Walking Onions: Scaling Anonymity Networks while Protecting Users

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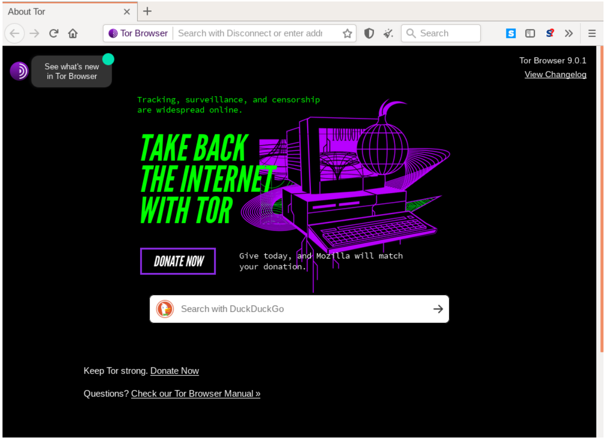
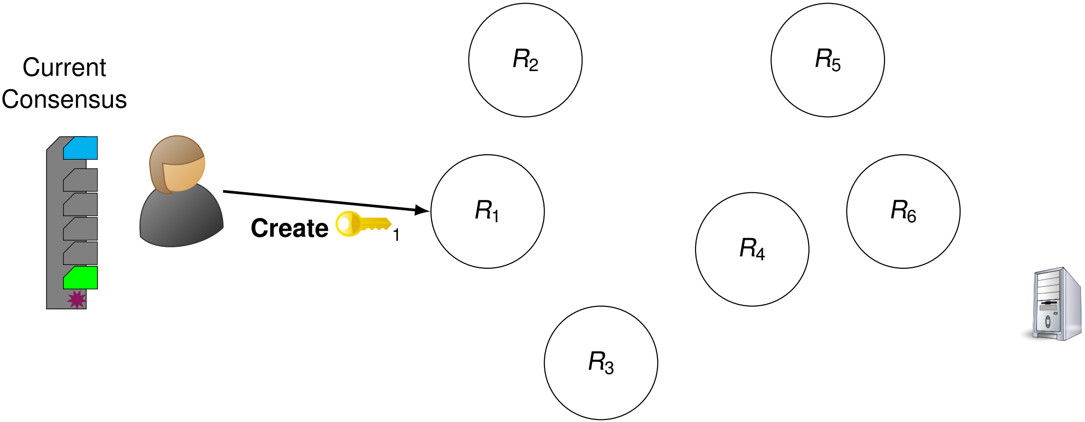
Cryptography, Security, and Privacy
— Research Group @ uWaterloo —

Tor is a privacy-enhancing tool to use the Internet privately and circumvent censorship.



Current Tor Path Selection and Circuit Extension



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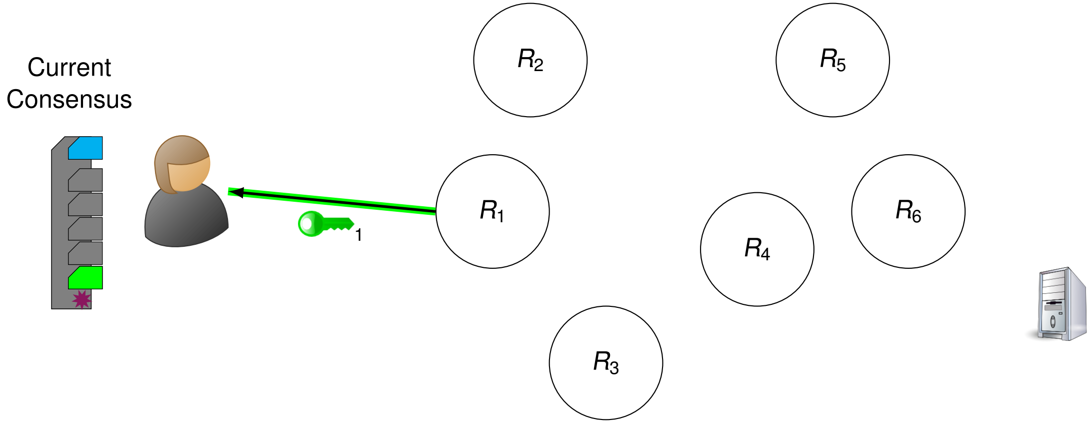

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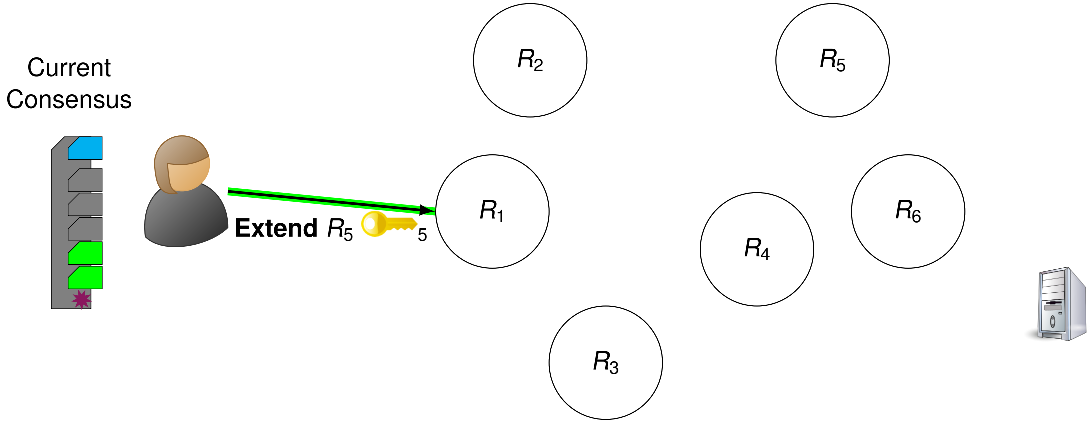

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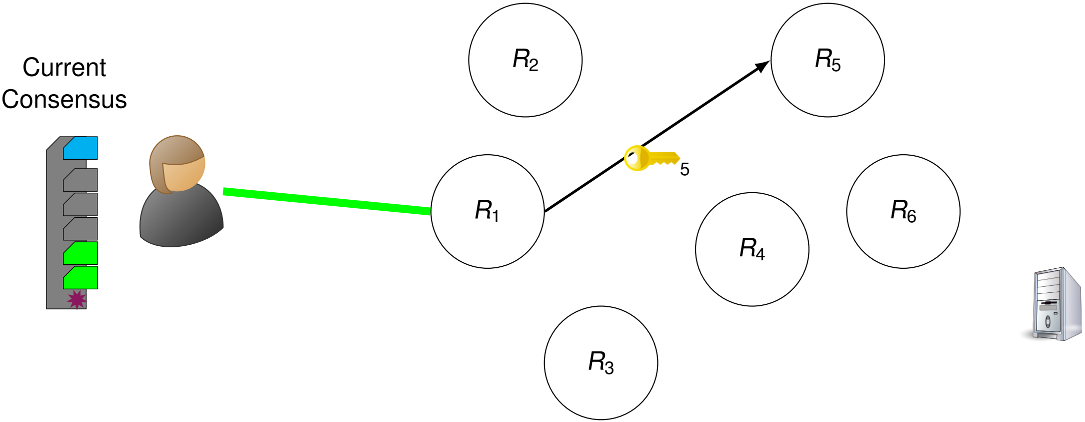

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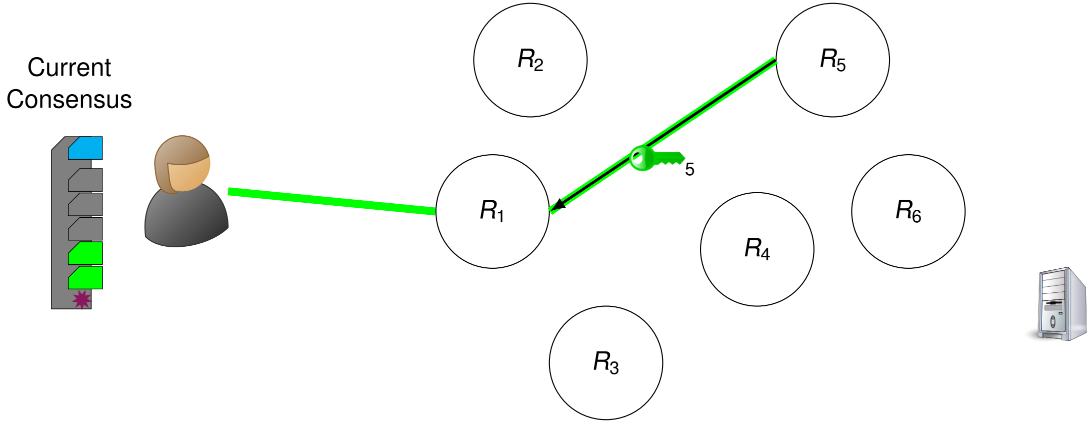

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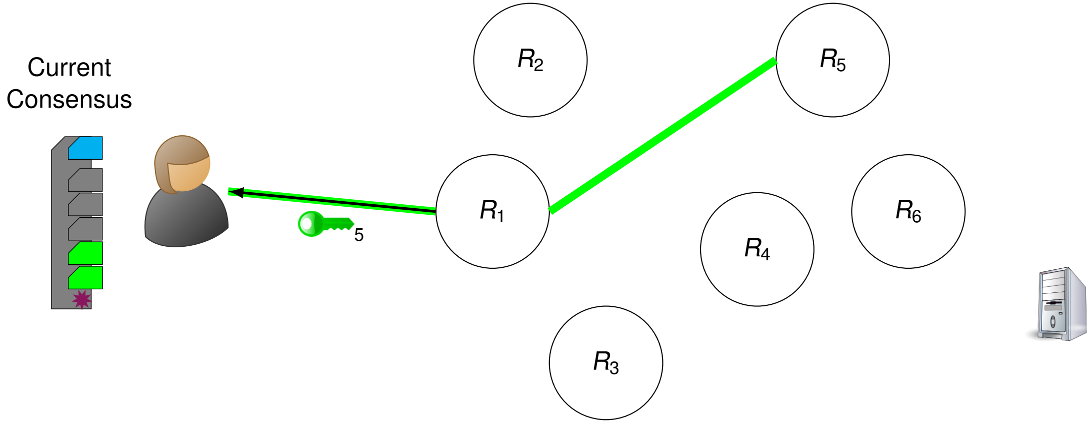

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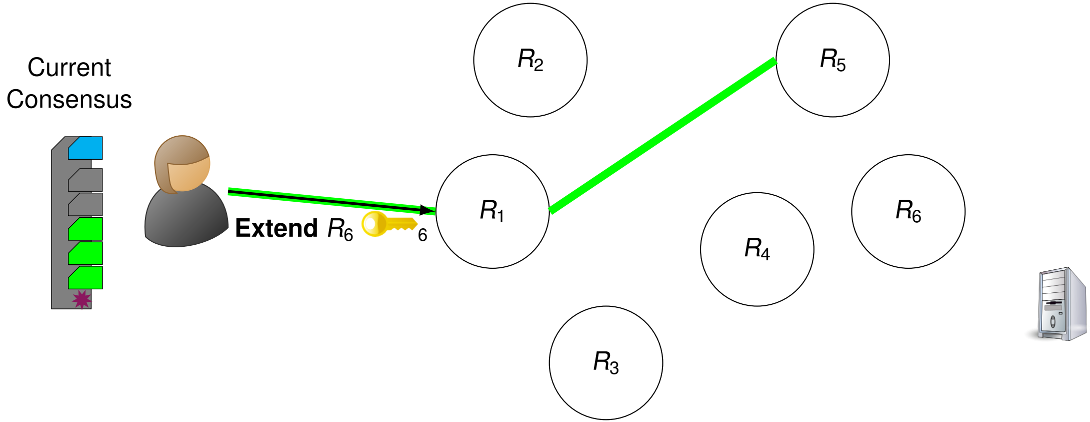

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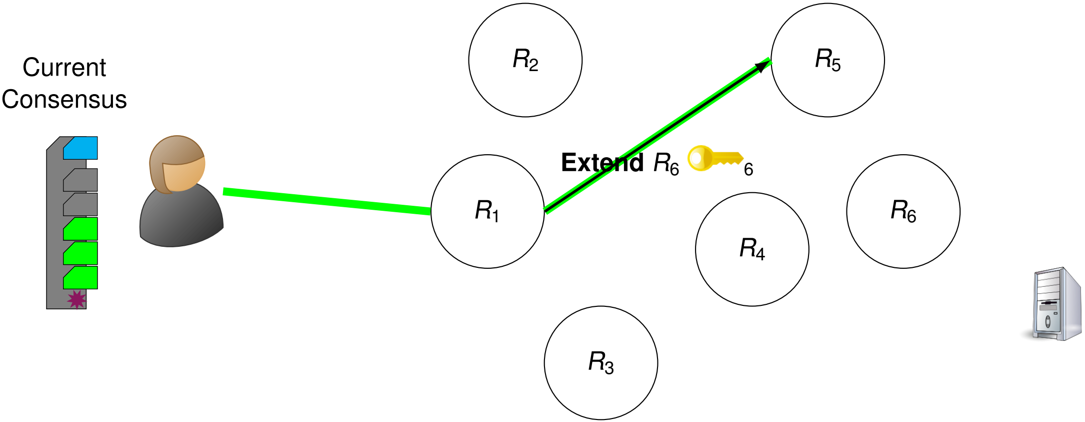

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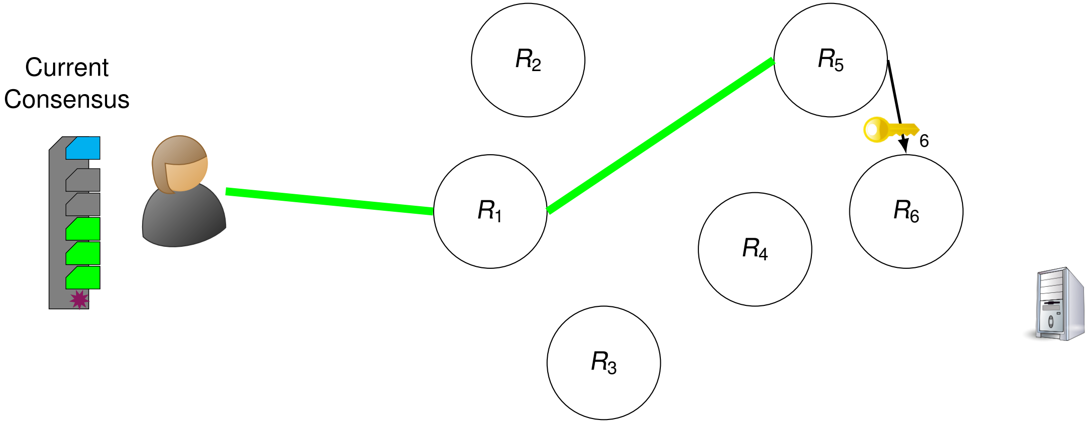

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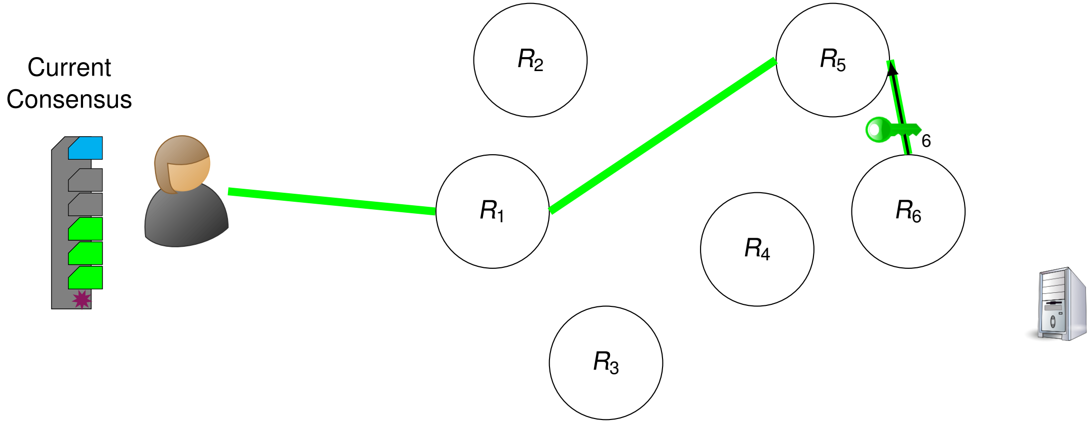

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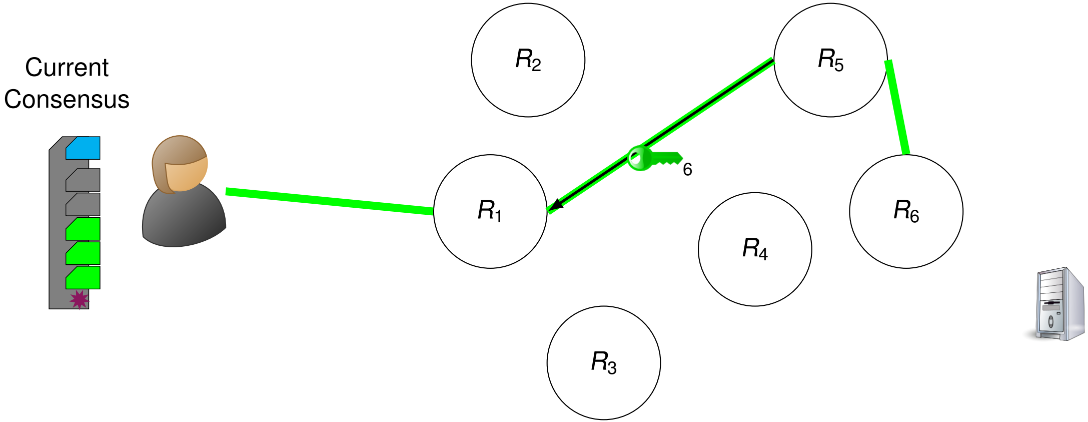

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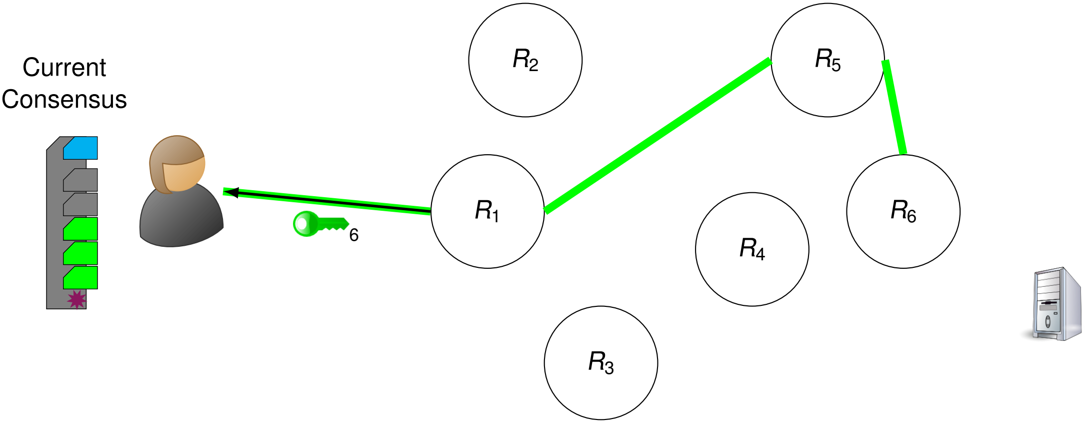

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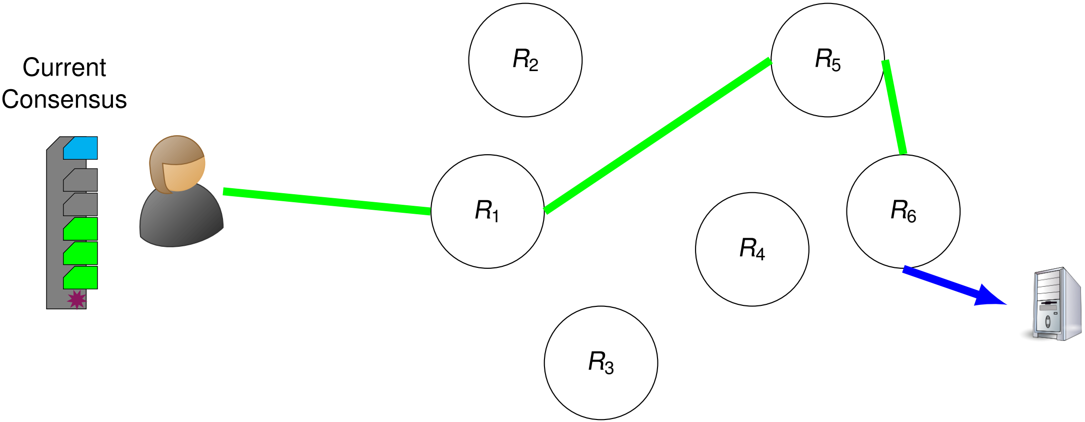

Tor Security Model: Security over Scalability

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- **Route-Capture Attacks**: When an adversary can influence users' relay selection.

  Tor's Protection: Clients verify relay responses using signing keys in the consensus.

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- **Immediate Performance Improvements.** Demonstrates improvements at networks the size of Tor today.
- **Generally Applicable.** Aspects of Walking Onions apply to network designs beyond Tor.

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What improvements does Walking Onions make?

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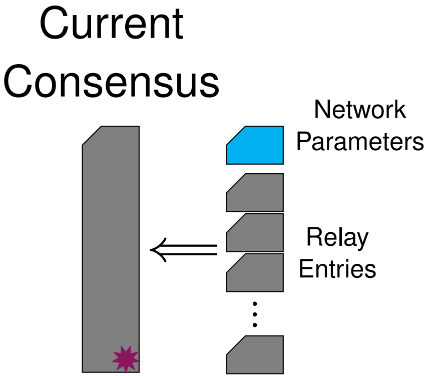

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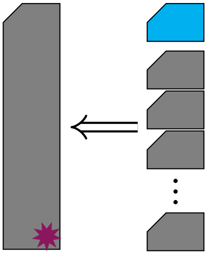

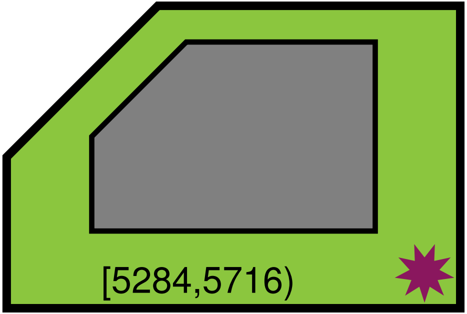

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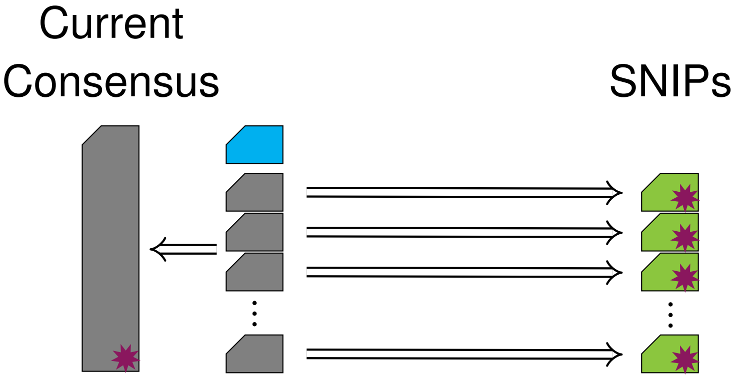
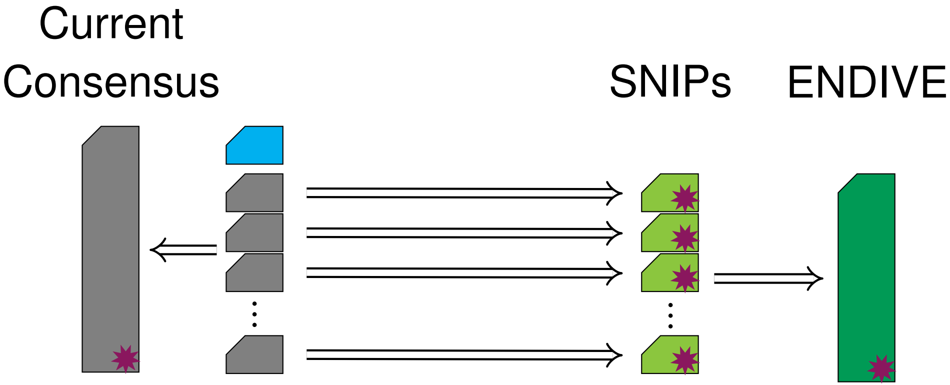


ENDIVE: Efficient Network Directory with Independently Verifiable Entries



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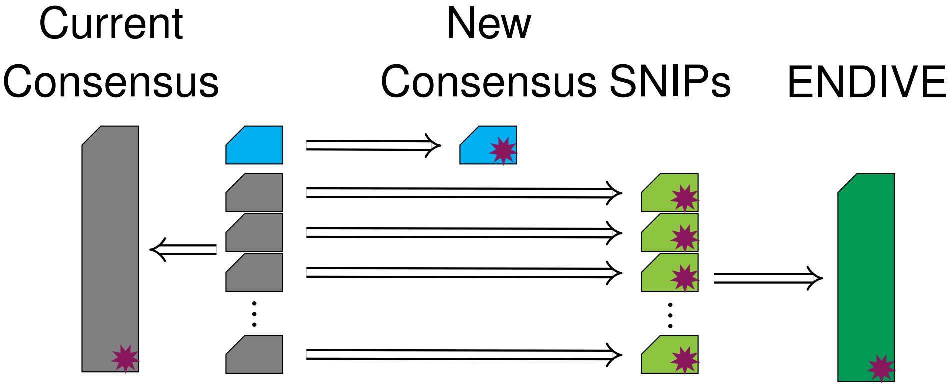

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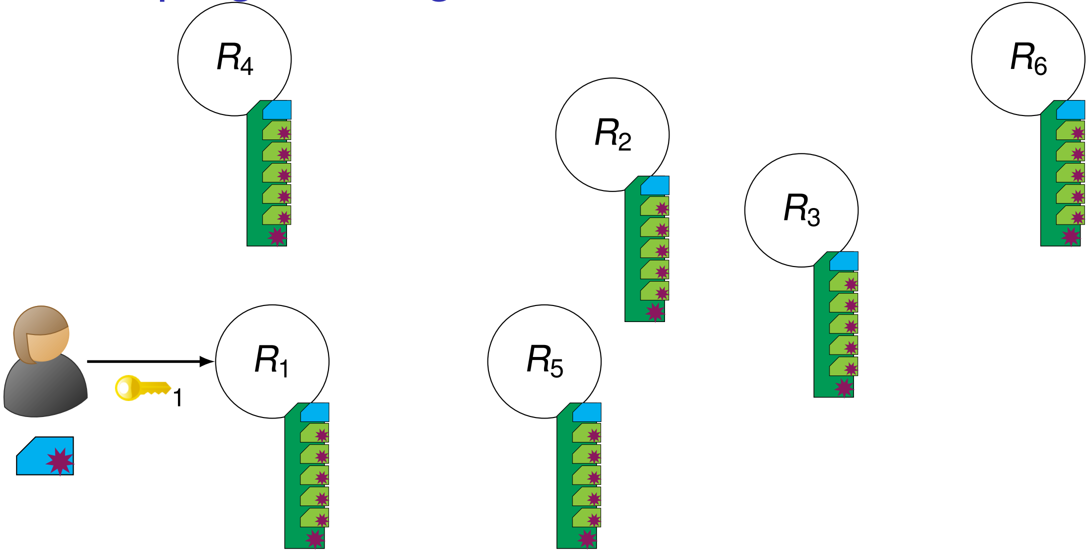

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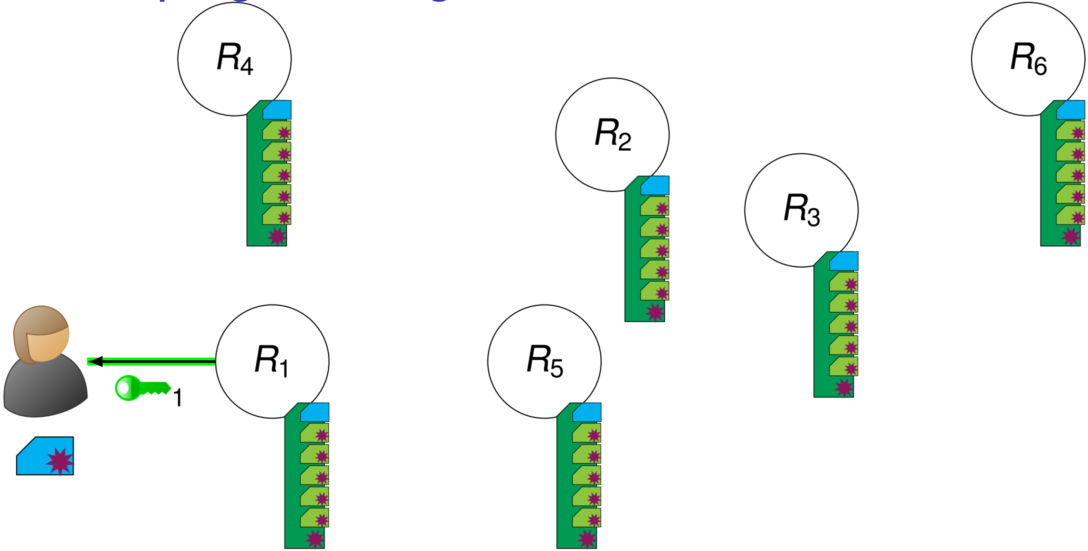

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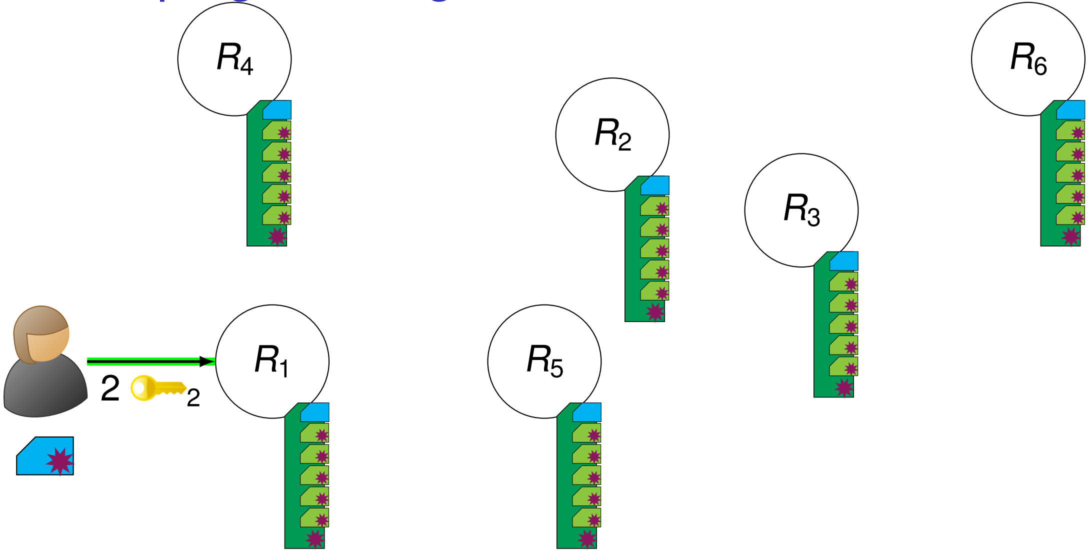

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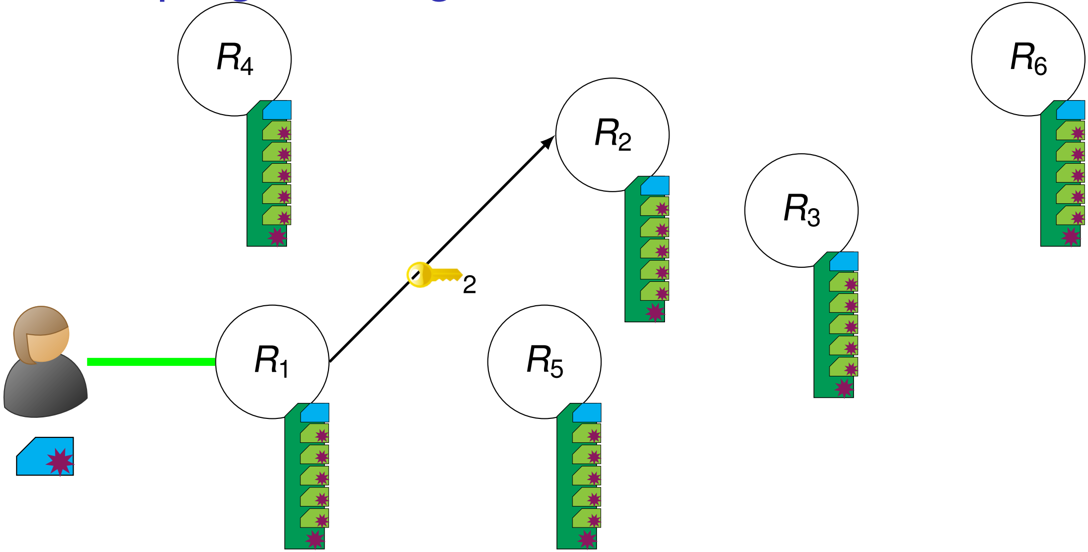

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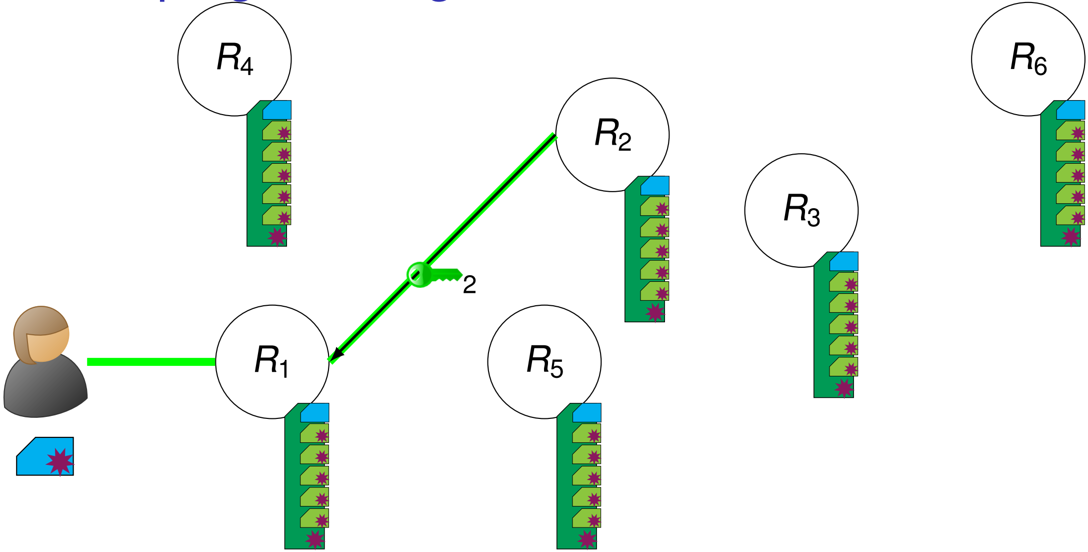

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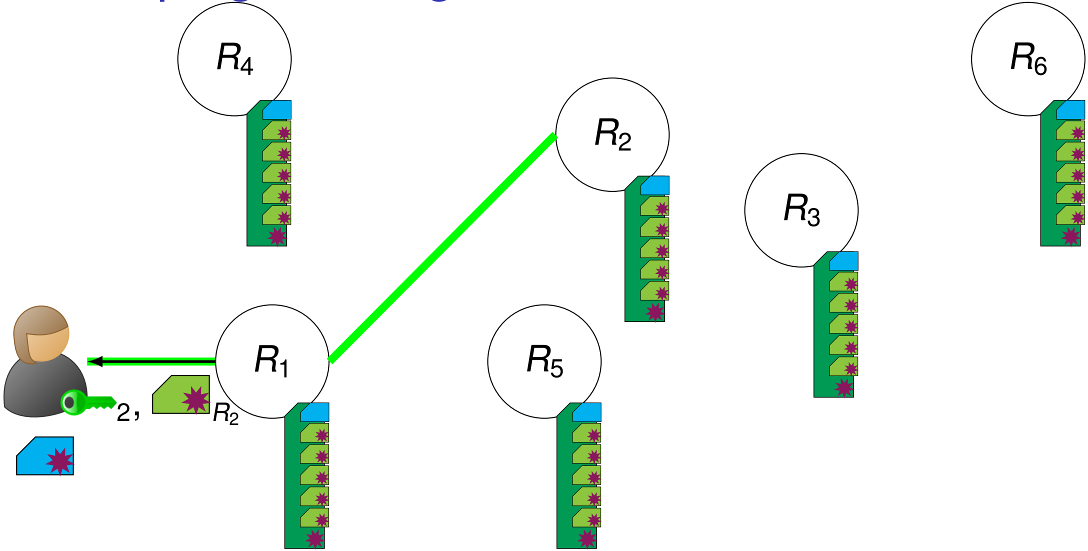

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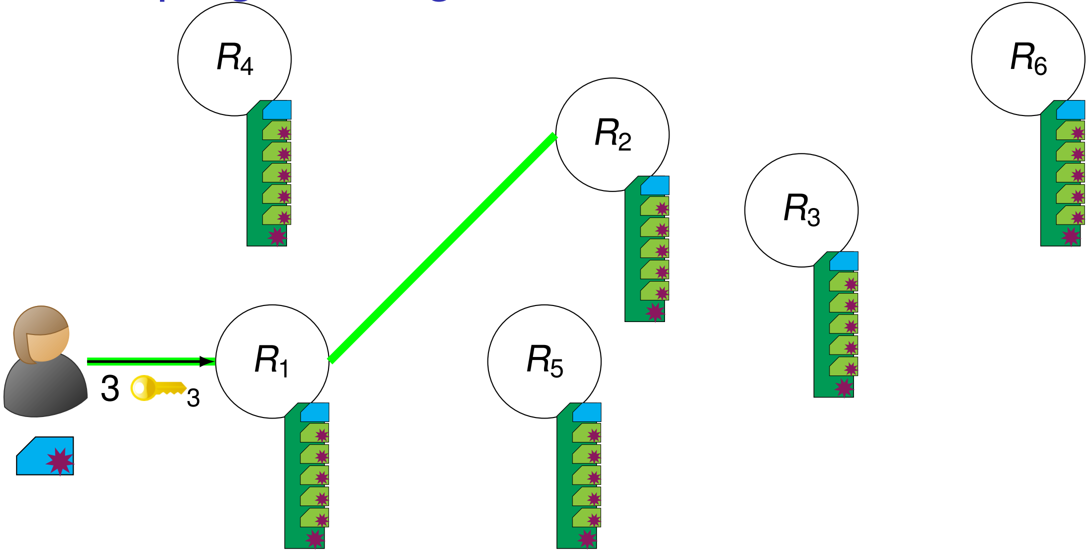

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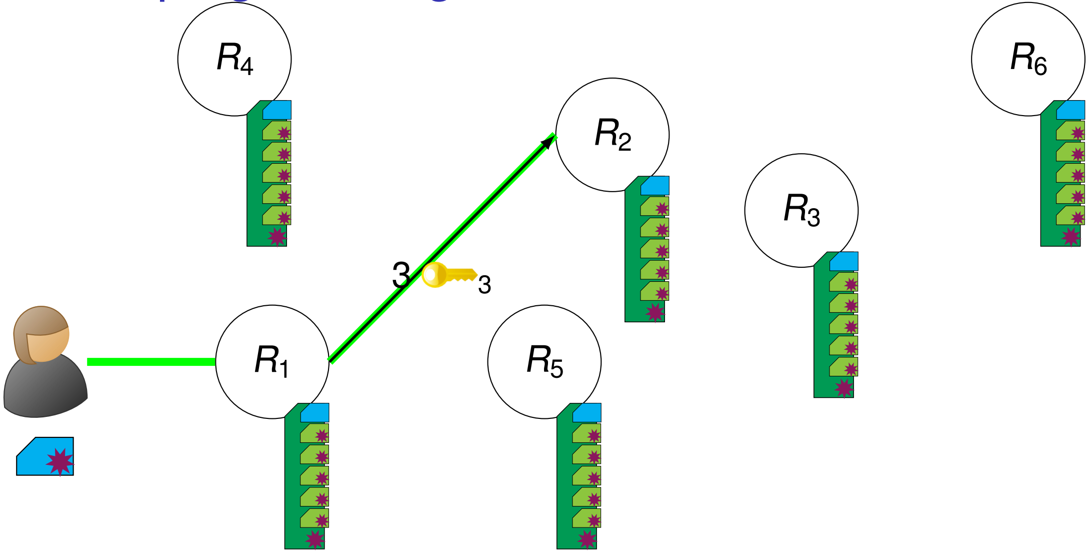

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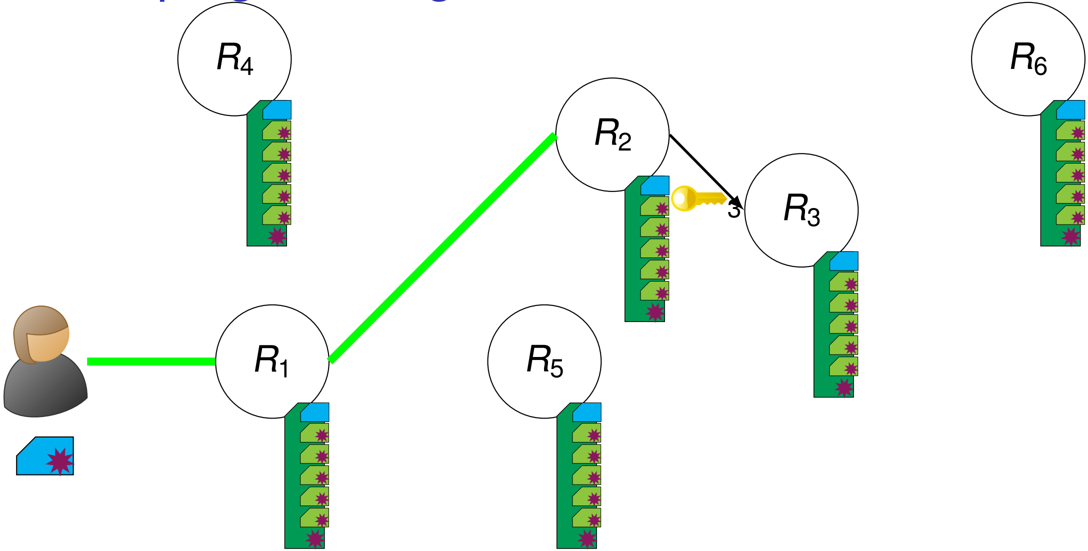

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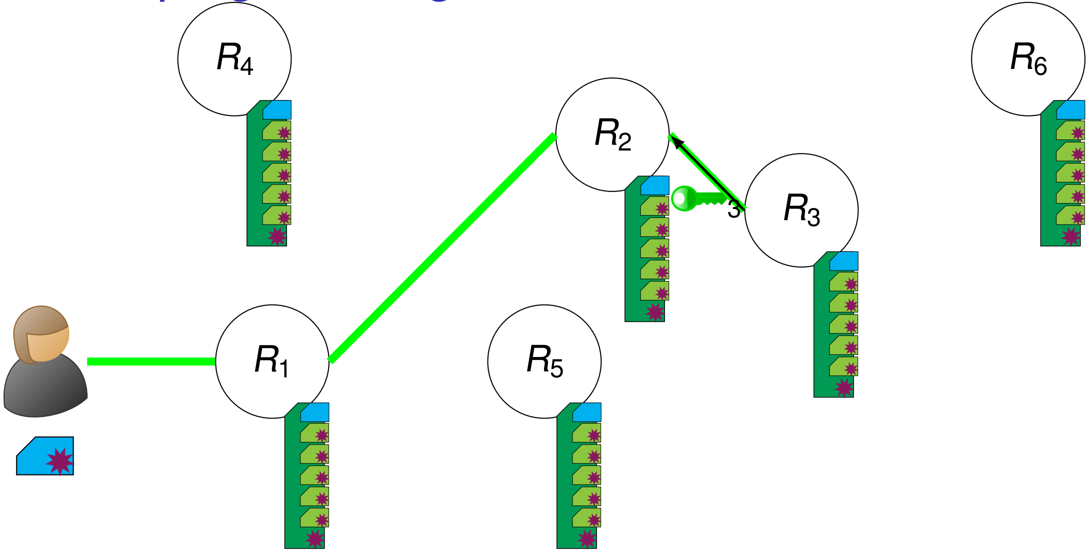

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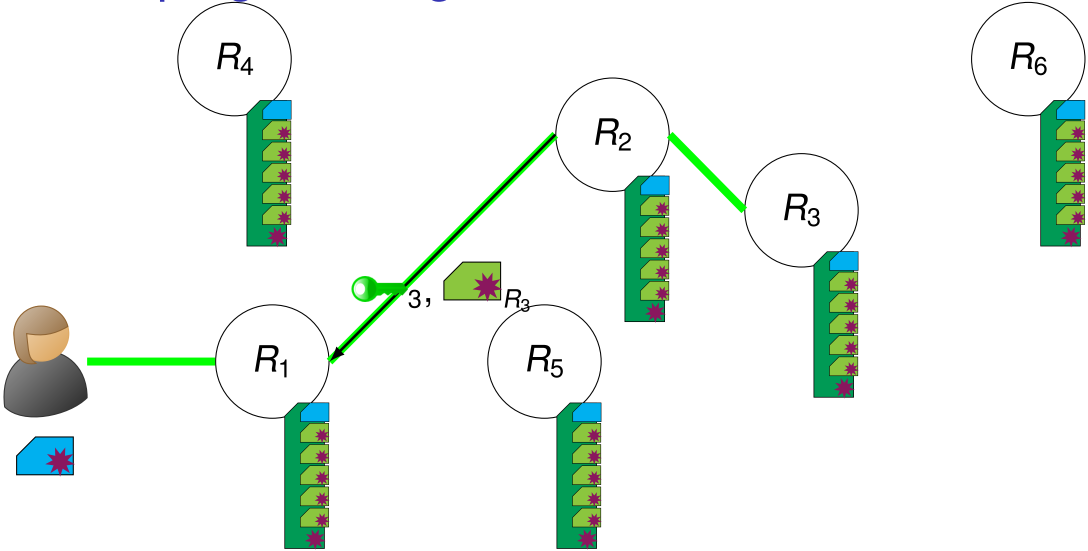

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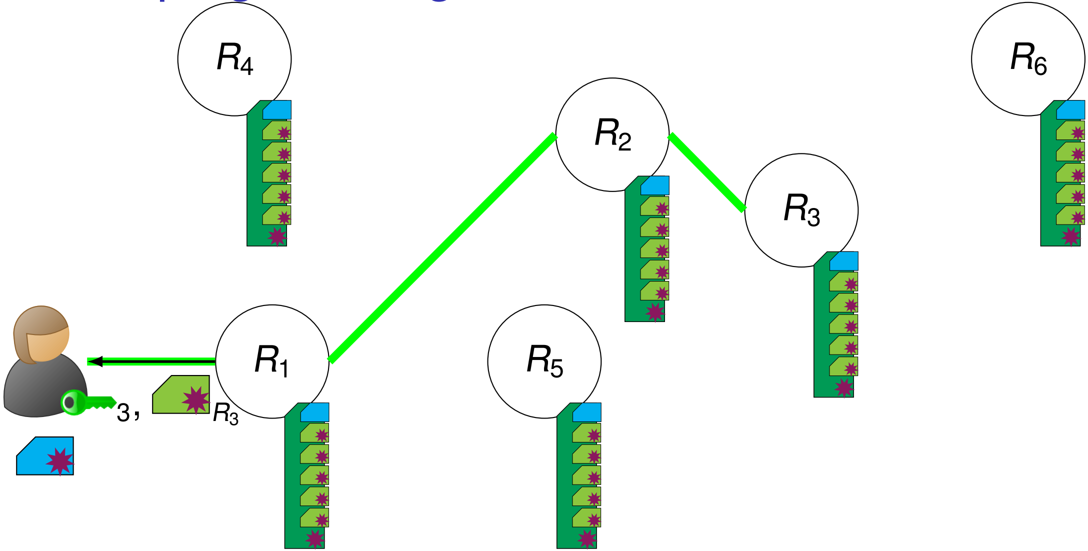

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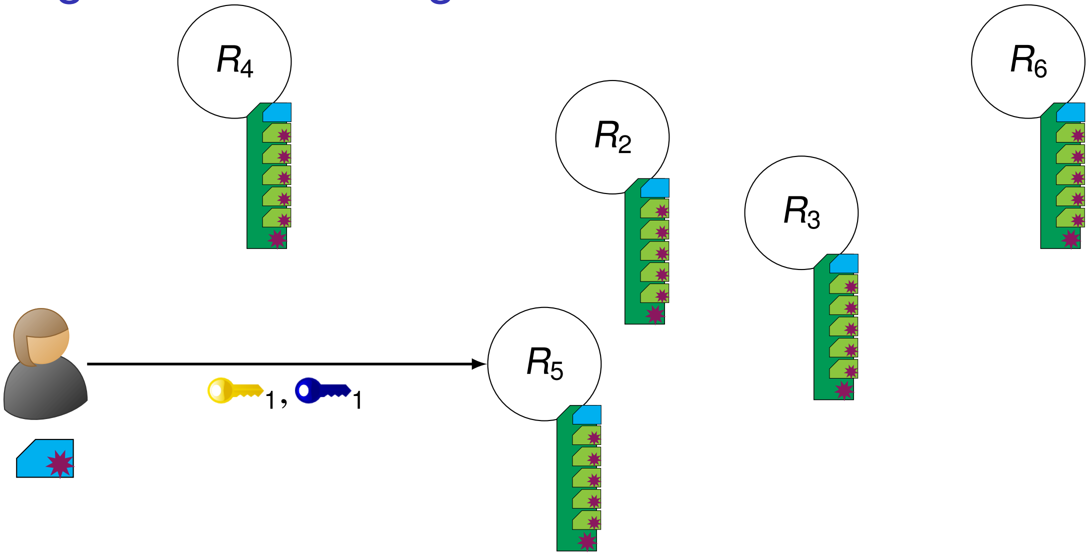

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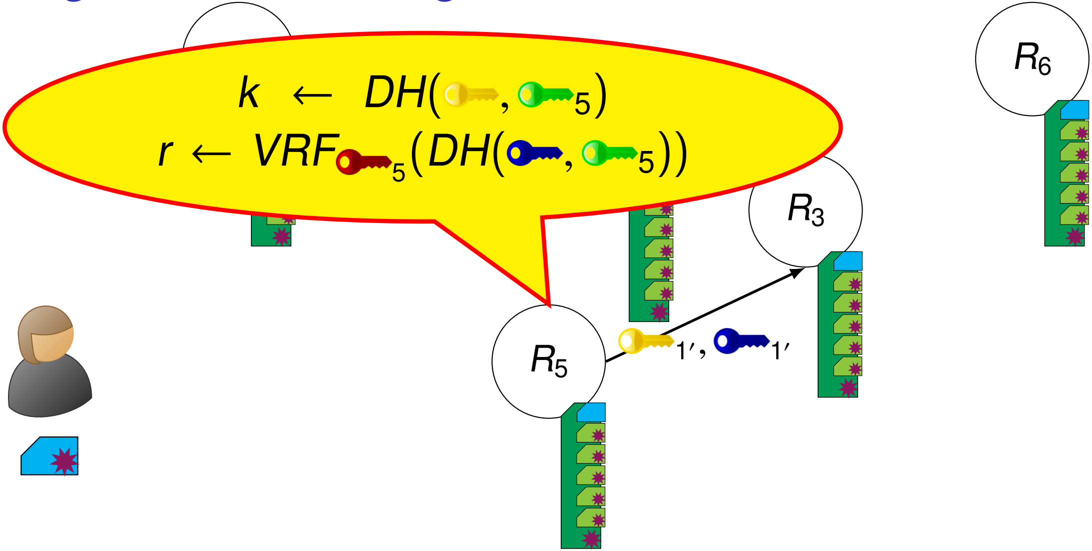

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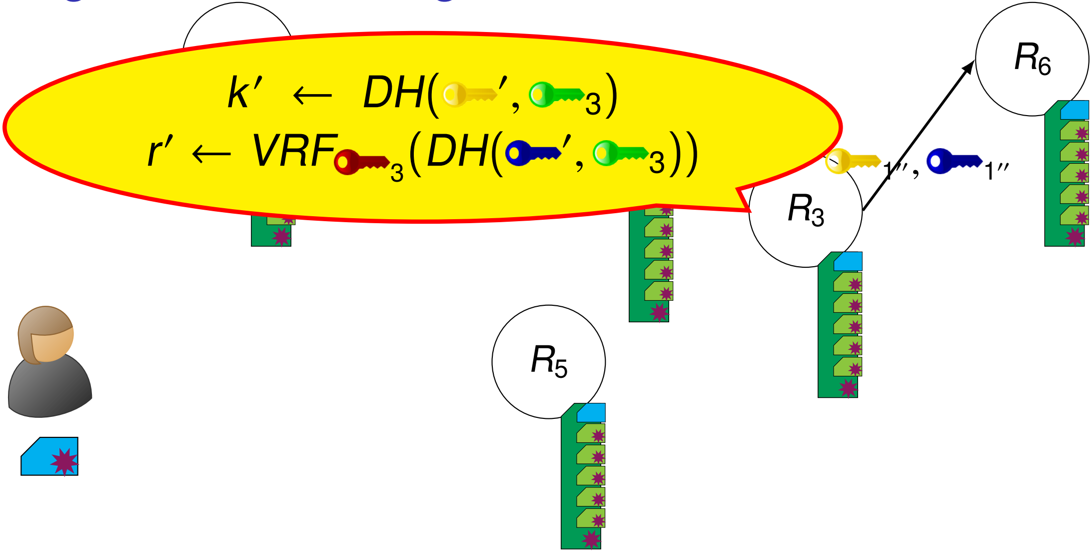

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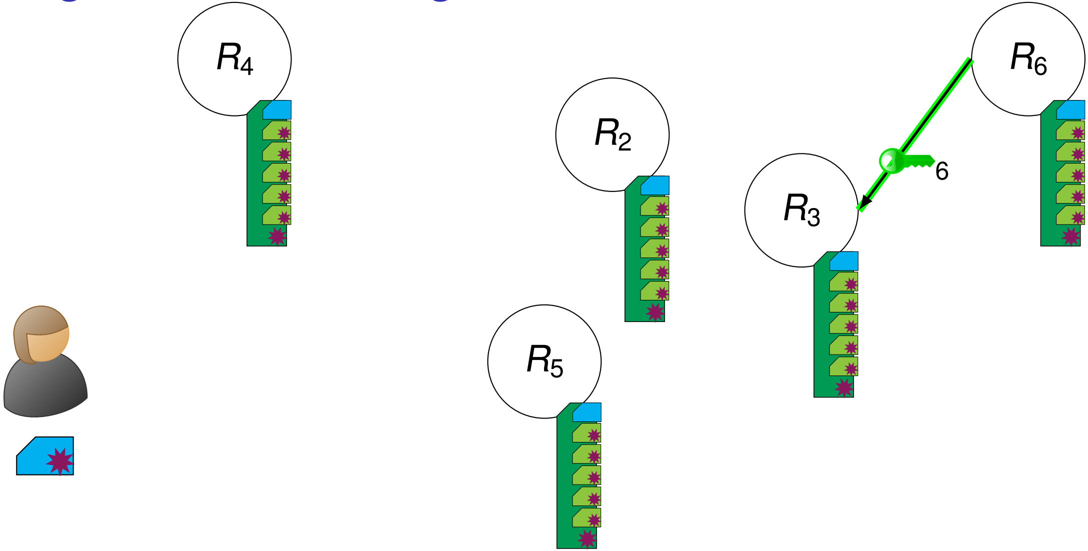

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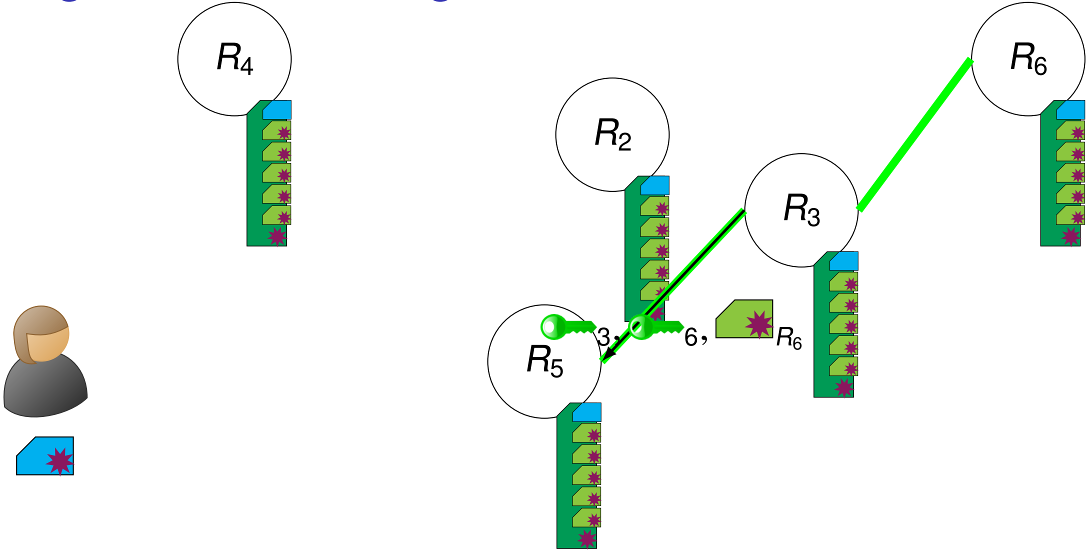

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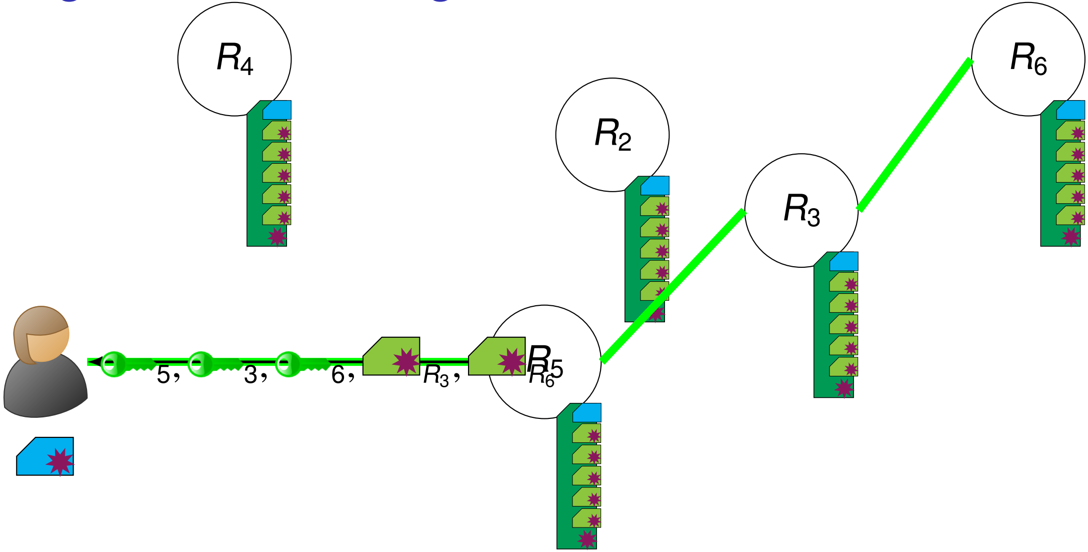
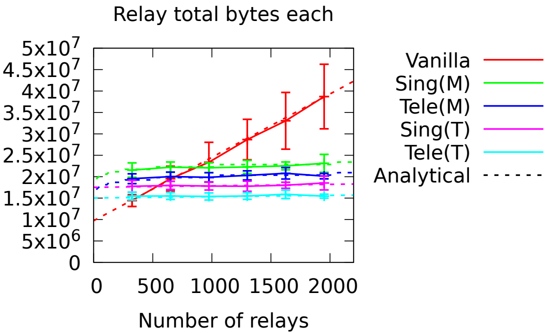
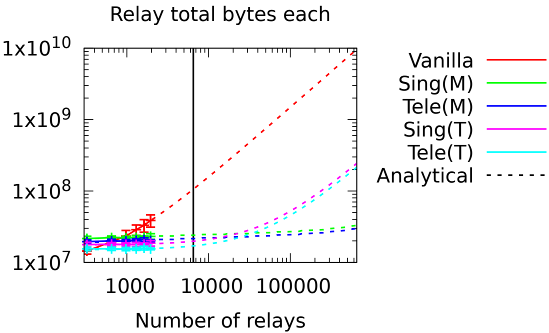


Performance Evaluation

Bandwidth Results for Tor Relays





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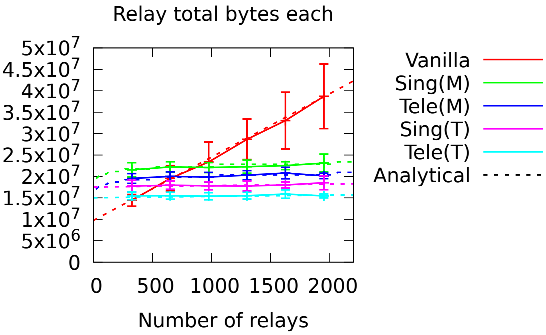

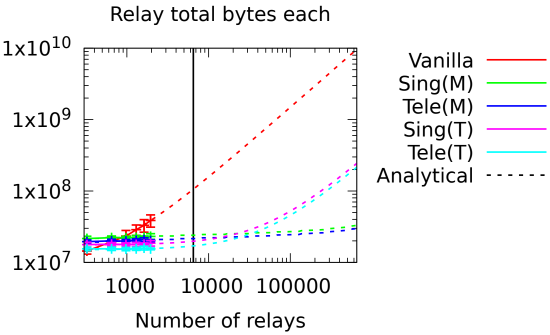

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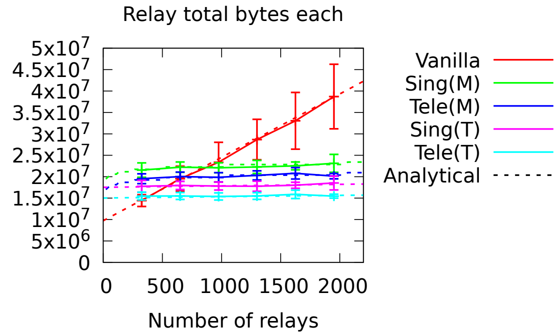

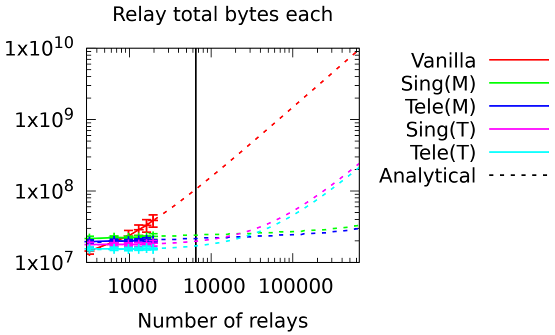

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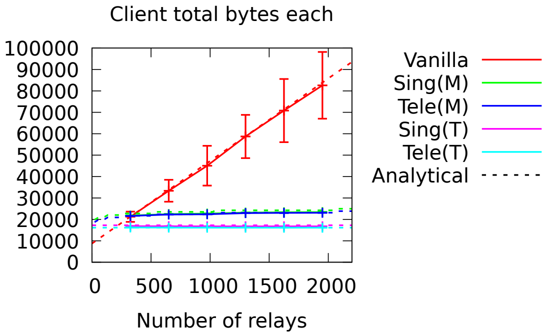
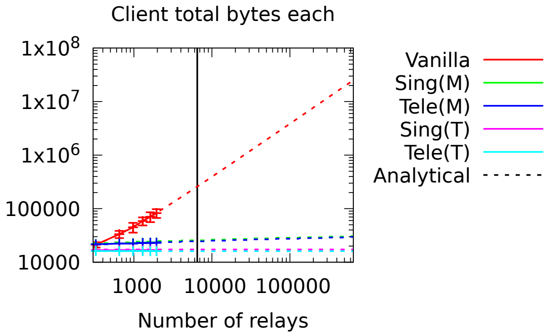
- Improvement of 25–40 times less bandwidth at a network 10 times the size of Tor.

Bandwidth Results for Tor Clients





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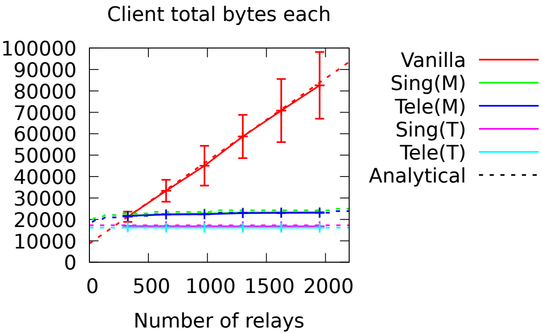

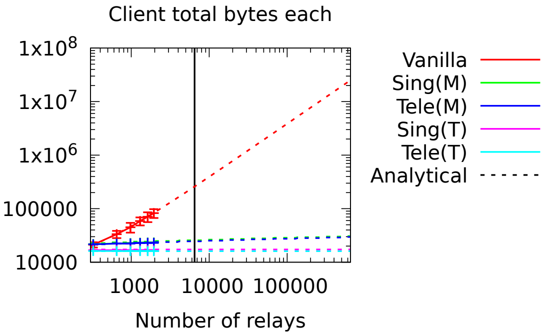

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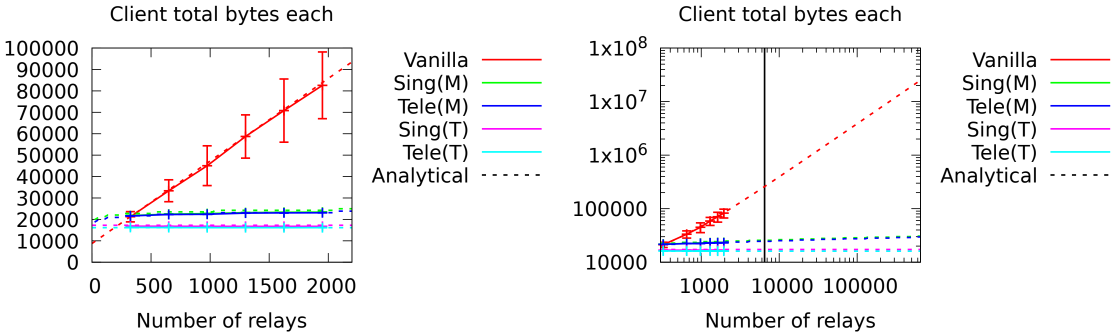

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- In a network 10 times the size of Tor, Walking Onions saves clients 90–150 times the bandwidth over Vanilla.

Takeaways

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Find our paper and artifact at https://crysp.uwaterloo.ca/software/walkingonions

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- Tor has already begun the specification work to integrate Walking Onions into the Tor protocol.

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