

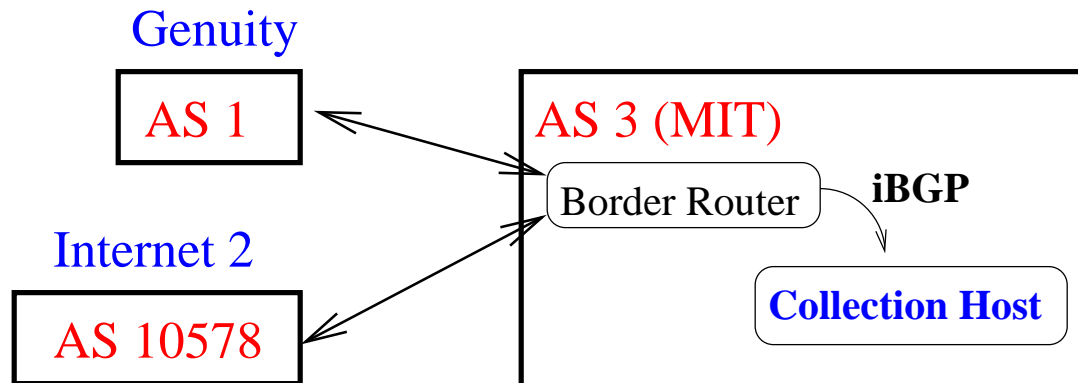
Measuring the Effects of Internet Path Faults on Reactive Routing

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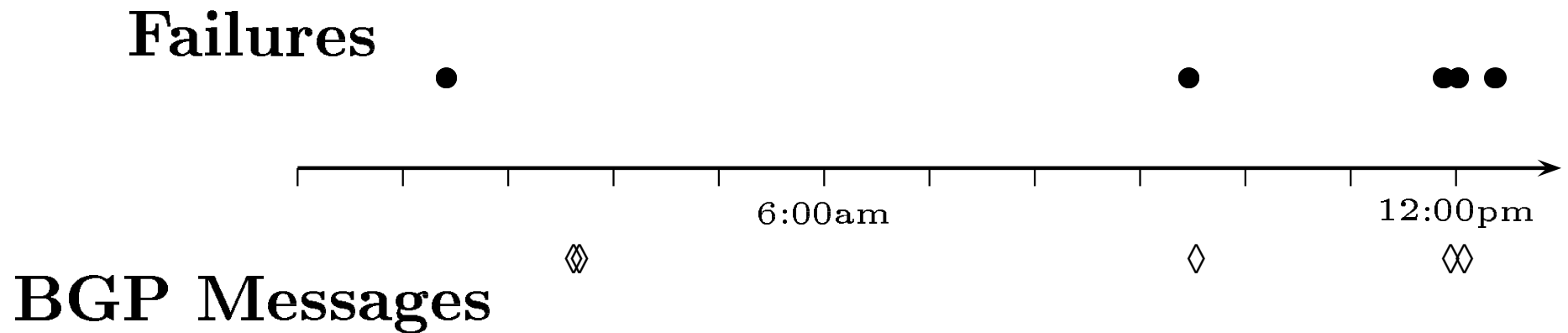
- 1. Where do end-to-end path failures appear?**
- 2. How long do they last?**
- 3. How do they correlate with BGP?**

Data Collection

- Topology: 31 widely distributed nodes (RON testbed)
- Active Probes
 - ▶ Periodic pairwise probing; logging detects one-way loss.
 - ▶ **Failure**: 3 consecutive lost probes, >2 minutes
- **Failure-triggered** traceroutes
- BGP Data Feeds at 8 measurement hosts



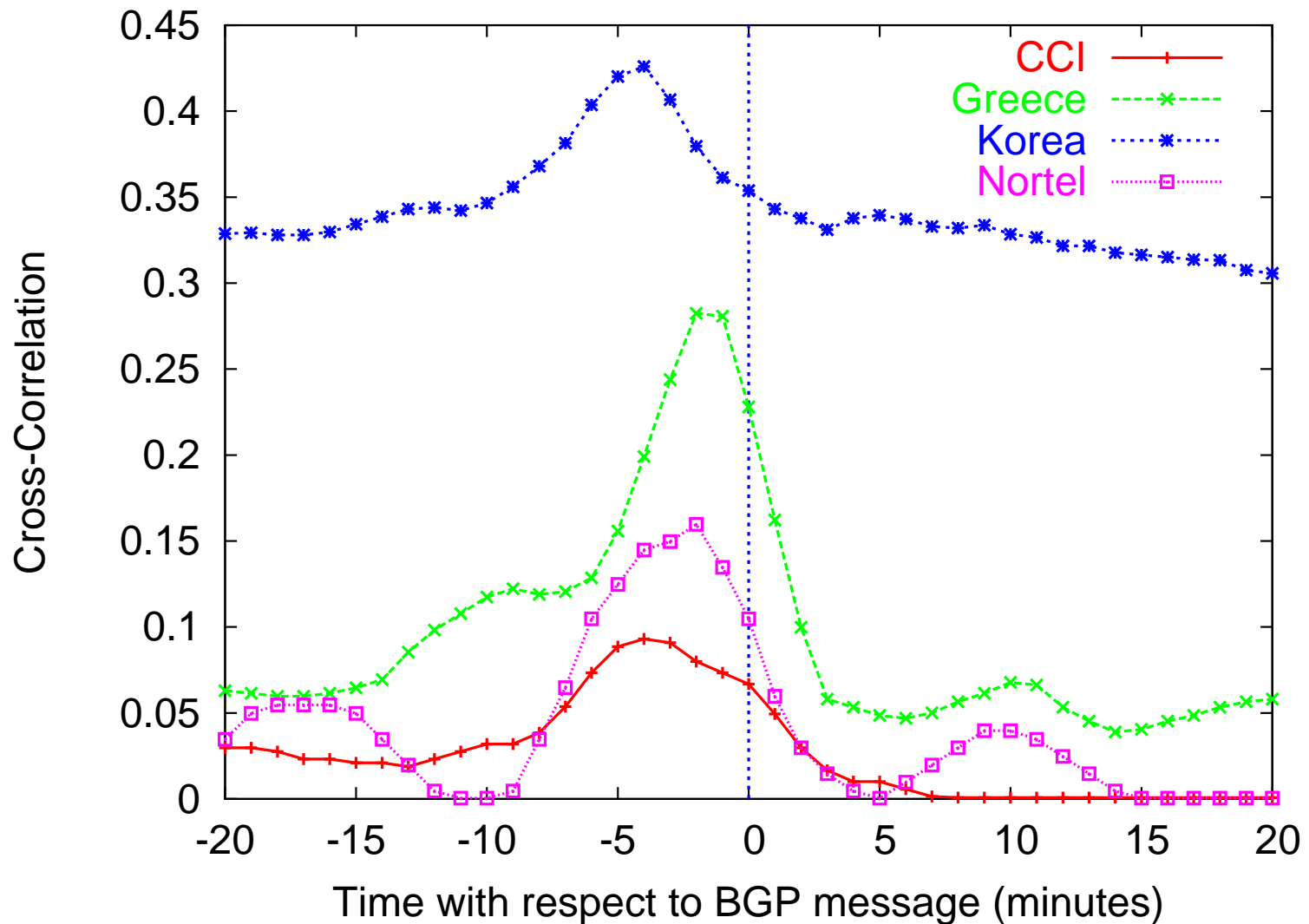
Relating Path Failures and BGP messages



- *Technique 1:* Cross-correlation of time-based signals
- *Technique 2:* Consider a failure and look for BGP (and vice versa)

Do failures correlate with routing instability?

Failures typically occur several minutes before BGP activity



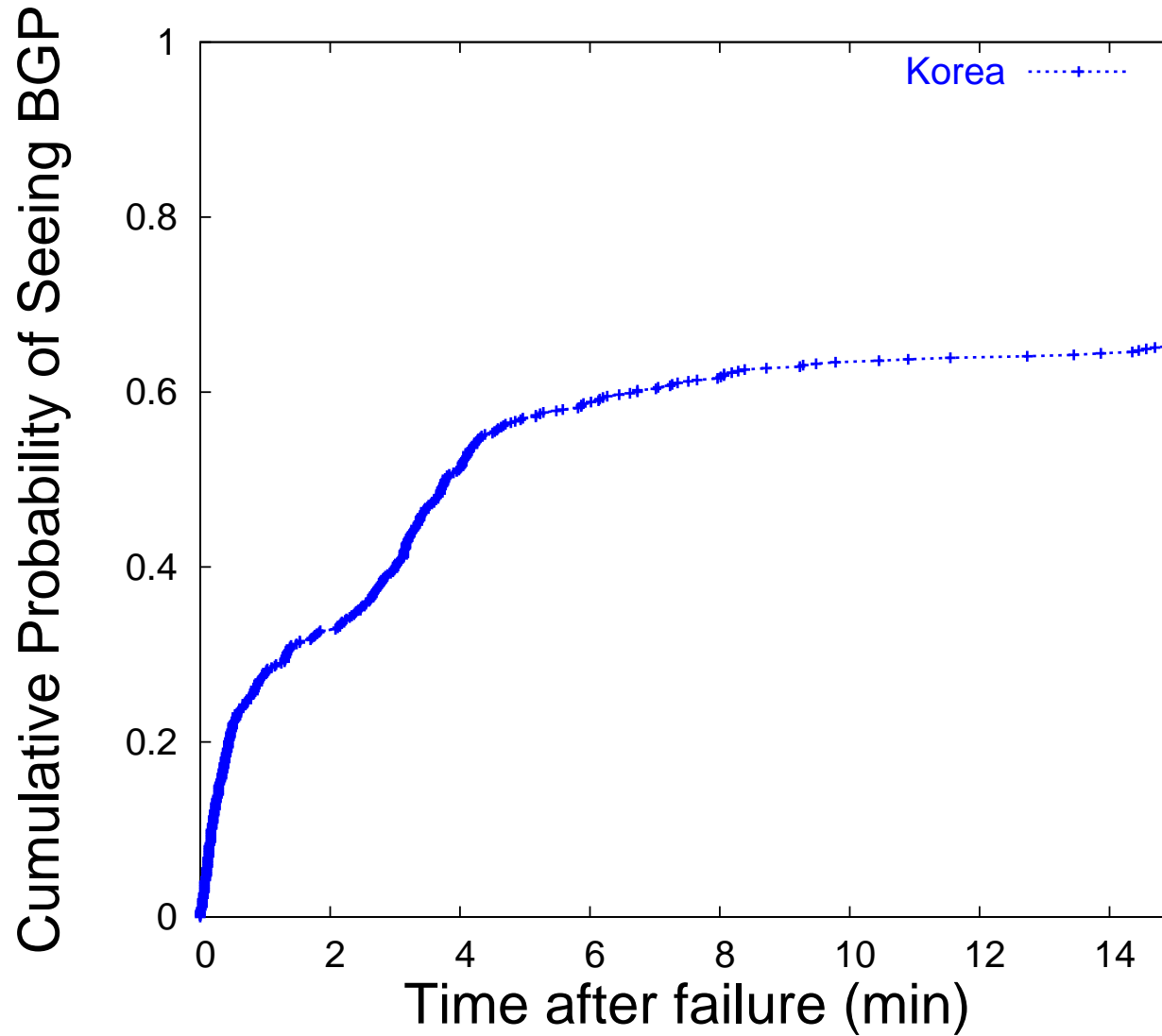
Which failures correlate with instability?

Failures that appear near end hosts are less likely to coincide with BGP instability.

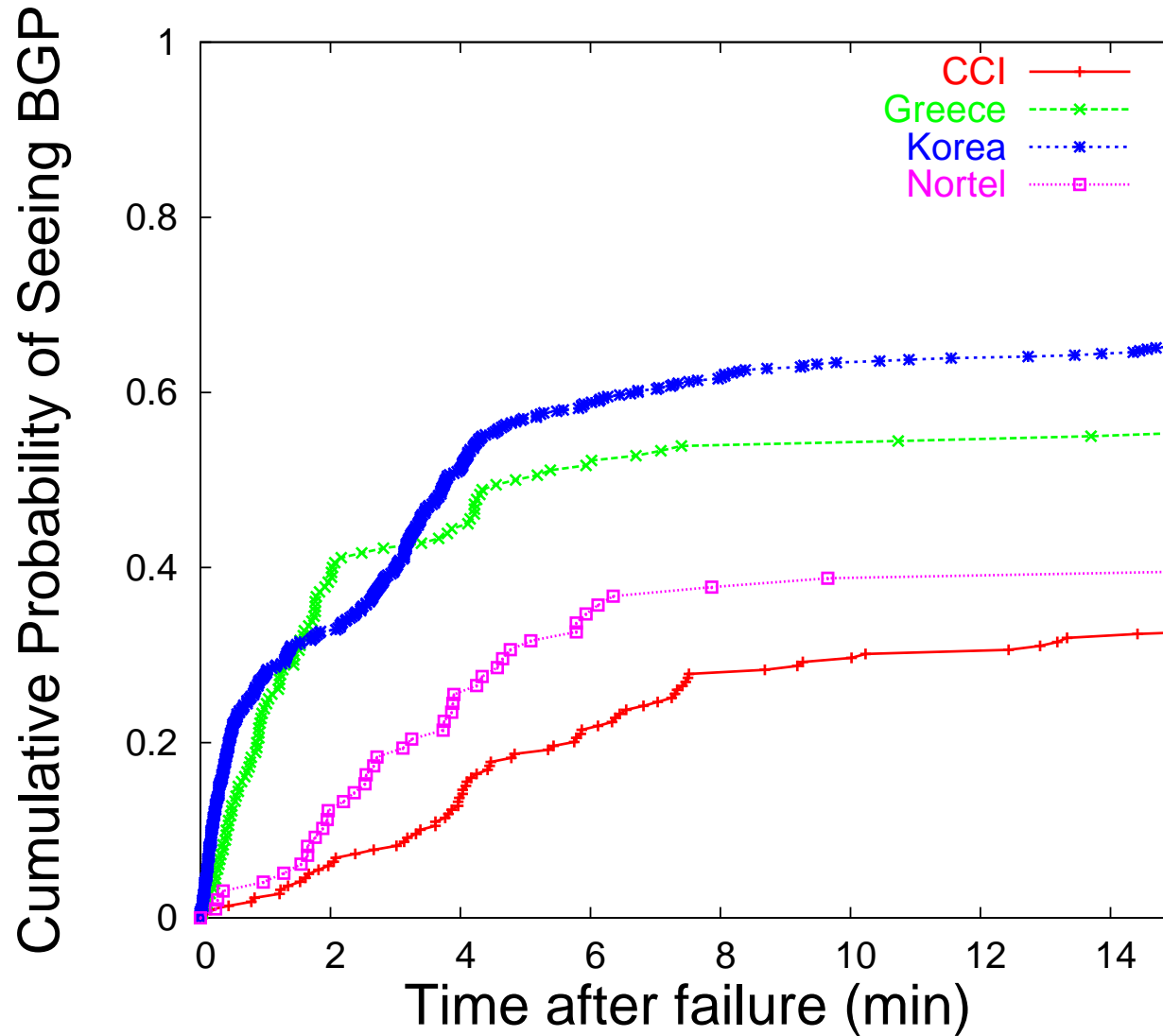
- 60% of failures that appeared at least three hops from an end host coincided with at least one BGP message.
- 22% of failures within one hop of an end host coincided with at least one BGP message.

Just because an ISP is reachable doesn't mean its customers are reachable!

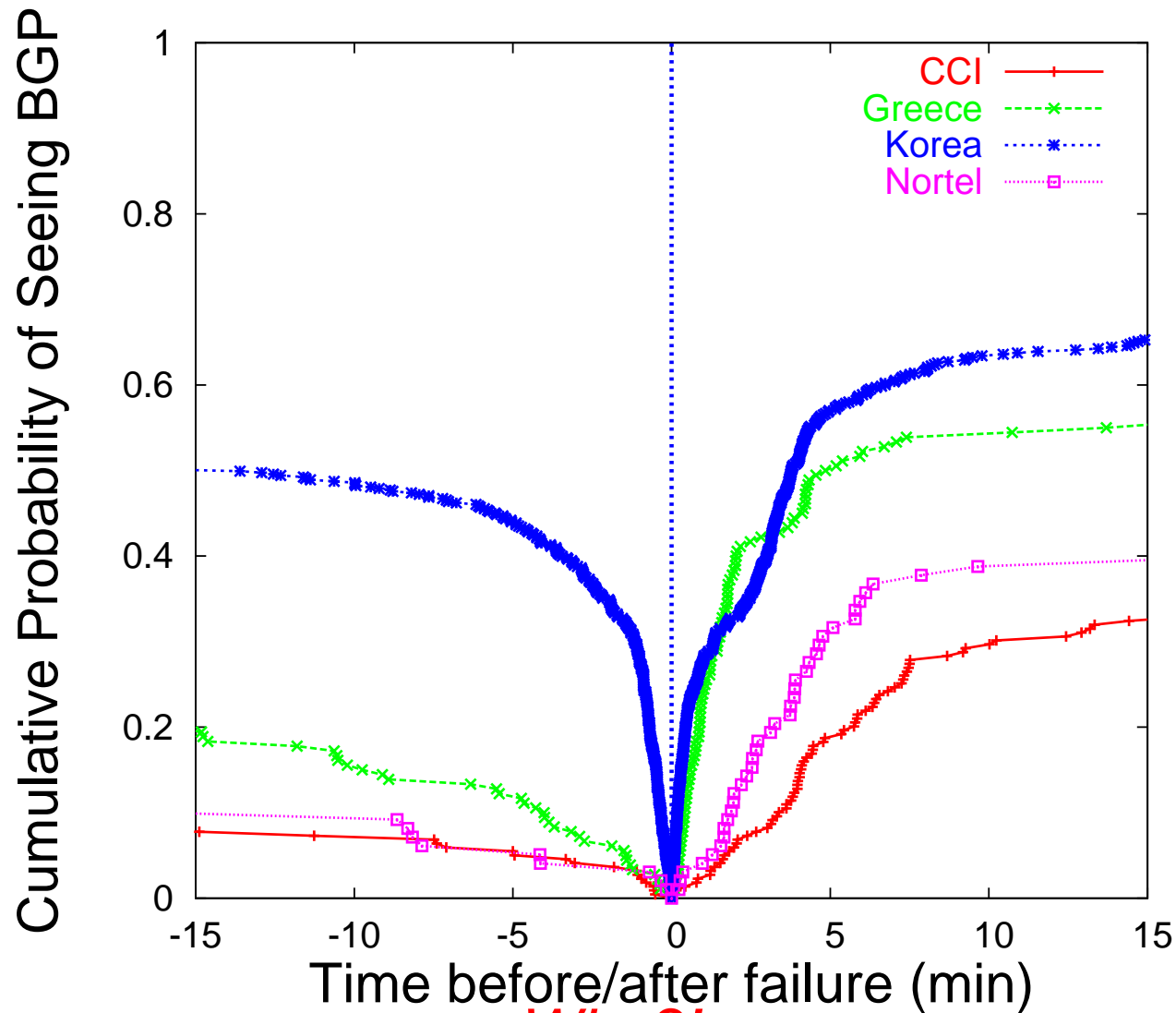
To put it another way...



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Surprise: BGP messages precede failures!



Why?!

Route flap damping, maintenance, misconfiguration, etc.

Summary

- *Location*

- ▶ Some links experience many path failures, but many experience some failures.
- ▶ Failures appear more often inside ASes than between them.

- *Duration*

- ▶ 90% of failures last less than 15 minutes
- ▶ 70% of failures last less than 5 minutes

- *Correlation*

- ▶ BGP messages coincide with only half of the failures that reactive routing could potentially avoid.
- ▶ When BGP messages and failures coincide, BGP messages most often follow failures by 4 minutes.
- ▶ BGP sometimes precedes failures.