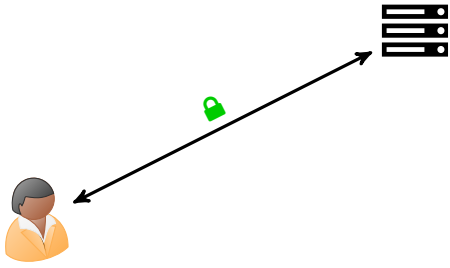
TLS-N: Non-repudiation over TLS
Enabling Ubiquitous Content Signing

Hubert Ritzdorf, **Karl Wüst**, Arthur Gervais, Guillaume Felley, Srdjan Čapkun

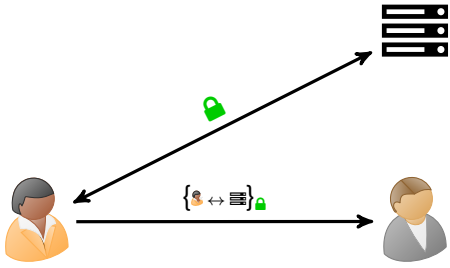
ETH Zurich

TLS

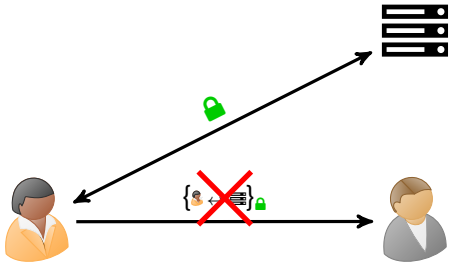
TLS



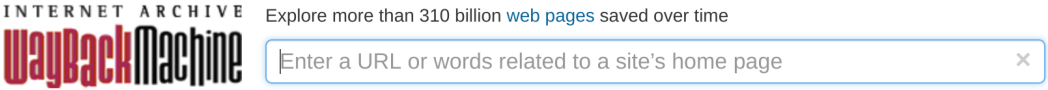
TLS



TLS



Web Archives



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How can we get reliable data into the blockchain?

Blockchain

World

How can we get reliable data into the blockchain?

Blockchain

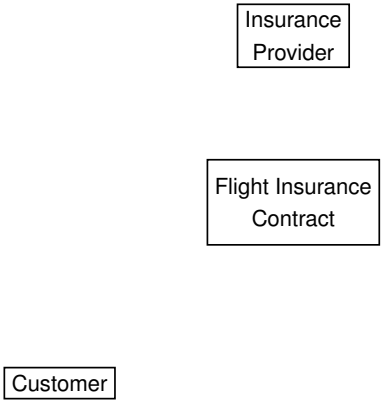
Oracle

World

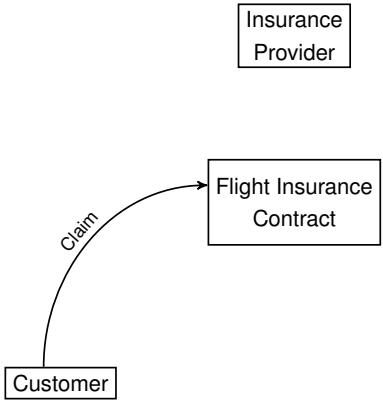
How can we get reliable data into the blockchain?

How can we get reliable data into the blockchain?

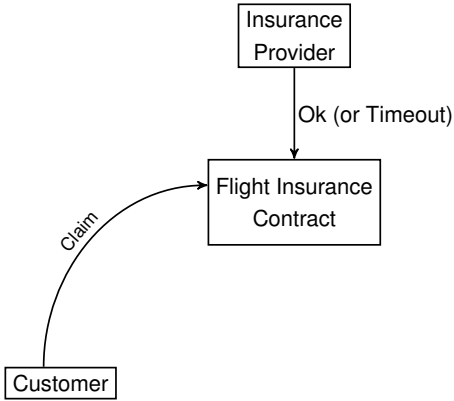
Example: Flight Insurance



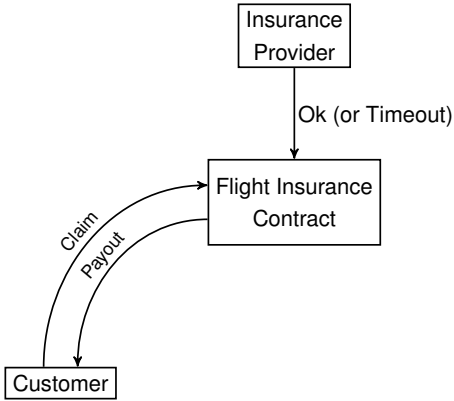
Example: Flight Insurance



Example: Flight Insurance



Example: Flight Insurance



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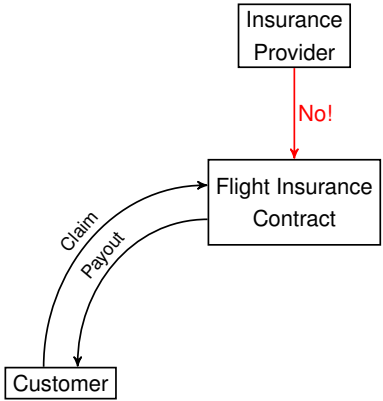
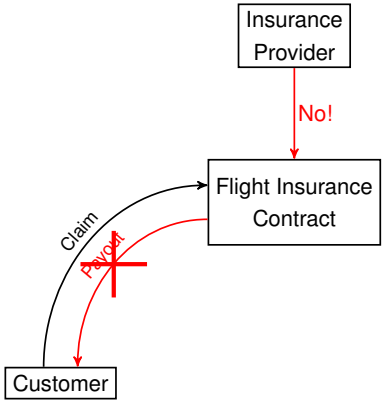


Example: Flight Insurance



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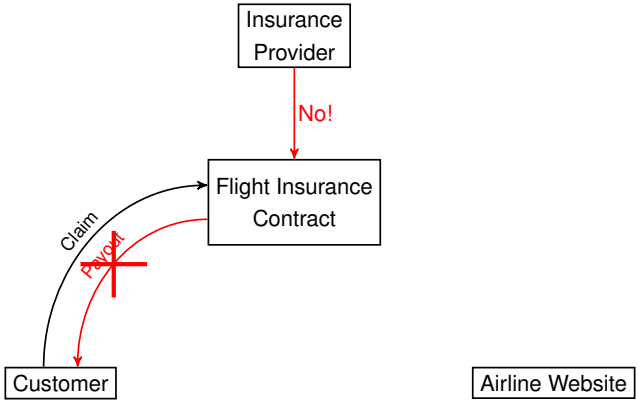

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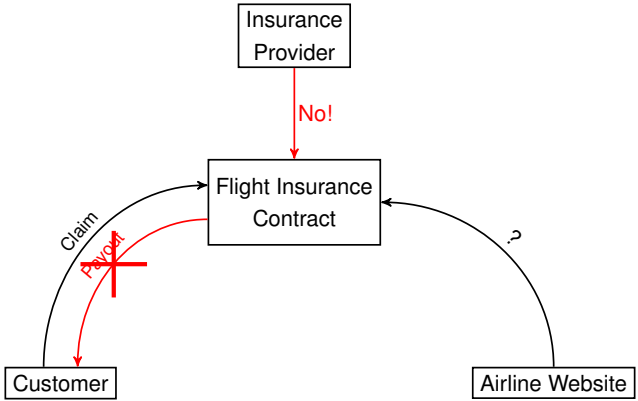
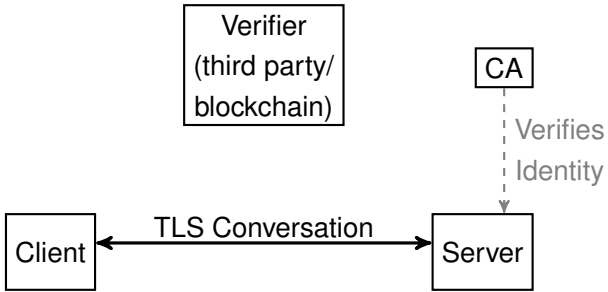


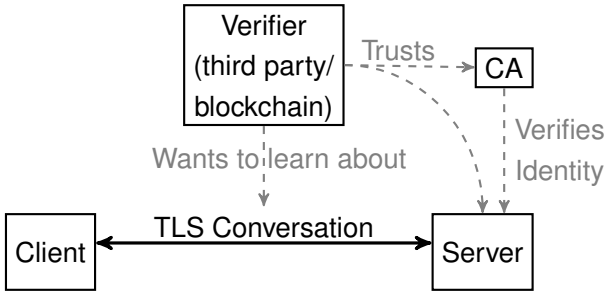
Contributions

- First secure TLS extension for non-repudiation
- Decentralized Blockchain Oracle
- Implementation using the NSS library
- Ethereum library for proof verification

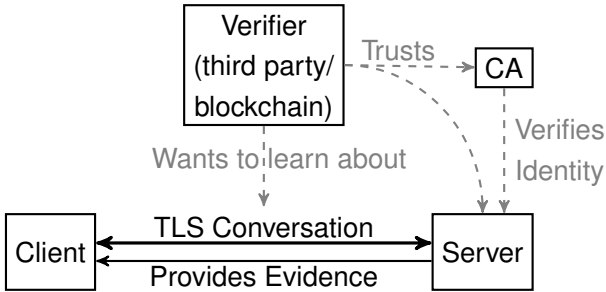
Non-Repudiation for TLS



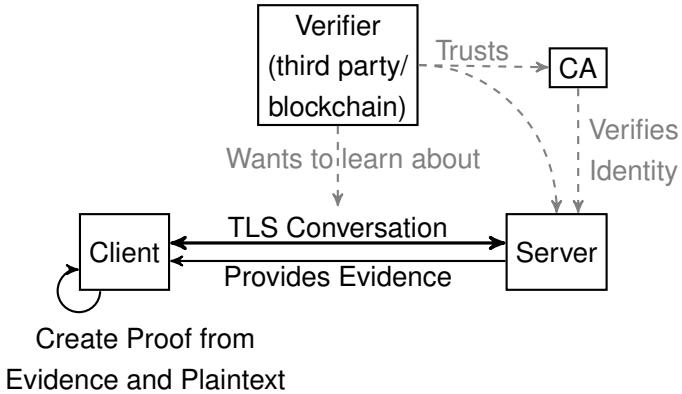
Non-Repudiation for TLS



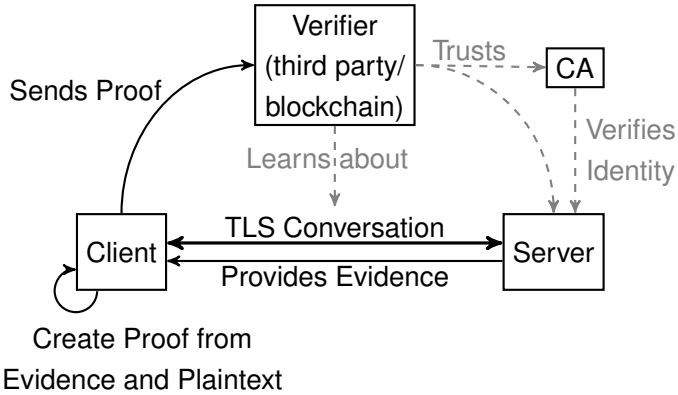
Non-Repudiation for TLS



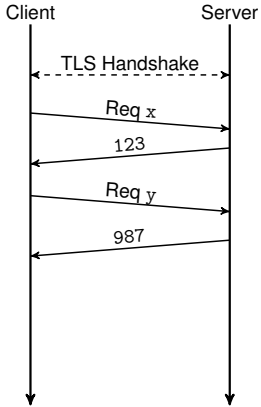
Non-Repudiation for TLS



Non-Repudiation for TLS



TLS-N Overview



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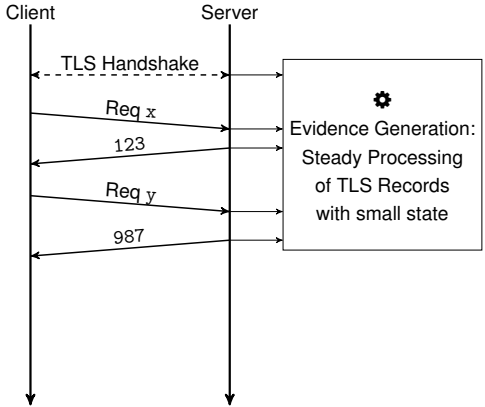
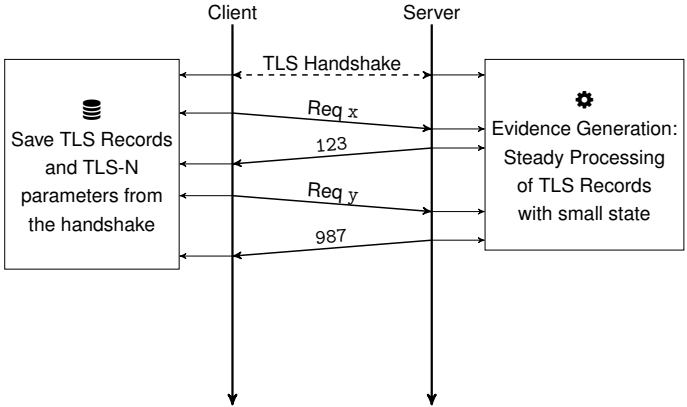


TLS-N Overview



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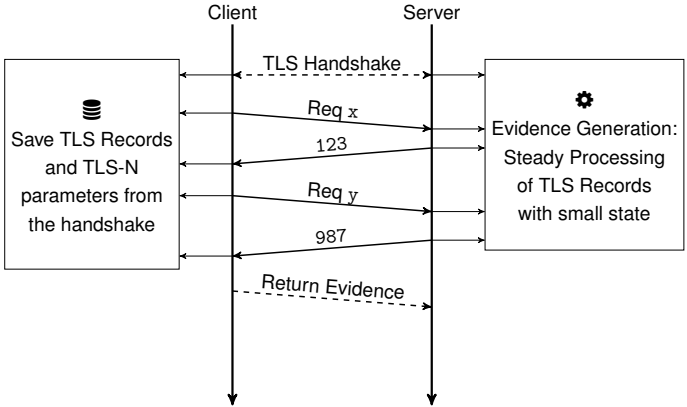

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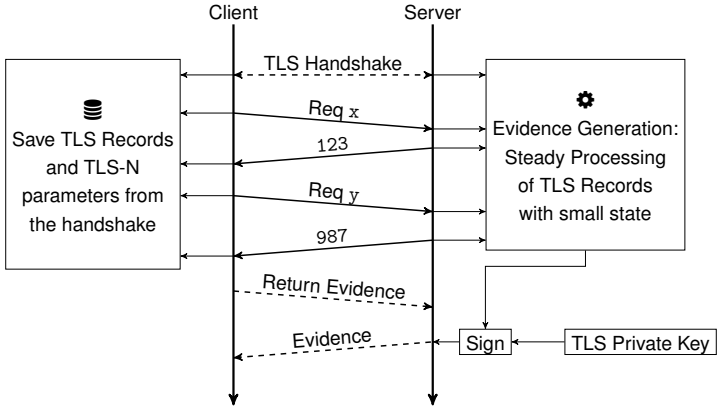

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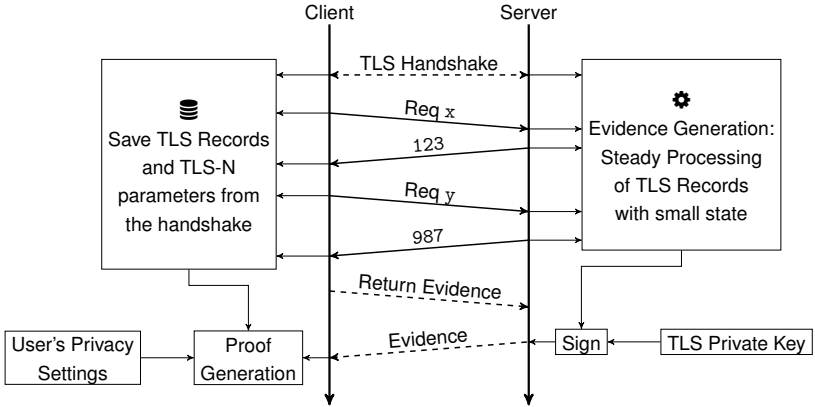
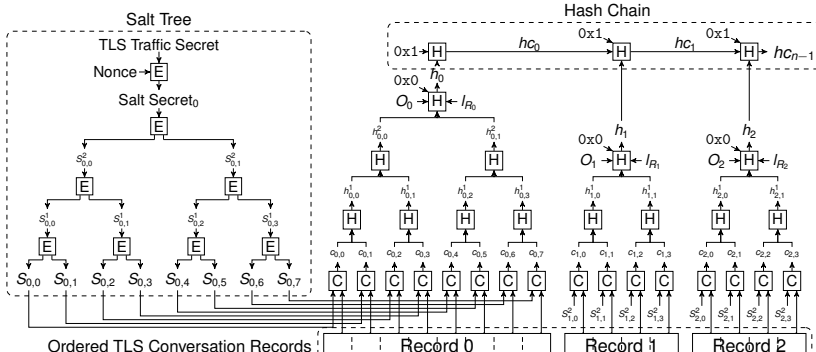


Chunk Level Privacy Protection



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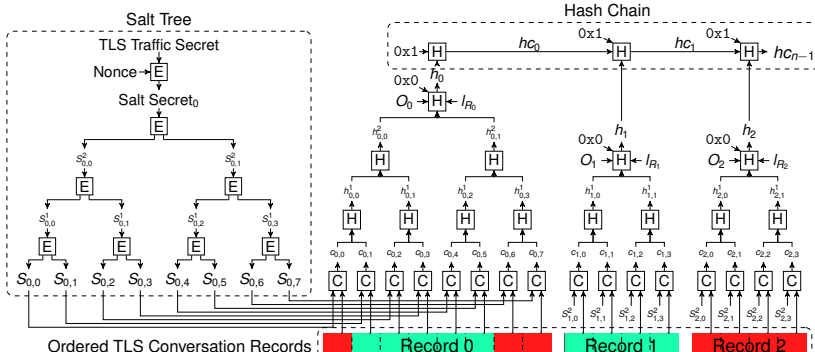

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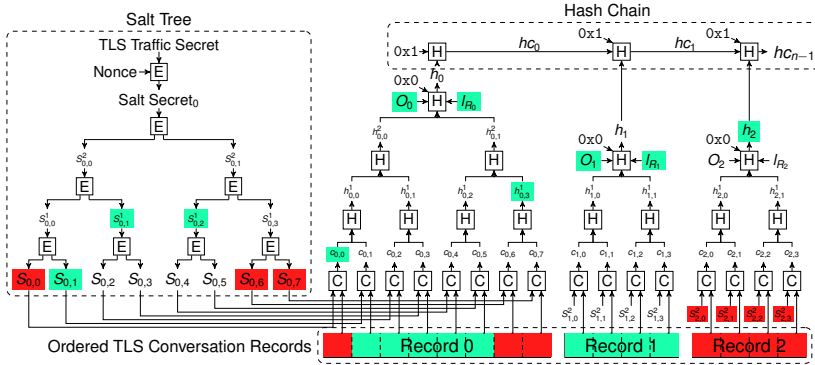
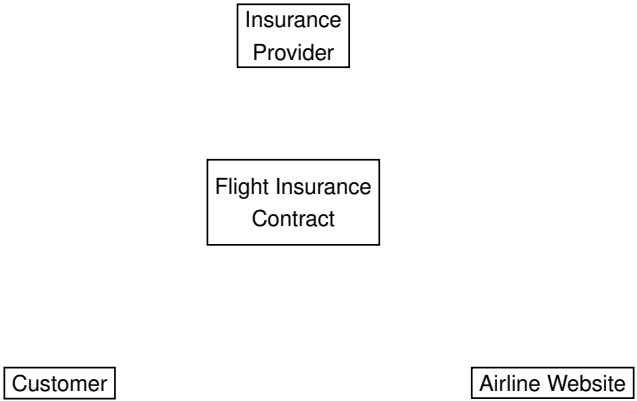


Flight Insurance (1)



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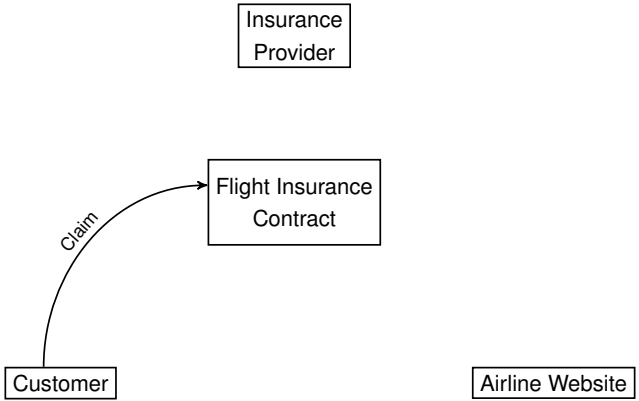

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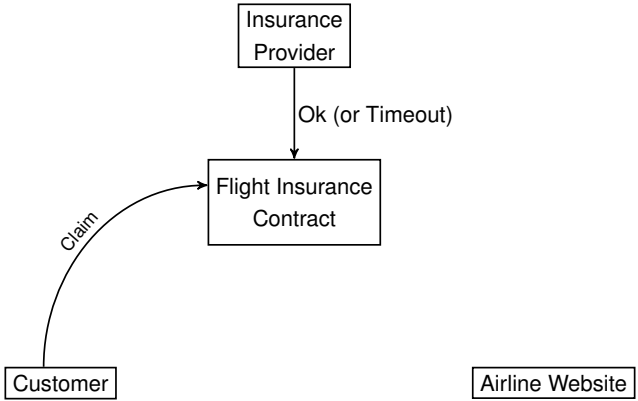

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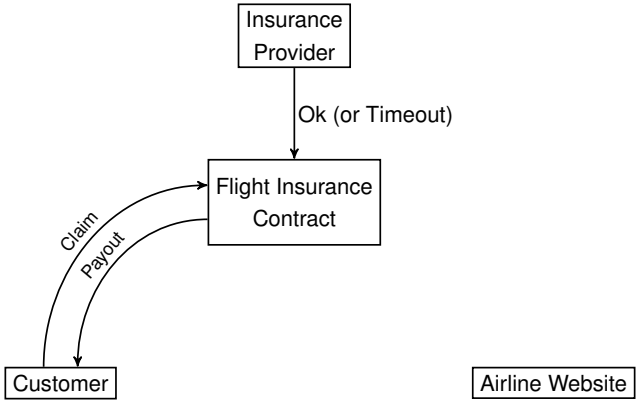

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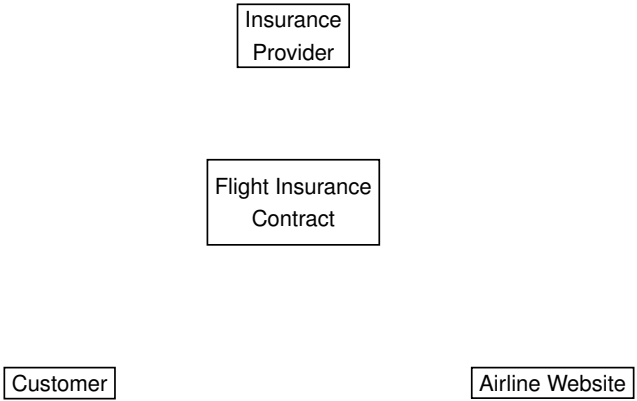

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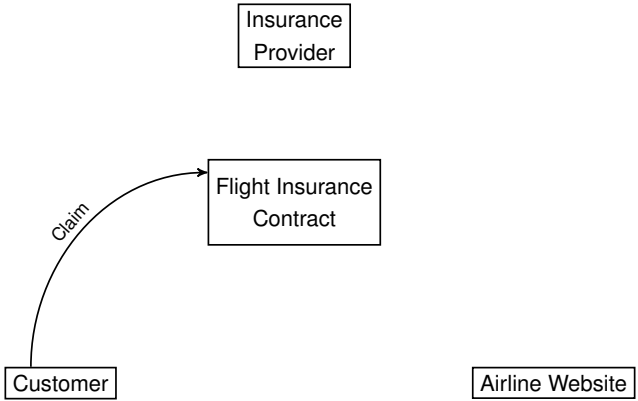

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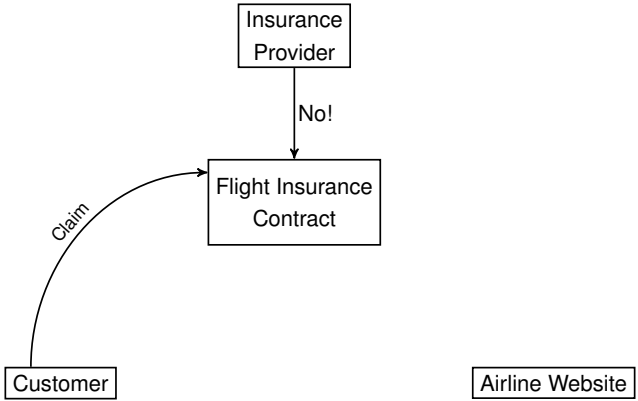

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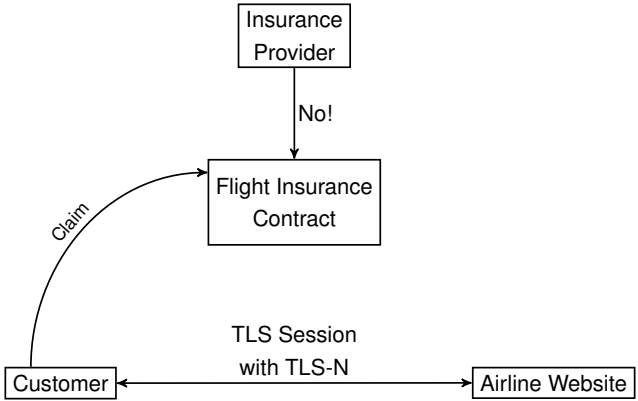

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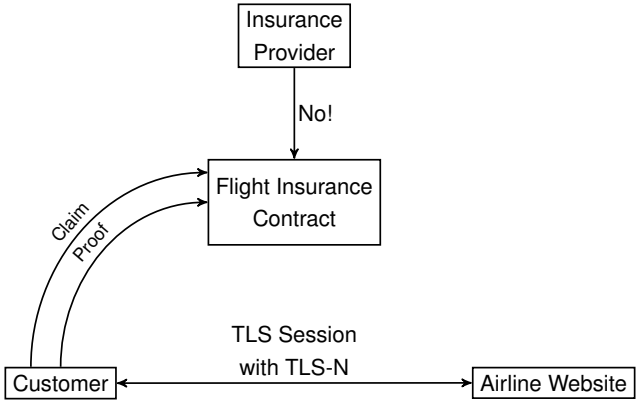

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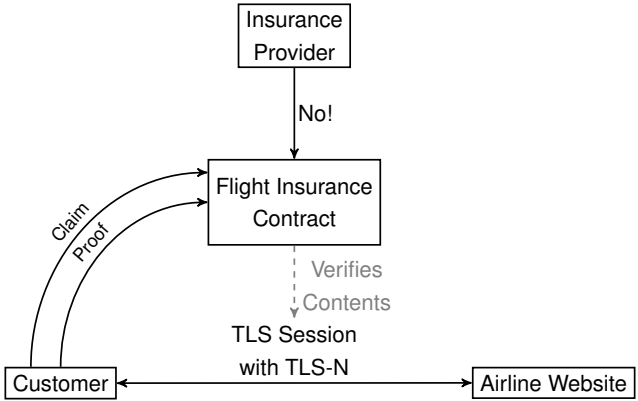

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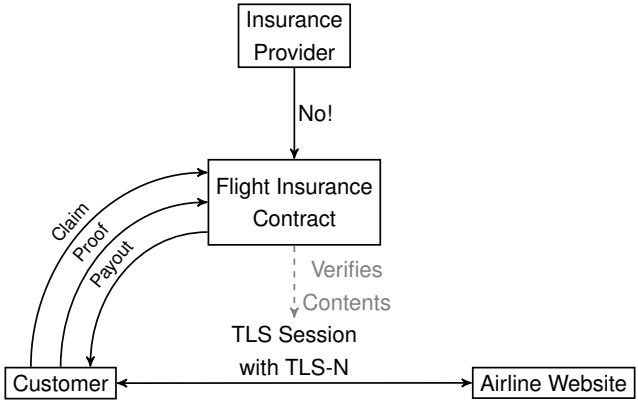

Conclusions

TLS extension for non-repudiation

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- Privacy Preserving

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- Redactions are visible to verifiers

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- Privacy Preserving
- Redactions are visible to verifiers
- Efficient

Conclusions

TLS extension for non-repudiation

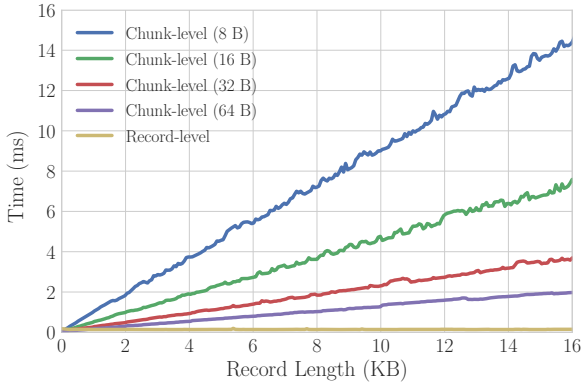
- Privacy Preserving
- Redactions are visible to verifiers
- Efficient
- Acts as decentralized Blockchain Oracle

Try it out: `https://tls-n.org`

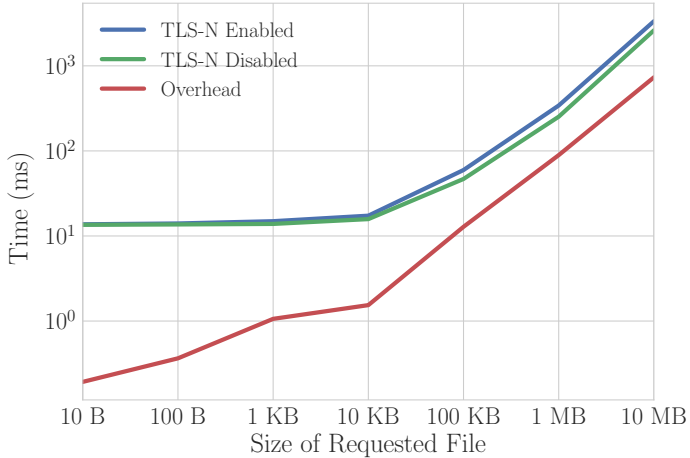
- Interactive Proof Generation
- Code for the TLS extension (NSS library)
- Smart Contract Library
- Example Smart Contract

Questions?

Overhead - Processing Time



Overhead - Requesting a File

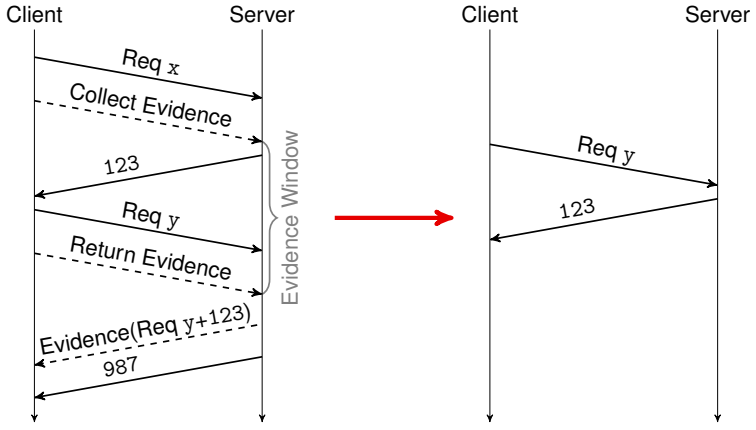


Smart Contract Costs

Costs (2018-01-23)

	Conversation Size			
	1 KB		10 KB	
	secp256r1	secp256k1	secp256r1	secp256k1
Basic Gas	119,758		737,159	
Total Gas	1,284,723	131,286	1,938,872	782,219
Ether	0.0434	0.0044	0.0655	0.0264
USD	41.08	4.20	62.00	25.01

Content Reordering Attack



Privacy

```
GET /me?fields=id&access_token=EAACEdEose0cB...  HTTP/1.1
Host:  graph.facebook.com
```

Privacy

```
GET /me?fields=id&access_token=EAACEdEose0cB...  HTTP/1.1
Host:  graph.facebook.com
```