Cracking into embedded devices

And beyond! - by Adrian Pastor

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The drive behind this research

- Most devices have web interfaces enabled by default
- This applies to consumer and corporate appliances

- The devices are ownable via their web interface
- Not just info theft is possible but also gaining root/admin privileges

The drive behind this research (2)

Why “and beyond”?

- Attack doesn’t end after owning the embedded device
- If device not properly segmented, we can probe the *internal network*

- Internet -> target device -> LAN
- Target device: stepping stone / bouncing point
- Not many companies consider DMZing “miscellaneous” devices

Why “and beyond”? (2)

- Most of what we need to probe the LAN already on device
- i.e.: Axis camera with shell scripting (mish) and PHP support

Why “and beyond”? (3)

- Who’s paying attention to printers, cameras, etc? Anyone?
- After all they’re just primitive devices
- Not taking into account as seriously as app / web servers security-wise

Why “and beyond”? (4)

- Can be exploited reliably
- Can be hard to detect by IDS
- No need to develop platform-specific shellcode

Focus on remotely exploitable web bugs

Focus on remotely exploitable web bugs (2)

- Devices' web interfaces often developed without parameter filtering in mind
  - Real example: Linksys WAG54GS [1]
    - Tons of persistent XSS
- Lots of possibilities / attack scenarios

The juicy bugs!

- Auth bypass
- File retrieval / directory traversal
- XSS - reflected and persistent!
- CSRF - most devices are affected
- Privilege escalation

- Any admin setting can be changed
- Ideal when web int. NOT enabled on WAN

Personal Fav. #1: CSRF + auth bypass

- Payload is launched when admin tricked to visit 3rd-party evil page
- Evil page makes browser send forged request to vulnerable device

Personal Fav. #1: CSRF + auth bypass (cont)

- Web server password-protected but enabled on WAN interface
- Attacker *doesn't* need to be authenticated
- Malformed request to web server injects malicious payload on logs page

Personal Fav. #2: Persistent XSS on logs page

- Admin browses vulnerable page while logged in
- Device is compromised – ie: new admin account is added
- Example: Axis 2100 IP cameras [2]

Personal Fav. #2: Persistent XSS on logs page (cont)

- Ironic: security-conscious admins get owned

Personal Fav. #2: Persistent XSS on logs page (cont)

- No interaction required from victim admin
- Usually simple to exploit. i.e.:
  - knowledge of “authenticated” URL
  - Replay request that changes admin setting

Personal Fav. #3: Auth bypass + WAN web interface

- No need to rely on password
- Ideal when web interface only on LAN
- Targets the internal user who can “see” the device’s web interface
- Some preauth leaks are WAY TOO GOOD – ie: WEP keys or admin passwords

Personal Fav. #4: Preauth leak + XSS on preauth URL

- Steal session IDs
- Overwrite login form's 'action' attribute
- Phishing heaven!
- Real example: Pers. XSS on Aruba 800 Mobility Controller's login page [3] – by Jan Fry
  - You own the controller you own all the WAPs – sweet! ☺

Personal Fav. #4: Pers. XSS on admin login page

- Because not needing to rely on cracking a weak password is great
- Let’s see review a few real examples

Love for auth bypass bugs

- Password prompt returned when accessing http://victim.foo/
- If creds correct, then redirect to “authed” URL

Auth bypass type 1: unprotected URLs

- Problem is no auth data (ie: password/session ID) is transmitted
- Simply knowing the admin URLs does the job! - ie: http//victim.foo/admin-settings.cgi
- Real example: 3COM APXXXX (vuln not published yet)

Auth bypass type 1: unprotected URLs (cont)

- Resources (URLs) password protected
- However, assumed to be accessed via a certain method – ie : GET
- Requesting resource as POST gives the goodies!
- Real example: BT Voyager 2091 Wireless ADSL [4]

Auth bypass type 2: unchecked HTTP methods

- Get config file without password:

POST /psiBackupInfo HTTP/1.1
Host: 192.168.1.1
Connection: close
Content-Length: 0
<CRLF>
<CRLF>

Auth bypass type 2: unchecked HTTP methods (cont)

- Admin URLs password-protected correctly
- However, admin requests are NOT
- Real example: Linksys WRT54GS [5] – by Ginsu Rabbit

Auth bypass type 3: unprotected requests

- Settings URLs requires password:
  GET /wireless.htm
- Submitting admin request does NOT:
  POST /Security.tri
  Content-Length: 24
  SecurityMode=0&layout=en

Auth bypass type 3: unprotected requests (cont)

- Web server OKs multiple representations of URL
- i.e.: the following URLs could all be valid:
  - http://victim.foo/path/
  - http://victim.foo\path\
  - http://victim.foo/path?
  - http://victim.foo/path.
  - http://victim.foo/path?anyparameter=anyvalue
  - http://victim.foo/path/
  - http://victim.foo/path//

Auth bypass type 4: URL fuzzing

- Real example: BT Home Hub and Thomson/Alcatel Speedtouch 7G [6]
- i.e.: the following URL gives you the config file without supplying creds:
  - http://192.168.1.254/cgi/b/backup/user.ini//

Auth bypass type 4: URL fuzzing (cont)

BT Home Hub hacking challenge

- No open tcp/udp ports on WAN interface by default
- Requirement: attack must be **remote**
- Most people would give up at this point
- Possible attack vectors, anyone?

BT Home Hub hacking challenge (cont)

- OK, WAN is not an option
- How about the **LAN interface**?
- “Didn’t you say it must be a remote attack?” you must be thinking ☺

BT Home Hub hacking challenge (cont)

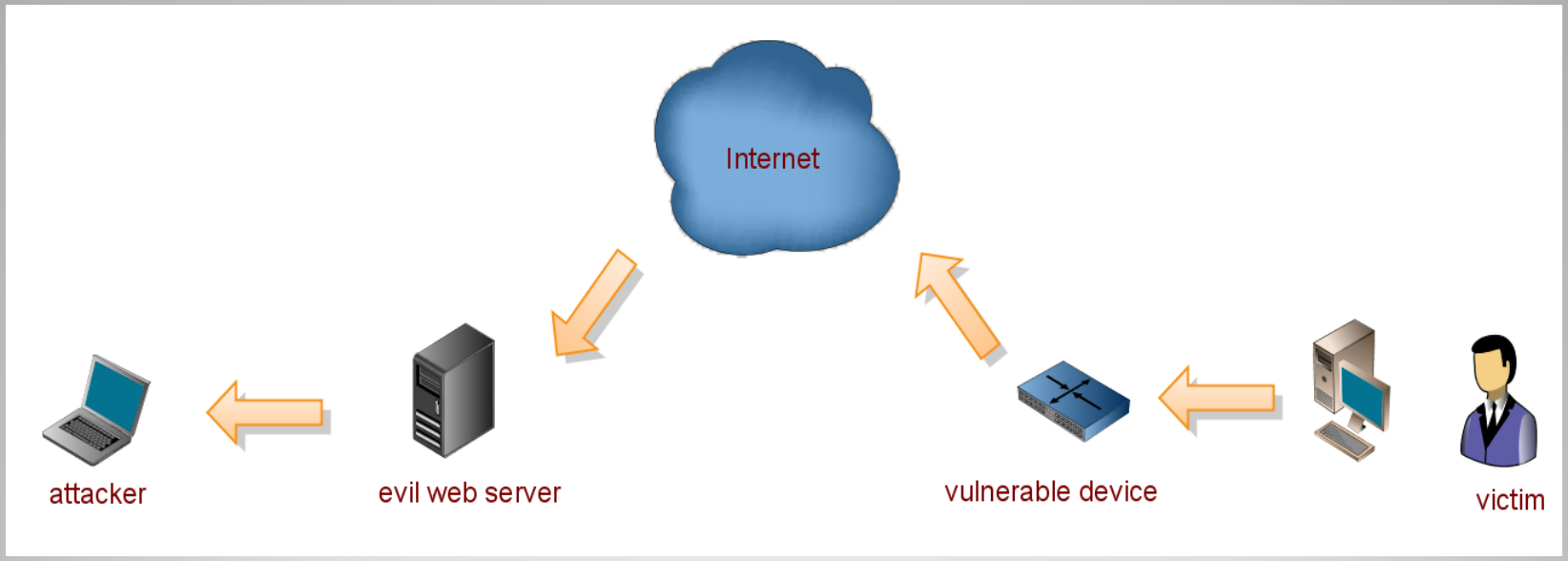
- Think **client side**!
- Victim user's **browser** his worst enemy
- If you can't attack via WAN, let the internal user do it via **LAN**
- The aikido way: blend in, take advantage of already-established channels

BT Home Hub hacking challenge (cont)

- The recipe:
  - CSRF
  - Auth bypass
- The weapon:
  - Simple form retrieved via hidden ‘iframe’

BT Home Hub hacking challenge (cont)

- The attack:
  - Any user in Home Hub's LAN visits malicious web page
  - Web page causes user's browser submit interesting request to Home Hub. i.e.: enable remote assistance



BT Home Hub hacking challenge (cont)

Demo time!

References

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