Hacking Web 2.0

Art and Science of Vulnerability Detection

ClubHACK 2007

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Who am I?

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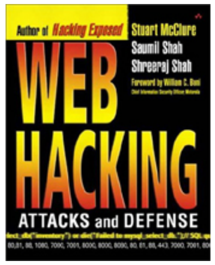
- Founder & Director
  - Blueinfy Solutions Pvt. Ltd. (Brief)
- Past experience
  - Net Square, Chase, IBM & Foundstone
- Interest
  - Web security research
- Published research
  - Articles / Papers – Securityfocus, O’erilly, DevX, InformIT etc.
  - Tools – wsScanner, scanweb2.0, AppMap, AppCodeScan, wsChess etc.
  - Advisories - .Net, Java servers etc.
- Books (Author)
  - Hacking Web Services (Thomson 2006)
  - Web Hacking (AWL 2003)
  - Web 2.0 Security (Work in progress)



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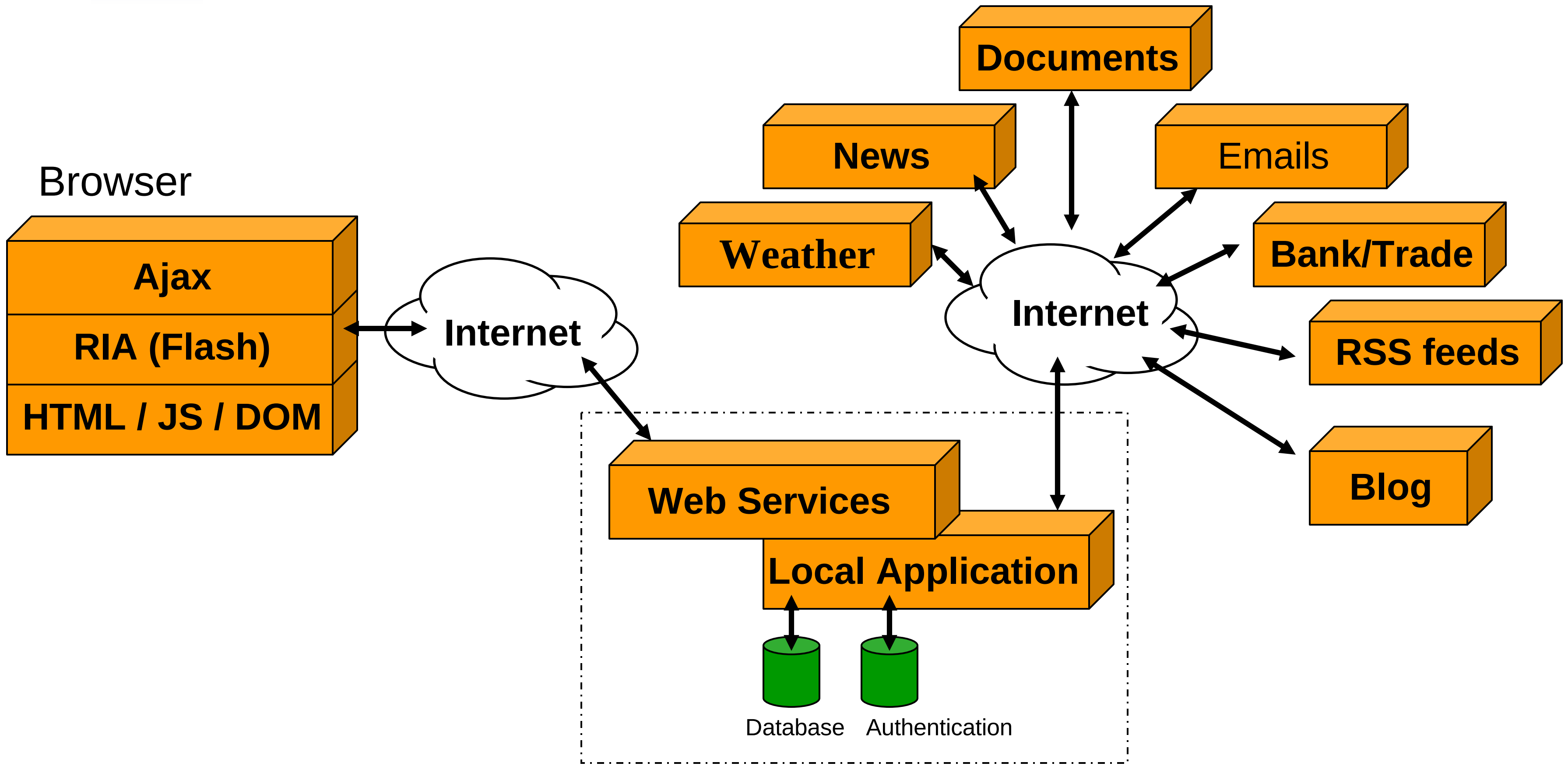
Agenda

- Web 2.0 overview and security concerns
- Ajax Security – Attacks and Defense
  - Methods
  - Vectors
  - Defense
- Web Services – Attacks and Defense
  - Methodology
  - Assessment and Tools
  - Defense

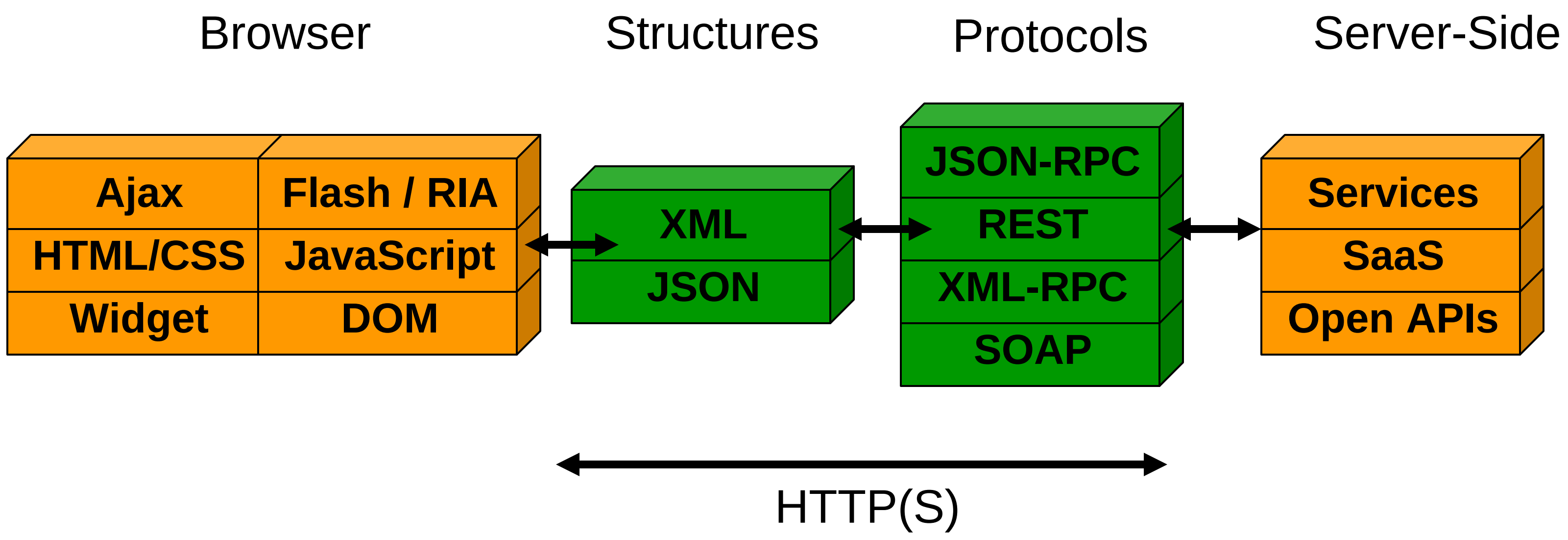
Web 2.0 Trends

- 80% of companies are investing in Web Services as part of their Web 2.0 initiative (McKinsey2007 Global Survey)
- By the end of 2007, 30 percent of large companies will have some kind of Web 2.0-based business initiative up and running. (Gartner)
- 2008. Web Services or Service-Oriented Architecture (SOA) would surge ahead. (Gartner)

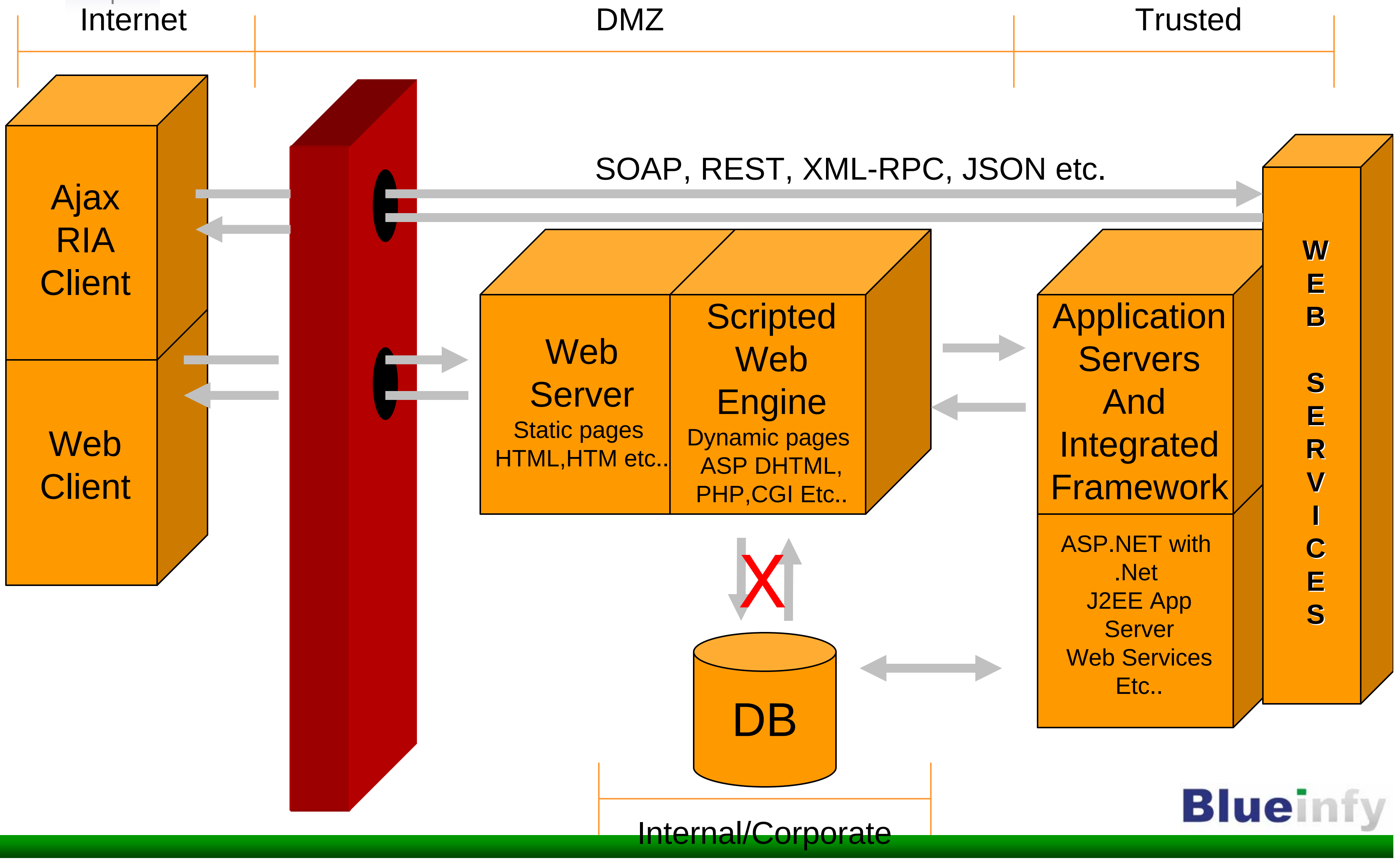
Web 2.0 – Ajax & Web Services



Web 2.0 Layers



Technologies



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Web 2.0 Security

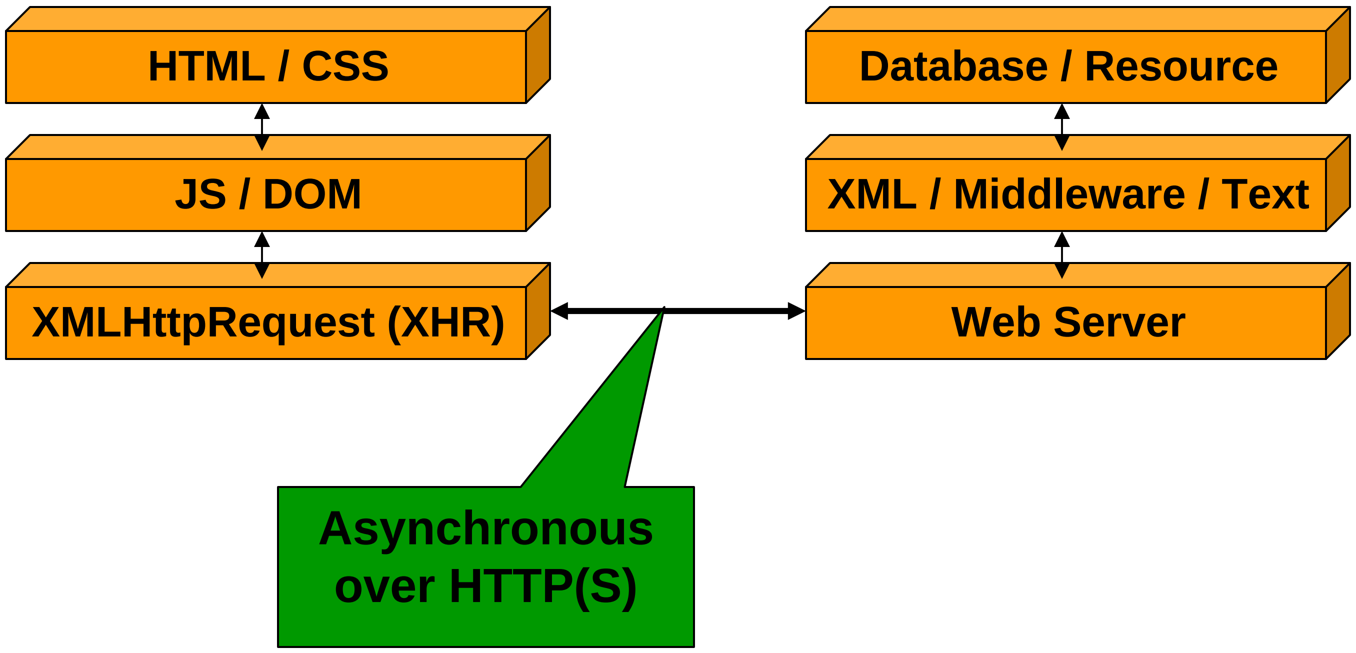
- Complex architecture and confusion with technologies
- Web 2.0 worms and viruses – Sammy, Yammaner & Spaceflash
- Ajax and JavaScripts – Client side attacks are on the rise
- Web Services attacks and exploitation
- Flash clients are running with risks

Ajax Security – Attacks & Defense

- Basics
- Structures and streams
- Fingerprinting
- Scanning and Enumeration
- XSS and CSRF issues
- Securing code base

Ajax basics

- Asynchronous JavaScript and XML



Ajax - Sample

```
function loadhtml()
{
      var http;
      if(window.XMLHttpRequest){
          http = new XMLHttpRequest();
      }else if (window.ActiveXObject){
                http=new ActiveXObject("Msxml2.XMLHTTP");
          if (! http){
                http=new ActiveXObject("Microsoft.XMLHTTP");
          }
      }
      http.open("GET", "main.html", true);
      http.onreadystatechange = function()
      {
                if (http.readyState == 4) {
                                var response = http.responseText;
                                document.getElementById('main').innerHTML = response;

      }
}
http.send(null);
}
```

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Ajax & Data structures

- Ajax is using various data streams
- Developers are innovating this field
- JavaScript can talk with back end sources
- Mashups application can be leveraged
- It is important to understand these streams
- It has significant security impact
- JSON, Array, JS-Object etc.

Cross-domain calls

- Browser security doesn’t support cross domain calls
- But cross domain callback with JavaScript is possible
- This can be lethal attack since cross domain information get executed on the current DOM context.
- Developers put proxy to bypass the SOP.

Ajax fingerprinting

- Determining Ajax calls
- Framework fingerprinting
- Running with what?
  - Atlas
  - GWT
  - Etc.
- Ajaxfinger a tool to achieve this
- Can help in assessment process
- RIA finger printing is possible

Ajax attack points

- Ajax components & Widgets
- Cross domain vulnerable browsers and callback implementations
- DOM manipulation calls and points
- Insecure eval()
- HTML tags
- Intranet nodes and internal resources

Ajax attack vectors

- Entry point scanning and enumeration
- Cross site scripting (XSS) attacks
- Cross site Request Forgery (CSRF) issues
- Client side code reverse engineering
- Security control and validation bypassing
- Local privacy information enumeration
- Ajax framework exploitation – known bugs

Ajax Scanning

- Scanning Ajax components
- Retrieving all JS include files
  - Part of <SCRIPT SRC=….>
- Identifying XHR calls
- Grabbing function
- Mapping function to DOM event
- Scanning code for XSS – look for eval() and document.write()

Ajax serialization issues

- Ajax processing various information coming from server and third party sources. – XSS opportunities

```
message = {
        from : "john@example.com",
        to : "jerry@victim.com",
        subject : "I am fine",
        body : "Long message here",
        showsubject :
function(){document.write(this.subject)}
};
```

XSS

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Ajax serialization issues

- JSON issues

```
{"bookmarks":[{"Link":"www.example.com","D
esc":"Interesting link"}]}
```

- JS – Array manipulation

```
new Array(“Laptop”, “Thinkpad”, “T60”,
“Used”, “900$”, “It is great and I have
used it for 2 years”)
```

Ajax and JS manipulation

- JavaScript exploitation – XSS
- Identifying DOM points like document.write()
- Eval() – another interesting point
- Attack APIs and tools for exploitation
- Lot can be done by an attacker from session hijacking to key loggers

Ajax and RSS injection

- RSS feeds are another entry point to the browser
- Injecting script to the RSS feeds and Ajax call may execute it.
- One click – Malformed linked injected into it and can lead to exploit “javascript:”
- Leveraging events – onClick, onMouse etc.

Ajax Crawling

- Crawling Ajax driven app – a challenge
- Resources are hidden in JavaScript
- Simple scanner will fail
- Crawling with actual DOM context
- Automated crawling with browser is required
- How?

Defending Ajax

- No business logic information on client side.
- Do not trust third party source – filter it out
- No direct cross domain call back
- Filtering at browser level before processing information
- Avoiding client side validation

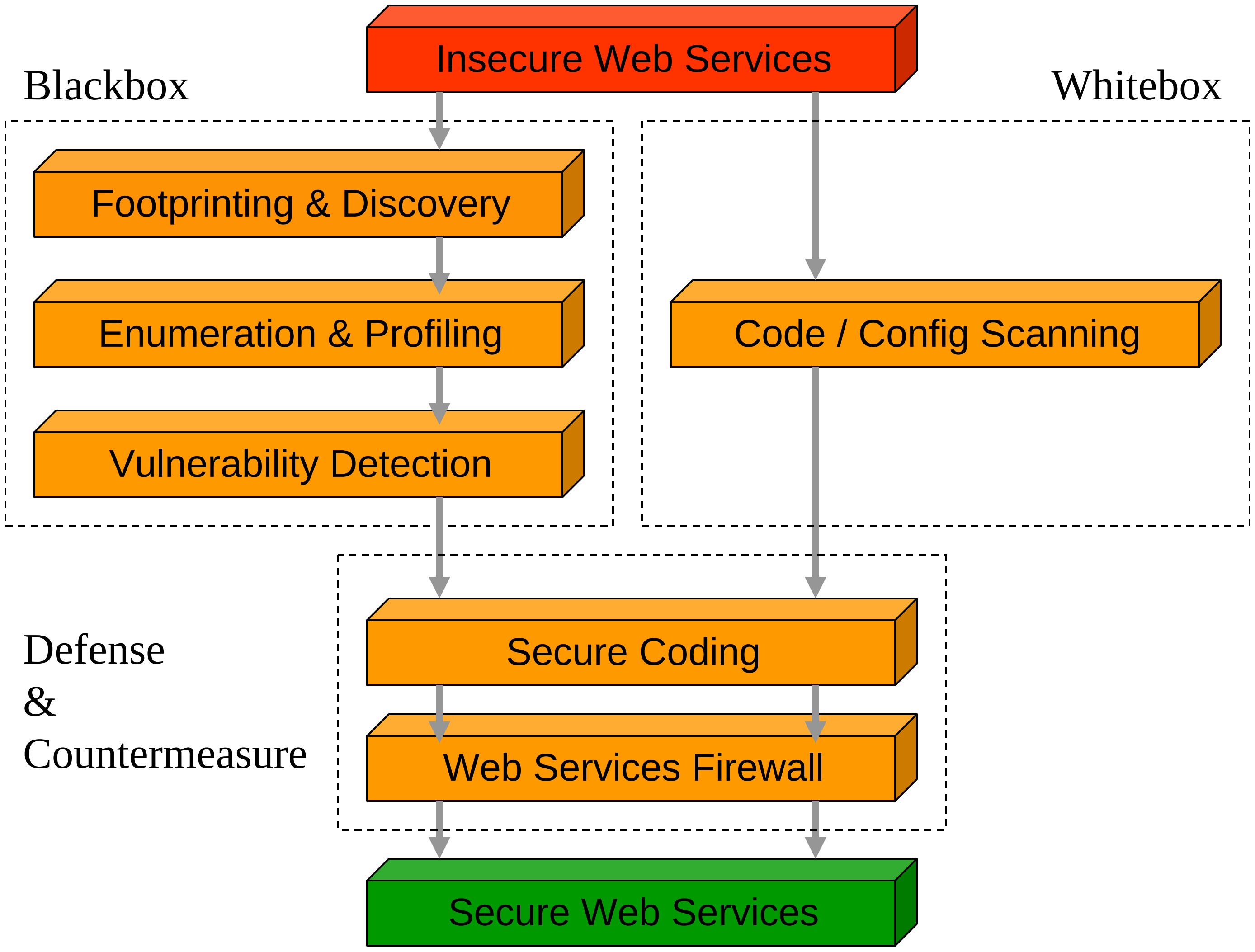
Defending Ajax

- No secret in Ajax calls
- Proper data structure selection and frameworks
- Avoid client side validation
- Securing client side calls like eval() and document.write()
- HTML tags filtering before serving to end client

Web Services – Attacks & Defense

- Methodology
- Footprinting & Discovery
- Profiling and Enumeration
- Scanning and Fuzzing
- Attack vectors
- Scanning code for vulnerabilities
- Defense by filtering

Methodology



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Footprinting and Discovery

- Objective: Discovering Web Services running on application domain.
- Methods
  - Primary discovery
    - Crawling and spidering
    - Script analysis and page scrubbing
    - Traffic analysis
  - Secondary discovery
    - Search engine queries
    - UDDI scanning

Primary Discovery

- Crawling the application and mapping file extensions and directory structures, like ".asmx"
- Page scrubbing – scanning for paths and resources in the pages, like atlas back end call to Web Services.
- Recording traffic while browsing and spidering, look for XML based traffic – leads to XML-RPC, REST, SOAP, JSON calls.

Primary Discovery - Demos

- Page scanning with grep – Look in JavaScripts for URLs, Paths etc.
- Crawling – Simple!
- Scanning for Atlas references – Framework creates stubs and proxy. – scanweb2.0/scanatlas
- Urlgrep can be used as well.

Secondary Discovery

- Searching UDDI server for Web Services running on particular domain.
  - Three tactics for it – business, services or tModel.
- Running queries against search engines like Google or MSN with extra directives like “inurl” or “filetype”
  - Look for “asmx”
- wsScanner – Discovery!

Enumerating and Profiling

- Scanning WSDL
  - Looking for Methods
  - Collecting In/Out parameters
  - Security implementations
  - Binding points
  - Method signature mapping

Scanning strategies

- Manual invocation and response analysis.
- Dynamic proxy creation and scanning.
- Auto auditing for various vectors.
- Fuzzing Web Services streams – XML or JSON
- Response analysis is the key
  - Look for fault code nodes
  - Enumerating fault strings
  - Dissecting XML message and finding bits
  - Hidden error messages in JSON

Cross Site Scripting (XSS)

- XSS is possible through Web Services.
- It would be DOM based XSS via eval().
- JSON-RPC based stream coming in the browser and get injected into DOM.
- Source of stream can be of third party and Un-trusted.
- XML streams coming in the browser and can cause XSS via document.write call.

Injection Flaws

- Web Services methods are consuming parameters coming from end users.
- It is possible to inject malicious characters into the stream.
- It can break Web Services code and send faultsting back to an attacker
- Various injections possible – SQL and XPATH

Malicious File Execution

- Malicious command can be injected through the parameter.
- WS supports attachments as well and that can lead to uploading a file.
- This can give remote command execution capability to the attacker.

Insecure Direct Object Reference

- Injecting characters to break file system sequences.
- Faultcode spits out internal information if not protected.
- Customized error shows the file refernces.
- Access to internal file and full traversal to directories
- Inspecting methods and parameters in the profile stage can help.

Cross Site Request Forgery

- CSRF with XML streams
- XML-RPC or SOAP based request can be generated from browsers.
- Splitting form and XML injection is possible – interesting trick.
- If Content-Type is not validated on the server then it can cause a potential CSRF.
- XForms usage in browser can produce XML requests to attack CSRF.

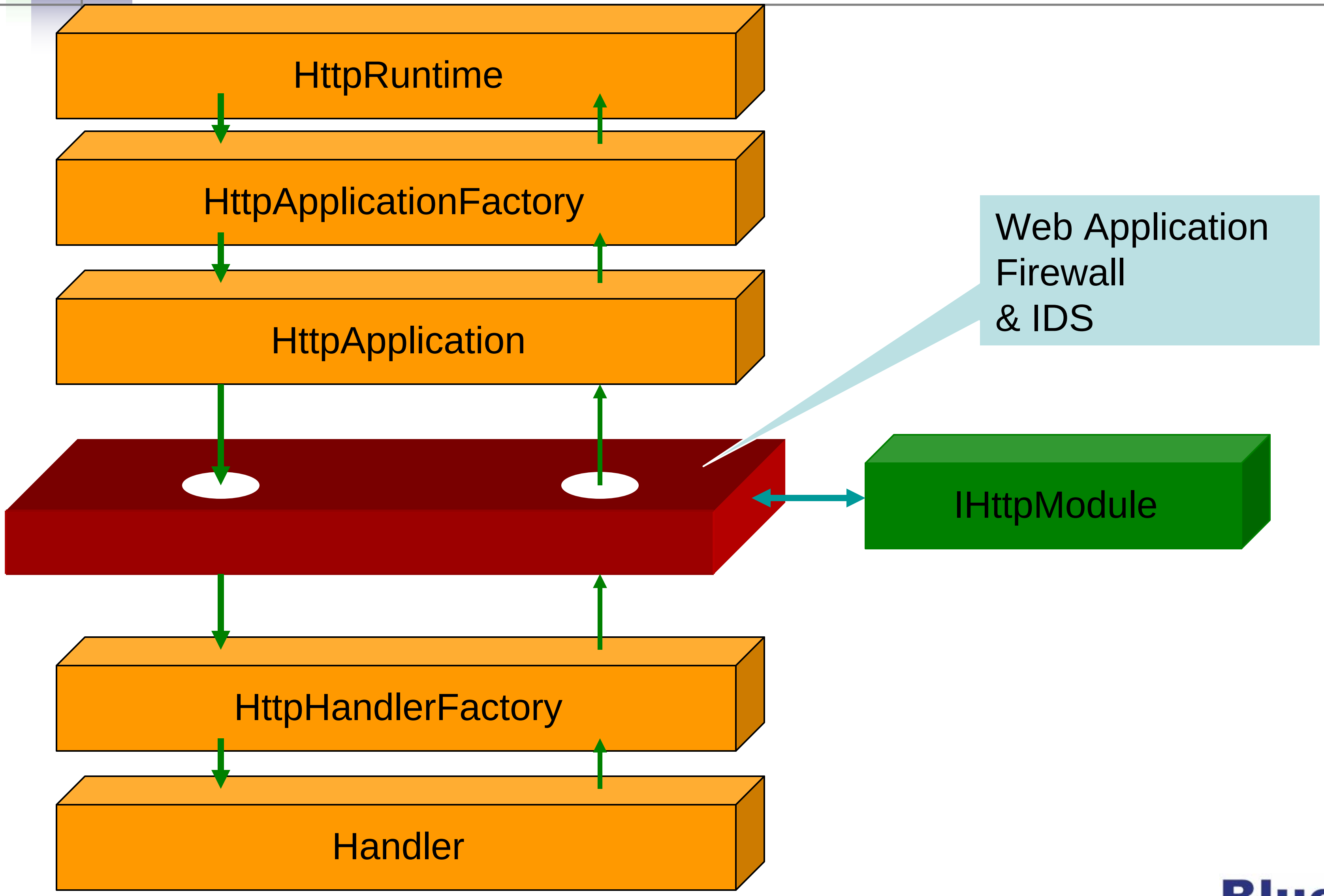
Code Analysis for Web Services

- Scanning the code base.
- Identifying linkages.
- Method signatures and inputs.
- Looking for various patterns for SQL, LDAP, XPATH, File access etc.
- Checking validation on them.
- Code walking and tracing the base - Key

Code filtering with IHTTPModule

- Regular firewall will not work
- Content filtering on HTTP will not work either since it is SOAP over HTTP/HTTPS
- SOAP level filtering and monitoring would require
- ISAPI level filtering is essential
- SOAP content filtering through IHTTPModule

HTTP Stack for .Net



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IHTTPModule for Web Services Firewall

- Code walkthrough – Events and Hooks
- Loading the DLL
- Setting up the rules
- Up and running!
- Demo.

Thanks!

- Questions?
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