

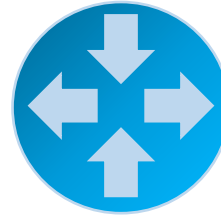
Exploiting Functional Connectivity Inference for Efficient Root Cause Analysis

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34th Multi-Service Networks Workshop, Coseners, 2022

Network Management: Root Cause Analysis

Router A



13:01 RouterA System shutdown by root

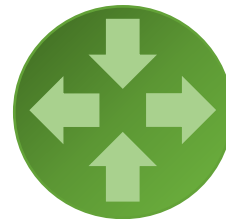


Switch D



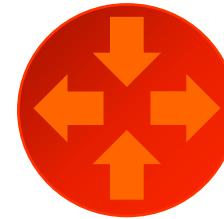
13:03 SwitchD Error detected on eth1

Router B



13:04 RouterC BGP state changed from established to idle

Router C



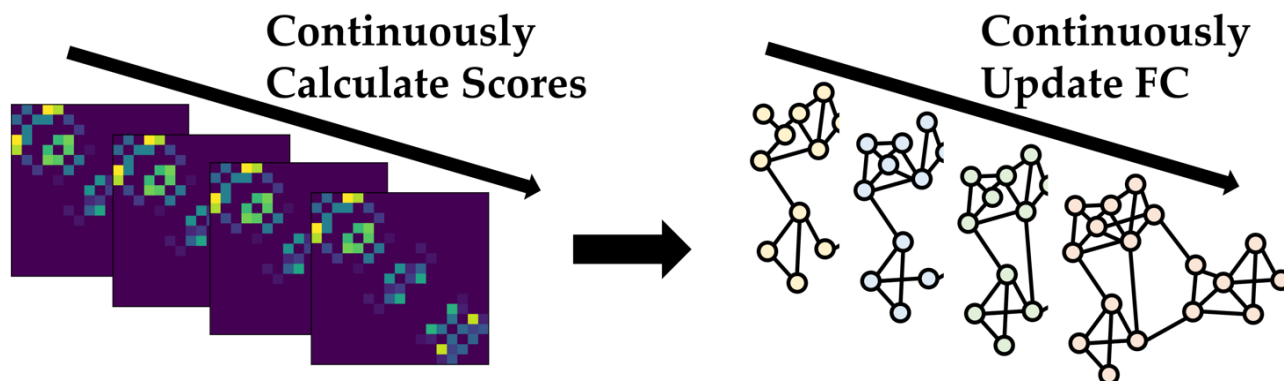
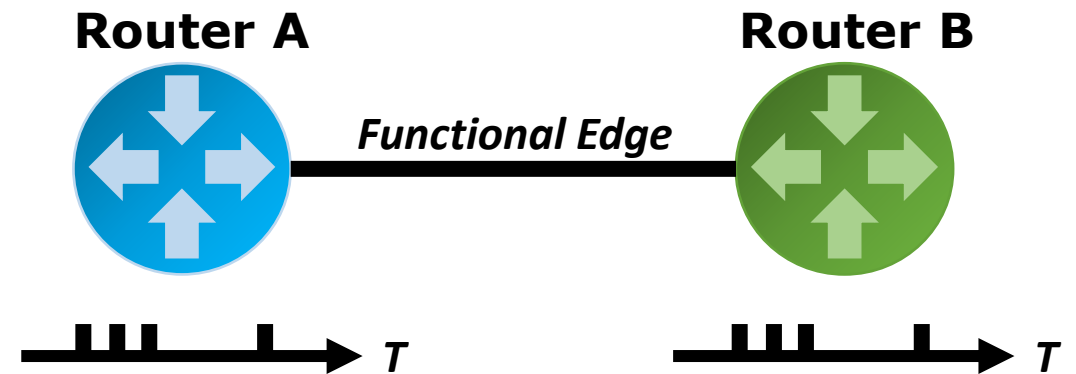
13:05 RouterC BGP state changed from established to idle

The Motivation of Our Work

- RCA algorithms can incur significant computational overheads.
- **However, modern networks are:**
- Large and complex
 - Algorithms must handle a large amount of data.
 - Expert knowledge is hard to obtain.
- Dynamic
 - Provided solutions must be able to update knowledge in a changing network with transient interactions [1].

Functional Connectivity Inference

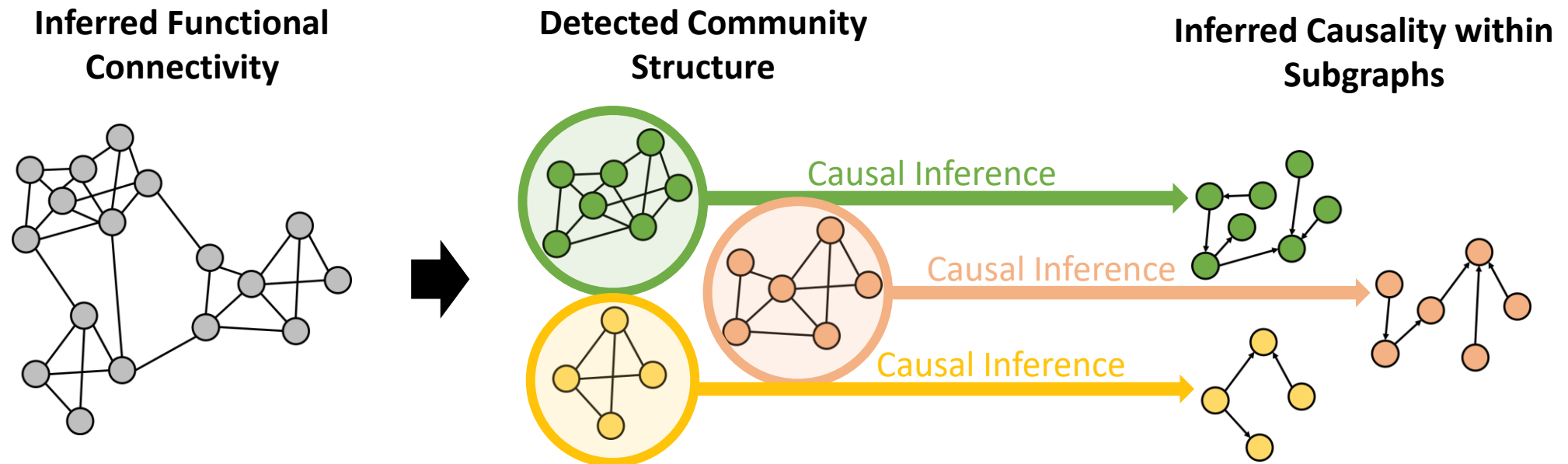
- Pair-wise measure of short-lagged statistical dependency in log message activity [2].
- Light-weight



[2] A. Messenger, G. Parisi, IZ. Kiss, R. Harper, P. Tee, and Berthouze. L. "Inferring functional connectivity from time-series of events in large scale network deployments." In IEEE TNSM, vol. 16, pp. 857-870, 2019.

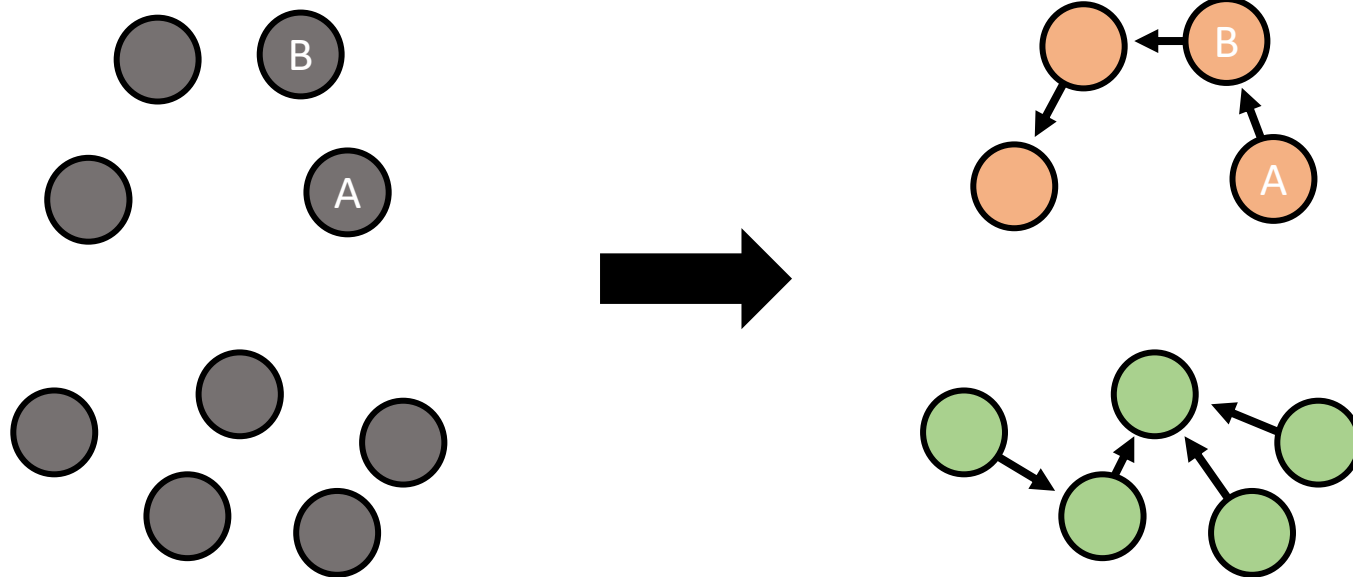
How can we exploit Functional Connectivity Knowledge for RCA?

- Pruning
- Community detection for parallelisation



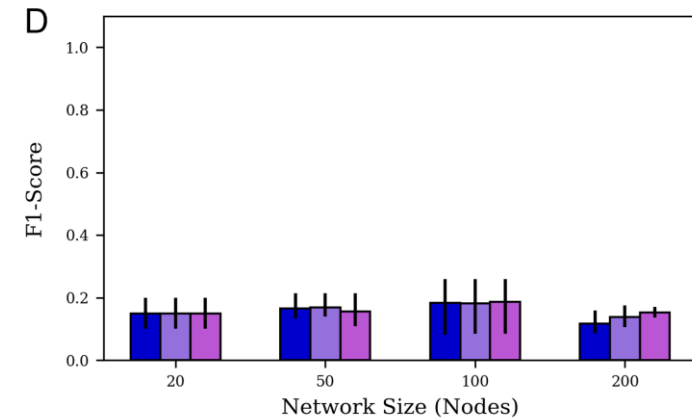
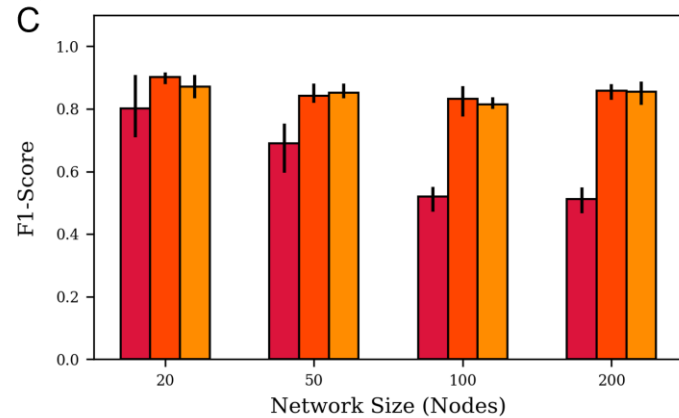
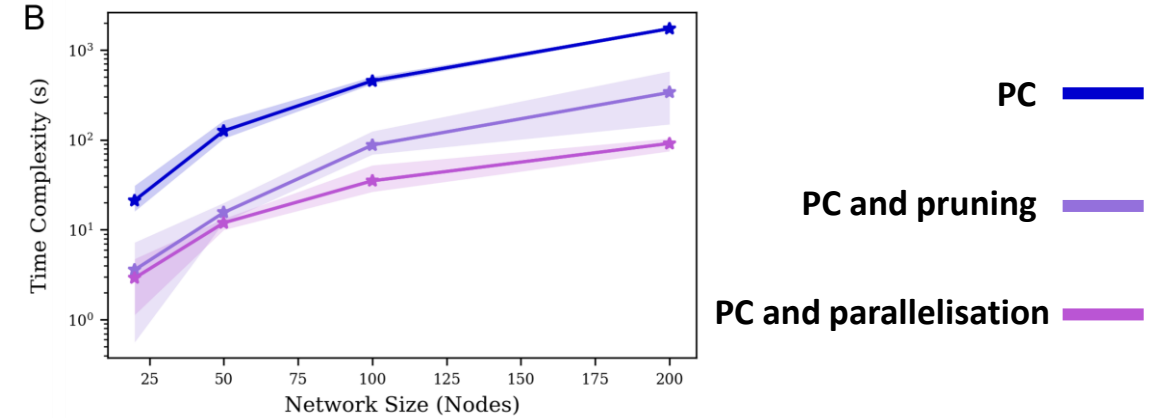
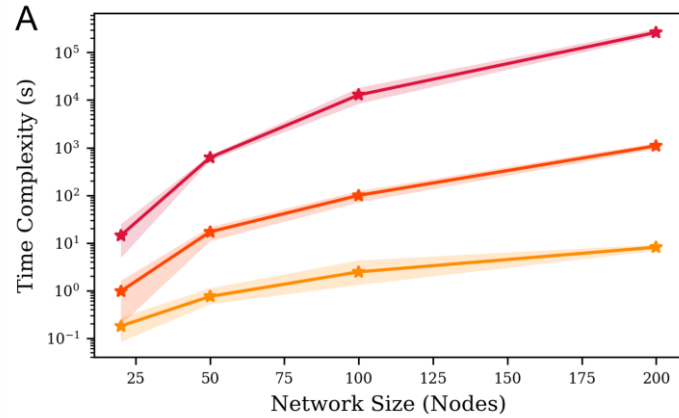
Performance on Synthetic Data

- Network of Poisson processes split into **Directed Acyclic Graphs**.
- Causal structure influences event rate.



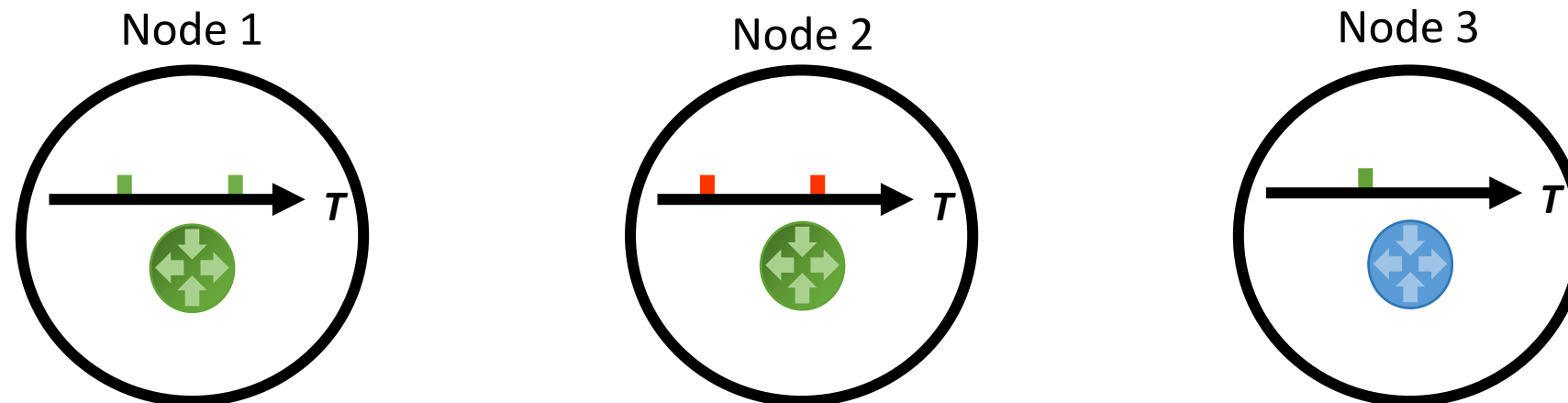
Performance on Synthetic Data

- █ THP
- █ THP and pruning
- █ THP and parallelisation

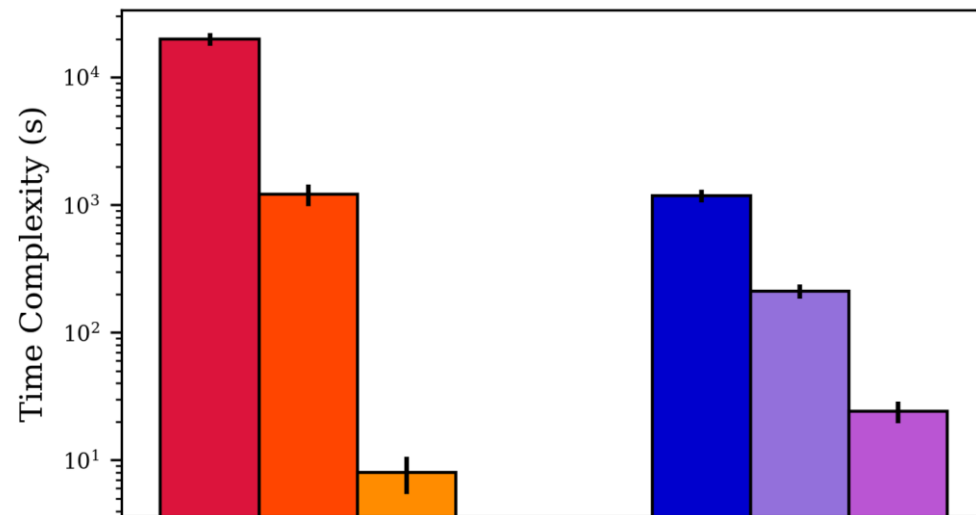


Performance on Real World Data

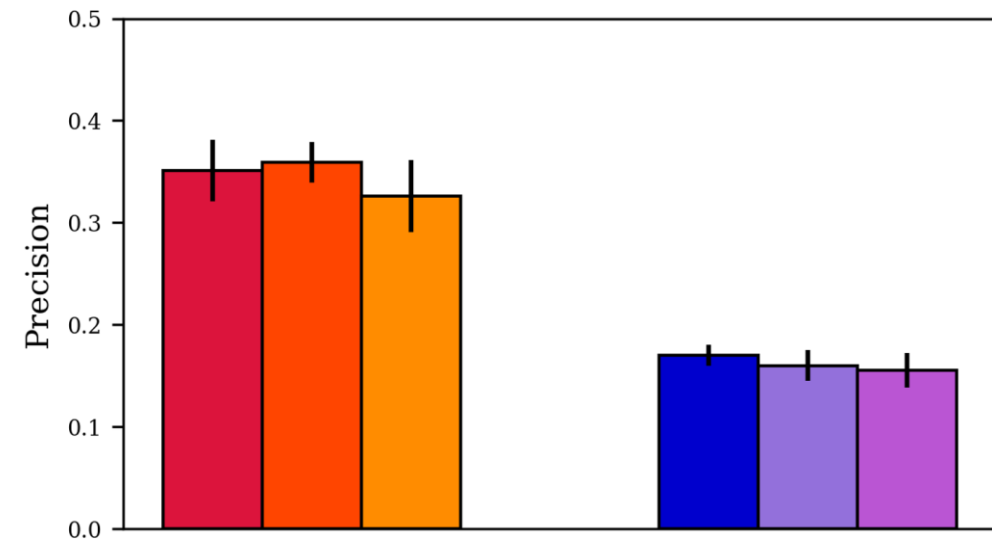
- Events from some ~200 devices and ~20 event types over 12 days.
- Curated ground-truth causality between types.
- Repurposed the dataset



Performance on Real-World Data



THP
THP and pruning
THP and parallelisation



PC
PC and pruning
PC and parallelisation

Conclusion

- Summary
 - We present a framework for exploiting Functional Connectivity to aid efficient RCA.
 - Functional knowledge is inferred without requirement for expert-derived domain knowledge.
 - The approach shows promise on both synthetic and real-world datasets.

Thank you for listening!