A Network Use for Incomplete Knowledge Management

Anduo Wang
Temple University

CIDR 2022, Jan 11

network innovation by database

declarative networking

- declarative programming
- distributed datalog

[SIGMOD] Declarative Networking: Language, Execution and Optimization.

2006

network innovation by database

declarative networking

- declarative programming
- distributed datalog

[SIGMOD] Declarative Networking: Language, Execution and Optimization.

2006

2013

[Communications of the ACM] Abstractions for Software-defined Networks

network programming APIs

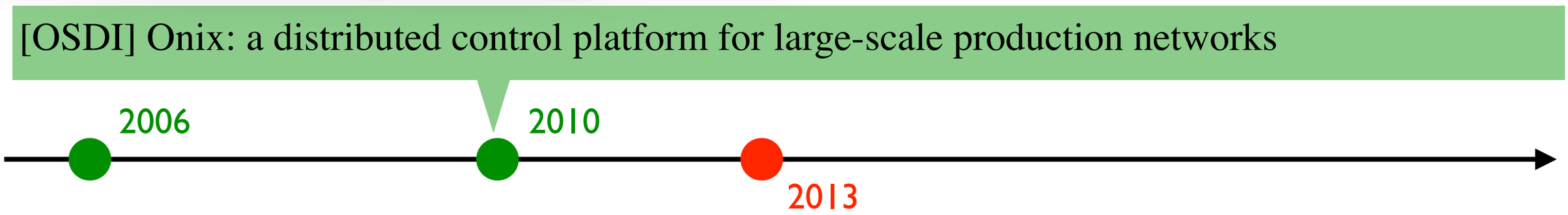
- imperative
- centralized

network innovation by database

early software-defined networks (SDNs)

- network information base (tables)
- transactional processing

[OSDI] Onix: a distributed control platform for large-scale production networks

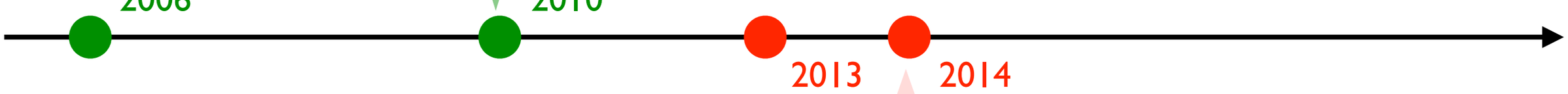


network innovation by database

early software-defined networks (SDNs)

- network information base (tables)
- transactional processing

[OSDI] Onix: a distributed control platform for large-scale production networks



[HotSDN] ONOS: towards an open, distributed SDN OS

production-scale control platform

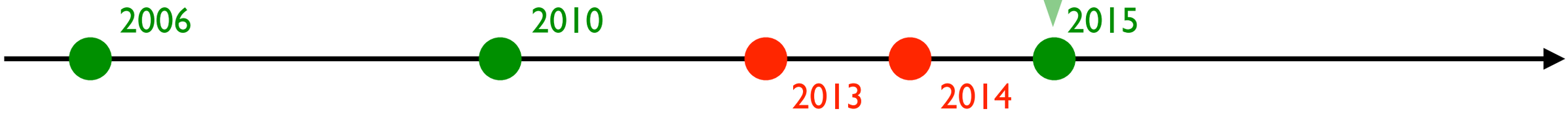
- distributed key-value store
- optimized for frequent updates

network innovation by database

high-level reasoning

- general modeling
- data provenance tracking

[NSDI] Checking Beliefs in Dynamic Networks



network innovation by database

high-level reasoning

- general modeling
- data provenance tracking

[NSDI] Checking Beliefs in Dynamic Networks

2006 2010 2013 2014 2015 2020

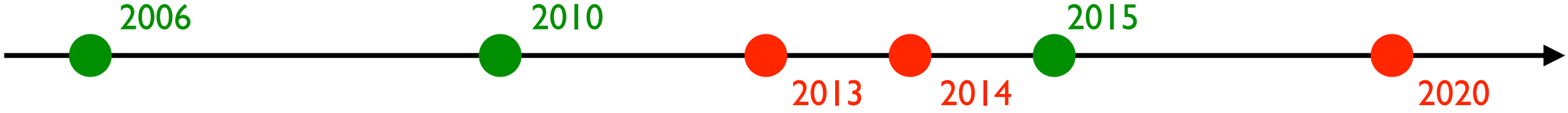
[SIGCOMM] Accuracy, Scalability, Coverage: A Practical Configuration Verifier on a Global WAN

practical network verifiers

- specialized model
- heuristic reasoning engine

a mixed success

database: elegant notions



imperative programming and distributed system:
performance, scalability

more permanent impact?

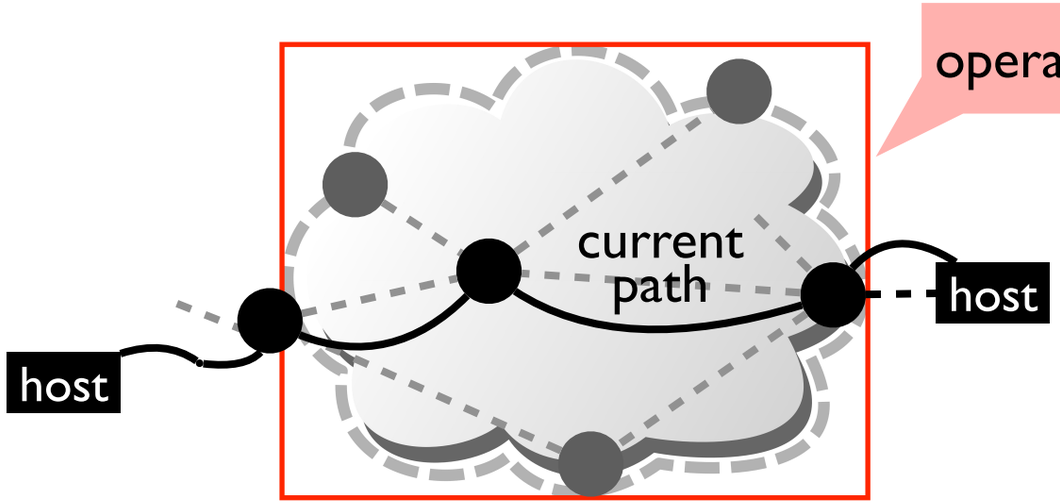
find a networking problem that cannot be easily addressed by other means?

incomplete knowledge in networking

- has been inherent, prevalent, and will likely to persist
- little native/systematic support in current networks

incomplete network knowledge

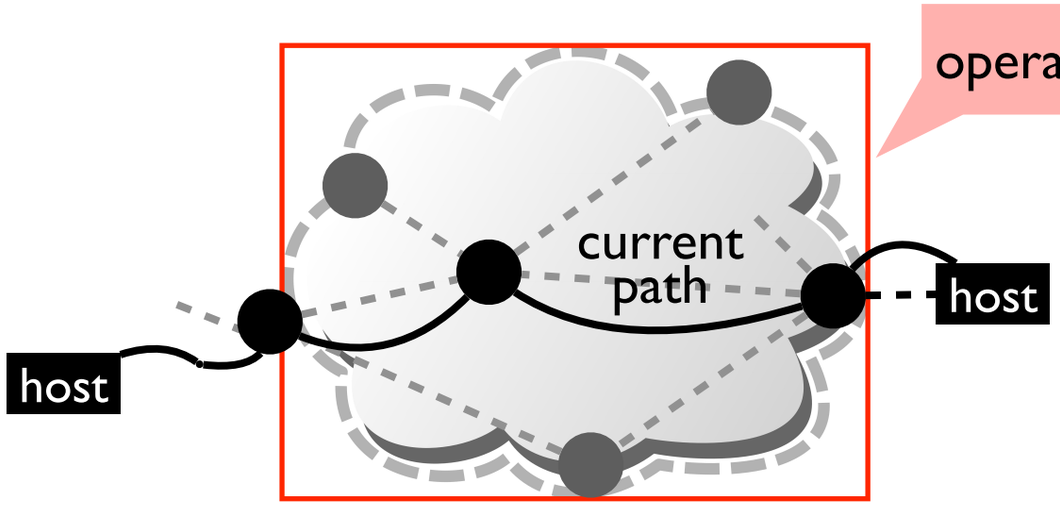
data



querying incomplete database

incomplete network knowledge

data



querying incomplete database

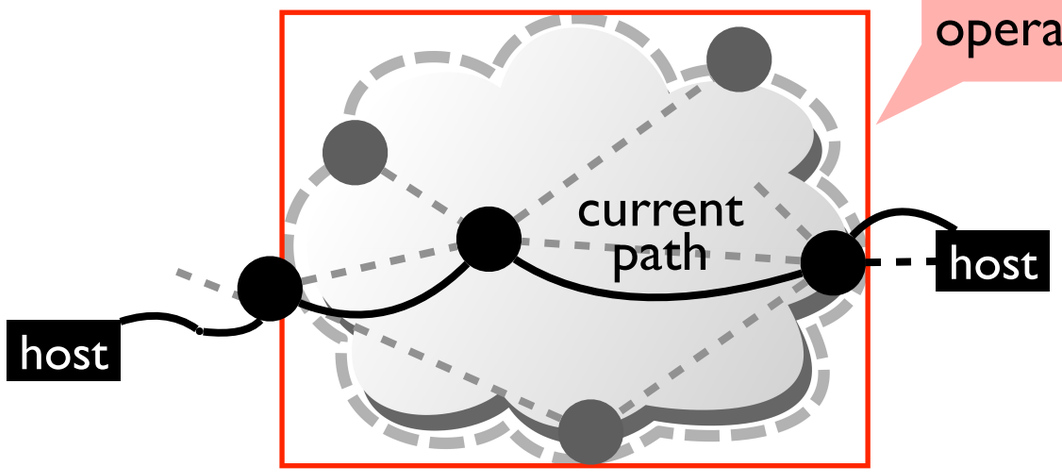
[HotNets'21] F. Lan, B. Gui, and A. Wang. Fauré: a partial approach to network analysis

https://github.com/ravel-net/Faure

our contribution: a datalog extension (fauré-log) for incomplete information, static analysis with fauré-log evaluation

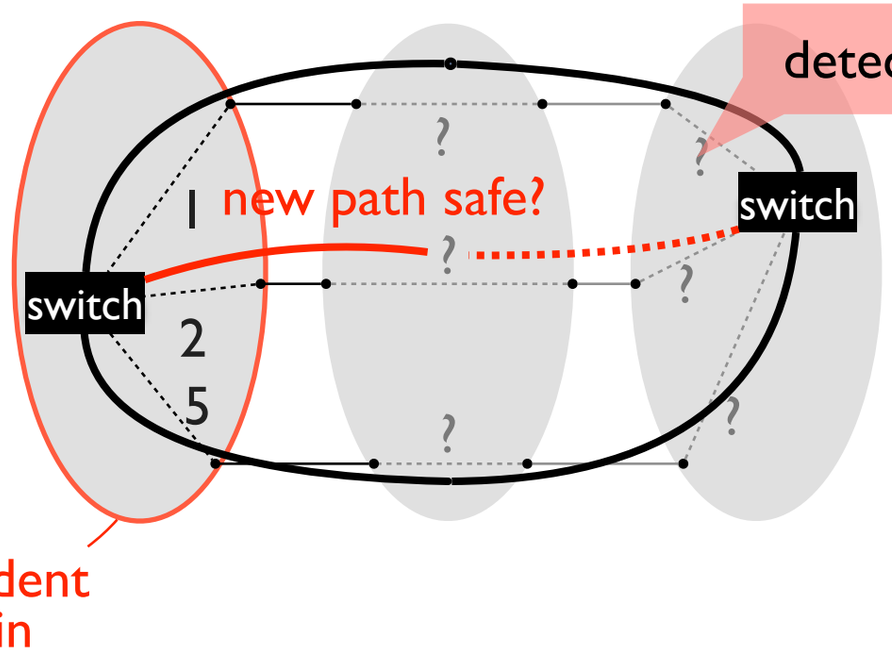
incomplete network knowledge

data



querying incomplete database

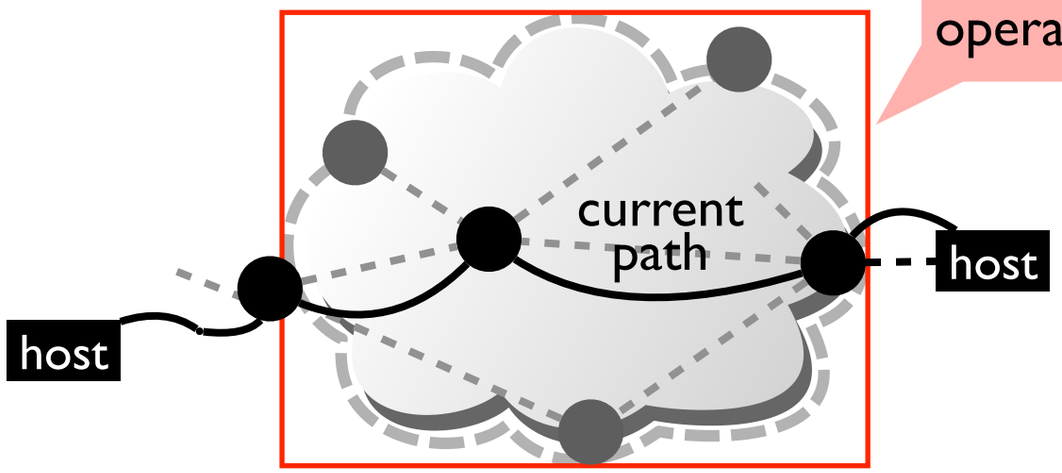
semantics



constraint checking in distributed database?

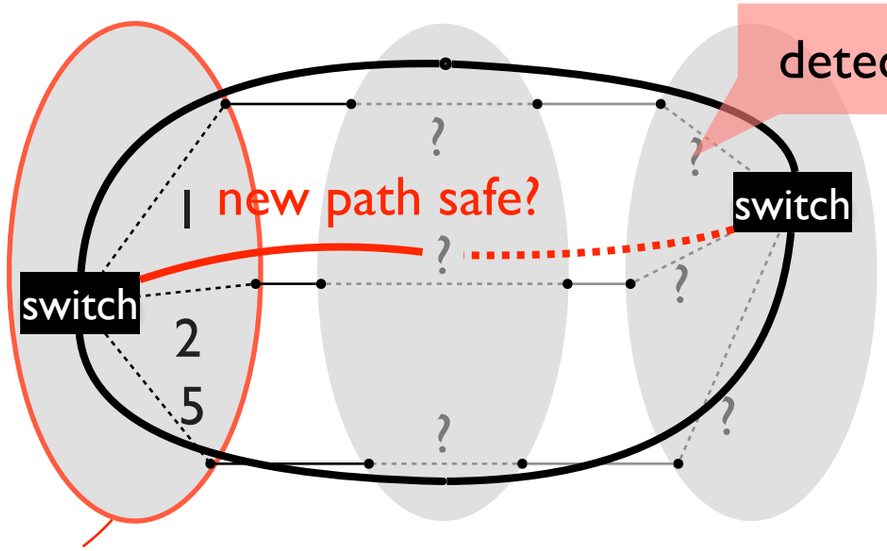
incomplete network knowledge

data



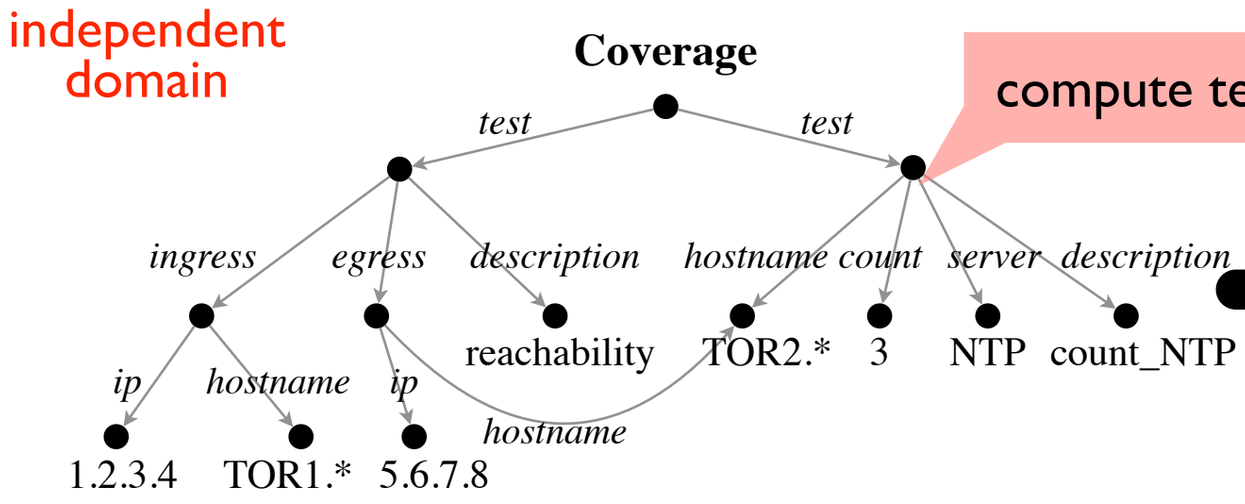
querying incomplete database

semantics



constraint checking in distributed database?

schema



semistructured data?

recap — manage incomplete network knowledge

	database solution	networking use (examples)
data	incomplete database	operating region analysis
semantics	distributed database	inter-domain routing
schema	semistructured data	network coverage

recap — manage incomplete network knowledge

	database solution	networking use (examples)
data	incomplete database	operating region analysis
semantics	distributed database	inter-domain routing
schema	semistructured data	test coverage

[HotNets'21] F. Lan, B. Gui, and A. Wang. Fauré: a partial approach to network analysis
https://github.com/ravel-net/Faure

thank you