OMash: Enabling Secure Web Mashups via Object Abstractions

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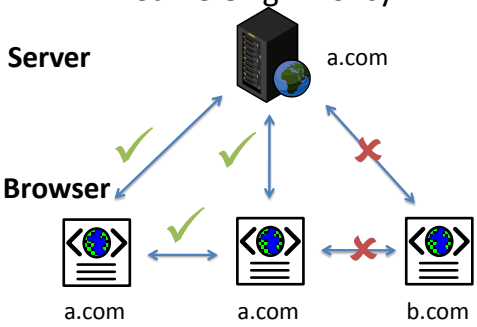
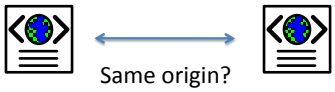
Mashups and the Same Origin Policy

- Mashups integrate content from multiple websites
- Content protection relies on Same Origin Policy (SOP)
  - Currently, contents get complete or no isolation
  - MashupOS proposes more flexible trust relationship [SOSP 07]
    - Isolated
    - Open
    - Access-Controlled
    - Unauthorized

Same Origin Policy



Problems with SOP – What Domains are of the Same Origin?

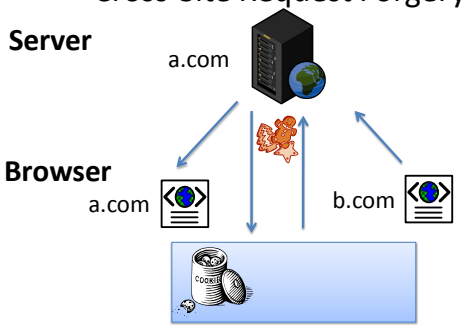


web1.acm.org	yes	web2.acm.org
cs.ucdavis.edu	maybe	ece.ucdavis.edu
amazon.co.uk	no	bbc.co.uk

DNS Insecurity

- Client vulnerabilities
  - DNS rebinding (Jackson et al, CCS 07)
  - Dynamic Pharming (Karlof et al, CCS 07)
- Server vulnerabilities
  - DNS cache poisoning (Kaminsky, BlackHat 08)

Cross-Site Request Forgery



OMash: Object Mashup

- A new browser security model
- Use Object-Oriented model (e.g. Java object model)
- Treat each Web page as an object
  - Encapsulate all scripts and data
  - Objects declare public interface
  - Objects communicate only via public interface

Object Abstractions

- Java (analogy)

```
public class FooObject {

   public void publicMethod() {
   }

   private int privateData;
}
```

- Web page object

```
<html>
<script>
function getPublicInterface() {
 function Interface() {
   this.publicMethod =
     function ()  {…}
 }
 return new Interface();
}
var privateData;
</script>
</html>
```

Page Objects

- A page consists of
  - DOM tree
  - Scripts
  - Credentials (HTTP auth, cookies)
- A page object can be contained in a
  - Window
  - Tab
  - Frame
  - Iframe

Public and Private Members

- Public interface
  - Each object declares getPublicInterface()
  - Returns a closure of all public methods and data
- Private data
  - DOM
  - Scripts
  - Credentials

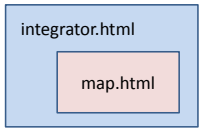
Usage Example

- map.html

```
<html>
function
getPublicInterface()
{
  function Interface()
{
    this.setCenter =
      function (lat,long)  {
      …
   }
  }
  return new Interface();
}
</html>
```

- integrator.html

```
<iframe src="map.html">
...
var map =
win.getPublicInterface();
...
map.setCenter(lat, long);
}
```



Trust Relationships

- Can model trust relationships needed for mashups (as identified by MashupOS)
  - Isolated
  - Open
  - Access-Controlled
  - Unauthorized

Isolated

- No access between provider and integrator

```
function getPublicInterface()
{
    function Interface()
    {
    }
    return new Interface();
}
```

Open

- Full access between provider and integrator

```
function getPublicInterface()
{
   function Interface()
   {
      this.getDocument = function ()
      {
         return document;
      }
   }
   return new Interface();
}
```

Access-controlled

- Limited access depending on caller

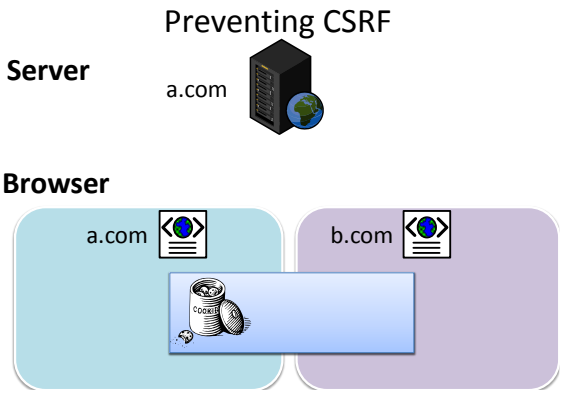
Provider

```
function getPublicInterface() {
  function Interface()   {
    this.auth = function(user,pass)
    { return token; }

    this.do = function (token,...)
    { check(token); }
  }
  return new Interface();
}
```

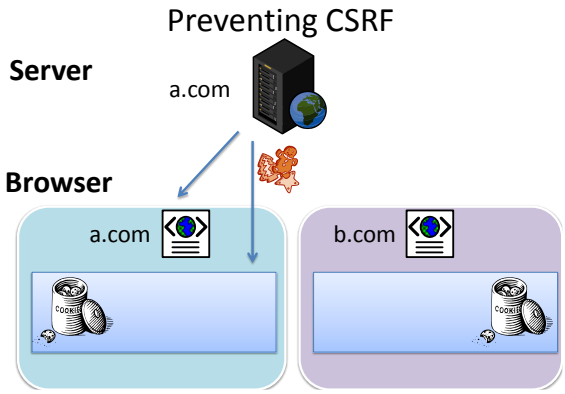
Integrator

```
var api =
win.getPublicInterface();

token =
api.auth(user, pass);

api.do (token,...)
```

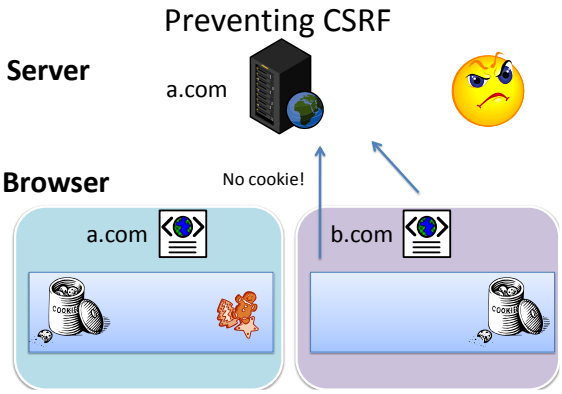
Preventing CSRF



Preventing CSRF



Preventing CSRF



Browser Sessions under OMash

- Each cookie
  - belongs to a window
  - is shared by subsequent pages from the same domain in that window
- Each window has an independent session
  - Desirable side effect:
    Can log in to multiple accounts in different windows in the same browser

Cross-window Sessions

- How to track a session across windows?
- Cookie Inheritance
  - When page P1 loads P2, P2 inherits P1's cookies
  - P1 and P2 now belong to the same session

Implementation

- Proof of concept as Firefox add-on
  - Make an exception to SOP in Mozilla's Configurable Security Policy
  - Change Cookie Manager to make each cookie private to a window
- No changes required on the server

Supporting SOP without DNS

- If application prefers using SOP to allow inter-page communication:
- To implement this under OMash
  - Server embeds a shared secret in all pages
  - Pages authenticate each other using this secret

Supporting SOP without DNS

Provider

```
secret = "1234";
function getPublicInterface() {
 function Interface()  {
  this.foo=function (secret, … )
  { check(secret); … }
 }
 return new Interface();
}
```

Integrator

```
<script>
secret = "1234"
api  = win.getPublicInterface()
api.foo(secret, …)
</script>
```

Related Work

- MashupOS (Wang et al, SOSP 07)
- SMash (Keukelaere WWW 07)
- Google's Caja

Conclusion

- OMash a new browser security model
  - Allows flexible trust relation
  - Simple
  - Familiar, easy to understand
- Don't rely on Same Origin Policy
  - Prevent CSRF attacks
  - Allows programmers to define "Same Origin" flexibly based on shared secrets