Exploring Synergies Between Privacy and Security Enhancing Technologies

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Preliminaries

- This is a sneak peak for a (so far) non public paper

⇒ David Klein, Benny Rolle, Thomas Barber, Manuel Karl, and Martin Johns. "General Data Protection Runtime: Enforcing Transparent GDPR Compliance for Existing Applications". In: *ACM CCS*. To appear. 2023

Preliminaries

- This talk covers privacy and some aspects of GDPR
- Some legal aspects

⇒ I'm not a lawyer!

Preliminaries

Setting:

- User of the software is not an adversary
  - ⇒ Wants to keep software secure
  - ⇒ Wants to comply with GDPR

Security Enhancing Technologies?

Example: Stored Cross-Site Scripting

```
app.post('/subscribe', (req, res) => {
  const email = req.body.email;

  db.saveEmail(email);

  res.send('Subscription successful!');
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app.get('/emails', (req, res) => {
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Read from storage

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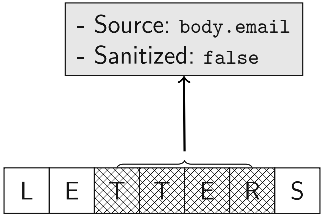

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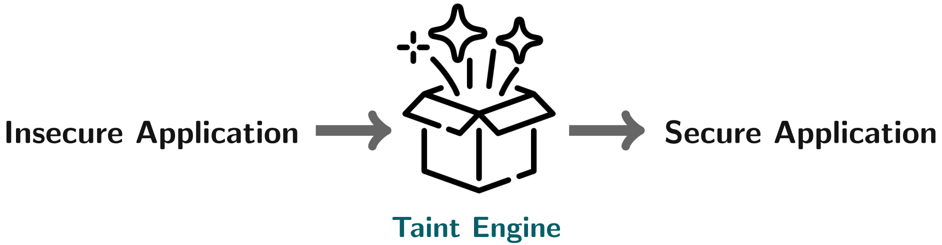

Preventing Stored Cross-Site Scripting

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app.get('/emails', (req, res) => {
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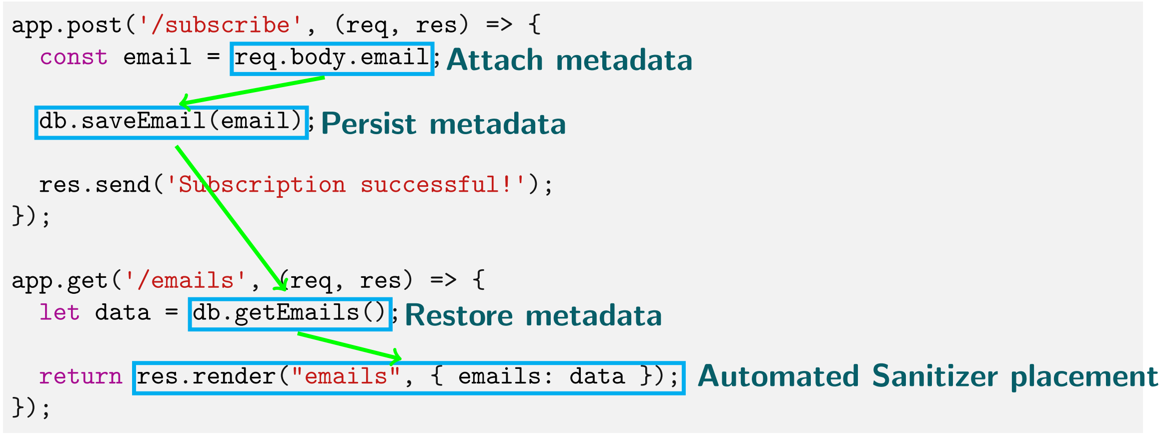
  return res.render("emails", { emails: data }); Automated Sanitizer placement
});
```

Preventing Stored Cross-Site Scripting



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From Security to Privacy

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- If done right, determines what controller can do with PII
  - As seen in Simons talk, great success in the wild 😉

GDPR Violation

```
app.post('/purchase', (req, res) => {
  ...
  const email = req.body.email;
  db.saveOrder( { ...
    email: email,
  });

  res.send('Purchase successful!');
});

// Automated backend
function sendNewsletter() {
  let data = db.getEmails();
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$\boxed{\texttt{req.body.email;}}$ **PII entering application**

GDPR Violation

```
app.post('/purchase', (req, res) => {
  ...
  const email = req.body.email; PII entering application
  db.saveOrder( { ...
    email: email, Storing PII
  });

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Those look fairly similar, right?

STORED XSS DATAFLOW
GDPR VIOLATION DATAFLOW
Corporate needs you to find the differences between this picture and this picture.
They're the same picture.
imgflip.com

Tainting for GDPR Compliance

- Important difference:
  - Deciding whether data flow is “unwanted” is much more involved for privacy
  - Requires more complex metadata

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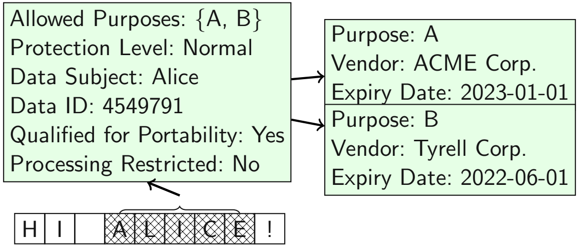

GDPR Taint Metadata

Preventing GDPR Violation

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Attach GDPR metadata

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$\boxed{\texttt{req.body.email;}}$ **Attach GDPR metadata**

$\boxed{\texttt{email: email}}$ **Persist metadata**

Preventing GDPR Violation

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app.post('/purchase', (req, res) => {
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    email: email, Persist metadata
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// Automated backend
function sendNewsletter() {
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  for (let email of data) {
    sendNewsletter(email); Check compliance of data flow
  }
});
```

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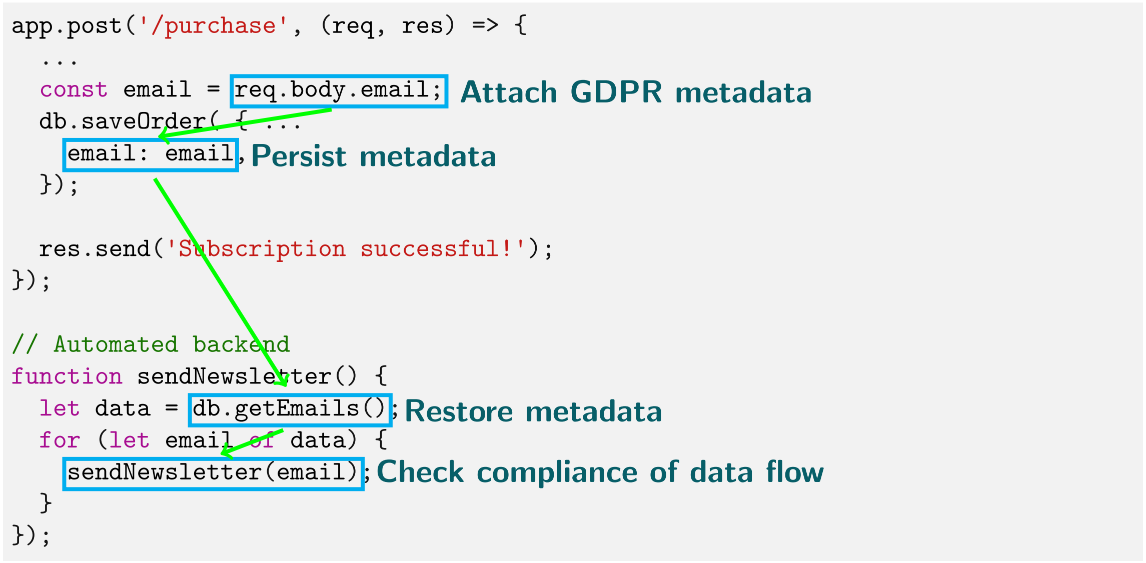

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- Prevents detection and prevention of complex Vulnerabilities

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Solution:

- Rewrite SQL queries on the fly to persist metadata alongside data
- Before:

```
UPDATE a = ? in tbl WHERE id = ?;
```

- After:

```
UPDATE a = ?, a_t = ? in tbl WHERE id = ?;
```

Why don't people use the magic tainting box?

Benchmark	Overhead
avrora	6.8%
batik	11.2%
biojava	104.4%
graphchi	-2.3%
luindex	7.2%
sunflow	-1.2%
zxing	5.6%
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  - Allows to automate e.g., Subject Access Requests

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⇒ **Security and Privacy despite Design**

- What's the maximum overhead for people to apply tainting in production?

Thank you for your attention!

TESTABLE

CASA
CYBER SECURITY IN THE AGE OF LARGE-SCALE ADVERSARIES

Contact

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