Tor

An Overview of the Second-Generation Onion Router

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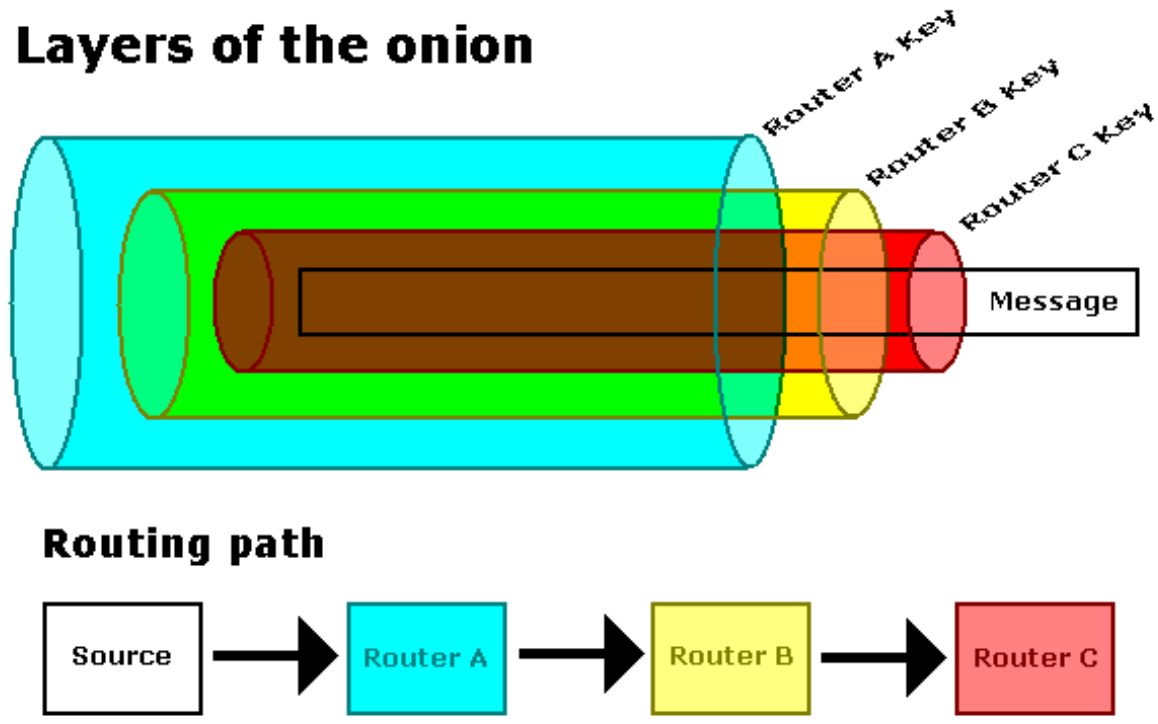
References

[1] Roger Dingledine, Nick Mathewson, and Paul Syverson. Tor: The second-generation onion router. In *Proceedings of the 13th USENIX Security Symposium*, August 2004.

Overview of Onion Routing

- Clients choose a path through the network
- Each node only knows the predecessor and successor nodes



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- Many TCP streams can share one circuit
- Leaky-pipe circuit topology
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- End-to-end integrity checking
- Rendezvous points and hidden services

Design Goals

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  - Simple Design
- Non-goals
  - Not peer-to-peer
  - Not secure against end-to-end attacks
  - No protocol normalization
  - Not steganographic

Tor Design

Overview

- Each onion router (OR) runs as a normal user-level process
- Each OR maintains a TLS connection to every other OR
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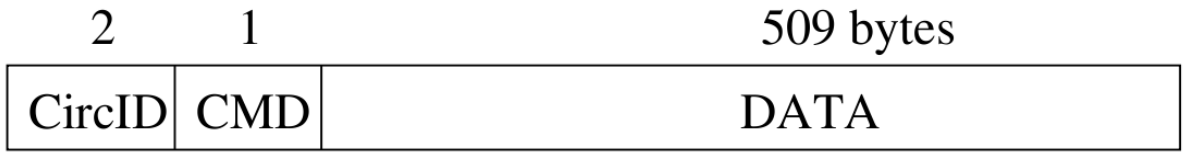
Keys

- Each OR has two keys: identity key and onion key
- Identity key signs TLS certificates and router descriptions
- Directory servers use identity keys to sign directories
- Onion keys used to decrypt circuit setup requests

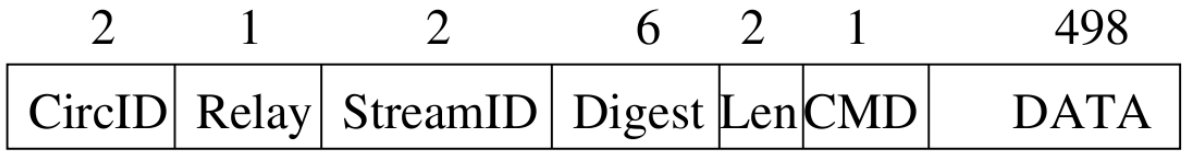
Cells

Cells are the basic unit of communication in Tor.

- “Control” cell:



- “Relay” cell:



Circuits and Streams