Presentation 5:
Side Channel Attacks

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What & Where & Who & When

All disciplinary incidents reported by school districts in New Mexico to the state's Public Education Department.

Covers the 2010-11 to 2021-22 school years.

Source: ProPublica & New Mexico Public Education Department

Incoming data is noised before entering database

Batches of raw data

Noising at Education Department server

Batches of noised data

Append

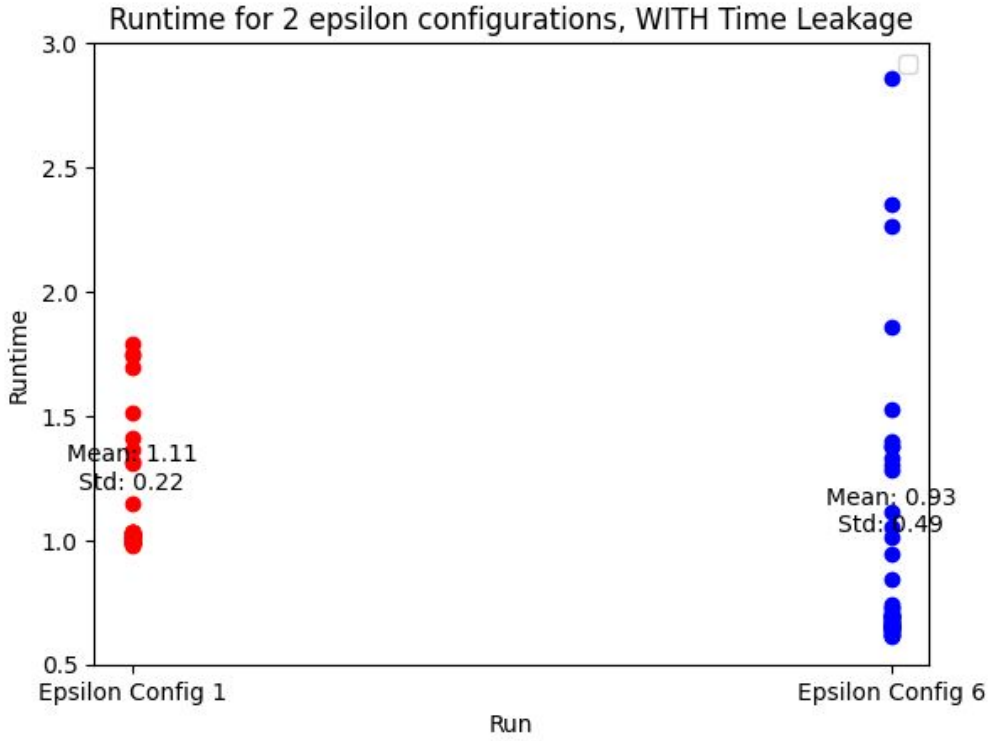
Noised dataset

Attack Venue

Malicious untrusted party can access Edu Dept. system and exploit side channel leakages

Side Channel Attack - Time

Graph of leakage
of 50 runs



Mean: 1.11
Std: 0.22

Mean: 0.93
Std: 0.49

Mitigation Method

Before

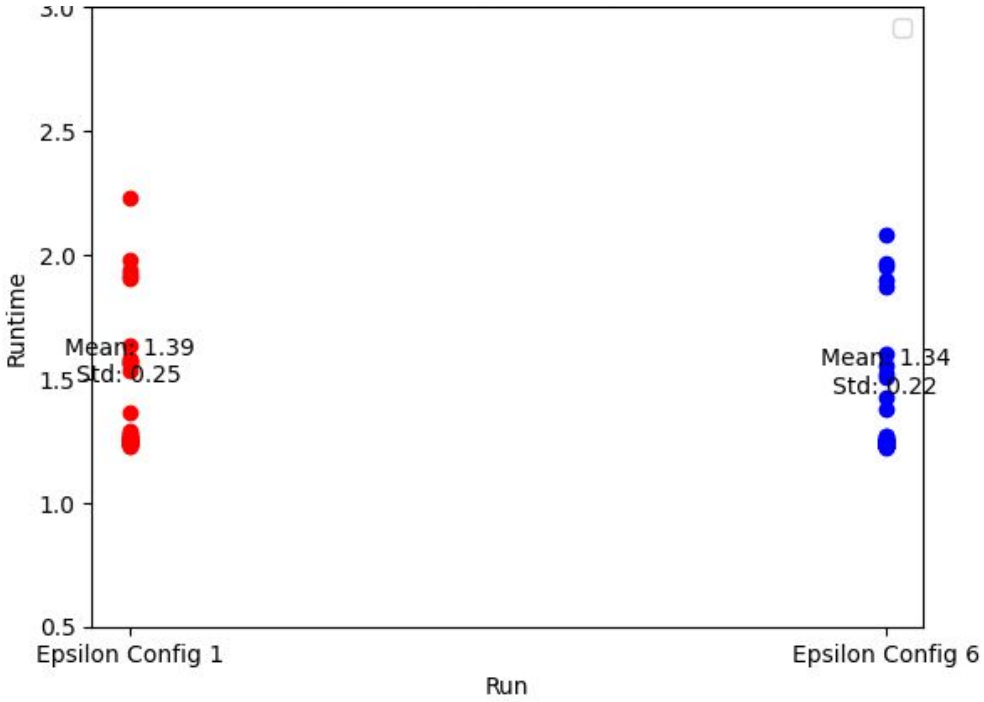
```
# Check if we should flip the value
if random_number <= flip_probability:
    # Flip the value by selecting a random value from known values other than 'x'
    y = random.choice([value for value in X if value != x])
    return y
else:
    # Keep the value x
    return x
```

Improved

```
# Check if we should flip the value
if random_number <= flip_probability:
    # Flip the value by selecting a random value from known_values other than 'x'
    y = random.choice([value for value in X if value != x])
    return y
else:
    y = random.choice([value for value in X if value != x]) # side channel prevention
    # Keep the value x
    return x
```

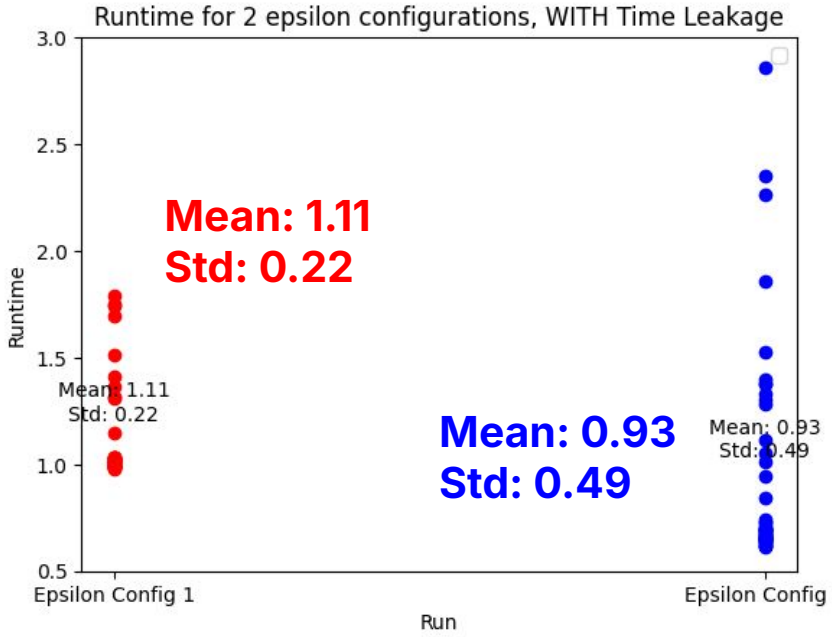
Mitigation Result
of 50 runs

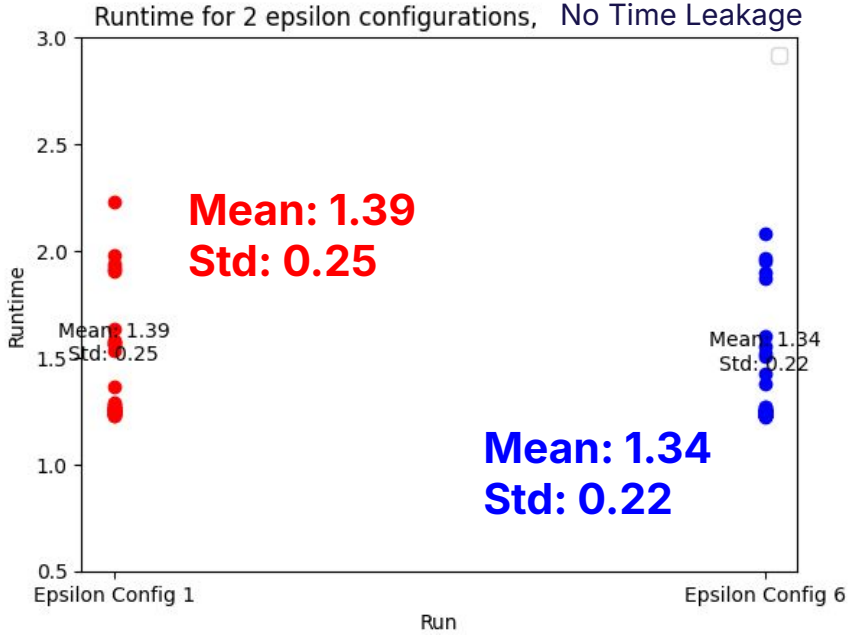
Mean: 1.39
Std: 0.25



Mean: 1.34
Std: 0.22

Before & Improved





Thank you!
Enjoy your summer.

https://ieeexplore.ieee.org/document/9519418

https://arxiv.org/abs/1909.09630

https://arxiv.org/pdf/2111.11534.pdf

Attack Venue 2

Batches of raw data

Noising at Education Department server

Batches of noised data

Append

Skewed Noised dataset

Malicious untrusted party can access School system and sends large batch of data for poisoning attack

Significantly skew distribution of noised dataset, making deduction of true pre-noise distribution possible(???)