Web 2.0

Lecture 4: Accessing and Utilizing Services

Ing. Milan Dojčinovski, Ph.D.
milan.dojcinovski@fit.cvut.cz • @m1ci • http://dojchinovski.mk

Czech Technical University in Prague
Faculty of Information Technologies • Software and Web Engineering • https://courses.fit.cvut.cz/MI-W20/

Modified: Mon Mar 15 2021, 12:02:21
Humla v0.3

Overview

- Mashups and XHR
- Security Mechanisms
- JSON and JSONP

Mashups

- Web application hybrid/Web 2.0 application
  - *Uses APIs of two or more applications to provide new value-added functionality*
- Types
  - *Data mashup – integration/aggregation of data (read only)*
  - *Service mashup – more sophisticated workflows (read, write)*
  - *Visualization – involves UI, e.g., third-party data displayed on the Google map*
- Client-Server View
  - *client-side mashups (mainly in a browser)*
    - *→ JavaScript, Dynamic HTML, AJAX, JSON/JSONP*
  - *server-side mashups*
    - *→ server-side integration of services and data*
    - *→ third-party programming languages*
    - *→ specialized environments: Google AppsScript*
- Web Apps developments will all be about mashups!

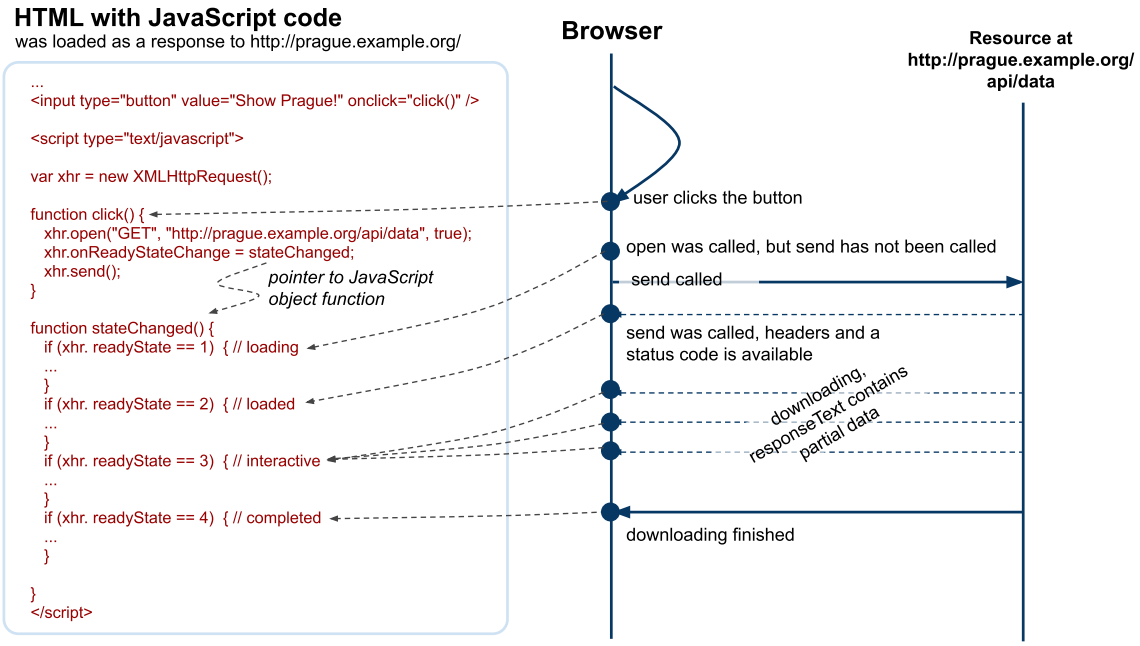
XMLHttpRequest (XHR)

- Interface to utilize HTTP protocol in JavaScript
  - *standardized by Web Applications WG at W3C*
  - *basis for AJAX*
    - *→ Asynchronous JavaScript and XML*
- Typical usage
  1. *Browser loads a page that includes a script*
  2. *User clicks on a HTML element*
     - *it triggers a JavaScript function*
  3. *The function invokes a service through XHR*
     - *same origin policy, cross-origin resource sharing*
  4. *The function receives data and modifies HTML in the page*

XHR Interface – Key Methods and Properties

- Method and properties of XHR object
  - open, *opens the request, parameters:*
    - method – *method to be used (e.g. GET, PUT, POST),*
    - url – *url of the resource,*
    - asynch – *true to make asynchronous call,*
    - user, pass – *credentials for authentication.*
  - onReadyStateChange – *JavaScript function object, it is called when* readyState *changes (uninitialized, loading, loaded, interactive, completed).*
  - send, abort – *sends or aborts the request (for asynchronous calls)*
  - status, statusText – *HTTP status code and a corresponding text.*
  - responseText, responseXML – *response as text or as a DOM document (if possible).*
  - onload – *event listener to support server push.*
- See XMLHttRequest (W3C), or XMLHttRequest (Mozilla reference) for a complete reference.

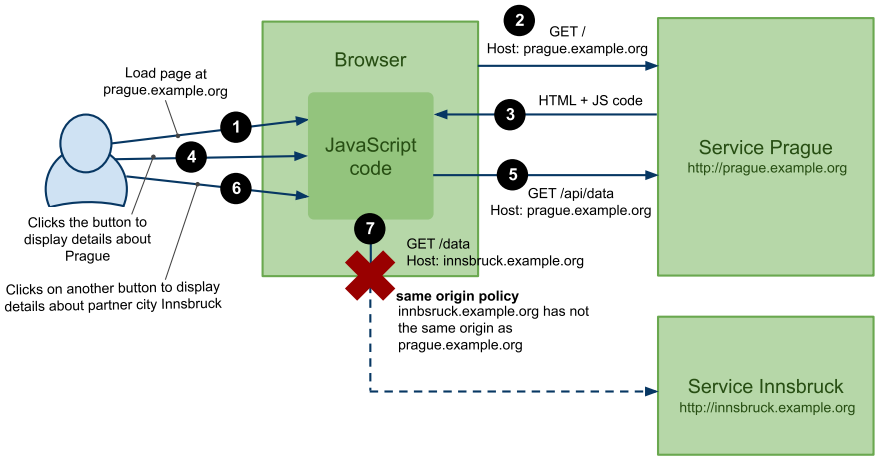
How XHR works



Overview

- Mashups and XHR
- Security Mechanisms
  - *Scripting Attacks*
  - *Cross-origin Resource Sharing Protocol (CORS)*
- JSON and JSONP

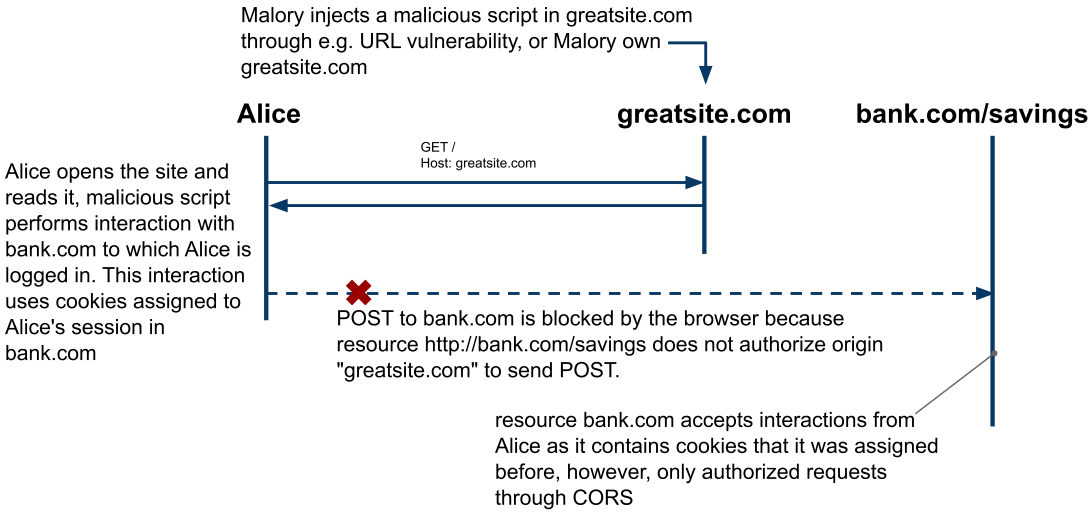
Same Origin Policy



- JavaScript code can only access resources on the same domain
  - *XHR to GET, POST, PUT, UPDATE, DELETE*
  - *Browsers apply **same origin policy***
- Solutions
  - *JSON and JSONP (GET only)*
  - *Cross-origin Resource Sharing Protocol (CORS)*

Why Same Origin Policy?

- Without the same origin policy, the following POST would be possible



Overview

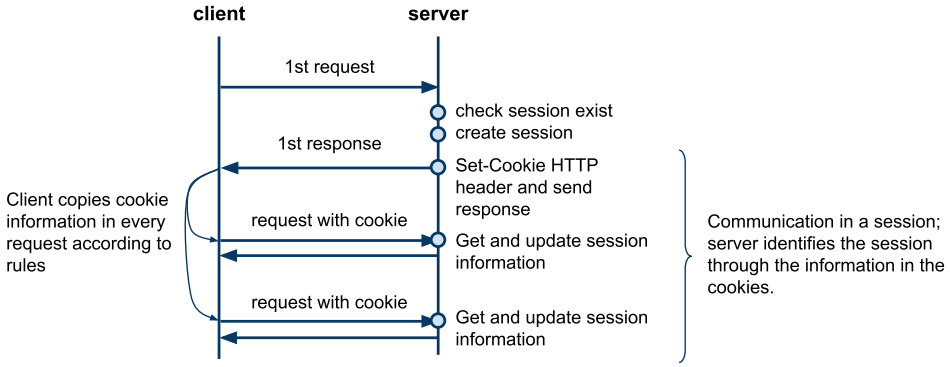
- Mashups and XHR
- Security Mechanisms
  - *Scripting Attacks*
  - *Cross-origin Resource Sharing Protocol (CORS)*
- JSON and JSONP

Overview

- Scripting Attacks
  - *Intruders make users perform action that has side effects on their resources*
  - *Intruders inject malicious code to Web pages*
- Roles in Security Scenarios
  - *Alice, Bob*
    - → *Normal users, usually Alices wants to send a message to Bob or Alice accesses a Bob's site.*
  - *Eve*
    - → *A user with bad intentions, usually a passive attacker.*
  - *Mallory*
    - → *An active attacker, usually sends a link to a page with malicious code.*

Recall: State management in HTTP

- Request-response interaction with cookies
  - *Session is a logical channel maintained by the server*



- Stateful Server
  - *Server remembers the session information in a server memory*
  - *Server memory is a non-persistent storage, when server restarts the memory content is lost!*

Cross-site Request Forgery (CSRF)

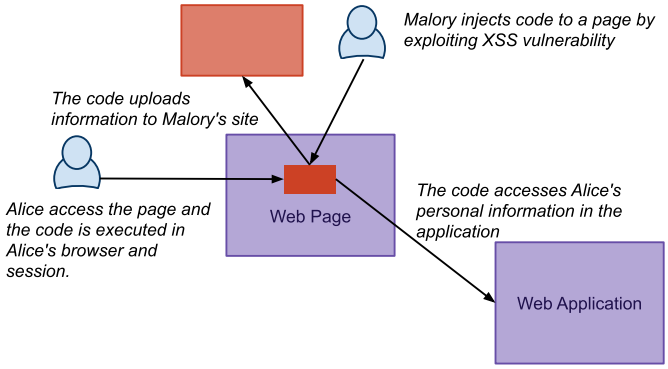
- Exploits a trust of a website in a user's browser
- Scenario
  1. *Mallory sends a link to Alice (in an email, in a chat, etc.)*
     - *The link points to a page that has HTML code with hrefs to Alice's private resources*
     - *For example, to perform an action on Alice's account, it is possible to use* img *like this:*

```
1 | <img src="https://bank.com/account?do=transfer_money&amount=50000"
```

  2. *Alice loads the page in her browser*
     - *Alice is authenticated to the bank's website, the browser sends Alice's authentication cookies with the request.*
- Issues and Prevention
  - *The bank site vilotes REST, i.e. overloading of GET for making actions*
  - *The bank should check HTTP* referer *header*
  - *It is a "blind" attack, Mallory does not see the result*
  - *To perform POST, current browsers today use CORS protocol*

Cross-site Scripting Attack (XSS)

- Exploits a trust of a user in a website



- Example Scenario
  1. *An attacker injects a code to a page*
  2. *A users executes the code in his/her browser's session*
  3. *The code provides information (cookies) to the attacker*
  4. *The attacker uses the cookies to access the user's data*

XSS Examples

- Twitter in Sep 2010
  - *Injection of JavaScript code to a page using a tweet*
  - *You posted following tweet to Twitter*

```
There is a great event happening at
http://someurl.com/@"onmouseover="alert('test xss')"/
```

  - *Twitter parses the link and wraps it with* <a> *element*

```
There is a great event happening at
<a href="http://someurl.com/@"onmouseover="alert('test xss')"
    target="_blank">http://someurl.com/@"onmouseover=
    "alert('test xss')"/</a>
```

  - *See details at Twitter mouseover exploit*
- Other example: Google Contacts

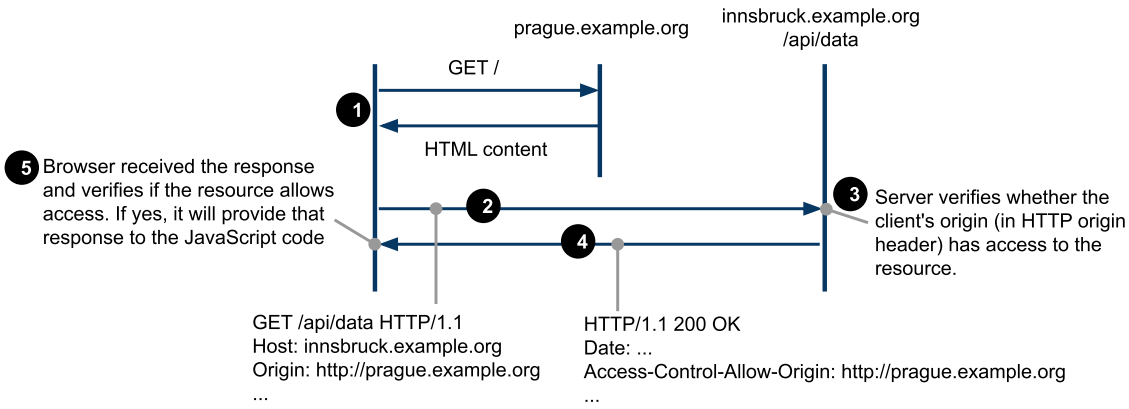
Overview

- Mashups and XHR
- Security Mechanisms
  - *Scripting Attacks*
  - *Cross-origin Resource Sharing Protocol (CORS)*
- JSON and JSONP

Overview

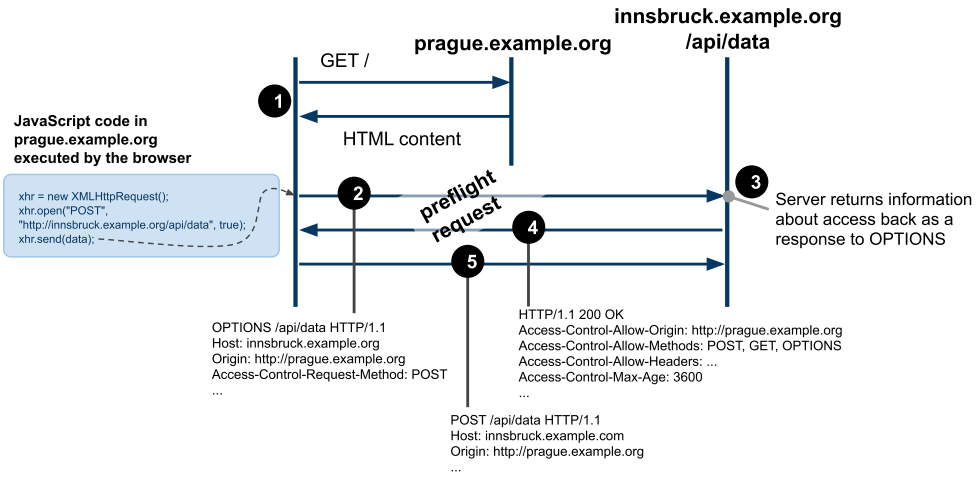
- Increasing number of mashup applications
  - *client-side mashups involving multiple sites*
  - *mechanism to control an access to sites from within JavaScript*
- Allow for **cross-site HTTP requests**
  - *HTTP requests for resources from a different domain than the domain of the resource making the request.*
- W3C Recommendation
  - *see Cross-origin Resource Sharing*
  - *Browsers support it*
    → *see HTTP Access Control at Mozilla*

CORS Protocol – GET



- Read-only resource access via HTTP GET
- Headers:
  - Origin – *identifies the origin of the request*
  - Access-Control-Allow-Origin – *defines who can access the resource*
  - *either the full domain name or the wildcard (*) is allowed.*

CORS Protocol – other methods and "preflight"



- Preflight request queries the resource using OPTIONS method
  - *requests other than GET (except POST w/o payload) or with custom headers*
  - *A browser should run preflight automatically for any XHR request meeting preflight conditions*
  - *The browser caches responses according to* Access-Control-Max-Age

Overview

- Mashups and XHR
- Security Mechanisms
- JSON and JSONP

Recall: JSON

- JSON = JavaScript Object Notation
  - *Serialization format for data representation*
  - *Very easy to use in JavaScript*
    → no need to use a parser explicitly
  - *Also great support in many programming environments*
- Key constructs
  - ***object** is a collection of comma-separated key/value pairs:*
    {"name" : "tomas", "age" : 18, "student" : false, "car" : null}
  - ***array** is an order list of values:*
    ["prague", "innsbruck", 45]
  - *can be nested: objects as values in an **array**:*
    [{ "name" : "tomas", "age" : 18 },
    { "name" : "peter", "age" : 19 }]
  - *and the other way around: array as values in an **object**:*
    { "cities" : ["prague", "innsbruck"],
    "states" : ["CZ", "AT"] }
  - *A complete grammar see JavaScript Object Notation*

JSON in JavaScript

- Native data format

```
1  // data needs to be assigned
2  var data = { "people" : ["tomas", "peter", "alice", "jana"] };
3
4  // go through the list of people
5  for (var i = 0; i < data.people.length; i++) {
6      var man = data.people[i];
7      // ... do something with this man
8  }
```

- Responses of service calls in JSON
  - *Many support JSON, how can we load that data?*
- Example Request-Response

```
1  GET http://pipes.yahoo.com/pipes/pipe.run?_id=638c670c40c97b62&_render=js
2
3  {"count":1,"value":
4     {"title":"Web 2.0 announcements",
5      "description":"Pipes Output",
6      "link":"http:\/\/pipes.yahoo.com\/pipes\/pipe.info...",
7      "pubDate":"Mon, 07 Mar 2011 18:27:20 +0000",
8      "generator":"..."
9      ...
10    }
11 }
```

JSONP

- Service that supports JSONP
  - *allows to specify a query string parameter for a wrapper function to load the data in JavaScript code*
  - *otherwise the data cannot be used in JavaScript*
    → *they're loaded into the memory but assigned to nothing*
- Example
  - *if a resource at* http://someurl.org/json_data *returns*

```
{ "people" : ["tomas", "peter", "alice", "jana"] }
```

then the resource at
http://someurl.org/json_data?_callback=loadData *returns*

```
loadData({ "people" : ["tomas", "peter", "alice", "jana"] });
```

- A kind of workaround for the same origin policy
  - *only* GET*, nothing else works obviously*
  - *no XHR, need to load the data through the dynamic* <script> *element*

JSONP in JavaScript

- JSONP example
  - *loads JSON data using JSONP by dynamically inserting* <script> *into the current document. This will download JSON data and triggers the script.*

```
var TWITTER_URL = "http://api.twitter.com/1/statuses/user_timeline.json?" +
  "&screen_name=web2e&count=100&callback=loadData";

// this needs to be loaded in window.onload
// after all document has finished loading...
function insertData() {
    var se = document.createElement('script');
    se.setAttribute("type","text/javascript");
    se.setAttribute("src", TWITTER_URL);
    document.getElementsByTagName("head")[0].appendChild(se);
    // And data will be loaded when loadDta callback fires...
}

// loads the data when they arrive
function loadData(data) {
    // we need to know the the structure of JSON data that is returned
    // and code it here accordingly
    for (var i = 0; i < data.length; i++) {
        data[i].created_at // contains date the tweet was created
        data[i].text // contains the tweet
    }
}
```