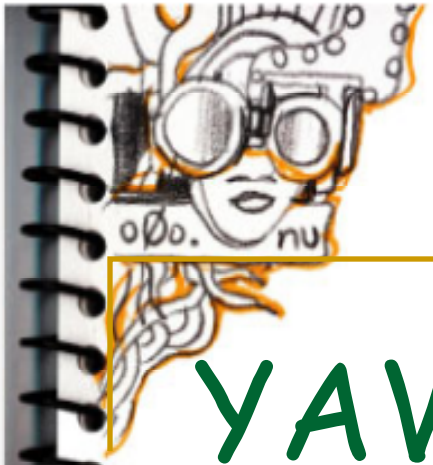

YAWATT – (yet) Another web application testing toolkit

HITB 2006

Kuala – Lumpur

Or a "non-monkey" approach to web applications hacking

By fyodor and meder

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"Nope. we are not writing another web scanner!!"

Agenda

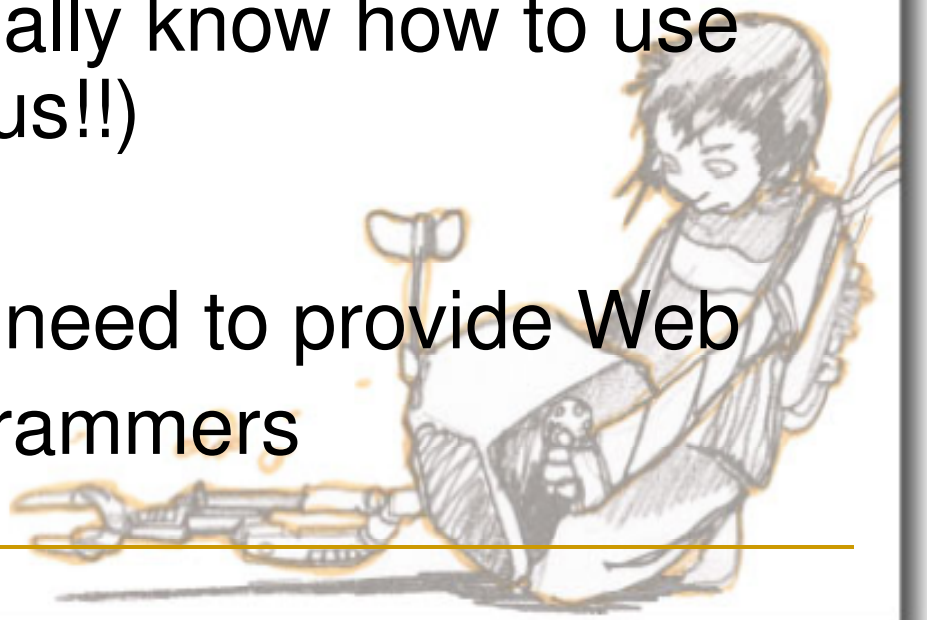
- Why hacking web applications
- What scanners do. Why they are useless (or not)
- What else could be done, but isn't (yet)
- Introduction to YAWATT
  - User-session based approach
  - Distributed
  - Intelligent (or not?)
  - Modular
  - More than "application security scanner" **..**

So, why going for the web

- Good Admins learnt to configure their firewalls
- Good Admins disable services they don't want
- Good Admins even finally know how to use nmap (and even nessus!!)

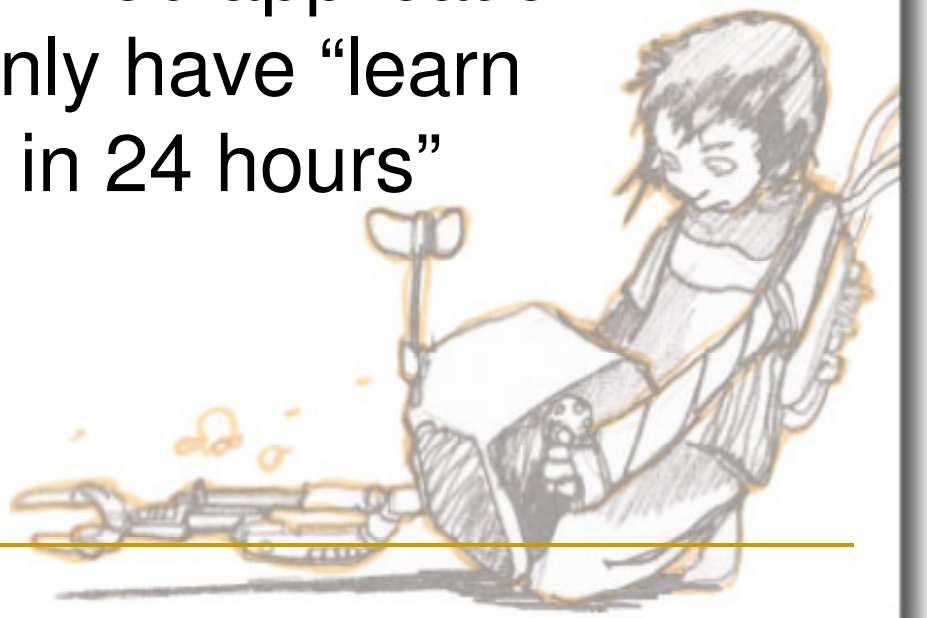
….

- But Good Admins still need to provide Web
- And they are not programmers



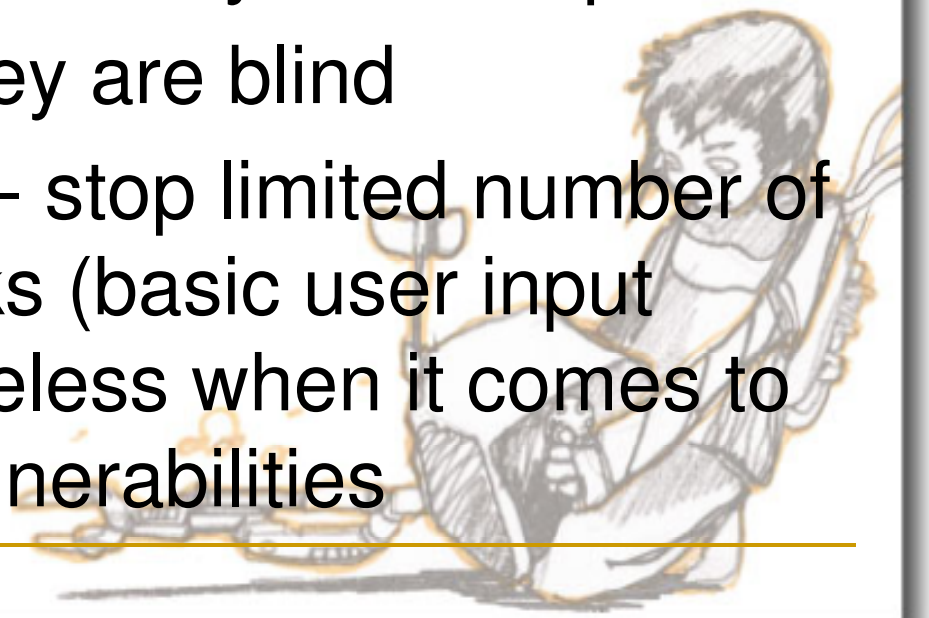
And more…

- The web applications get complex
- New web frameworks make it even more fun (AJAX)
- Due to high demand of web application programmers, many only have “learn {CGI|PHP|perl|ASP|..} in 24 hours” experience



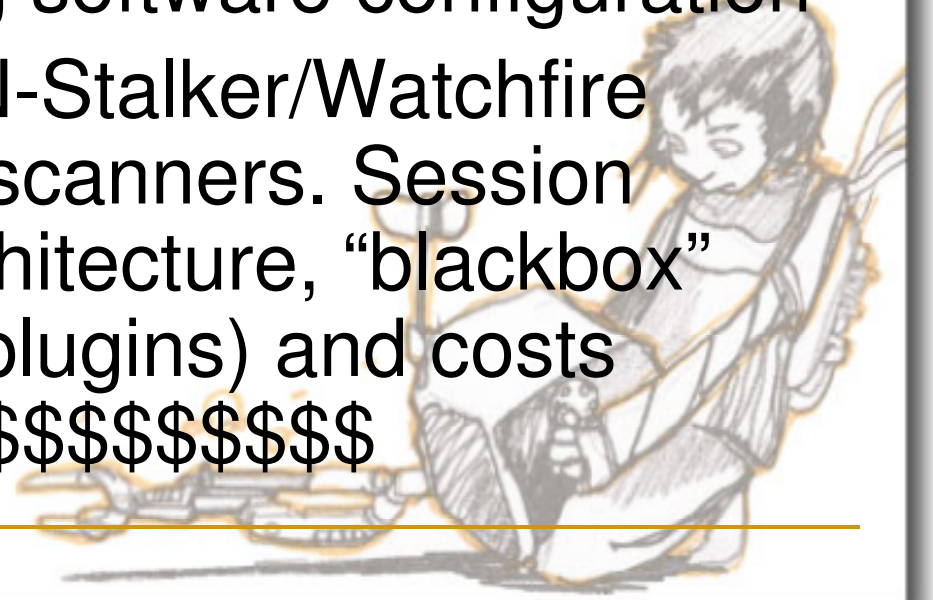
So the Web applications remain the largest hole in one's network

- The code is bad
  - Q/A not security oriented
  - Must get product to market ASAP
- Firewalls are there – **but** they can't help
- IDS are there – but they are blind
- Application "firewalls" - stop limited number of web application attacks (basic user input validation), but are useless when it comes to detection of logical vulnerabilities



Scanners evolution - summary

- Libwhisker/nikto – signature based. Relatively primitive. Efficient for finding default misconfigiurations and typical vulnerabilities
- Nessus et all – don't see web applications beyond the underlying software configuration
- Kavado/Webinspect/N-Stalker/Watchfire Appscan – intelligent scanners. Session aware. But closed architecture, "blackbox" (some allow scripted plugins) and costs $$$$$$$$$$$$$$$$$$$$$$$$$$$



Why scanners aren't enough

- Single-host based
- Non-extendable, non-correctable.
- Little or no control on “hacking” process execution flow
- Not easily “extend on the fly” with new ‘automation’ methods
- Often primitive, strict signature based logic

What would we like to have

- Maximum automation of web hacking process
- Minimum of code writing.
- Event-driven workflow
- Manual control

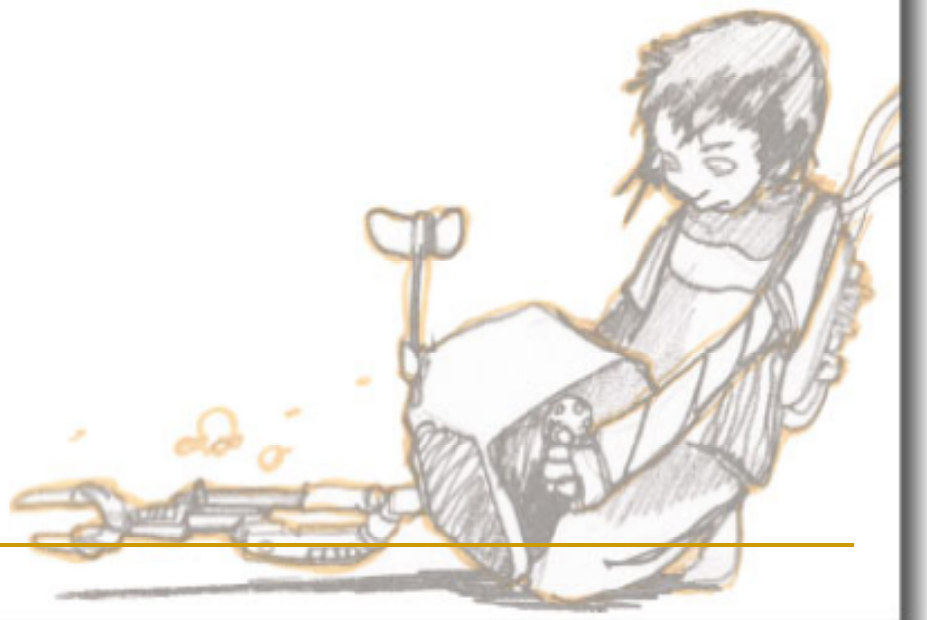
More on the wishlist

- Autonomous functionality (you can shutdown, restart, reload modules, provide new data on the fly and so on)
- *"Human to machine"* knowledge transfer
- Ability to add new 'hacks' on the fly
- Deal with uncertainty in "intelligent way"
- Learn from valid user session data

Wish list (cont)

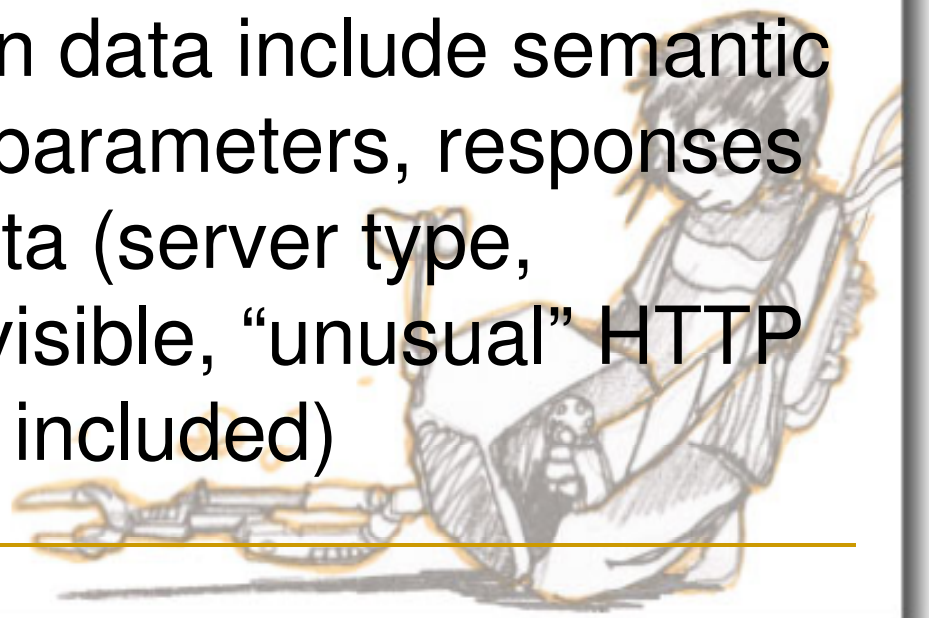
- Be able to attack web application from multiple-locations (bypass IP restrictions, improve brute-forcing process)
- Be able to automate the testing of application logic bugs
- Be able to make intelligent guesses in case of uncertainty

Introducing YAWATT method



YAWATT learns from user sessions

- User sessions – collections of user's requests and responses (url, name/value pairs, session information and selective HTTP protocol data)
- Classified user session data include semantic classification of URL, parameters, responses and HTTP protocol data (server type, backend system(s) if visible, "unusual" HTTP headers detected and included)

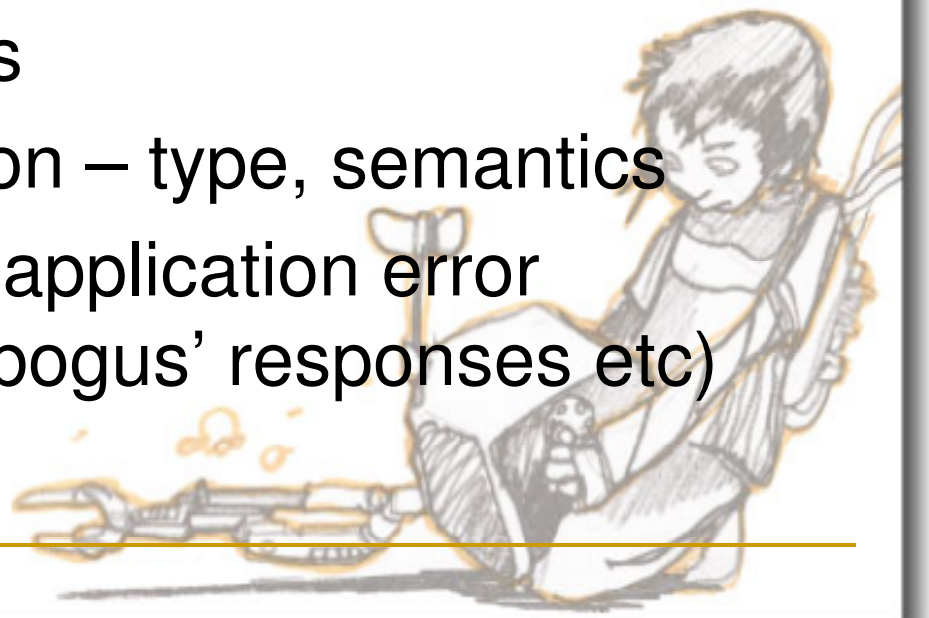


Automation

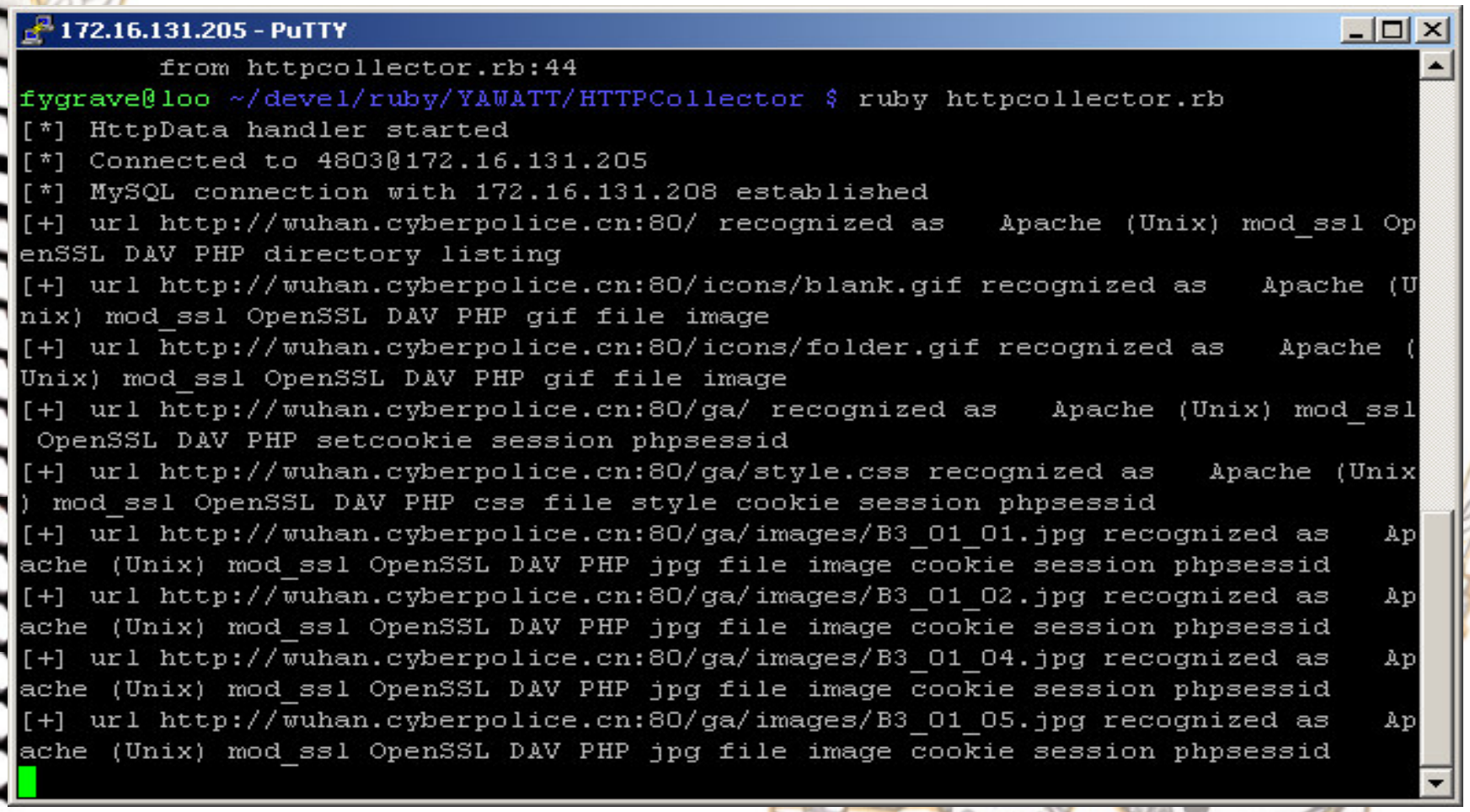
- Application content is learnt from user sessions (data feeders: proxies, enumeration tools)
- Real-time content analysis with additional verification

Classification

- User session data is classified by:
  - Semantic and functional classification of URL
  - HTTP protocol classificators (server type, cookies ..)
  - Session classificators
  - Input data classification – type, semantics
  - Output classification (application error detection, redirects, “bogus’ responses etc)



Classification process as new data arrives into the system



Testing process

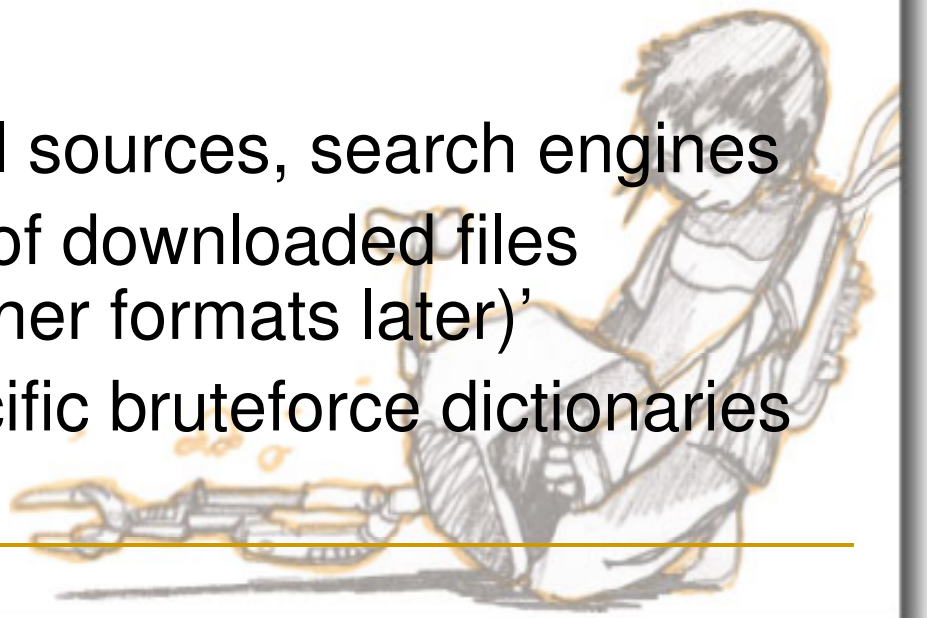
- Plugins (tests) could be executed during the collection of user session data if any of user session data triggers certain plugin
- Plugins (tests) are executed on demand, when user session data is completed

YAWATT Intelligence components (components under development)

- Web application components (URL) classification
- Semantic classification for web application input data
- LSI based response analysis (comparison of web content)

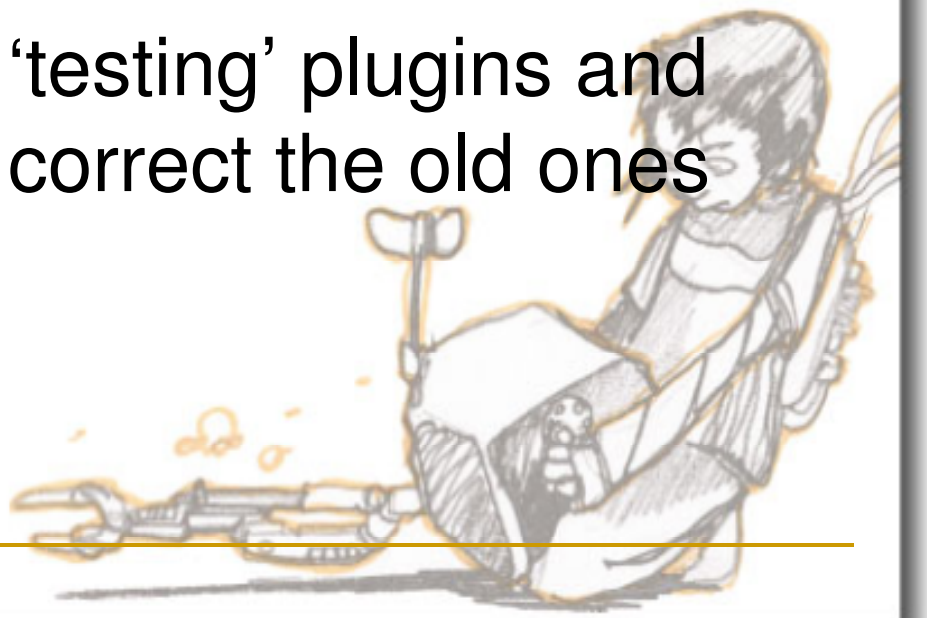
In response analyzers.

- Use of queries to external sources, search engines
- Limited “binary analysis” of downloaded files (decoding pdf, doc, rtf (other formats later)’
- Generation of target-specific bruteforce dictionaries



H2M Knowledge Transfer

- Possibility to create new classification rules on the fly (and let the system re-learn from it)
- Possibility to ‘reclassify’ application responses
- Possibility to add new ‘testing’ plugins and methods on the fly or correct the old ones

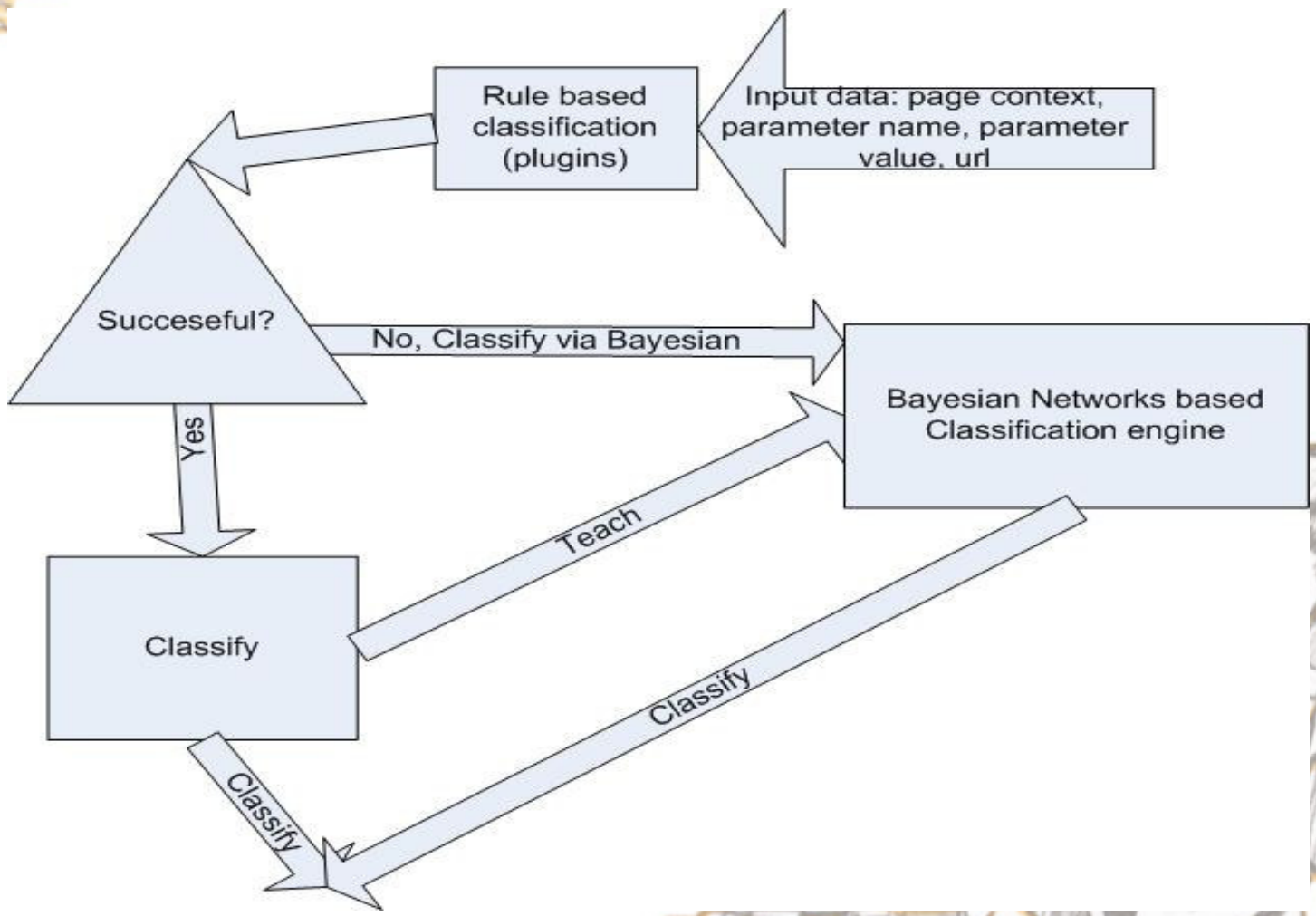


How is URL classification used

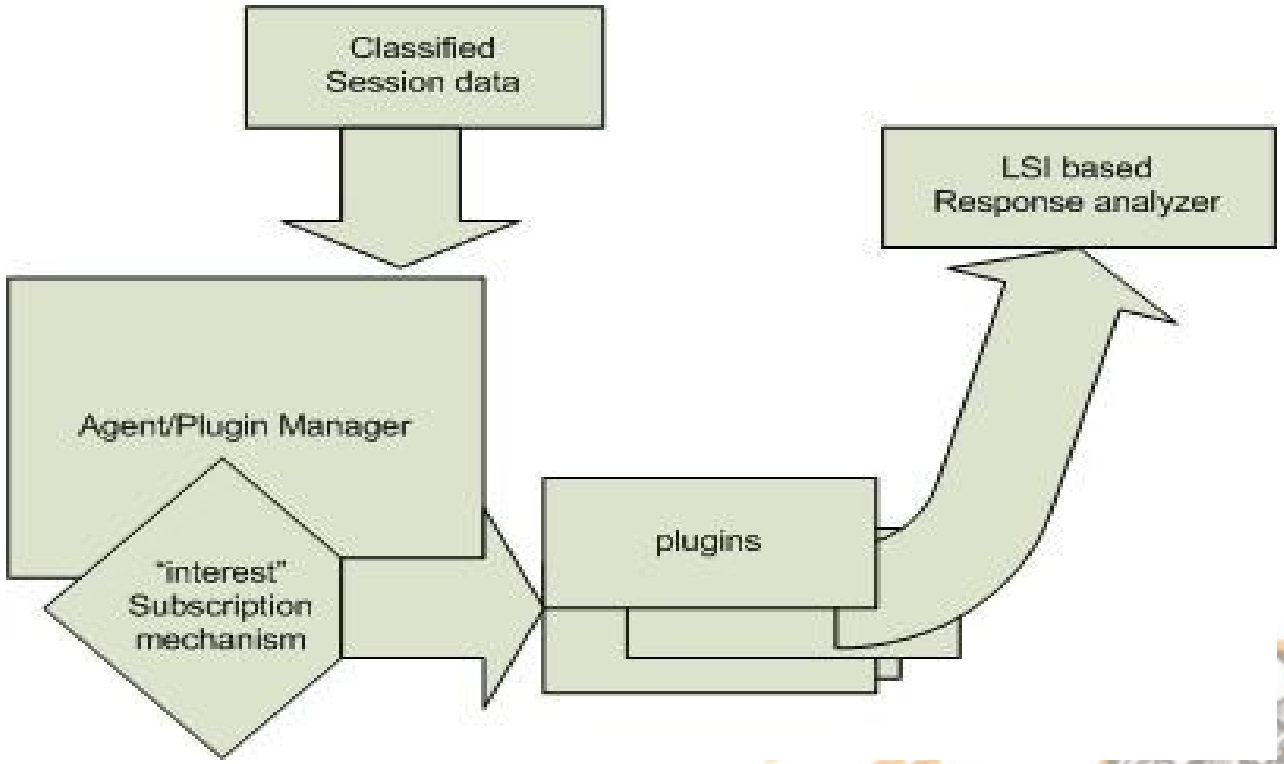
Vulnerability scenario testing – uses ‘classificators’ subscription mechanism.

- For example: login page tester will need ‘login’, ‘executable’ and ‘session’

Input data classification

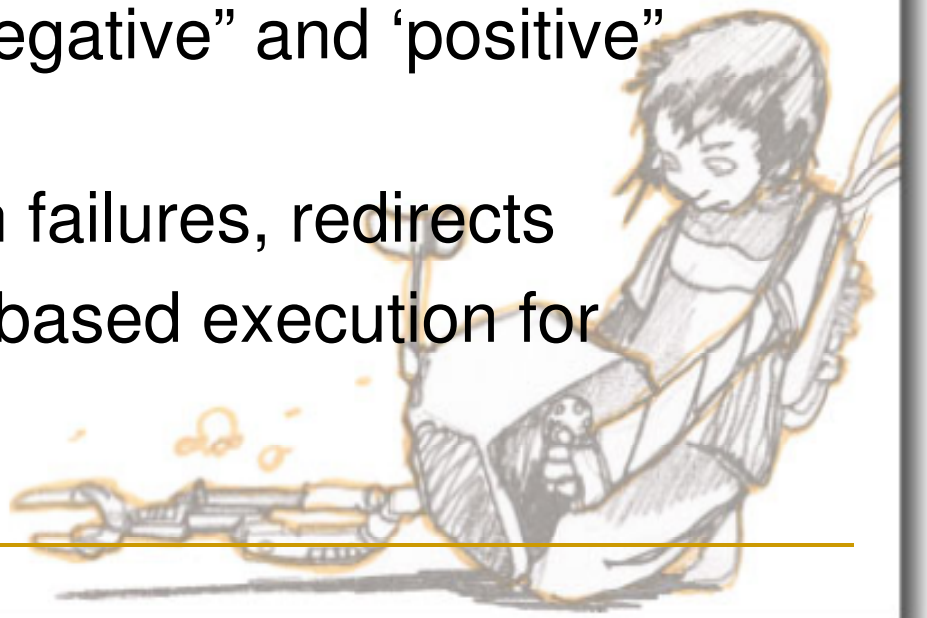


Use of classified user session data

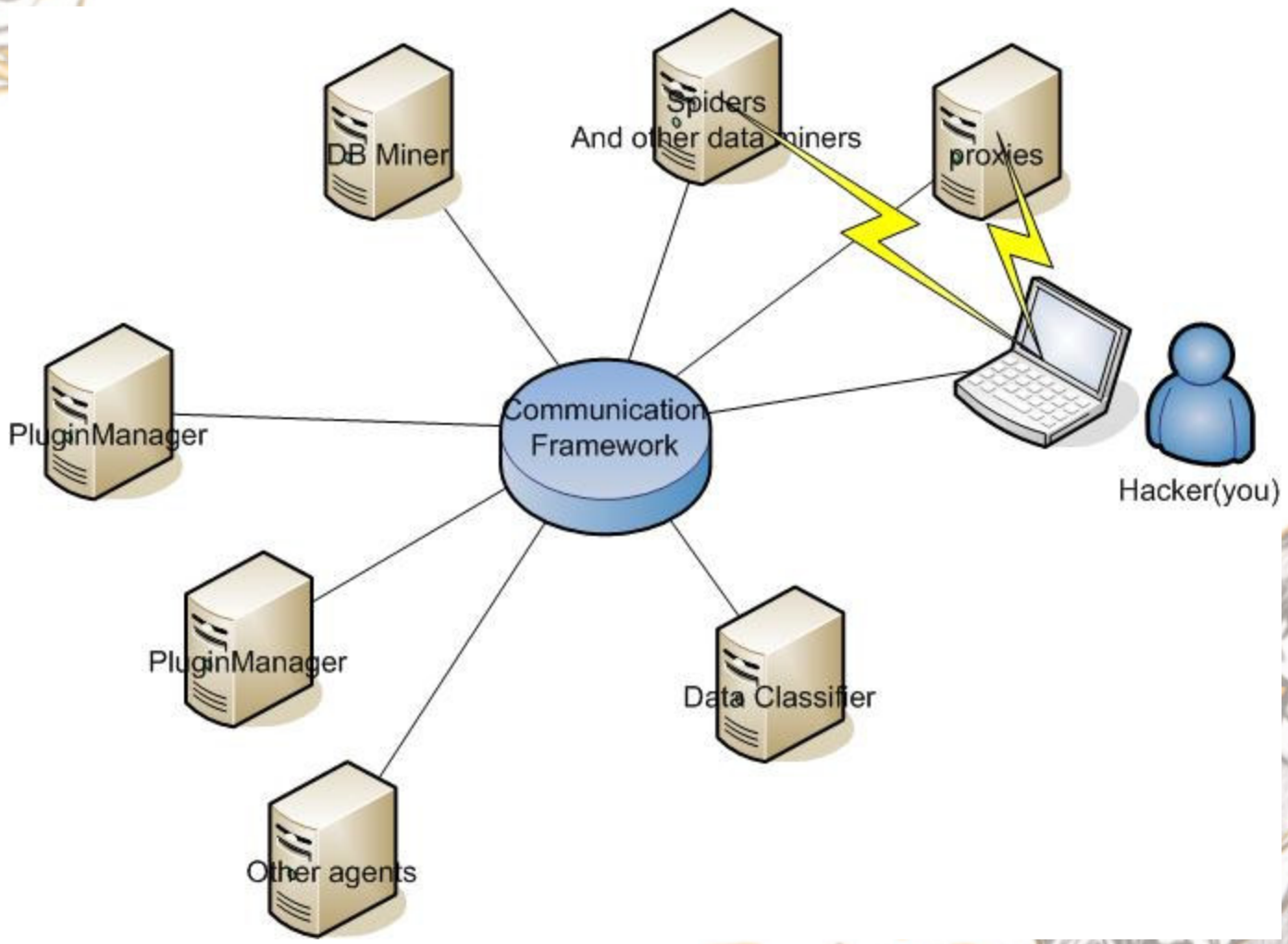


Additional research directions

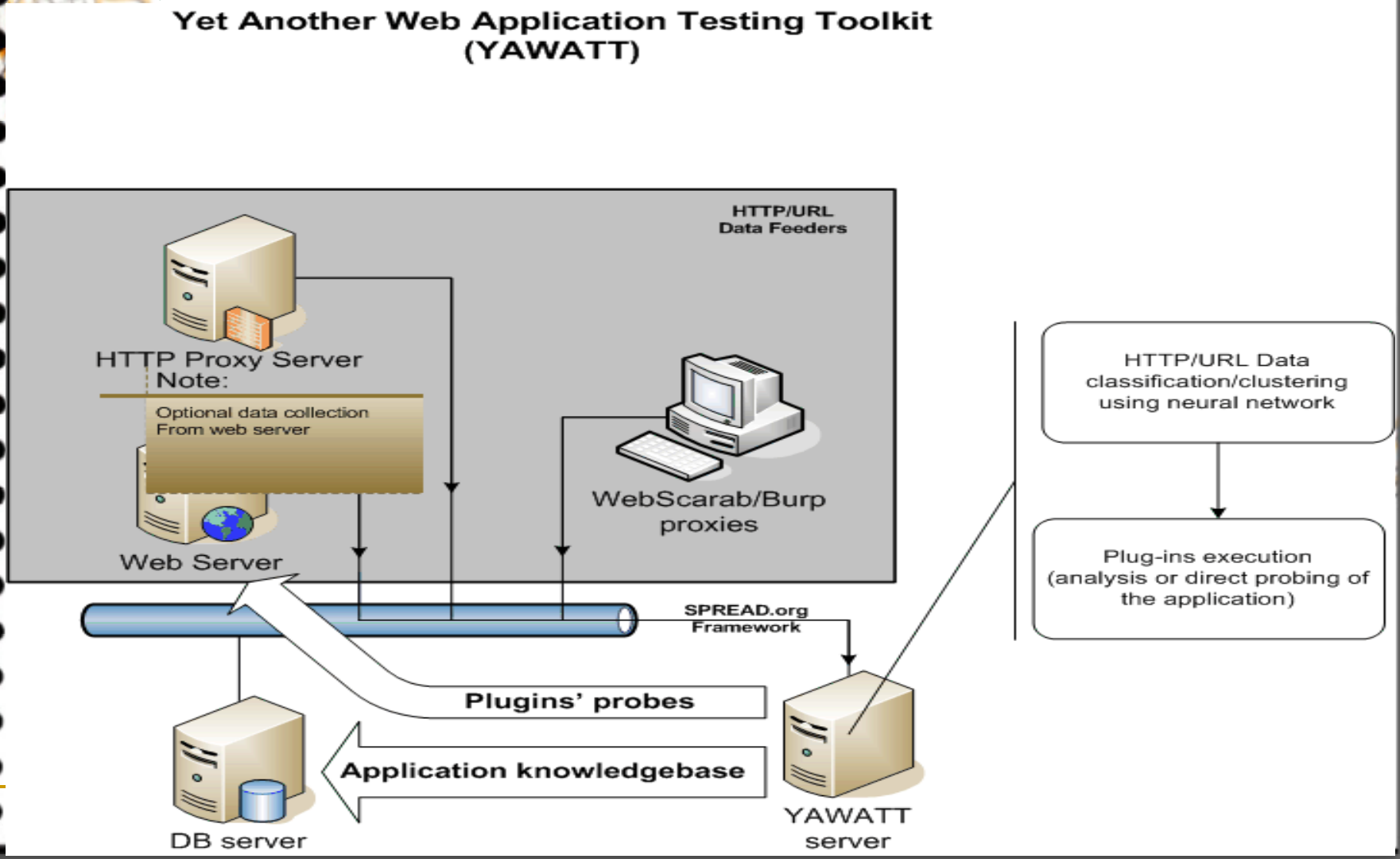
- Other ideas to work on:
  - Detection of “hidden” parameters (“intelligent” fuzzy tests)
  - Identification of “hidden” URLs
  - Fuzzy recognition of “negative” and ‘positive” responses using LSI
  - Detection of application failures, redirects
  - Evaluation and priority based execution for plugins



Distributed architecture

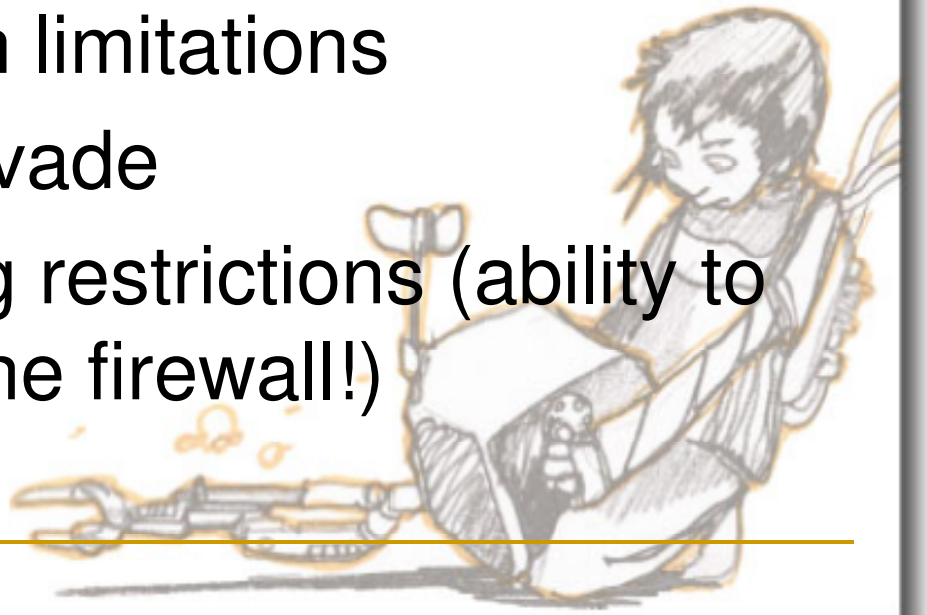


Distributed architecture (another look)



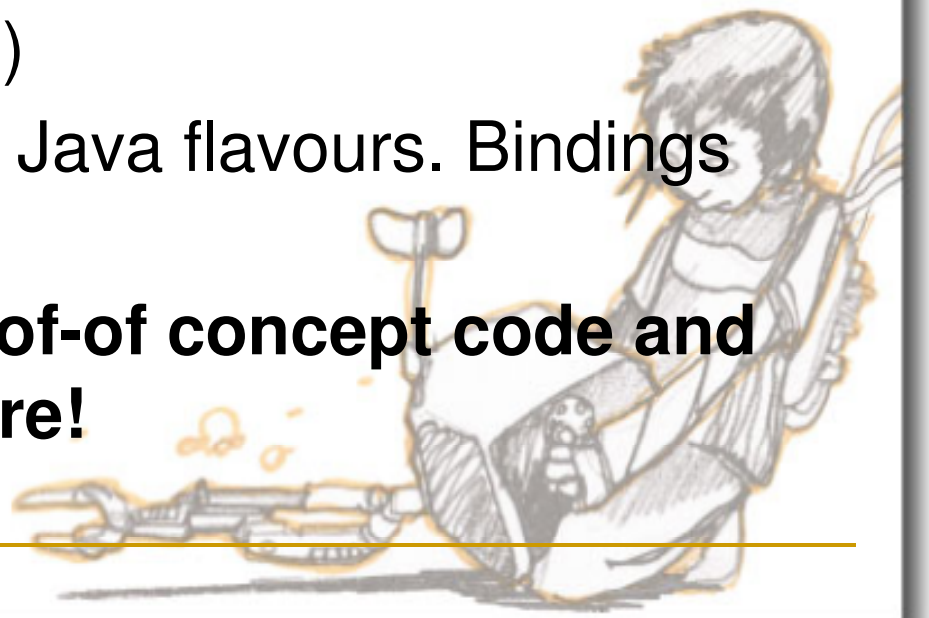
What distributed approach gives us:

- Heterogeneous environment (different platforms with different software can work together)
- Distributed brute-forcing. Bypassing IP based restrictions, bandwidth limitations
- IDS – more tricks to evade
- Bypass packet filtering restrictions (ability to place agents behind the firewall!)



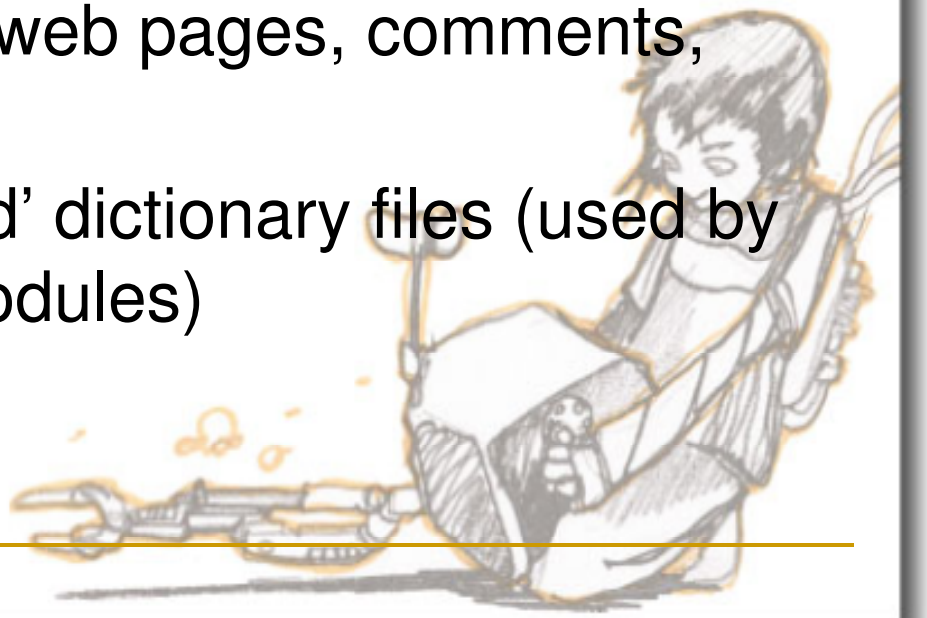
Communication layer framework in detail:

- Modified version of spread toolkit used as base
  - Robust
  - Reliable message delivery
  - Portable (windows/unix)
  - Available in C/C++ and Java flavours. Bindings exist for Python, Ruby!
  - **Spread is used in proof-of concept code and will be ditched in future!**



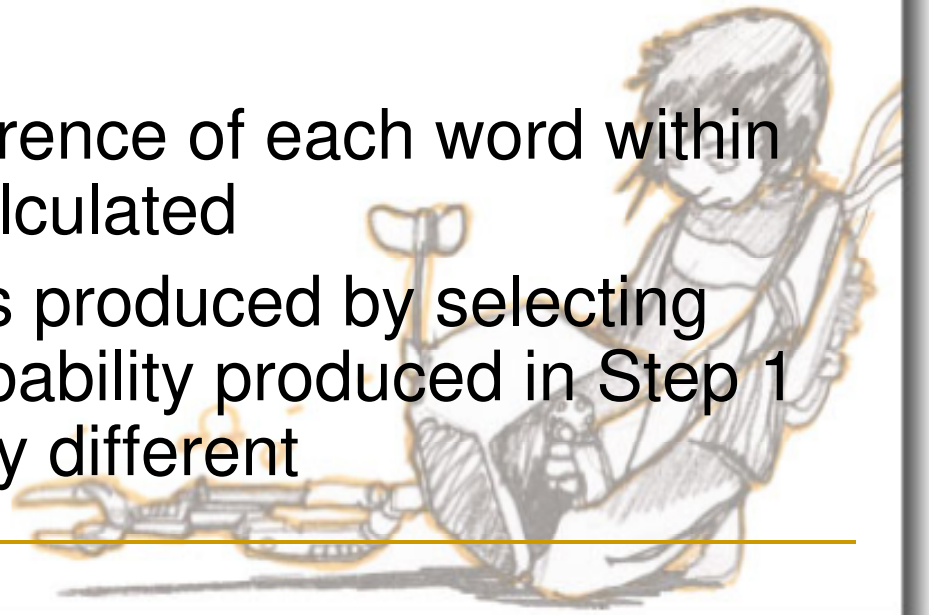
More on intelligence

- Aside from application vulnerabilities, other things of interest are:
  - Email addresses, user ids that could be seen within web content
  - Domain names (within web pages, comments, binary files, etc)
  - Building ‘target-oriented’ dictionary files (used by brute-force cracking modules)



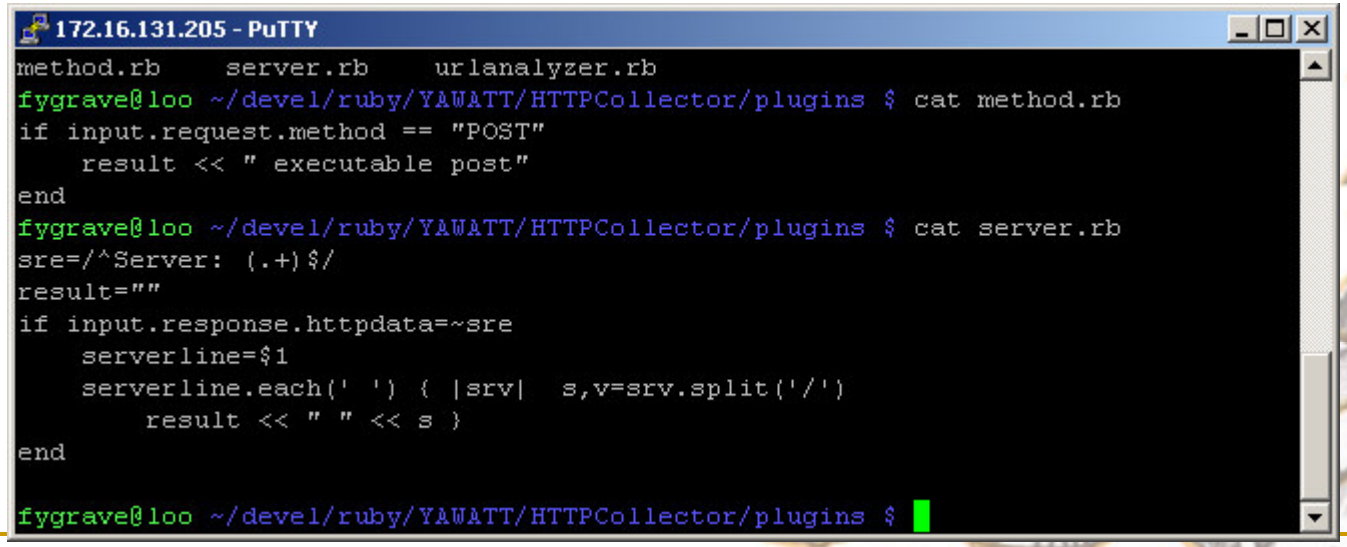
How the targeted dictionaries for brute-force attacks are generated:

- A statistical information extraction method is applied:
  - Step 1:Random similarly styled texts in the same language as the target application content, are analyzed and the statistical occurrence of each word is calculated
  - Step 2:Statistical occurrence of each word within the target website is calculated
  - Step 3:The dictionary is produced by selecting those words which probability produced in Step 1 and Step 2 is significally different



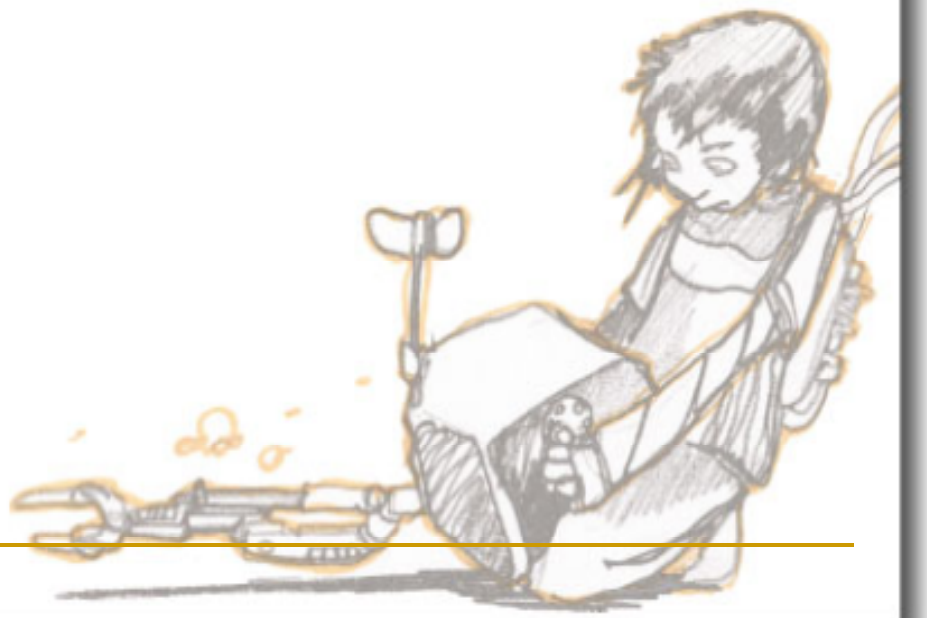
Other good things

- Add your plugin code on the fly (attack automation plugins via subscription mechanism, classification plugins etc):
  - Can't be simpler:

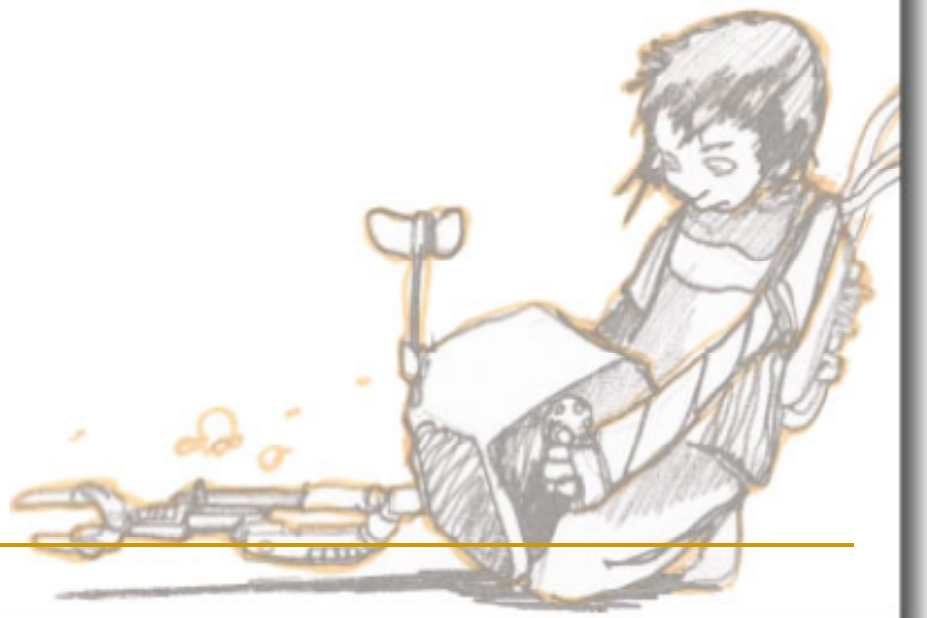


Look mah, no hands!

- No reload is needed, plugins executed next time the new data is processed

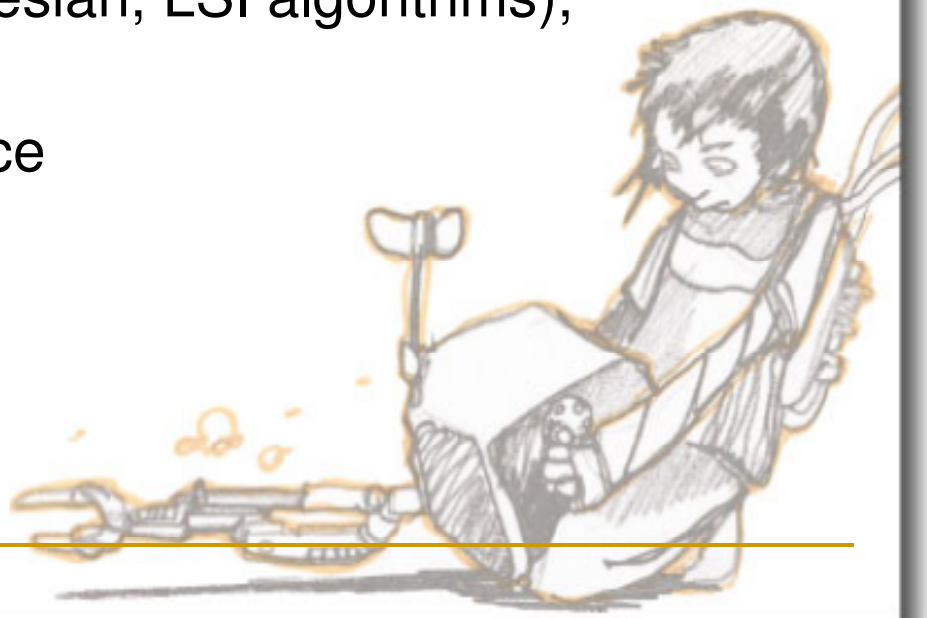


DEMO



Trying code

- http://o0o.nu/ - pre-release.
  - You will need:
    - Spread toolkit (www.spread.org)
    - Patched version of Ruby, Spread bindings for ruby. ‘classifier’ package (Bayesian, LSI algorithms), ‘mysqldb’
    - Burp proxy as data source
    - MYSQL database



Questions and Answers

Sample questions, pick one: ;---------)

- Why another web hacking tool?
- Can you do X too..?
- Can X be integrated too ..?
- This presentation is boring, any excuse ..? ☺

Thanks

- Thanks for your patience
- Send us emails if you try the code
- The code, slides and docs will be available in a while:

http://o0o.nu/