

Green Routing

CO₂ Transparency and Optimization on
Inter-Domain Paths

Seyedali Tabaeiaghdaei, Simon Scherrer



Why CO₂-Awareness?

The New York Times

Democrats Consider Adding Carbon Tax to Budget Bill


A tax on carbon dioxide pollution could be an effective policy to tackle climate change. It is explosive.

(c) Making financial decisions that reduce greenhouse gas emissions

BlackRock About us Products Themes Insights Education

Access BlackRock's Q4 2021 earnings

Net zero: a fiduciary approach



Is it possible in Today's Internet?

ISPs select inter-domain paths

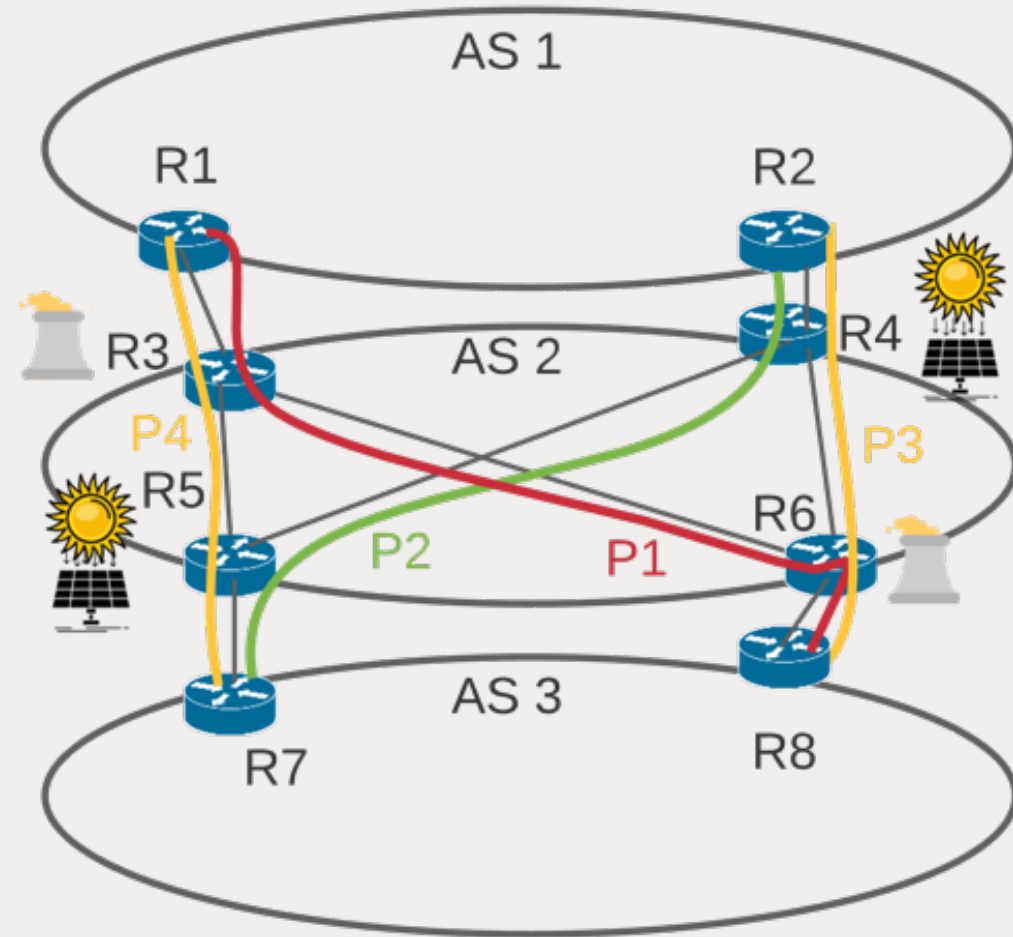
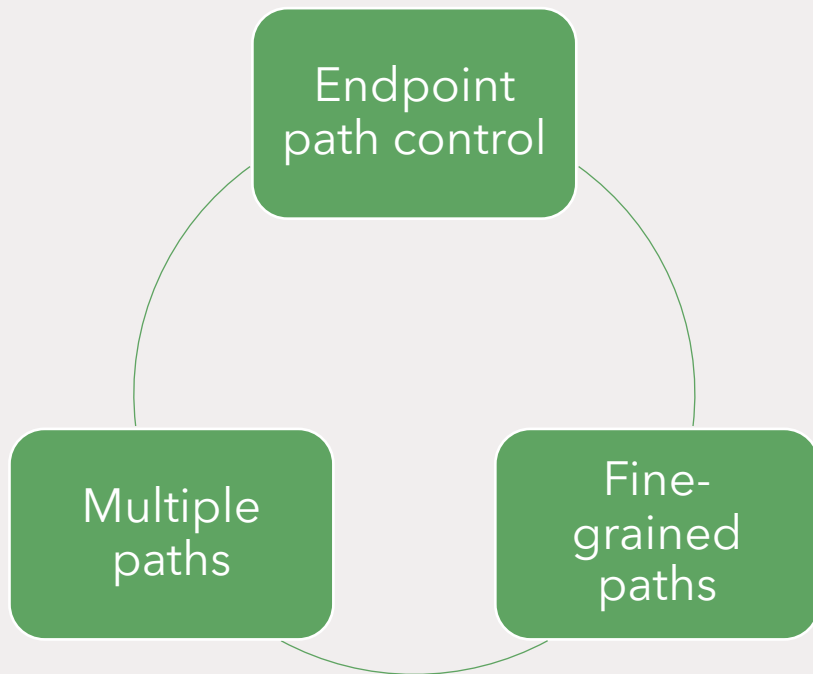


Endpoints have no control over paths



No means of carbon transparency

Why SCION?



System Design



CARBON INTENSITY
ESTIMATION



DISSEMINATING CARBON
EMISSION INFORMATION



GREEN PATH SELECTION
AND CARBON
FOOTPRINT MONITORING

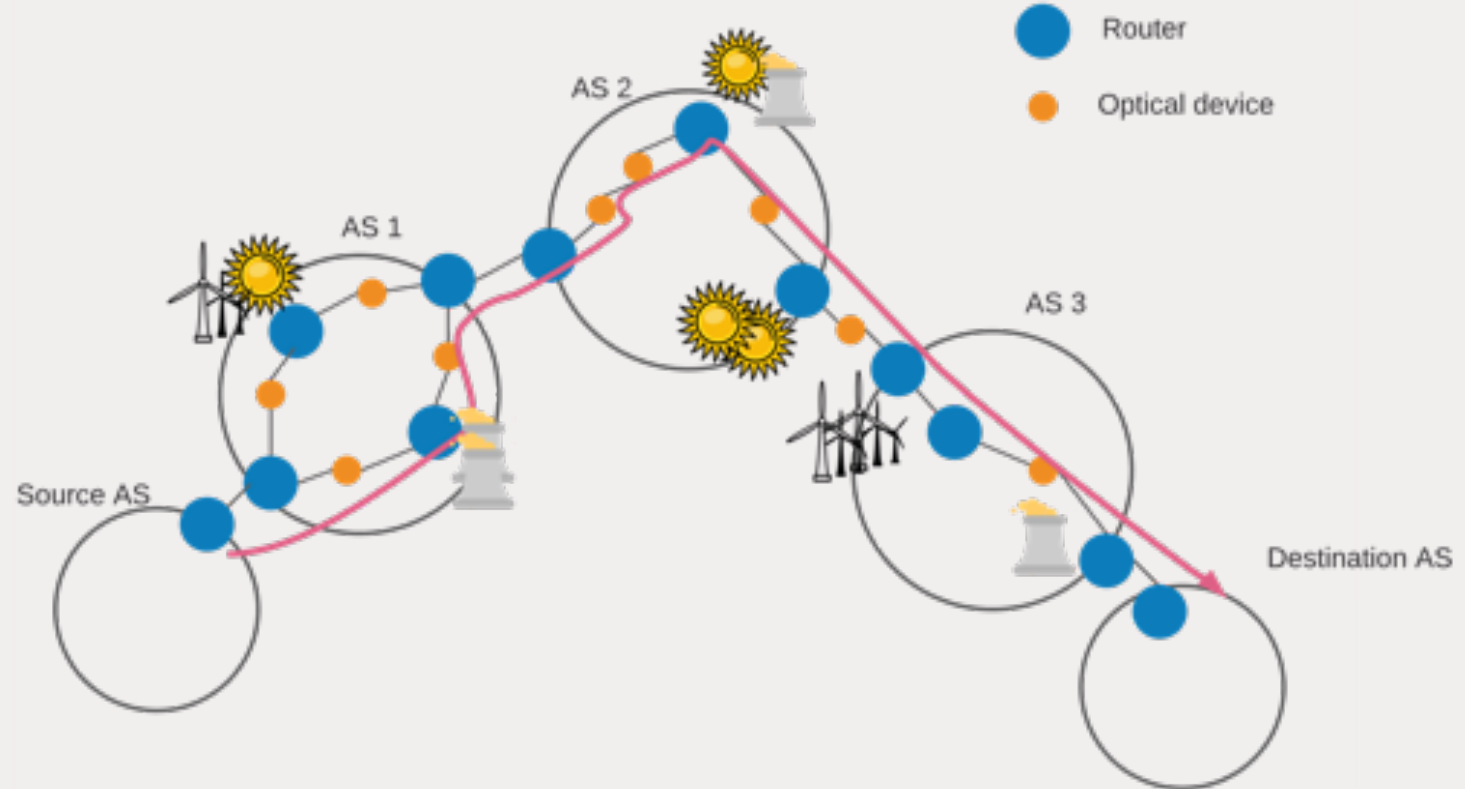
Carbon Intensity Estimation



Average carbon intensity



Instant carbon intensity



Disseminating Carbon Emission Information

Beaconing-based

- Average intensity
- During beaconing
- Using StaticInfoExtension in PCBs

Path-service-based

- Instant intensity
- During communication
- By iteratively requesting on-path path services

Green Path Selection and Carbon Footprint Monitoring

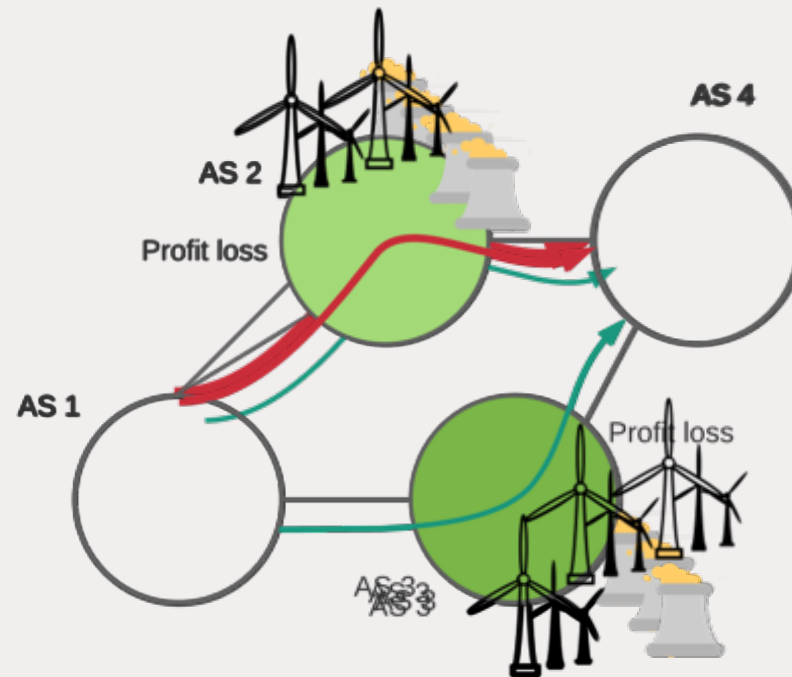
Selection

- According to the average carbon intensity
- According to the instant carbon intensity

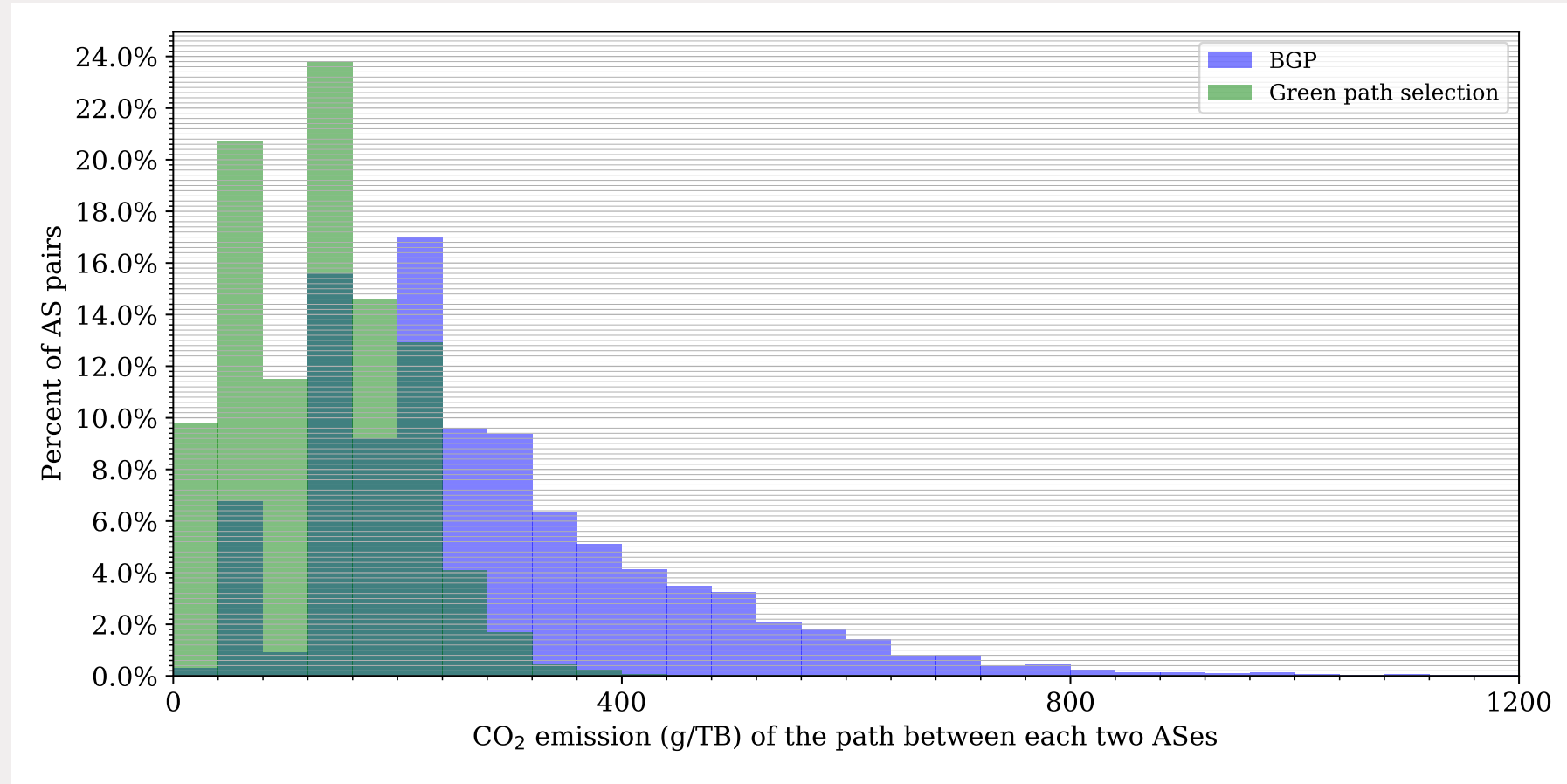
Monitoring

- Periodically
- Requesting the instant carbon intensity

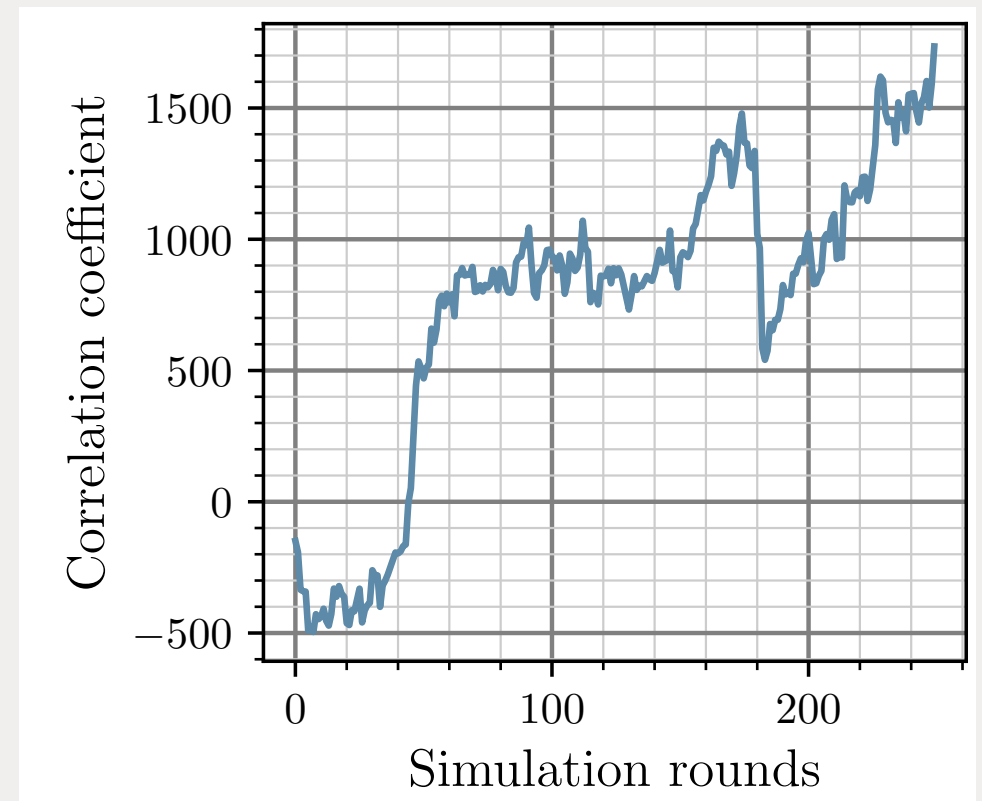
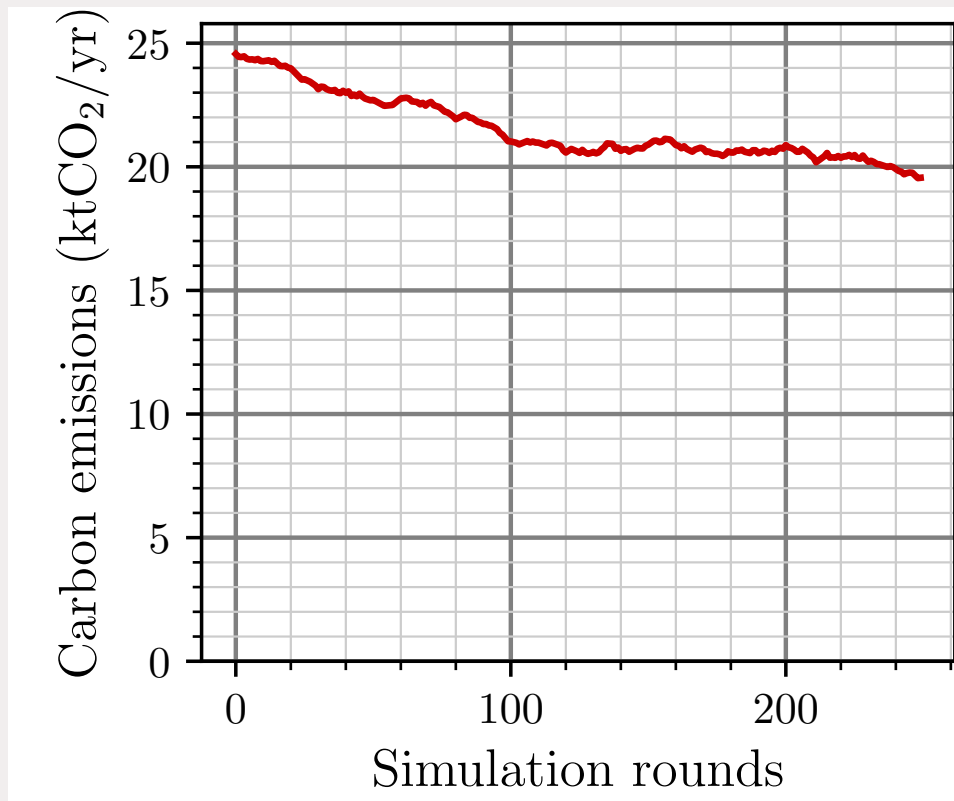
A Green Competition?



Direct Impact of Green Path Selection



The Impact of Green Competition



Conclusion

The first Internet-wide carbon footprint monitoring system

Enabling endpoints to select the greenest paths

Introduces green competition between ISPs

Expected savings: 20% CO₂ reduction for global ISPs

Thank You

Seyedali Tabaeiaghdaei
Network Security Group
ETH Zürich
seyedali.tabaeiaghdaei@inf.ethz.ch