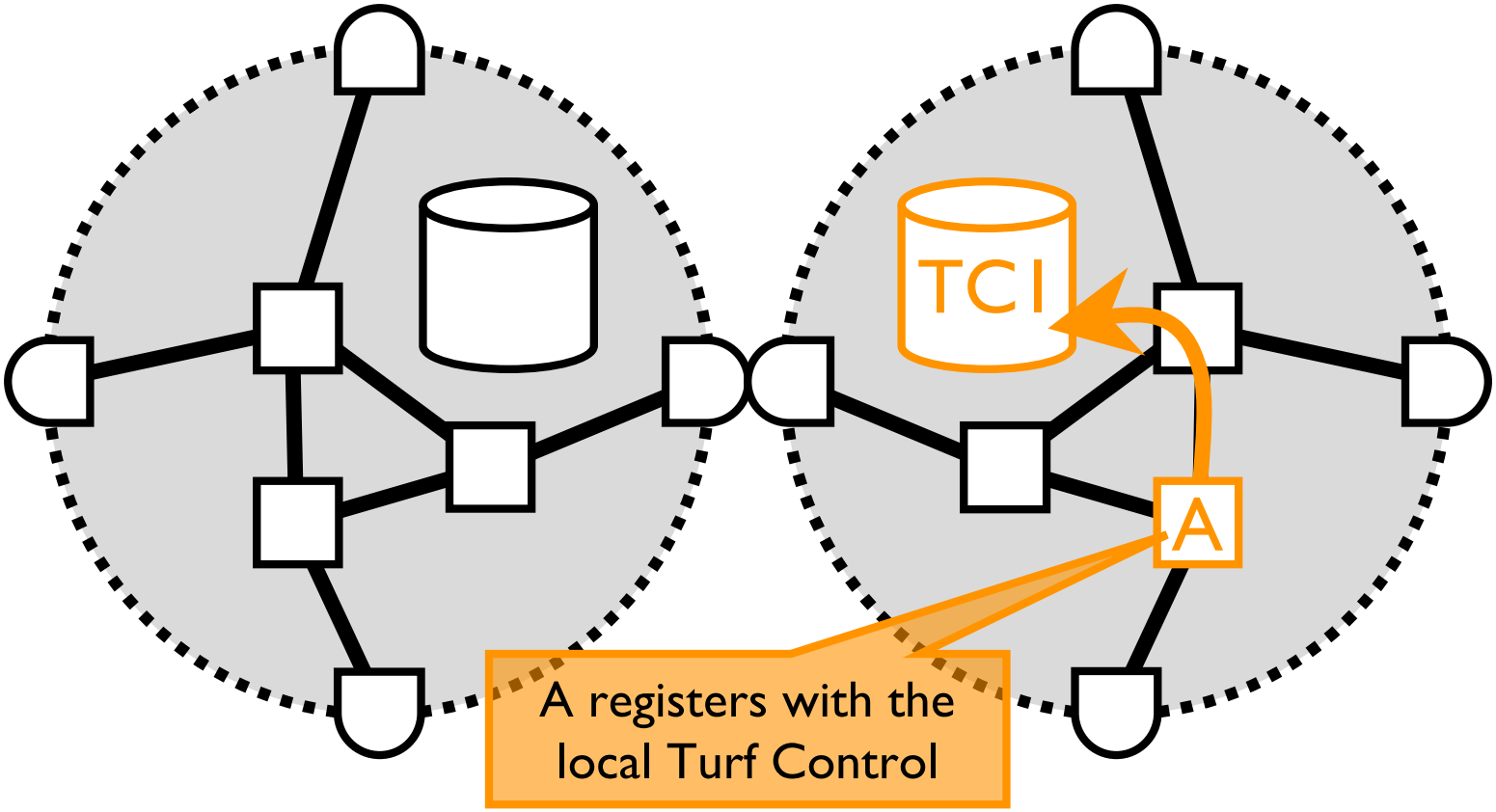


Turf Control
logical entity for intra-turf control functions and inter-turf communication

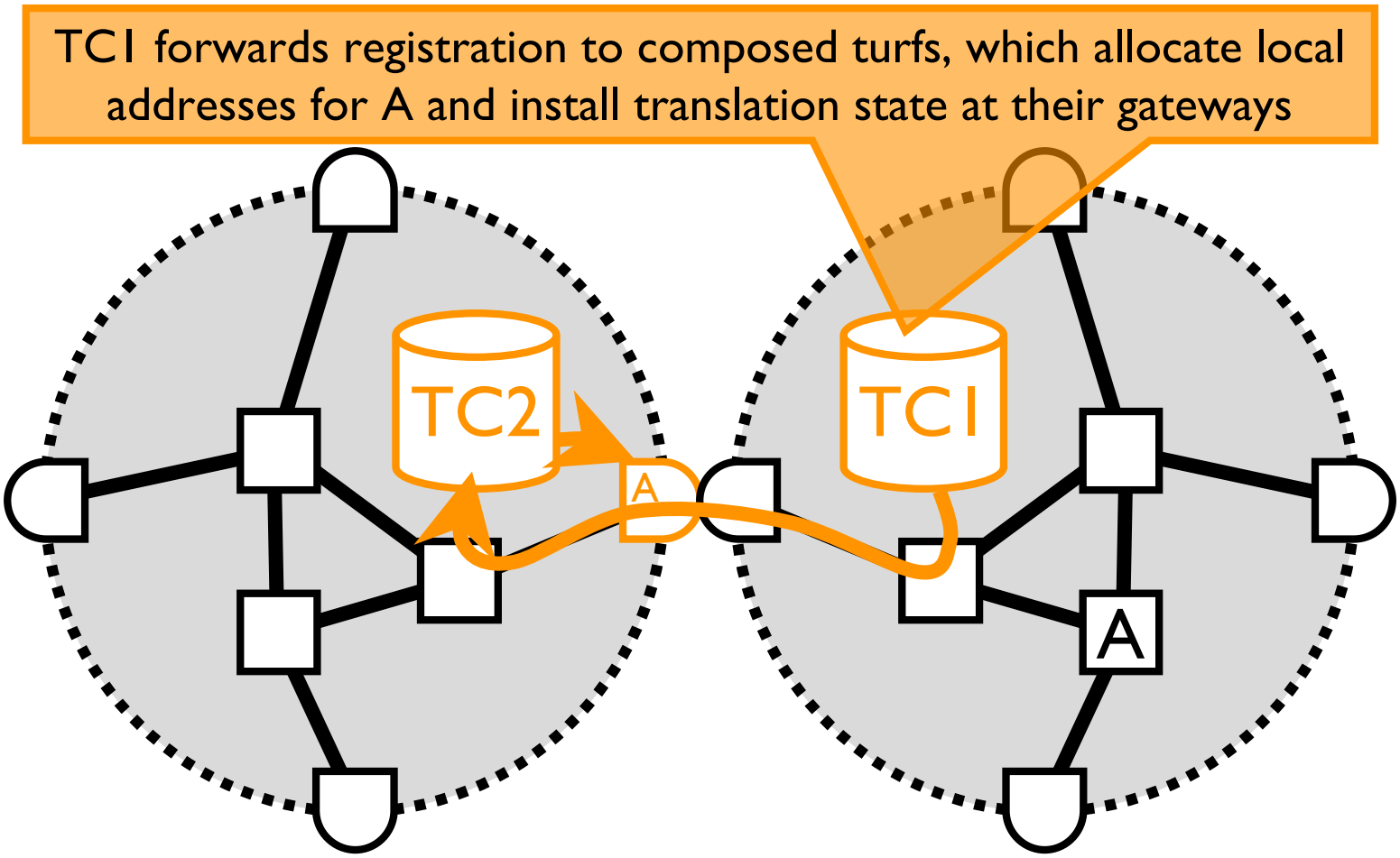
Gateway
unique node ID; translates multiple intra-turf protocols

Turf Node
unique node ID; speaks intra-turf protocols

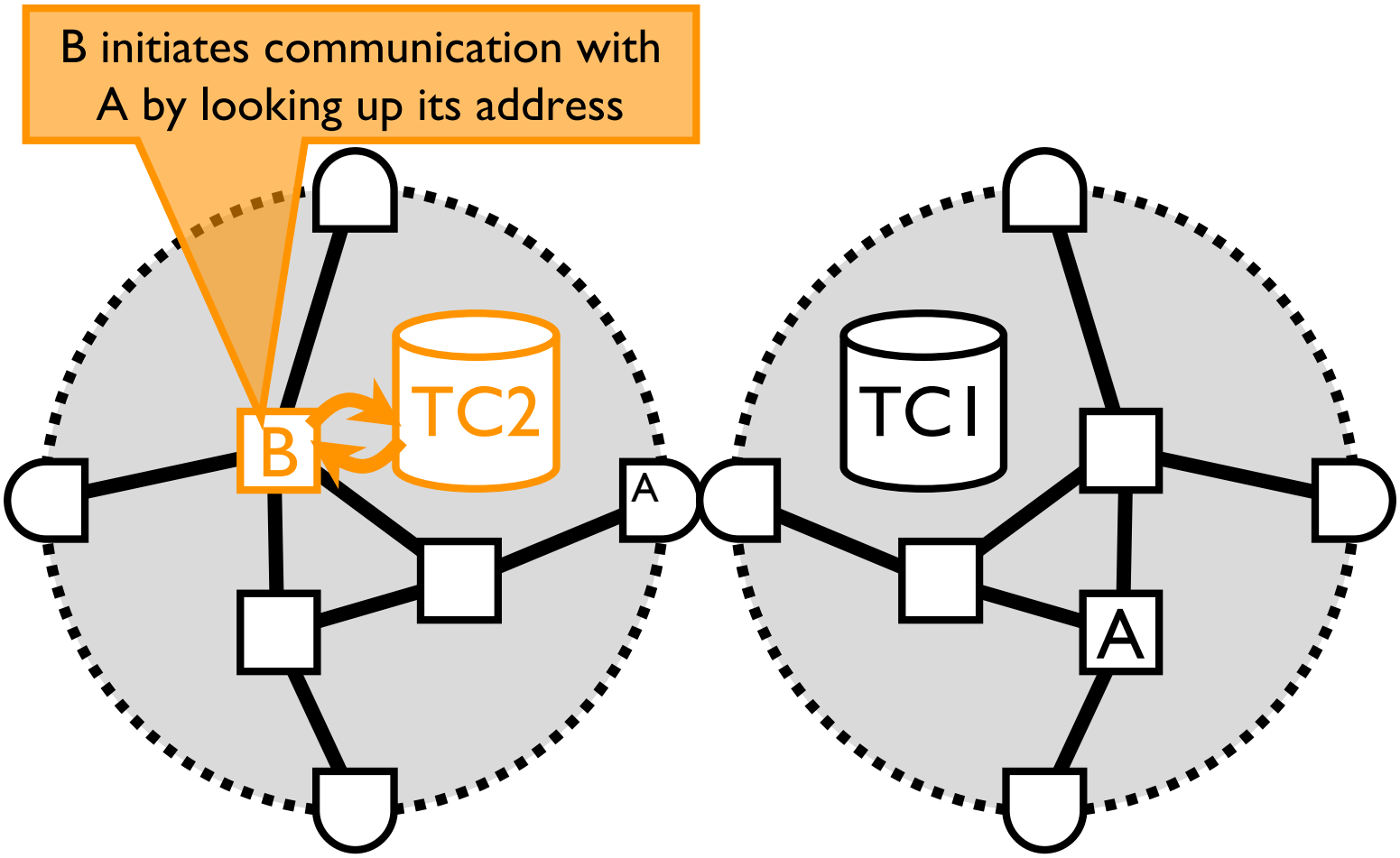
Inter-Turf Communication



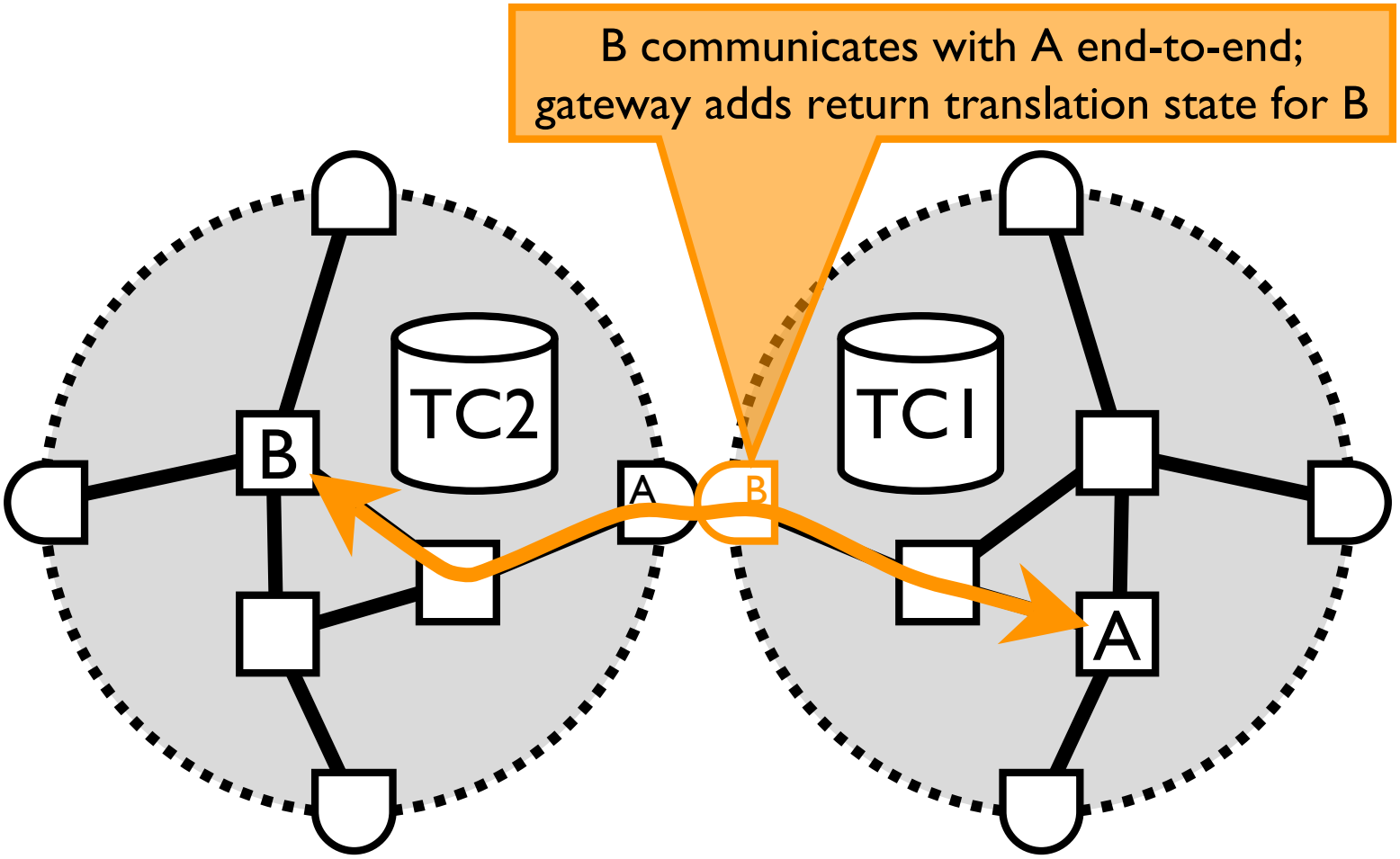
Inter-Turf Communication



Inter-Turf Communication

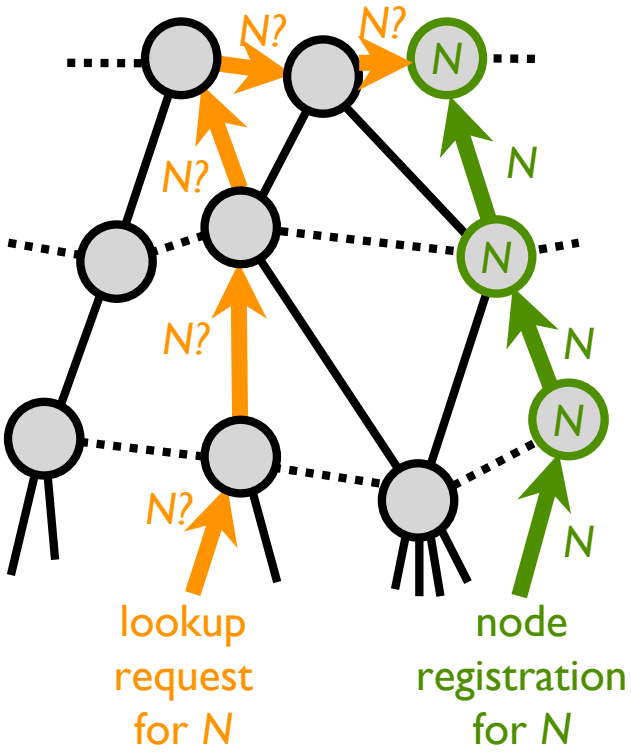


Inter-Turf Communication



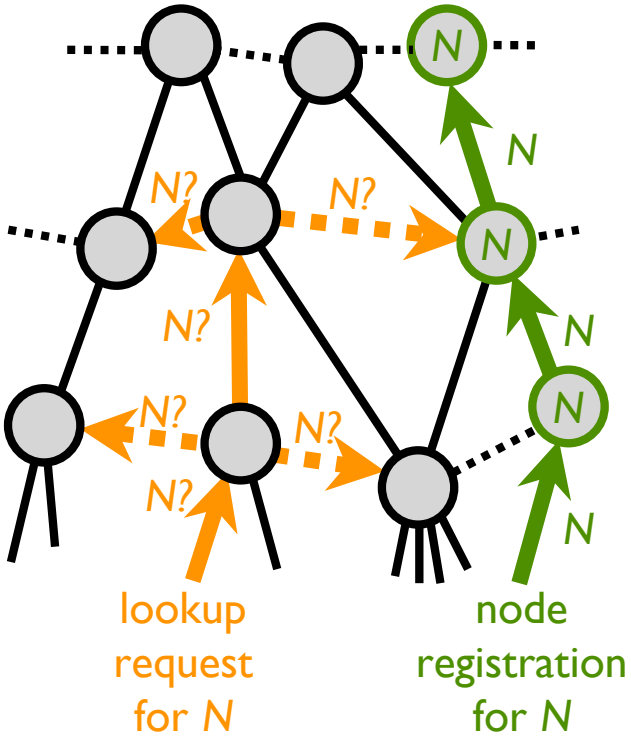
TurfNet Hierarchy

- similar to Internet ASs
- dynamic, self-configuring according to interconnect types (customer/provider vs. peering)
- inherent routing
- resolution guarantee
- flexible optimizations



Optimizations

- use peer interconnects for registration and/or resolution
- selective registration
- push-down caching
- others – only need to terminate at root



Reality Check

- can TurfNet support very large internetworks?
- how would a very large TurfNet hierarchy look like?
- assumption: similar to the Internet's AS-level topology, *i.e.*, AS ≈ Turf

Modeling a Global TurfNet

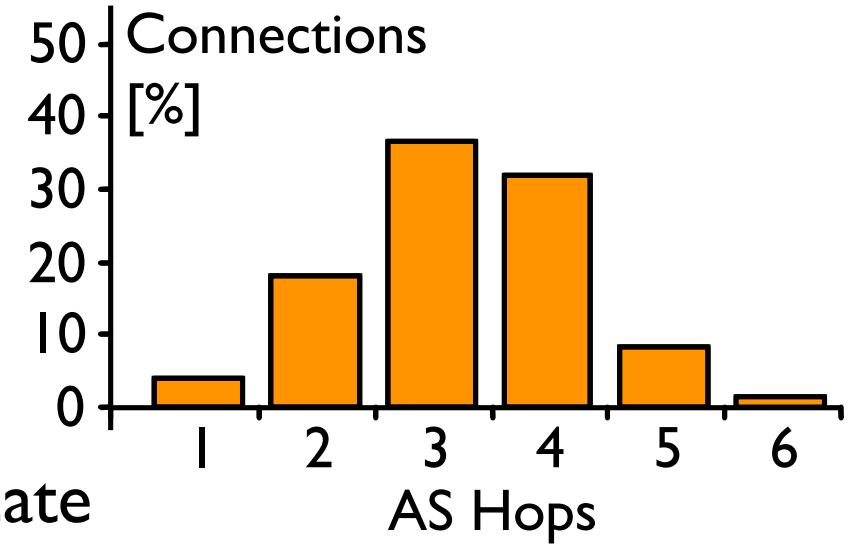
- derive AS-level topology from BGP tables
- infer "peering" and "provider" interconnect types
- infer hierarchy levels

Level	AS Count	Avg. Distance	Dia-meter	Avg. AS Degree
1	22	1.25	2	15.8
2	215	3.90	10	5.7
3	1391	1.98	11	1.0
4	1421	no peering		
5	13872			

Characterizing the Internet Hierarchy from Multiple Vantage Points. L. Subramanian, S. Agarwal, J. Rexford and R.H. Katz. Proc. *IEEE INFOCOM*, NY, USA, June 2002, pp. 618-627

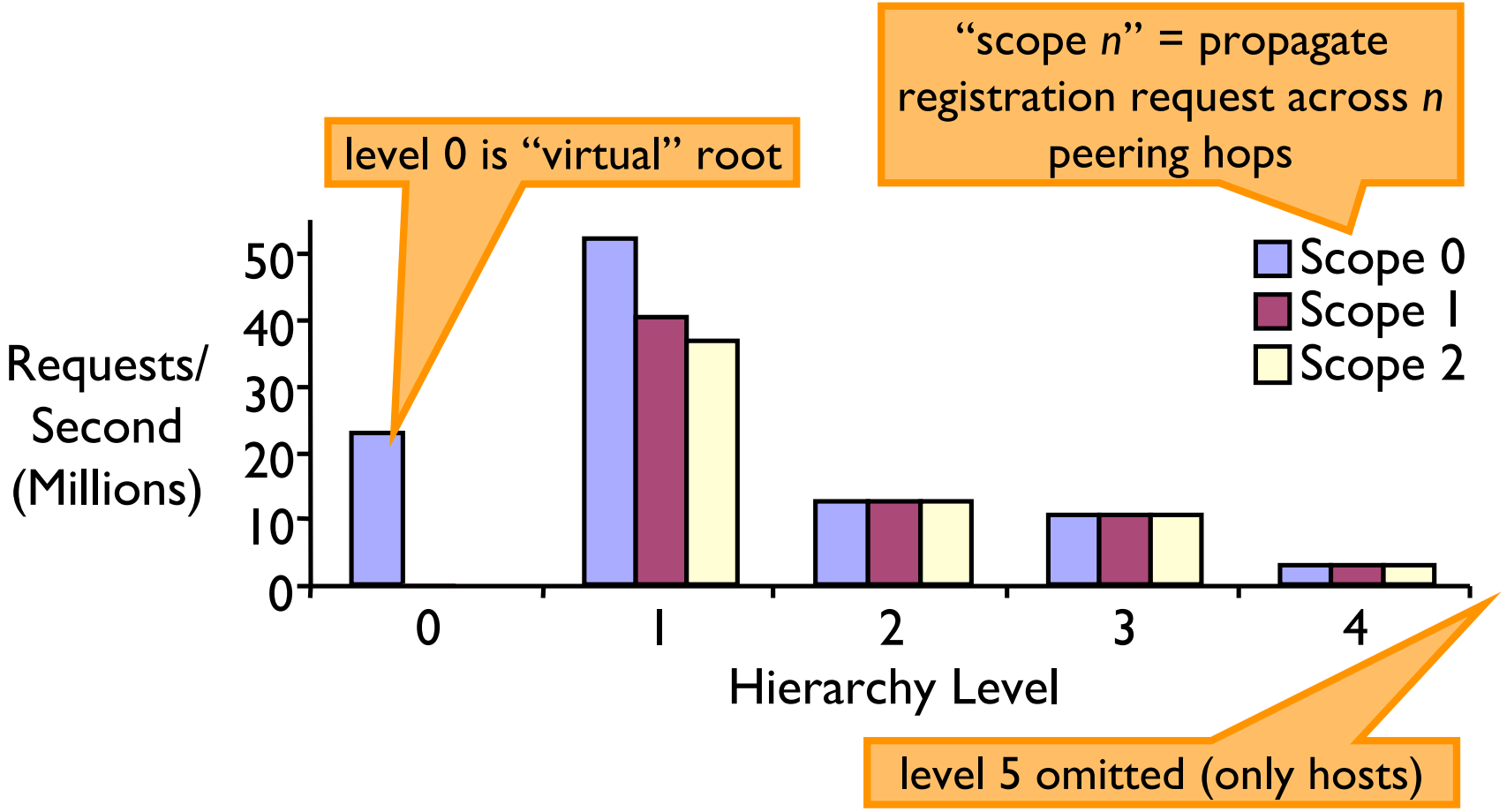
Communication Assumptions

- Internet-like communication patterns
- 1 billion level-1 nodes ("hosts")
- only hosts communicate
- 0.01 communications/second/host
- all hosts globally reachable

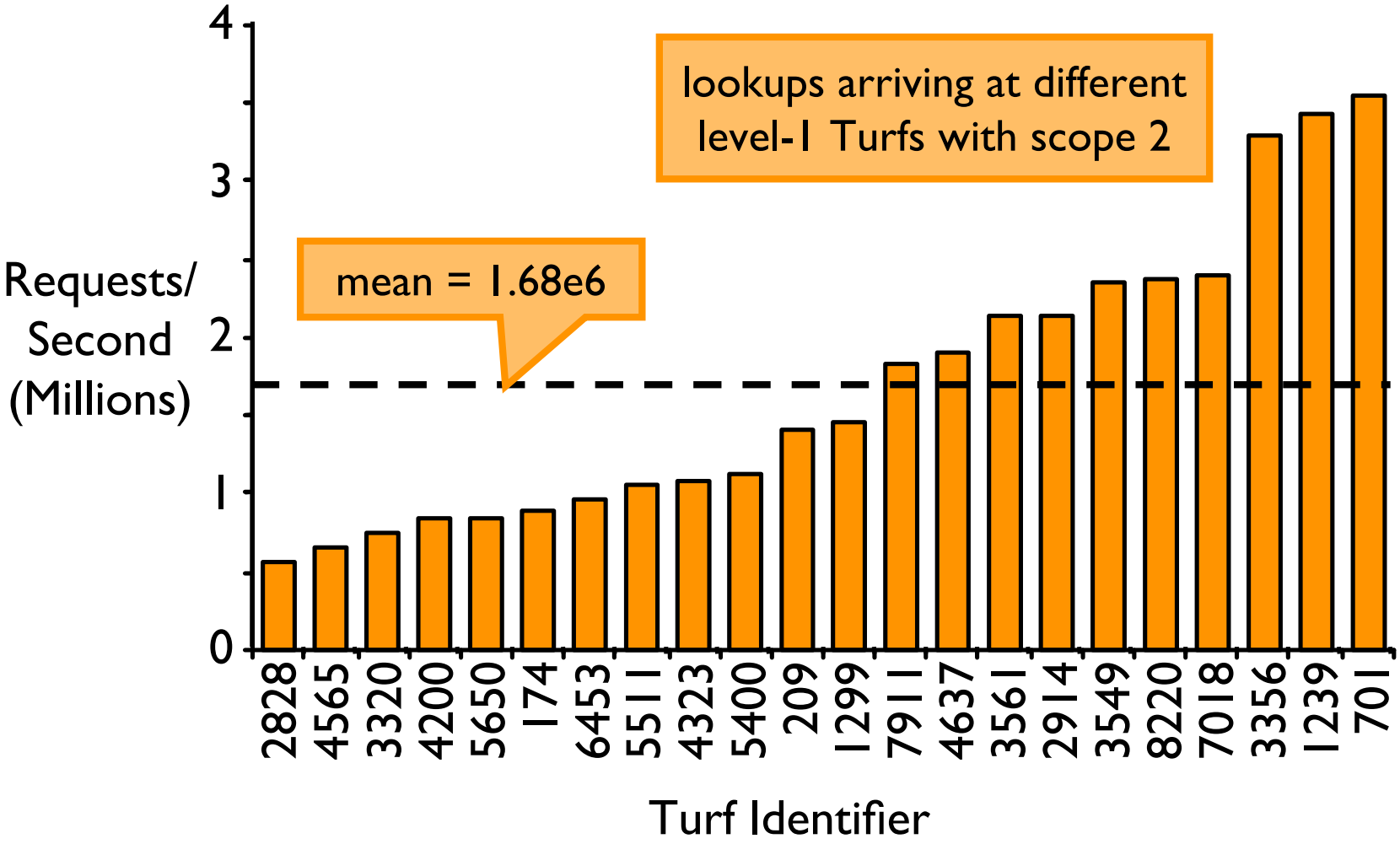


Implications of Interdomain Traffic Characteristics on Traffic Engineering. S. Uhlig and O. Bonaventure. *European Transactions on Telecommunications*, Special Issue on Traffic Engineering, 2002

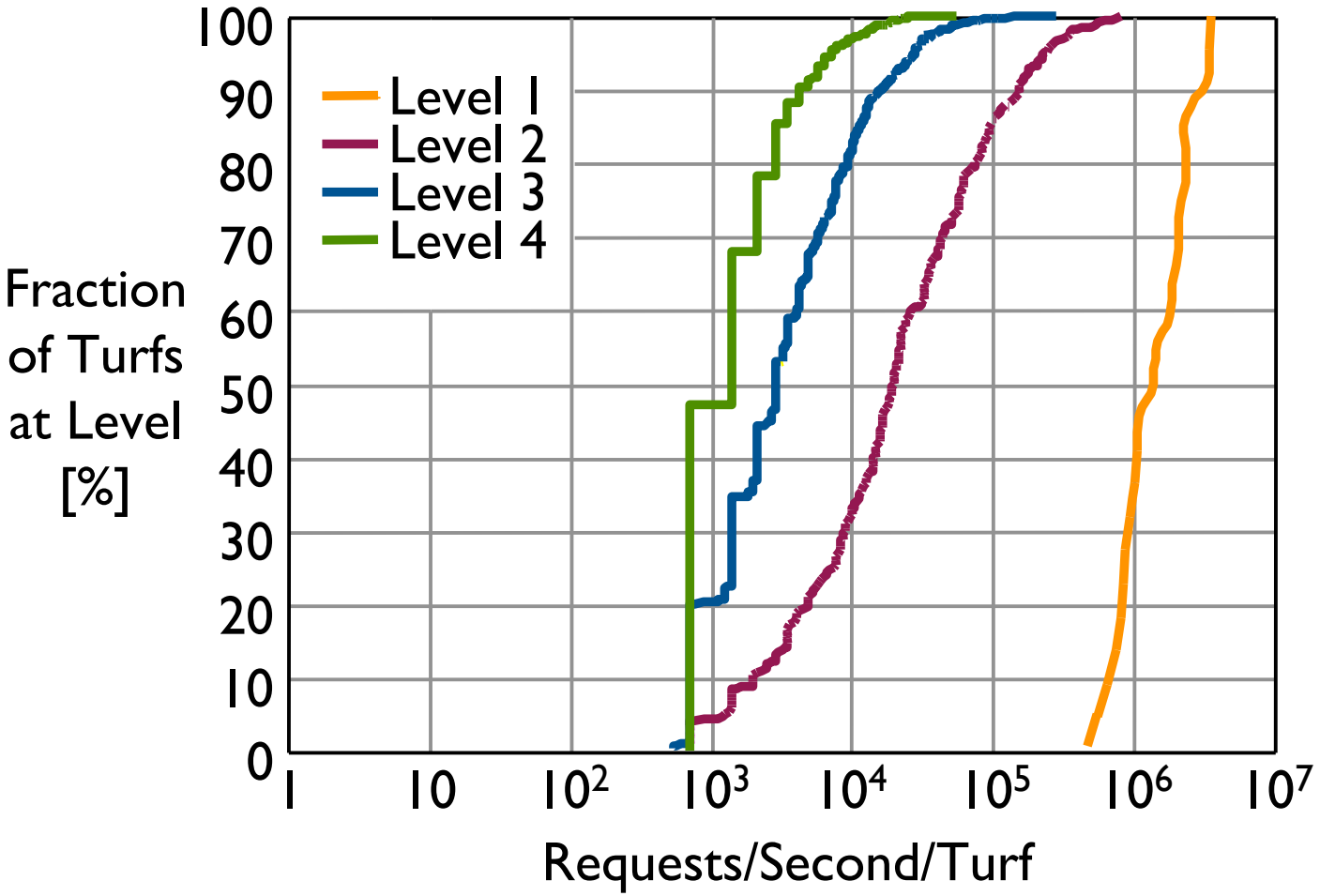
Aggregate Lookup Load



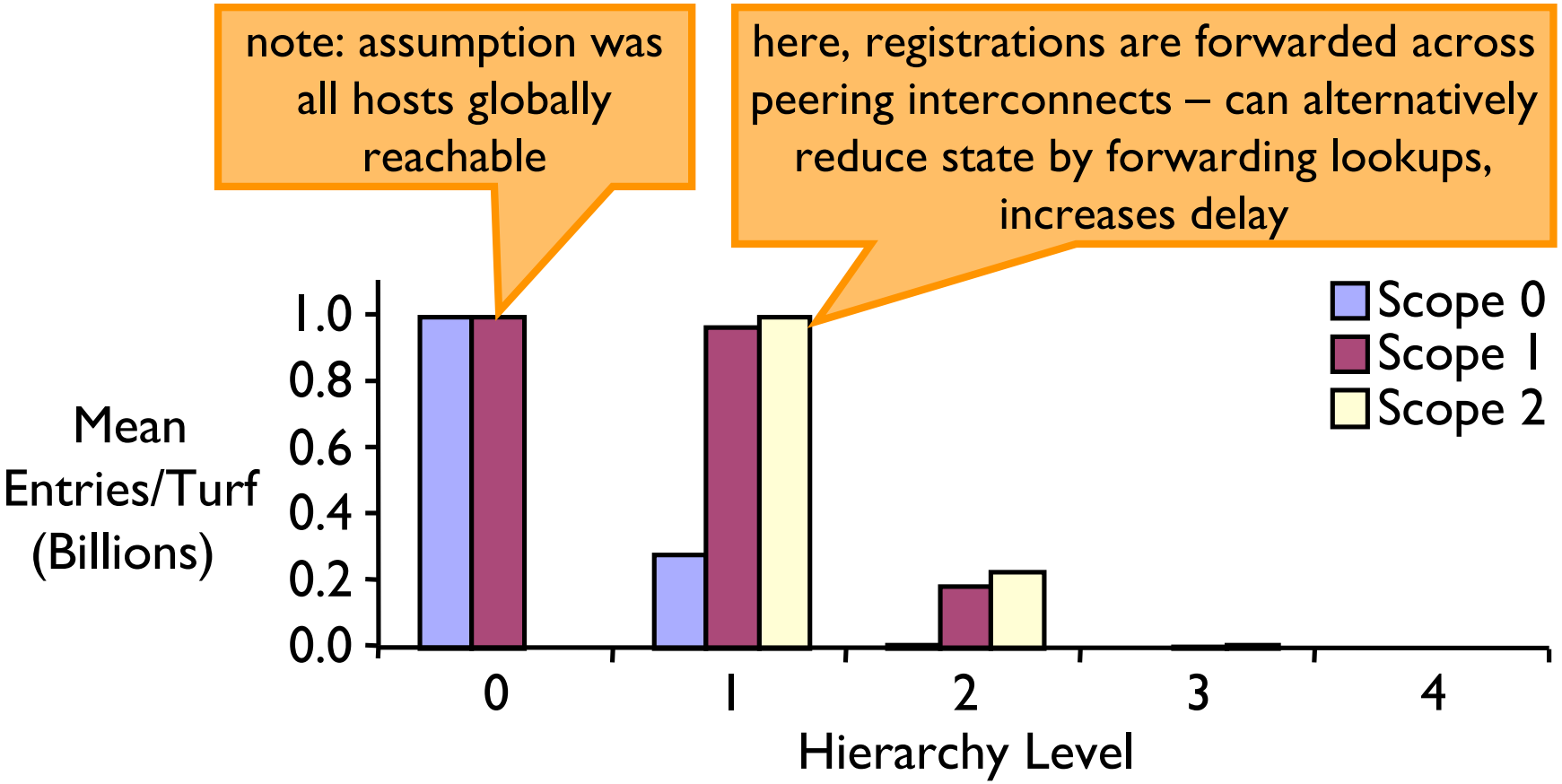
Load Variances



Load Variances CDF



Mean Registration Table Sizes



Recent Results

- enhanced lookup mechanism that intelligently forwards up the hierarchy
- reduces lookup load by up to 80%
- additional analyses, such as mean hop count for successful resolution

Scalability Analysis of a New Internetwork Naming and Addressing Architecture. Jordi Pujol. M.S. Thesis, Universitat Politècnica de Catalunya, Spain, September 2005

Ongoing Work

- prototype implementation
- design and evaluation of mobility mechanisms
- design and evaluation of enhanced registration and resolution mechanisms
- revisiting the assumptions underlying this analysis

Conclusion

- AFAWK first attempt at evaluating the scalability of a next-gen architecture
- calibrated model with Internet characteristics
- TurfNet appears to be technically feasible; more work needed

Partially supported by the EU's *Ambient Networks* project.