

# LogPicker

## Strengthening Certificate Transparency Against Covert Adversaries

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@z4lem

## (In)Secure Web Communication



# Secure Communication on the Web

- ▶ HTTPS → default nowadays [4]

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- ▶ Increasing number of illicit certificate creations [10]

# A Tale of Illicit Certificate Creations



[14]

**COMODO**  
Certification Authority

POWERED BY **SECTIGO** [12]



[12]

**digicert**  
[15]







**DigiNotar**  
Internet Trust Services



[9]



# HTTPS Interception Attempts by Governments

1

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
<sup>1</sup>Kazakhstan: [16], Mauritius: [3], Syria: [8], Iran: [17]







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Why should attacker stop here?

<sup>1</sup>Kazakhstan: [16], Mauritius: [3], Syria: [8], Iran: [17]

# A Strong Attack Scenario

**Covert Adversary** [5]<sup>2</sup>

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<sup>2</sup>Aumann & Lindell, 2007

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# A Strong Attack Scenario

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# A Strong Attack Scenario

**Covert Adversary** [5]<sup>2</sup>

**Compelled Certificate Creation** [18]<sup>3</sup>

Attacker succeeds if he can create a rogue certificate that remains unnoticed by domain owner!

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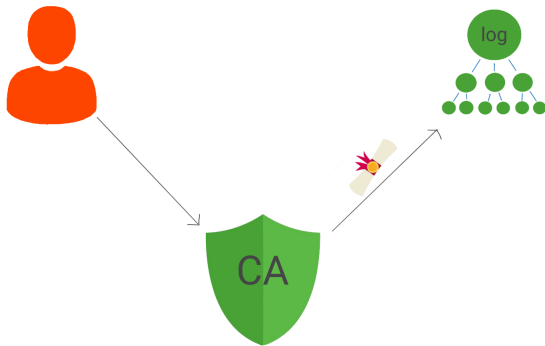
## Public Certificate Creation<sup>4</sup>



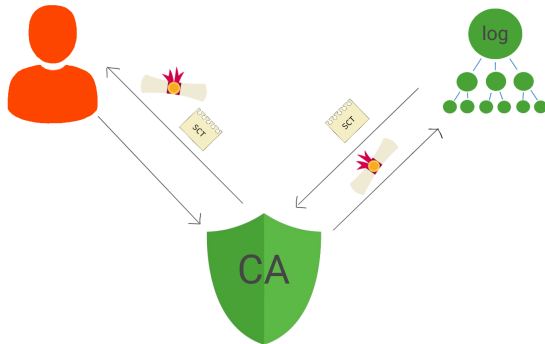
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<sup>4</sup>Laurie, 2012

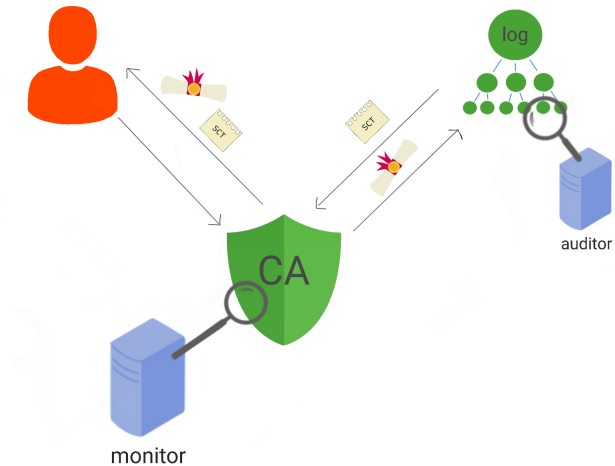
# Certificate Transparency



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# Certificate Transparency is still vulnerable

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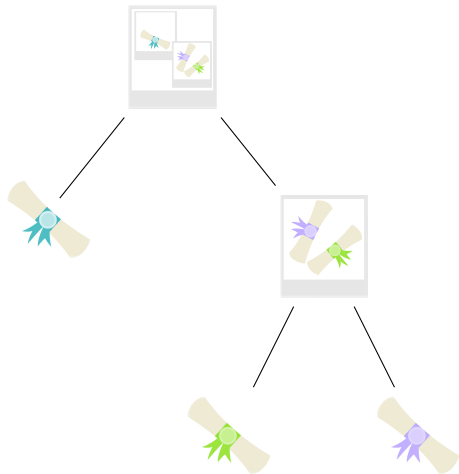
- ▶ All logs belong to CA vendors[1]<sup>5</sup>
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  - Split View attacks possible

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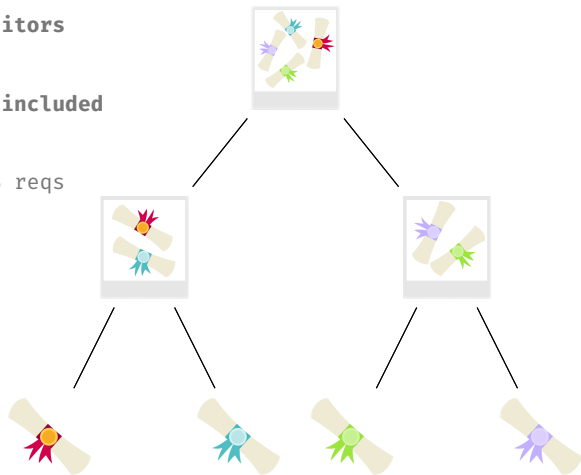
# Split View Attack



- ▶ View served to **monitors**
- ▶ Rogue certificate **excluded**
- ▶ Attack remains undetected

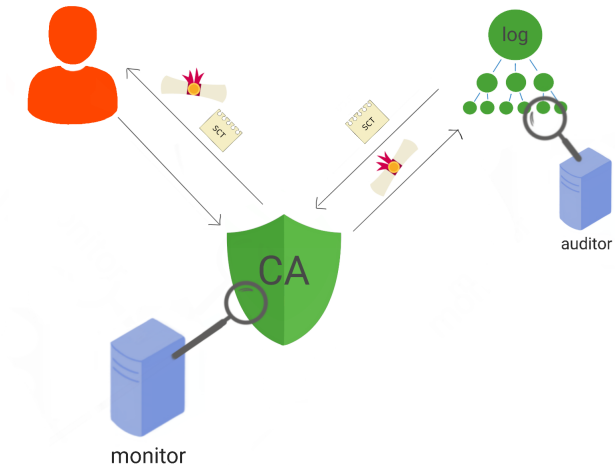
# Split View Attack

- ▶ View served to **auditors**
- ▶ Rogue certificate **included**
- ▶ Violations of CA/B reqs remain undetected



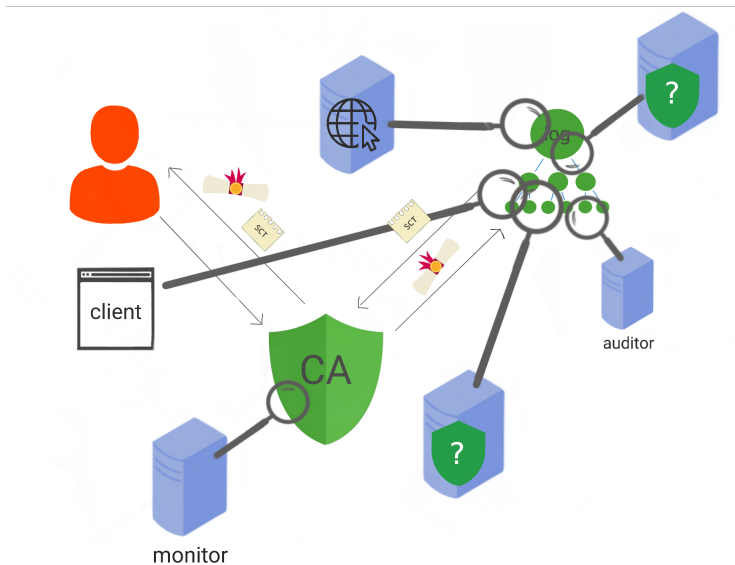


# Certificate Transparency - Reminder on CT

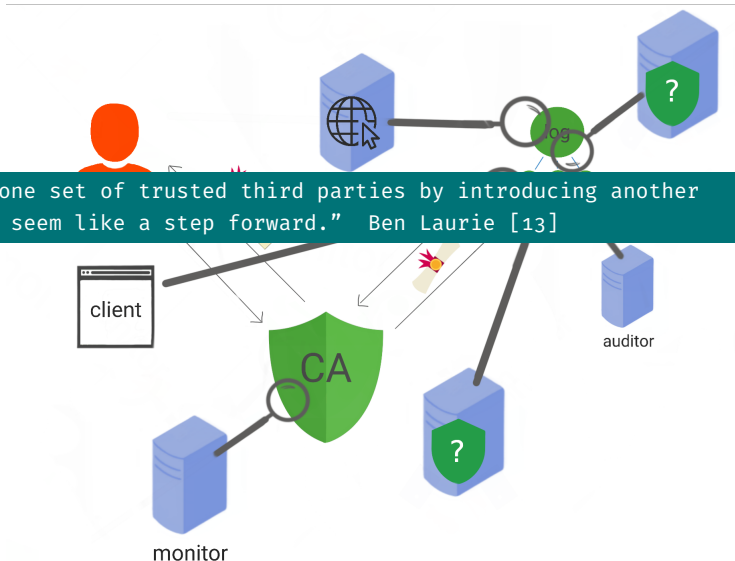




## Further Trusted Parties?



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## LogPicker: A Decentralized Approach



# Desiderata

- ▶ Security Goals

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## ► Security Goals

- Thwarts collaboration of malicious CA/CT logs
- More witnesses to the certificate issuance



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- No change on webserver [19]

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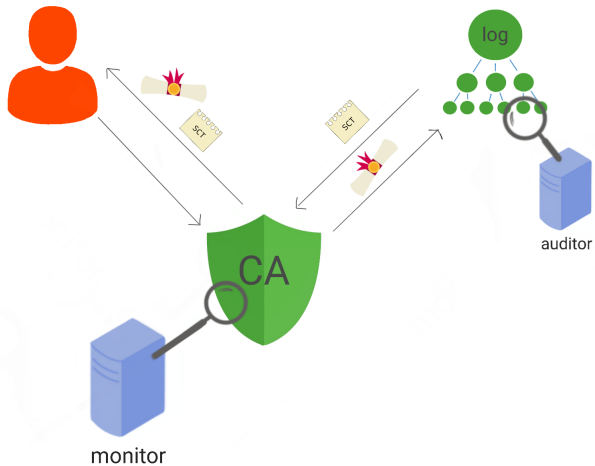
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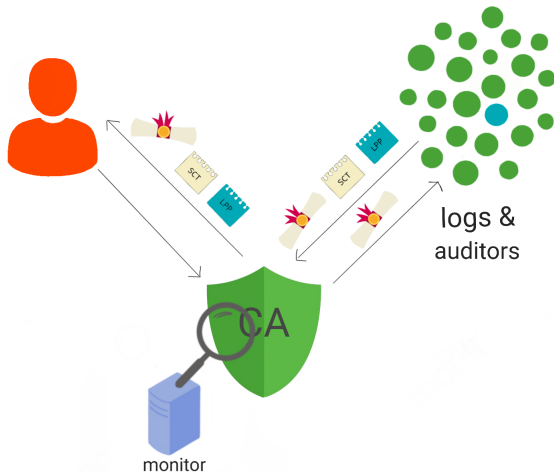
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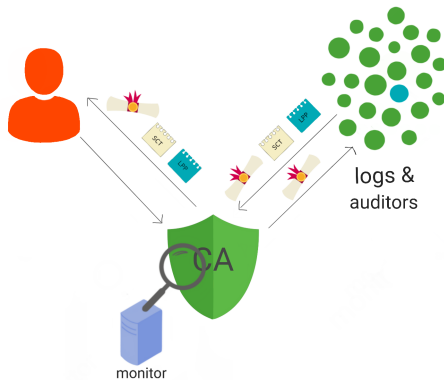




# LogPicker - High Level Overview

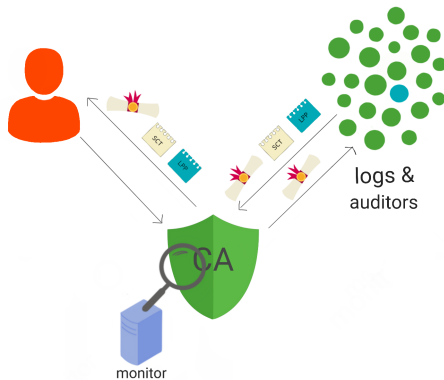


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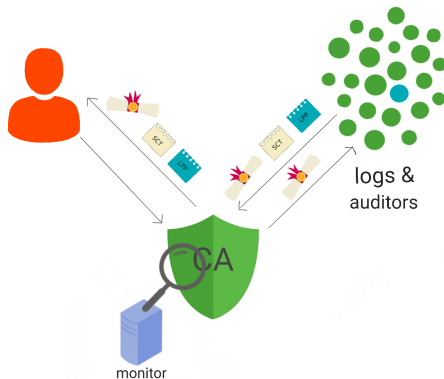
1. CA chooses leader

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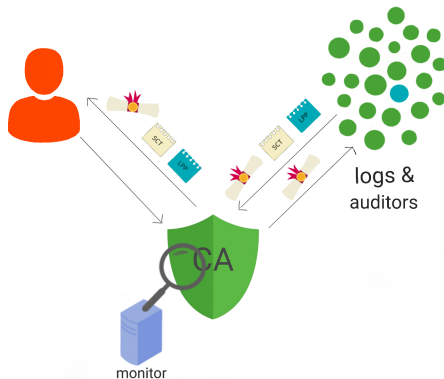
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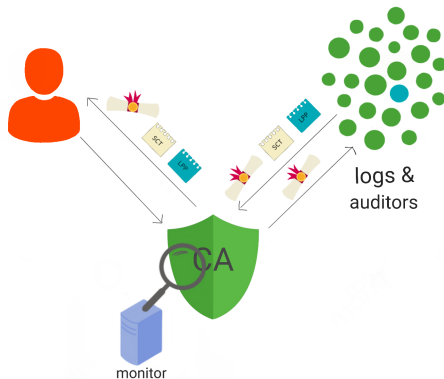
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# LogPicker - High Level Overview



1. CA chooses leader
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3. Pool select one log

4. Each log signs the proof
5. Proof is aggregated & attached to cert

# LogPicker's Achievements

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## Additional paper contribution

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<sup>7</sup><https://logpicker.github.io/>

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- ▶ Protocol goals and crypto primitives

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## Additional paper contribution

- ▶ Protocol goals and crypto primitives
- ▶ Analysis of LogPicker's achievements
- ▶ Probabilistic analysis of correctness
- ▶ Discussion on the policies of CT and LP based PKI
- ▶ Prototyped simulation of LogPicker protocol <sup>7</sup>

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# Outlook


- ? Inclusion of monitors
- ? Interlog auditing
- ? Handling protocol aborts
- ? Revocation's still a nightmare


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